The Impact of Investor Attention on Corporate Innovation

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Abstract. As the main body of R&D, enterprises play an important role in breaking through key technologies, however, the improvement of enterprise innovation level is affected by many factors, and investor's attention is one of them. This paper selects the data of listed companies in Shanghai and Shenzhen from 2011 to 2018 to empirically test the impact of investor attention on corporate innovation, and introduces the moderating variable of internal control disclosure to explore the moderating role of internal control disclosure. It then discusses the differences in the role of investor attention on corporate innovation between state-controlled and private enterprises. The results show that investor concern has a positive facilitating effect on corporate innovation; internal control disclosure positively moderates the relationship between investor concern and corporate innovation; and investor concern has a greater impact on innovation in private firms than in state-owned firms in different property ownership subgroups. This paper enriches the literature research in the field of investor concern, and also provides a new perspective for the exploration of the path of corporate innovation in China.

Keywords: Investor Attention, Corporate Innovation, Internal Control, Nature of Property Right

1 Introduction

This study examines the impact of investor attention on corporate innovation. Innovation has a positive effect on the development of the national economy and the overall improvement of firms, and an in-depth analysis of the factors affecting innovation is essential to improve firms' innovation and R&D capabilities. At the internal governance level, equity incentives (Lerner and Wulf, 2007)[1], financing constraints (Chundakkadan and Sasidharan 2019)[2], institutional investors (Luong et al., 2017)[3], and board structure all have an impact on corporate innovation(Chen et al., 2019)[4]. At the external environment level, industrial policy (Rui and Han, 2020)[5], financial development (Maskus et al., 2011)[6], tax policy (Yuan et al., 2016)[7] and political affiliation (Li et al., 2008)[8] also have an impact on firm innovation.

Investor attention, i.e. limited investor attention, refers to the fact that investors are faced with a lot of information whose attention is limited. Limited attention is crucial to the process of screening information, using information and forming decisions, as investors hope to obtain timely and effective information about the enterprise, reduce the degree of information asymmetry between internal and external stakeholders, and thus make decisions on whether to allocate capital. As an important field of behavioural finance, investor attention has been

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widely discussed. Previous studies have focused on the economic consequences of investor attention, mainly on the impact of investor attention on stock trading volume (Engelberg, 2009)[9], stock pricing (Jiang et al., 2020)[10] and internal financial opportunistic behaviour (Dellavigna and Pollet, 2009)[11]. Rare studies examine its impact on corporate innovation, and the results of the existing studies do not make it clear whether investor attention has a positive or negative impact on corporate innovation.

This study uses enterprise data from China from 2011 to 2018. Python and Stata are used for data acquisition and empirical testing, and it is concluded that investor attention has a significant role in promoting corporate innovation; after adding the adjustment variable of internal control disclosure to the model, the interaction between investor attention and internal control disclosure is still significantly positive correlated, thus verifying that internal control disclosure positively regulates the relationship between investor attention and corporate innovation. The test is implemented separately for the sample of state-controlled enterprises and the sample of private enterprises in the model, and it is found that investor attention has a greater degree of influence on corporate innovation in private enterprises compared to state-owned enterprises.

The contributions of this paper mainly include: first, based on the limited attention perspective, the relationship between investor attention and corporate innovation is studied, so that investor attention and corporate innovation activities are combined, enriching the research in the field of corporate innovation. Secondly, from the perspective of different property rights nature, the degree of influence of corporate innovation on different enterprises is explored in depth. Third, at the practical level, feasible suggestions are made for Chinese enterprises to innovate and break through key core technologies.

The reminder of the paper is organized as follows. Section 2 presents theory and develops our hypotheses. Section 3 discusses the research design, and Section 4 presents the results of our empirical tests. Section 5 concludes.

2 Theory and Hypothesis

2.1 Investor Attention and Corporate Innovation

The innovation activities of enterprises are characterised by high investment risks, high adjustment costs and long payback periods. Therefore, external stakeholders of enterprises are eager to obtain more information related to the innovation activities of the company. Tasker (1998) argues that external investors pay more attention to R&D-intensive firms, and such firms are more likely to receive telephone requests from external analysts, i.e., investors are more eager for R&D-intensive firms to disclose information[12]. However, researchers have not reached a unanimous opinion on the impact of the level of investor attention on firms' innovation activities.

Some researchers have argued that an increase in the level of investor attention can effectively promote firms' innovative activities. On the one hand, the increase of investor attention can be used as a signal guide to effectively reduce investor's inner doubts, alleviating the financing constraints in conducting R&D. On the other hand, investor concern brings strong external

pressure, which is conducive to regulating the behaviour of executives and prompting them to make reasonable innovation decisions.

However, other researchers argue that an increase in the level of investor attention will inhibit firms' innovative activities. R&D activities are characterised by exploratory, uncertainty and high investment risk, which are at odds with short-term performance requirements, and professional managers tend to give up innovative activities under the pressure of external investors. Eric and Falkenstein (1996) find that institutional investors can have a negative impact on the degree of corporate innovation, due to the fact that institutional investors tend to maximise portfolio returns[13]. Besides, the current rules for disclosure of corporate R&D expenditures in China are still imperfect, which enhances the cost of supervision of innovation activities by external investors, and reduces the willingness of R&D investment by corporate managers.

Based on the disscusion, the following hypotheses are proposed:

H0: The investor attention has no effect on corporate innovation, ceteris paribus.

H1a: The investor attention is positively associated with corporate innovation, ceteris paribus.

H1b: The investor attention is negatively associated with corporate innovation, ceteris paribus.

2.2 Reconciliation of Internal Control Disclosures

High level of corporate internal control disclosure mitigates the lack of investment in innovation due to agency problems. On the one hand, a high level of internal control disclosure alleviates the agency problem between managers and shareholders. Yermack (1996) points out that the participation of independent directors in decision-making within the board of directors can provide different opinions for innovative activities and promote the scientific decision-making of enterprises[14]. On the other hand, a high level of internal control disclosure effectively reduces the misappropriation of funds and transfer of benefits by major shareholders through reasonable authorisation approvals, and reduces the lack of funds for innovation in enterprises caused by such operations.

Further, high level of corporate internal control disclosure mitigates the lack of innovation investment due to information asymmetry (Wang and Dai, 2019)[15]. High quality of the enterprise's internal control disclosure transmits positive signals to the securities market, enhances the investors' trust in the enterprise, thus enhancing the enterprise's level of innovation. What’s more, good internal control disclosure alleviates the phenomenon of inhibiting the R&D activities of enterprises due to the high level of debt capital. The above discussions lead to another hypothesis:

H2: The relation between investor attention and corporate innovation is more positive for firms with better internal control disclosure, ceteris paribus.

3 Sample and Methodology

3.1 Data

Baidu Index data were obtained using Python; total patent applications data from CNRDS database (CIRD); internal control disclosure data from DIB; and other data from CSMAR database. Baidu index has been published since 2011, and after 2020, due to the impact of COVID, the policy standard and time of patent audit are quite different from the previous years, so this paper selects the relevant data of A-share listed companies in Shanghai and Shenzhen from 2011 to 2018 (the lag period of enterprise innovation data is from 2012 to 2019) for the study.

3.2 Variable Measurement

The explanatory variable is enterprise innovation (INNOV). Compared with R&D expenses, enterprise patent application data is not susceptible to the manipulation of surplus management, but also reflects the output of enterprises on intangible assets. This paper draws on the research method of Zhou et al. (2019) to construct corporate innovation indicators[16]. Specifically, it is expressed as follows: the total number of enterprise patent applications is added to 1, and then the logarithm is taken.

Baidu search volume is selected as a direct indicator to measure investor attention (IA). The specific reasons are as follows: on the one hand, more and more investors obtain market information through the Internet, and the search volume serves as a direct indicator to measure the degree of investor attention. According to CNNIC's relevant research, among mobile phone users, the use of this channel is 87.2%. On the other hand, search engines can bring search services to users, but also aggregates the user's search behaviour, so search engine data can be mapped to the user's stock trading. Considering the fact that stock code and abbreviation of the company are searched together, this paper draws on the methodology of Yu and Zhang (2012)[17], based on the relevant abbreviation and the relevant code, so that they are summed up and construct the explanatory variables of this paper. At the same time this explanatory variable using Python, and find the Baidu index to calculate the annual average of the daily search index:

$$IA_{i.t} = \ln(NameIndex_{i,t}+NumberIndex_{i,t}) \quad (1)$$

3.3 Regression Model

To test whether and how investor attention has an effect on corporate innovation, a multiple linear regression model of investor attention and corporate innovation was constructed:

$$INNOV_{i.t+1} = \beta_0+\beta_1 IA_{i.t}+\beta_2 SIZE_{i.t}+\beta_3 LEV_{i.t}+\beta_4 ROE_{i.t}+\beta_5 CYCLE_{i.t}+\beta_6 CBFY_{i.t}+\beta_7 SHARE_{i.t}+\beta_8 GROWTH_{i.t}+\beta_9 CASH_{i.t}+\sum Year+\varepsilon_{i.t} \quad (2)$$

To further explore whether and how internal control disclosure moderates the relationship between investor attention and firm innovation. An interaction term between internal control disclosure and investor attention based on models (2) is introduced:

$$INNOV_{i.t+1} = \beta_0+\beta_1 IA_{i.t}+\beta_2 IA_{i.t}\times IC_{i.t}+\beta_3 IC_{i.t}+\beta_4 SIZE_{i.t}+\beta_5 LEV_{i.t}+\beta_6 ROE_{i.t}+\beta_7 CYCLE_{i.t}+\beta_8 CBFY_{i.t}+\beta_9 SHARE_{i.t}+\beta_{10} GROWTH_{i.t}+\beta_{11} CASH_{i.t}+\sum Year+\varepsilon_{i.t} \quad (3)$$

To investigate whether the role of investor attention on corporate innovation is different for state-owned enterprises and private enterprises. On the basis of model (2), the test is implemented separately for the sample of state-controlled enterprises and the sample of private enterprises.

IC reprensents logarithmic enterprise internal control disclosure index. The internal control disclosure index is based on the C-SOX system and consists of five sub-indicators. SIZE is the natural log of total assets. LEV is total liabilities divided by total assets. ROE is cacluated by net profit divided by average balance of shareholders' equity. CYCLE is the sum of inventory turnover days and accounts receivable turnover days. CBFY is cost-effectiveness ratio. SHARE is shareholding ratio of the largest shareholder. GROWTH is operating income growth ratio. CASH represents increase in cash less net financing cash, divided by paid-in capital.

4 Result and Discussion

4.1 Descriptive Statistics

Table 1 reports descriptive statistics. The standard deviation of INNOV is 1.790, the minimum value is 0, and the maximum value is 7.089, which indicates that there are big differences in patent outputs produced by different enterprises, and some enterprises even have no patent outputs. The standard deviation of IA is 0.658, and comparing with the standard deviation of INNOV, the differences in the degree of attention paid to each enterprise by investors are relatively small. The minimum value of IC is 2.708, and the maximum value is 3.875, indicating that there are also differences in the level of internal control disclosure among enterprises. The descriptive statistics of the control variables are generally consistent with the existing literature. In addition, the results of Pearson's test (table 2) show that IA, IC and INNOV are significantly and positively correlated at the 1% statistical level. The values of Variance Inflation Factor (VIF) ranged from 1.03 to 1.76 with a mean value of 1.35 and was less than 5. Therefore, in this paper there is no evidence of significant multicollinearity in the study.

Table 1. Descriptive statistics of the main variables.

Variable	N	Mean	Std Dev	Min	Max
INNOV	15,746	2.591	1.790	0	7.089
IA	15,746	6.839	0.658	5.476	8.925
IC	15,746	3.526	0.230	2.708	3.875
SIZE	15,746	22.22	1.306	19.77	26.19
LEV	15,746	0.426	0.209	0.0488	0.893
ROE	15,746	0.0733	0.101	-0.397	0.358
CYCLE	15,746	5.134	1.006	2.212	7.871
CBFY	15,746	0.140	0.214	-0.458	1.154
SHARE	15,746	0.355	0.152	0.0877	0.751
GROWTH	15,746	0.184	0.408	-0.502	2.629
CASH	15,746	-0.198	1.006	-4.113	2.729

Table 2. Table of correlation coefficients.

	INNOV	IA	IC	SIZE	LEV	ROE	CYCLE	CBFY	SHARE	GROWTH	CASH
INNOV	1										
IA	0.314***	1									
IC	0.128***	0.014*	1								
SIZE	0.339***	0.514***	0.141***	1							
LEV	0.070***	0.217***	-0.047***	0.517***	1						
ROE	0.114***	0.048***	0.050***	0.133***	-0.115***	1					
CYCLE	0.020**	-0.050***	0.0100	-0.101***	0.00600	-0.083***	1				
CBFY	-0.080***	-0.023***	0.036***	0.013*	-0.319***	0.585***	0.076***	1			
SHARE	0.037***	0.0120	-0.00100	0.228***	0.078***	0.118***	-0.084***	0.079***	1		
GROWTH	0.028***	-0.046***	0.00600	0.024***	0.021***	0.228***	-0.056***	0.125***	-0.027***	1	
CASH	-0.024***	0.069***	-0.00900	0.019**	-0.047***	0.082***	-0.072***	0.075***	0.053***	-0.112***	1

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

4.2 Results of Regression Analysis

Column (1) of Table 3 shows the regression results between investor attention and corporate innovation. IA and INNOV are significantly and positively correlated at the 1% level with a coefficient of 0.125.Therefore, the higher the investor attention, the higher the level of corporate innovation, and so Hypothesis H1a holds. Column (2) of Table 3 shows the regression results of the moderating effect of internal control disclosure. With the introduction of the moderating variable of the level of internal control disclosure, p-value of the interaction term (IA×IC) is 0.000 and the coefficient is 0.178. Therefore H2 holds.

Columns 3-6 of Table 3 explore the relationship between investor attention and firm innovation and the moderating effect of internal control disclosure across ownership. Columns (3) and (5) are subgroups of private firms, and columns (4) and (6) are subgroups of state-controlled firms. Based on the results of columns (3) and (4), the between-group coefficients are tested using the Chow test. The test results found that the coefficient of the cross term is -0.112, which is significant at 1% confidence level. This indicates that there is a significant difference in the coefficient of IA between state-controlled firms and private firms, and that investor attention has a greater positive impact on innovation in private firms. In addition,

columns (5) and (6) show that internal control disclosure positively moderates the relationship between investor attention and firm innovation for both private and state-controlled firms.

The reasons for this are mainly the differences in the motivation for innovation investment and the objectives of enterprise managers in enterprises of different natures. Private enterprises face greater external competitive pressure and have a stronger willingness to enhance their innovation capability. The objectives of state-controlled enterprises, on the other hand, will take into account non-economic factors such as appointment, tenure, appraisal and promotion, and they are more reluctant to invest in R&D than private enterprises.

Table 3. Regression results.

Variable	(1)INNOV	(2)INNOV	(3)INNOV	(4)INNOV	(5)INNOV	(6)INNOV
IA	0.125***	0.131***	0.176***	0.084***	0.181***	0.089**
	(5.21)	(5.45)	(0.034)	(0.038)	(0.034)	(0.038)
IA×IC	-	0.178***	-	-	0.147*	0.143**
		(3.70)			(0.079)	(0.068)
IC	-	0.044	-	-	0.059	0.120**
		(1.19)			(0.057)	(0.052)
SIZE	0.328***	0.330***	0.342***	0.389***	0.342***	0.391***
	(16.04)	(16.11)	(0.030)	(0.035)	(0.030)	(0.035)
LEV	-0.081	-0.085	-0.120	0.015	-0.115	0.021
	(-1.05)	(-1.09)	(0.110)	(0.131)	(0.111)	(0.131)
ROE	0.617***	0.619***	0.773***	0.326**	0.778***	0.333**
	(5.49)	(5.51)	(0.195)	(0.143)	(0.195)	(0.143)
CYCLE	-0.009	-0.008	-0.031	-0.027	-0.031	-0.024
	(-0.45)	(-0.39)	(0.030)	(0.030)	(0.030)	(0.030)
CBFY	-0.060	-0.066	-0.137	-0.045	-0.143	-0.051
	(-0.93)	(-1.02)	(0.101)	(0.100)	(0.101)	(0.100)
SHARE	-0.260**	-0.261**	-0.058	-0.569***	-0.065	-0.560***
	(-2.04)	(-2.05)	(0.196)	(0.200)	(0.196)	(0.200)
GROWTH	0.012	0.013	-0.035	0.027	-0.034	0.027
	(0.62)	(0.67)	(0.027)	(0.031)	(0.027)	(0.031)
CASH	-0.007	-0.006	-0.010	0.001	-0.009	0.001
	(-0.86)	(-0.81)	(0.012)	(0.011)	(0.012)	(0.011)
Constant	-5.641***	-5.870***	-6.067***	-6.691***	-6.295***	-7.210***
	(-13.13)	(-13.13)	(0.633)	(0.752)	(0.663)	(0.775)
Year fixed effect				YES		
Firm fixed effect				YES		
F	21.18	20.96	14.64	28.51	14.48	28.28
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	15746	15746	8191	6399	8191	6399

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

5 Conclusion

This paper investigates the impact of investor attention on corporate innovation and obtains the following conclusions: first, investor attention promotes the level of corporate innovation. Increased investor attention can obtain more information about the risks and benefits of enterprise operation and R&D, and enhance confidence in the innovation investment of high-

quality enterprises. At the same time, as an external monitoring mechanism, investor attention can regulate management's unreasonable behaviour, prompting executives to pay attention to market evaluation and make timely and effective responses to the enterprise's innovation and R&D decisions. Second, a high level of internal control disclosure enhances the relationship between investor attention and corporate innovation. Internal control disclosure mitigates the short-sightedness effect of managers, reduces the likelihood of investor adverse selection, and further amplifies the positive impact of investor attention on corporate innovation. Third, there are differences in the extent to which corporate innovation is affected by investor attention under different ownership properties. Compared with state-controlled firms, the positive impact of investor attention on private firms' innovation is greater. This is due to the differences in management modes, decision-making mechanisms, and the strength of state support for these two types of enterprises with different property rights.

This paper may have the following limitations: First, this study constructs investor attention based on the sum of stock abbreviation and code searches to measure the degree of external investors' attention to the enterprise, but it cannot cover all investors in the data collection, and some of them may obtain information about the enterprise through reading stock news, collating information from financial websites, or listening to analysts' recommendations, and so on. In the future, Baidu index, financial website search volume, the number of institutional investors' research, and turnover rate can be selected as the constituent variables of the comprehensive index. Second, the role of investor attention on corporate innovation may be different in different industries. In the future, we can combine the national macroeconomic policies and select key industries for research to explore whether there is an impact of investor attention in industries with weak innovation capacity.

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