Investor Sentiment, Chairman-CEO Duality and R&D Investment

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***Abstract*—With a sample of Chinese listed firms during 2007-2010, the paper studies the impact of the investor sentiment on firm's R&D investment, and the results suggest that the firms' management do not catering investor sentiment significantly. But when the study import the variable of chairman-CEO duality and its interaction with investor sentiment, it is suggested that the stock mispricing which induced by investor sentiment and chairman-CEO duality have a positive effect on firms' R&D investment. Furthermore, the coefficient of the interaction of investor sentiment and chairman-CEO duality is negative significantly, which suggests that the firms with board member act as CEO will cater investor sentiment through R&D investment, while the firms which separate of chairman and CEO will make investment decisions more rationally.**

I. INTRODUCTION

It is increasingly recognized that the investors in the financial markets are "normal" rather than "rational". The systematic biases in their beliefs, which the researchers called "investor sentiment", will induce investors to transact not based on the fundamentals [2, 19], and may make systematic errors in forming expectation, so that "stocks can become significantly over- or undervalued at particular points in time [12, p.431]".

Existing researches suggested that stock mispricing induced by investor sentiment does have impact on the individual firm's investment decision because the management will cater such stock mispricing for maximizing short-term gains, for example, Stein [12], Polk and Sapienza [10, 11], Dong et al [5, 6], Chirnko and Schaller [4], Zhu [16] have confirmed that the management will invest heavily to cater optimistic market expectation, vice verse. And it is also suggested that whose assets are more difficult to value (such as R&D investment or intangible investment) should cater more [5, 11].

Facing economic transformation, Chinese firms are facing changing market and the investor with violent fluctuating sentiment, and may have different characteristics in their R&D activities [8]. But our preview research[18] suggests that the firms managers may cater investor sentiment through different types of investment, but the fixed assets investment may be the most important channel while intangible investment is used to be affected by investor sentiment only in the turbulence period of the capital market. This result is different with the conclusions of Polk and Sapienza [10] and Dong et al [5] that whose assets are more difficult to value (such as R&D investment or intangible investment) should cater more. And we consider that there may be some important factors which will have moderating effect on the relationship between investor sentiment and firm's R&D investment, and this paper focuses on moderating effect of Chairman-CEO duality.

The possible reason is maybe the Chinese capital market investors are with great irrational and pay more attention on the fixed assets with more reliable return. The paper studies the impact of the investor sentiment on firm's R&D investment, and whether the firms separate the Board's chairman and CEO play an effect on the relationship between investor sentiment and firms' R&D investment.

The paper is organized as follow. In Section II, the paper analyzes how investor sentiment and Chairman-CEO duality affect firm's R&D investment and formulate hypotheses. Section III describes the sample, variables, and the framework for identifying moderator variables. Then, the hypotheses are tested in Section Ⅳ. Lastly, a brief conclusion is put forward.

II. DEVELOPMENT OF HYPOTHESES

A. Investor sentiment and R&D investment

For maximizing short-term stock price-linked incentives, increasing private benefits of control, or maintaining their position, and so on, the managers of the listed firms have strong motivation to keep their firms' stock price. On the other hand, the information in the capital market is asymmetry, and therefore the investors can evaluate the firms only by observing the behavior of the listed firms, especially the major investment behavior and then make their investment decisions. So, the managers with motivation of keeping stock price are likely to cater the investors' cognitive bias. That is, the firms may have an incentive to invest the negative NPV projects when their stock is overpriced, and forgo the positive investment opportunities when the investors are pessimistic [18]. Such paradigm of investor sentiment and stock mispricing affect firms' investment decisions is called "catering channel" by researchers [10,11].

According to catering theory, the more difficult valuating of the company's assets, the higher future growth, the greater well the firms' investment to cater more[11]. Intangible assets investment, particularly R&D investment, is the source of innovation and firms' growth, but it has a greater probability of failure and remoter returns. Therefore, it is relatively hard for investors to value firms' investment; this presents managers with greater opportunities for catering to mispricing. Polk and Sapienza [11] find that the catering effect is weaker for firms with relatively low R&D intensity. Dong et al [5] find the sensitivity of R&D investment to investor sentiment is about 4-5 times greater than that of tangible assets. Baker et al [1] also find, under high financing constraints, the catering effect of intangible investments are greater than capital expenditure investments.

Based on the above reasons, the paper wants to test whether this high sensitivity of R&D and intangible assets investment to stock mispricing exist in China and proposes the following hypothesis:

Hypothesis 1: the level of firms' R&D investment is sensitive to the level of stock mispricing.

B. The moderating effect of chairman-CEO duality on the relation between investor sentiment and R&D investment

There are two main theories about the impact of duality on firms' operation and performance. Agent theory considers that people are rational and self-interested, and will seek to maximize their benefits. Therefore, senior management may not make decisions from the interests of shareholders. So, it is necessary for firms to separate board chairman and CEO in order to balance the powers and supervise CEO effectively. On the other hand, stewardship theory suggests that the managers are good stewards of the firms; there is a selfless fiduciary relationship between owners and managers. So, the managers will act in accordance with the principle of maximizing shareholder value.

Few studies have done about the relation between duality and R&D investment in China. Xu and Liu [15] suggest that the separation of duties of directors and CEO can promote the level of enterprise technology innovation. Kang Hua et al [9] find Stock concentration is a moderator of the relationship between duality and R&D strategy. With high concentration, duality has a positive impaction on firms R&D strategy; while with low concentration, there's no significant relation. Chen et al. [3] finds that Chairman－CEO duality played a positive role in moderating the relationship between R&D and market value of firms, which is shown to support the stewardship theory.

From a view which is different from the above research, this paper focuses on analyzing whether separation of chairman/director and CEO plays a role on the relation of firms R&D investment and investor sentiment/stock mispricing. Though investors are bounded rational, managers of the listed firms may have similar cognitive and decision-making biases as investors. Overconfidence, herd behavior, and short-sightedness are the common biases in managers' cognition and decision making. So, they will exploit and cater stock mispricing in decision making, and may further promote such mispricing to maximize their short-run value, even though this may result in lower long-run values. Managers are myopically rational rather than fully rational [17]. So, separation of board chairman/director and CEO can ensure the independence and effectiveness of the board, and reduce opportunistic behavior in the R&D activities. That is, separation of board chairman/director and CEO will reduce the catering investment. Therefore, we propose the second hypothesis:

Hypothesis 2: Separation of board chairman/director and CEO plays a negative role in moderating the relationship between R&D investment and stock mispricing. The level of the firms with chairman-CEO duality is sensitive to stock mispricing.

III. VARIABLE AND SAMPLE

A. Data sources and Sample

The current China Accounting Standards which prescribes the disclosing of the firms' R&D first is carried into execution in 2007. So, the paper takes the sample includes the listed manufacturing firms from 2007-2010. The following datum are eliminate: (1) special treatment (ST) firms, because such firms maybe have strong motivation to manage their earning through multi-means including change R&D investment and R&D expenditures treatment. (2) Incomplete and abnormal samples. Winsorizing has been conducted to remove the effect of outliers. Only some firms disclose their R&D expenditures, and so only 727 firm-years are analyzed in this paper.

B. Variable

The independent variable is R&D intensity, which is labeled RDA, is calculated as firm's R&D expenditures to its same year's assets.

The level of stock mispricing is conducted as dependent variable, which is labeled QS. It is suggested that the value of Tobin's Q ratio may contain mispricing and information about the profitability of investments [1, 5, 7], so we can decompose non-fundamental components from the Q ratio to calculate QS. As Goyal and Yanada [7] and Tan and Xia [13] did, the study takes a cross-sectional regression of the Q ratio on firms' fundamental indexes, such as return on equity, equity to debt ratio, sales growth, and industry dummies. The fitted values from this regression are proxies for the fundamental component of stock values (QC), which represents the opportunity and profitability of investment, while the residual components are proxies for mispricing (QS = Q-QC). The previous year's QC (QCL) may have an impact on firm's investment [8], so, QCL in our study is conducted as control variables

The chairman-CEO duality (DUAL) is conducted as moderating variable, which is defined as "0" when the board chairman or directors serve as firm's CEO, otherwise, it is recorded as "1".

In addition to QCL, the study conducts the firm's current flow (CF=operating cash flow /opening balance of assets), and previous cash flow (CFL), firm's size (SIZE=natural logarithm of opening balance of assets), asset/liability ratio (LEV), the return on equity (ROE), and the profit growth rate (Grow=operating profit of the current year-operating profiting of the previous years/-1) are conducted as control variables.

IV. EMPIRICAL STUDIES AND RESULTS

A. Descriptive Analysis

The descriptive analysis results are shown in Tab. I, and the histogram of R&D intensity are shown in Fig. 1.

TABLE I. DESCRIPTIVE ANALYSIS

N	Mean	Std. Deviation	Min.	Max.
RDA	0.0149	0.0338	0.0000	0.5092
QS	0.1746	0.6535	0.7989	2.1213
DUA	0.7621	0.4261	0	1
QCL	1.4887	0.1518	0.9850	1.8973
CF	0.0686	0.0731	0.1306	0.4293
CFL	0.0685	0.0759	0.2921	0.4293
SIZE	21.8324	0.8834	19.9304	23.4659
LEV	0.4841	0.1621	0.1363	0.7616
ROE	0.0685	0.0843	0.1658	0.2135
GROW	0.0840	0.2169	0.4082	0.8518

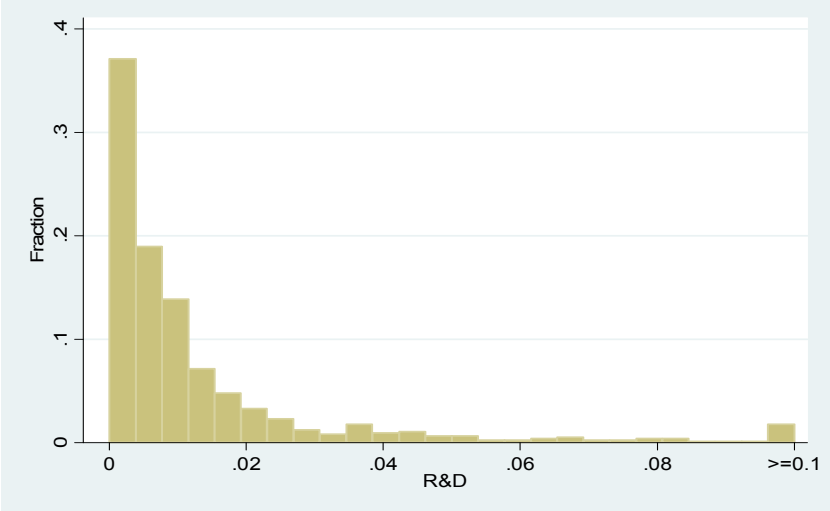

Figure 1. The Histogram Of R&D Intensity

As Tab. I and Fig. 1show, the R&D intensity of the sample firms are small. About 37% sample firms' R&D intensity is lower than 0.004% of their assets, and more than 80% firms' R&D intensity are lower than 0.02%.

In order to test multicollinearity of the model, the correlations between independent variables and variance inflation factor (VIF) are calculated, which are shown in Tab. II and Tab. III respectively.

TABLE II. CORRLEATIONS BE TWEEN INDEPENDENT VARIABLES

	QS	DUA	QCL	CF	SIZE	LEV	ROE
QS	1.0000						
DUA	-0.0318	1.0000					
QCL	0.1616*	-0.0308	1.0000				
CF	0.0908	-0.0278	0.2554*	1.0000			
SIZE	-0.1748*	-0.1007*	0.0571	0.1057*	1.0000		
LEV	-0.1358*	-0.0146	-0.5433*	-0.1398*	0.3335*	1.0000	
ROE	0.1547*	-0.0546	0.3942*	0.3692*	0.2601*	-0.1290*	1.0000
GROW	0.0763	0.0234	0.0674	0.1625*	0.2004*	0.0867	0.2885*

TABLE III. VIF TEST

Variable	VIF	1/VIF
QCL	1.86	0.5387
LEV	1.77	0.5640
ROE	1.48	0.6740
SIZE	1.42	0.7040
CFL	1.30	0.7700
CF	1.28	0.7817
GROW	1.14	0.8734
QS	1.11	0.8976
DUA	1.02	0.9833
Mean VIF	1.38	

TABLE IV. REGRESSION RESULT

Variable	Coefficient	t-Statistic	Sig.
QS	0.0006	0.91	0.366
QCL	-0.0018	-0.42	0.678
CF	0.0265	3.50	0.001***
CFL	0.0035	0.44	0.661
SIZE	0.0124	5.85	0.000***
LEV	-0.0183	-2.28	0.023**
ROE	-0.0016	-0.21	0.831
GROW	0.0036	1.62	0.106
N	727		
Adjusted R^2	0.7791		
Prob	0.0000		

***:P<0.01; **: P<0.05; *: P< 0.1, the same below

As Tab. II show, all of the correlations between independent variables are low; and Tab. III shows that the average of the VIF tests is about 1.38, which is far smaller than 10, so there is no multicollinearity between independent variables.

B. Do firms' R&D investment cater investor sentiment?

According to the hypothesis 1, a multiple regression analysis is conducted to test whether firms cater investor sentiment through R&D investment. The results is shown in Tab. IV.

It is noticed that there's no significant correlation between firms' R&D investment and stock mispricing. Hypothesis 1 is rejected.

This result suggests that the managers do not cater invest sentiment through R&D investment, which do not support the conclusion that whose assets are more difficult to value should cater more as Polk and Saienza [11] and Dong et al. [5] suggested. There may be three possible reasons. (1) Compared with tangible assets investments, the returns of R&D and intangible assets investment have characteristics of high-risk, high-uncertainty, remote and lagged; while the investors of Chinese capital market have strong speculative motivation, and are bound to treat R&D investment modestly. Xie et al.[14] find that consumers in the product market recognize the value of business investment in R&D, while investors in the stock market do not recognize the value of R&D expenditure in financing reporting. (2) Though the existing "intangible assets" accounting standards of China suggests that qualified R&D expenditure can be capitalized, a large part of firms' R&D expenditure is expensed which recognized in the account of "overhead expense". That is, such R&D investment is mixed with entertainment expense, office allowance, and conference expenses and so on, and then cannot be noticed by most of investors. (3) As described above, most of sample firms have low R&D density, and the managers may cater investors through tangible assets which have a higher proportion and more certain return.

C. *Does Chairman-CEO duality act as a moderator in the relation between investor sentiment and R&D investment*

In order to test the moderating role of chairman-CEO duality in relation between R&D investment and investor sentiment, a moderate regression analysis (MRA) is conducted used the total sample firms, and the results are shown in Tab. V.

TABLE V. MRA RESULTS OF TOTAL SAMPLE

Variable	A		B	
	Coefficient	t-Statistic	Coefficient	t-Statistic
QS	0.0006	0.85	0.0026**	1.97
DUA	0.0027	1.45	0.0037*	1.93
QS*DUA			-0.0027*	-1.78
QCL	-0.0003	-0.07	-0.0007	-0.15
CF	0.0274***	3.60	0.0265***	3.49
CFL	0.0033	0.42	0.0028	0.36
SIZE	0.0127***	5.96	0.0129***	6.05
LEV	-0.0194**	-2.40	-0.0202**	-2.51
ROE	0.0003	0.04	-0.0001	-0.01
GROW	0.0033	1.49	0.0034	1.53
N	727		727	
Adjusted R^2	0.7797		0.7808	
Prob	0.0000		0.0000	

As the results of model B in Tab. Ⅴ shows, both QS and DUA have a positive relation with firms' R&D investment ((β=0.0026, t=-1.97, and (β=0.0037, t=1.93 respectively), which suggest that the stock mispricing which induced by investor sentiment and Chairman-CEO duality may have a positive effect on firms' R&D investment. In addition, the interaction between DUAL and QS have a week negative relationship with the firms' R&D investment (β=-0.0027, t=-1.78). But as the results of model A shows, there's no significant relationship between DUA and R&D investment (β=0.0027, t=1.45). So, we can conclude that DUA is a pure moderator variable here. That is, if the chairman or directors of the Board do not serve as the firms' CEO, they will supervise the senior executive to innovate, select and implement the innovation project according rational analysis, and do not cater the irrational investor sentiment. The firms with separation of chairman and CEO will make investment decisions more rationally. H2 is confirmed.

V. CONCLUSION

A. Conclusion

R&D is at the core of business strategy for firms' survival and growth; it is suggested that firms will make R&D investment decisions according to the investor sentiment. This study tests whether the stock mispricing affects firms' R&D investment decisions in China, and arrives at the following conclusions: (1) Firms' do not catering investor sentiment significantly. (2) Chairman-CEO duality acts as a moderator in the relation between firms' R&D investment and investor sentiment. It is suggested that separation of board chairman/director and CEO will reduce firms' catering R&D investment.

B. Contribution and Limitation

It is recognized gradually that the limited rationality of the investors has a significant impact on the real firm's investment, but the existing literatures concentrates only on the relationship between investor sentiment and investment level directly. This paper tries to analyze the relationship from a new perspective and proposes that there may be some important factors which will have moderating effect on the relationship between investor sentiment and firm's investment, such as chairman-CEO duality.

As an exploratory study, the paper has some limitations. There are two main problems. First, our focus is concerned about the relation between investor sentiment, chairman-CEO duality and firms' R&D investment, instead of other factors, such as industry type, technology type, economic conditions…, which might influence the relationship examined in this paper, are not discussed. It may be partial and incomplete. Second, according to the existing Chinese Accounting Standards 6 – intangible assets, eligible R&D investment of a firm can be capitalized, while other R&D investment is conducted as administrate expense and charged in full to the profit and loss account of the accounting period in which they are incurred. That is, the firm can deal with the R&D investment discretionarily, and only part of the firms disclose there R&D investment completely, which may have a material impact of our research conclusion.

ACKNOWLEDGMENTS

This study has been developed from research projects supported by the National Social Science Fund (13AGL002) , the Natural Science Foundation of Zhejiang Province (LY13G020005) and Zhejiang Federation of Humanities and Social Sciences Circles (2013N120).

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