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Managerial overconfidence and over-investment: Empirical evidence from China

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Abstract Based on data of A-shares listed companies in China, this paper studies the relationship between managerial overconfidence and firms' overinvestment behaviors. We first define a manager as an overconfident one if his or her company's announced earnings forecast is higher than its actual earnings at least once in 2002–2004. After controlling such factors as growing opportunity, size, etc., we find that overconfident managers tend to over-invest and their overinvestment behaviors have higher sensitivity to cash flow generated by financing activities. In other word, when their firms obtain an abundant cash flow from financing activities, overconfident managers will over-invest, or vice versa. Contrary to other relevant studies, we find that the sensitivity between over-investment and free cash flow has little to do with managerial overconfidence. Robustness testing is conducted to verify the reliability of our conclusions. We also use “whether top managers increase their holdings of company shares within the observation period” as a substitute variable for managerial overconfidence and run the tests again, and the results are consistent with the above. Finally, findings of this paper indicate that it is necessary for firms to establish a scientific and rigorous investment managing mechanism.

Keywords over-investment, overconfidence, cash flow from financing activities,

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free cash flow

摘要 以非金融类 A 股上市公司为研究样本,考察了管理者过度自信与企业投资行为的关系。如果样本公司在 2002–2004 期间内至少有一次发布的盈利预测值大于实际盈利,我们就将该公司的管理者定义为过度自信的管理者。控制了增长机会、规模等因素后,研究发现,过度自信的管理者倾向于过度投资,并对融资活动产生的现金流有更高的敏感性。即当公司有充裕的融资活动现金流时,过度自信的管理者会过度投资;反之,则投资不足。还发现过度投资与经营活动产生的自由现金流之间的敏感性基本上不受管理者过度自信心理特征的影响,这与其他一些研究的结论不一致。此外,我们以样本期间内管理者是否增持本公司的股票作为过度自信的替代变量重新进行了研究,研究结论保持一致。结论证明,公司有必要建立科学、严格的投资管理制度。

关键词 过度投资, 过度自信, 融资现金流, 自由现金流

1 Introduction

The principal-agent theory and information asymmetry have long been used to explain over-investment and the sensitivity of investment to cash flow. The principal-agent theory argues that, due to conflicts of interest between managers and shareholders, the former are likely to make investment decisions for their own sake, for example, building a huge business empire or to avoiding being involved into the entrenchment. Generally speaking, high external financing cost is more likely to constrain managers' investment level while free cash flow (FCF) enables managers to over-invest or under-invest (Jensen, 1986; Jensen and Meckling, 1976). The information asymmetry theory believes that for shareholders' interests, managers restrict external financing to avoid shares' dilution. Under such circumstances, FCF enhances investment and lowers the possibility of managers' investment distortion. Therefore, both principal-agent theory and information asymmetry theory presume that managers and investors are rational decision-makers pursuing utility maximization (Myers and Majluf, 1984).

However, decision making in the real business world is far different from that of a rational economic man. Relevant studies in the field of psychology have found that people are inclined to believe their talents are higher than that of the average level of the group when comparing their skills with those of their peers in the same group. Particularly, such an overconfidence characterized by "higher than the average level" prevails among senior managers. Cooper et al.'s (1988) survey of American entrepreneurs showed that these entrepreneurs believed that the average "possibility of success" of other companies is 59%, while the

possibility of their own company is a high 81%. Only 11% interviewed entrepreneurs thought others would definitely succeed, while 33% had 100% confidence in their own success. Respectively, Landier et al. (2004), Langer (1975) and Weinstein (1990) also confirmed in their empirical study that top managers are more likely to become overconfident when in comparison with common employees.

Nowadays, behavioral finance has made its entry into the field of asset pricing. However, there has been little research applying behavioral finance to investment behaviors of companies. Baker, Ruback and Wurgler (2006) found that the impact of top managers' irrational behaviors on decision-making of companies has drawn little attention in comparison with investors' irrational behaviors. In relevant literature on the impact of top managers' irrationality on investment decision-making, Roll (1986) proposed for the first time that propositions of overconfident managers affects both managers' decision-making behaviors and the acquisition process. Top managers firmly believe that they could create more value for their companies by acquisition and merger. However, their overconfidence usually brings a failure to acquisition and merger.

Moreover, due to the lack of a reliable scale to measure a top manager's overconfidence, Roll's proposition has aroused heated controversy among financial experts. The lack of credible proxies for managerial overconfidence becomes a bottleneck in the development of relevant research. Studies that followed mainly use experimental methods and theoretical approach to study the effects of managerial overconfidence on company investment behavior. For example, Camerer and Lovo (1999) adopted an experimental method and proved that managerial overconfidence affects a company's entry into a market. Heaton's theoretical model shows that, on the one hand, overconfident managers believe that capital market undervalues their companies' shares, thus reluctant to use external financing channels and in the end has to give up some projects with positive net present value due to insufficient internal funds. On the other hand, when there are FCF in their companies, overconfident managers will overestimate investment opportunities. Under such circumstances, these managers would invest in projects with negative net present value even if they remain loyal to shareholders (Heaton, 2002).

In recent years, scholars have studied the impact of managerial overconfidence on their investment behavior by means of empirical approaches. For example, Malmendier and Tate (2003) regarded managers whose predicted company annual profit exceeds the real profit as overconfident managers. They found this type of managers tend to over-invest. Malmendier and Tate (2003) showed that overconfident managers are more likely to conduct acquisition and merger. Malmendier and Tate (2005) empirically proved Heaton's theoretical model and assumed that compared with rational managers, overconfident managers

have higher investment sensitivity to cash flow, especially for those “equity-dependent” companies (Malmendier and Tate, 2005). Lin et al. (2005), Brown and Neal (2006) also drew similar conclusions in their empirical study

Recently, domestic scholars have started to focus on the influence of managerial overconfidence on their companies’ investment and financing decisions. Hao et al. (2005) empirically studied the relationship between managerial overconfidence and company investment. Results reveal that, in comparison with “behaviors with moderate confidence”, top managers’ overconfident behaviors are positively and significantly related to their companies’ investment scale. In addition, these top managers are likely to have higher sensitivity of investment to flow. Yu et al. (2006) explored the relationship between managerial overconfidence and companies’ financing decisions. Their results showed that managerial overconfidence leads to radical debt financing decisions. Wu et al. (2007) explored the relationships among the management’s study behavior, managerial overconfidence, and performance change caused by continuous acquisition and merger. They found that the managerial overconfidence and study behaviors decide the performance of continuous acquisition and merger.

Based on the above research, this paper takes into account the characteristics of the newly emerged Chinese capital market. It also explores the sensitivities of over-investment to FCF and financing cash flow respectively. Two indicators are used as the proxy for managerial overconfidence, namely the difference between predicted and real annual (or semi-annual or quarterly) profitability and whether a company’s top managers increase their shares in the observation period. Results show that the over-investment decisions made by overconfident managers are not sensitive to FCF generated by operating activities, but are sensitive to FCF generated by financing activities.¹ In other words, the more cash a company’s financing activities generates, the more likely overconfident managers are to over-invest. This conclusion is consistent with the empirically proved and widely criticized equity financing preference and low efficiency in utilization of raised funds among Chinese listed companies (Huang and Zhang, 2001; Zhu, 2002).

The contributions of this paper are as follows: First, we empirically test the influence of managerial overconfidence on companies’ investment behaviors, and verify the applicability of the emerging behavior finance theory in China’s capital market. Our results show that managerial overconfidence affects companies’ investment behaviors and leads to abnormal investment behaviors. Therefore, this paper extends and enriches the behavior finance theory. Second, our results show that managerial overconfidence deteriorates the abuse of raised funds in

¹ A possible explanation could be that the independent variable Hao et al. (2005) used in their article was “cash flow generated by production and operating activities”, while we use the variable of “free cash flow generated by production and operating activities” in this paper.

listed companies. Chinese listed companies prefer equity financing to other financing means and their low efficiency in utilization of raised funds has long been criticized by Chinese scholars. Zhu (2002) pointed out that there investment failure prevails among Chinese listed companies. This paper provides a theoretical basis and empirical support for competent government bodies in their efforts to strengthen supervision on listed companies and improve resource allocation efficiency.

The rest of this paper is arranged as follows: Section 2 brings out two hypotheses of the influence of managerial overconfidence on company investment behaviors, Section 3 introduces research method and sets up the regression model, Section 4 presents the empirical results and Section 5 conducts a robust test. Conclusion, implications and limitations are provided in Section 6.

2 Hypotheses

Investment plays a critical role in ensuring companies' sustainable development in market competition and creating new value for shareholders. However, investment also entails a lot of business risks. Whether an investment behavior is rational or not depends on the net present value (NPV) it creates. However, overconfident managers tend to overestimate potential investment returns or underestimate investment risks. Thus, some investment projects with negative NPVs got approved

Suppose there are three period of succession, namely $t=0$, $t=1$ and $t=2$. Investors invest k at $t=0$ and the investment generates cash flow at $t=1$ and $t=2$. The amount of cash flow generated at $t=1$ is fixed (y_1), while the amount of cash flow generated at $t=2$ is uncertain. It could be either positive (Gy_2) or negative (By_2) ($Gy_2 > By_2$). The possibilities for Gy_2 and By_2 to happen are TpG and TpB , respectively ($TpG + TpB = 1$). Suppose at $t=0$, all players in the market are aware of y_1 , Gy_2 , By_2 , TpG and TpB . However, overconfident managers tend to overestimate TpG and underestimate TpB , resulting in $MpG > TpG$ and $MpB < TpB$, in which MpG stands for overconfident managers' estimated possibility of Gy_2 , and MpB stands for overconfident managers' estimated possibility of By_2 . As $MpG * Gy_2 + MpB * By_2 > TpG * Gy_2 + TpB * By_2$, overconfident managers always have more optimistic expectations of the cash flow at $t=2$ than that of market expectation. As shown in Fig. 1a, assuming a constant discount rate, overconfident managers overestimate future returns, thus give permission to investment projects with negative NPVs.

Similarly, suppose the investors' expected rate of return for Gy_2 and By_2 at $t=2$ are rL and rH ($rH > rL$), respectively. The real possibilities for Gy_2 and By_2 at $t=2$ are TpL and TpH ($TpL + TpH = 1$), accordingly. Suppose at $t=0$, all players

in the market are aware of r_L , r_H , Tp_L and Tp_H . However, overconfident managers tend to overestimate r_L and underestimate r_H . Suppose their subjective possibilities for r_L and r_H to happen are Mp_L and Mp_H ($Mp_L > Tp_L$), respectively, as $Mp_L * r_L + Mp_H * r_H > Tp_L * r_L + Tp_H * r_H$, overconfident managers' personal expectation of risk adjusted discount rate (r_M) will be smaller than the discount rate expected by market (r_T). As a result of this underestimation of potential risks, investment projects with potential negative NPVs might get approved without being noticed. In other words, overconfident managers' overestimation of potential returns or underestimation of potential risks is likely to lead to over-investment. As shown in Fig. 1, a and b represent over-investment brought out by overconfident managers' overestimation of returns and underestimation of risks, respectively. The shadowed area in the figure shows losses caused by over-investment.

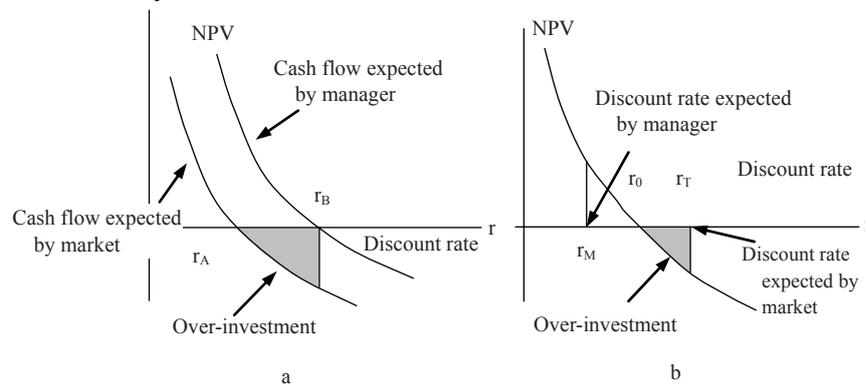


Fig. 1 Overinvestment

Based on the above rationale, we propose the following hypothesis:

H1 The degree of managerial overconfidence is positively related to the level of over-investment in a company.

Theoretically, in a developed capital market, a company's investment level has nothing to do with its internal cash flow. The company can raise fund from external capital market if it needs to invest. Any amount of FCF that exceeds the needing of the investment project shall be distributed among shareholders. However, in reality, capital market friction restricts a manager's fund-raising capability in external capital market, leading to a positive relationship between a company's investment behaviors and internal cash flow. Therefore, when a company's decision-making power is in the hand of an overconfident manager, he/she is usually reluctant to finance externally out of consideration that the market

underestimates the value of the company's shares. Under such circumstances, a company's investment behavior has higher sensitivity to internal cash flow. As above, Heaton (2002) and Malmendier and Tate's (2003) studies supported this assumption from theoretical and empirical approaches, respectively.

However, in China's unique institutional context, the principal-agent problem is not embodied as conflicts between principals and agents in Western countries with highly dispersed shareholding, but as big shareholders' encroaching upon the interests of small and medium shareholders. In Chinese listed companies, almost all top managers, including presidents, managers, general managers, are appointed by controlling shareholders. And as the cost of equity financing is much lower than that of debt financing in China's capital market, Chinese listed companies all suffer from a so-called "financing hungry".² For example, Huang and Zhang (2001) found that none of the listed companies gave up their equity financing opportunities. They called this abnormal phenomenon with distinctive Chinese characteristics as Chinese listed companies' "equity financing preference", which brings forth a series of negative influences on utilization efficiency of raised capital, company growth, corporate governance, investor interests, and economic health, etc. In China's capital market, overconfident managers would not give up equity financing opportunities out of underestimating of the real value of company shares. Therefore, their investment behaviors do not solely rely on FCF, resulting in uncertain sensitivity of investment to cash flow. Low equity financing cost in China's capital market is more likely to stimulate overconfident managers to over-invest. Therefore, we argue that sensitivities of investment to cash flow in China are more likely to come from cash flow generated by external financing activities, rather than that of generated by production and operating activities.

We therefore develop the second hypothesis as follows:

H2 The sensitivity of the investment to cash flow generated by financing activities is higher for firms with overconfident managers than others. However, the sensitivity of the over-investment to free cash flow is uncertain.

3 Sample and regression model

Sample used in this study consist of all non-financial A-shares companies (went to public before 2001) from 2002 to 2004. After eliminating ST companies and companies with incomplete data, a sample of 895 companies are obtained (Type I

² Although such an explanation was doubted by Lu and Ye (2004), researchers generally agree that China's listed companies have strong preference for equity financing.

sample). All data are from the *China Stock Market Financial Statements Database* (2005) co-developed by the Hong Kong Polytechnic University and Shenzhen Guotaian and the *Genius Security information system* developed by Guotaian.

To explore the relationship between managerial overconfidence and company investment behaviors, we establish the following regression model:

$$\begin{aligned} \text{Over-investment}_i = & \beta_0 + \beta_1 \text{Confidence}_i + \beta_2 X_i' + \beta_3 \text{Confidence}_i * X_i' + \beta_4 \text{Grow}_i \\ & + \beta_5 \text{Control}_i + \beta_6 \text{Governance}_i + \beta_7 \text{Ownership}_i + \beta_8 \text{Size}_i \\ & + \beta_{10} \text{Lev}_j + \beta_{11} \text{Year}_j + \varepsilon \end{aligned}$$

In which *Confidence* is the proxy for managerial overconfidence. As noted, the biggest challenge for analyzing managerial confidence is to develop a reliable scale to measure managerial overconfidence. Due to the data availability and special conditions of China's security market, we choose the "difference between manager's predicted company profit and real profit" to measure the variable managerial overconfidence. If a manager's predicted profit level is higher than that of real profit level (at least for one time), we regard the manager as an overconfident manager. Such a presumption has been supported by a lot of relevant studies. For example, based on listed companies' data in the U.S. market, Hribar and Yang (2006) found that overconfident managers are more likely to predict higher profit level. Lin et al. (2005) used Taiwan companies' data and got similar conclusions. Among domestic scholars, Yu et al. (2006) also adopted similar approach in their study.³

Sample companies' predicted performances are collected. If a company's predicted profit level is lower than that of real one during the observation period once (and at least once), its manager is regarded as overconfident. Specifically, there are three different situations in which predicted profit level is lower than that of real one: (1) predicted for profit, but actually suffer loss; (2) predicted for positive profit growth rate, but the actual profit growth is negative; (3) predicted for higher profit growth rate, but the actual growth rate is lower. Meanwhile, to ensure the robustness of our results, we eliminated some unqualified samples. Table 1 demonstrates the distribution of all sample companies.

³ Yu et al. (2006) divided optimistic performance prediction into 4 sub-types, namely slight growth, turning losses into gains, making profit continuously, and predicted growth. They also divided pessimistic performance prediction into 4 sub-types, namely slight decline, loss for the first time, continuous loss and predicted loss. Yu et al's study focused on the 4 optimistic performance predictions. They regarded a company's managers as overconfident if these optimistic performance predictions were proved not consistent with actual performance. Yu et al also used the Business Climate Index from the official website of the State Statistics Bureau to represent the degree of managerial overconfident. However, we can only climate index by industries at from the official website of the State Statistics Bureau. Therefore, we do not use the climate index as a substitute variable of managerial overconfidence in this paper.

Table 1 Distribution of all sample companies

	2002	2003	2004	Total
The whole sample (Sample type I)	895	895	895	2 685
Companies with profit-making prediction (Sample type II)	423	495	475	1 393
Companies with at least once predicted profit level is higher than that of actual profit level	28	27	16	71
Minus: Companies refinanced within one year after issuing profit-making prediction	3	0	2	5
Companies changed both presidents and general managers in the observation period	2	0	1	3
Samples of managerial overconfidence (Sample type III)	23	27	13	63

Over-investment is the dependent variable, representing over-investment. Following Richardson (2006), overinvestment is represented by the residuals of the expectations model of investment. Meanwhile, to reduce the influence of company size, we deflate the sample companies' total assets at the end of the year.⁴

X_i represents a company's cash flow. FCF and NCF stand for "free cash flow" generated by operating activities and "net cash flow from financing activities" respectively. FCF equals (cash flow generated by production and operating activities) – (ideal level of investment + depreciation and amortization + predicted expenditure of a new investment project with positive NPC value). NCF equals the amount of net cash inflow generated by financing activities at the end of a year. The same as *Over-investment*, we also deflate the cash flow by total assets at the end of the year.

$Confidence_i * X_i$ is an interaction variable of managerial overconfidence and cash flow. It is used to test H2, namely to test the sensitivity of over-investment conducted by overconfident Managers to cash flow.

Other variables in the regression model are chosen based on Malmendier and Tate's (2005). Specifically, *Grow* stands for a company's development opportunities. Considering the distinctive characteristics of China's capital market, we chose the growth rate of a company's Prime operating revenue to represent *Grow*. In the model, *Grow* is used to control the influence of potential investment opportunities on investment decisions. The dummy variable *Control* stands for the real controller of a company, 1 for non-state-owned, 0 otherwise. *Governance* is the number of directors on the board. The variable is used to control the influence of corporate governance on investment decisions. *Ownership* is the ratio of shares held by the president to the total number of shares in a company. To avoid a too small regression coefficient caused by tiny ratios, we multiple all the ratios with 1 000. Such a treatment will not influence

⁴ No detailed calculation is provided here due to space limitation.

the statistical significance of regression coefficients. *Size* is the natural logarithm of a company's total assets at the beginning of a year. *Industry* is a dummy variable for industry. Classification of different industries is based on the *Industry Classification Standard of Chinese Listed Companies* issued by the China's Securities Regulatory Commission in 2001. *Industry* equals 1 for manufacturing industry, 0 otherwise. *Lev* is assets liabilities ratio. *Year* is a dummy variable for year. In the section of robustness testing, we will redefine the above variables.

Table 2 reports the descriptive statistics for all variables. As shown, the mean and median of the over-investment in Sample Type III is higher than that in Type I and II. The mean of over-investment in Sample Type III is 0.012, while the same means for Sample Type I and II are less than 0.001 and 0.001 respectively. This shows that overconfident managers conduct higher level of over-investment. In addition, the mean of *NCFE* for Sample Type III is also higher than that in Type I and II, while the same phenomenon does not occur to *FCF*. Therefore, we can draw a preliminary conclusion that, as presumed in H2, the over-investment level of overconfident manager may be affected by cash flow generated by financing activities. Of course, such an assumed relationship still needs to be verified empirically.

Table 2 Descriptive statistics for all variables

Panel A Sample Type I—The whole sample					
Variable	Mean	Median	Max value	Min value	S.D.
<i>Over-investment</i>	0.000	-0.015	0.690	-0.321	0.082
<i>Confidence</i>	0.071	0	1	0	0.256
<i>NCFE</i>	0.005	0.000	0.221	-0.192	0.026
<i>FCF</i>	-0.046	-0.040	0.741	-0.831	0.101
<i>Grow</i>	0.388	0.142	86.381	-0.970	3.441
<i>Control</i>	0.243	0	1	0	0.429
<i>Governance</i>	9.937	9	19	5	2.314
<i>Ownership</i>	0.064	0.000	4.902	0.000	0.259
<i>Lev</i>	0.523	0.512	0.990	0.009	0.274
<i>Size</i>	21.167	21.140	24.331	17.890	0.873
Observed values			2 685		
Panel B Sample Type II—Sample companies issued profit-making predictions					
Variable	Mean	Median	Max value	Min value	S.D.
<i>Over-investment</i>	0.001	-0.015	0.463	-0.321	0.084
<i>Confidence</i>	0.045	0	1	0	0.208

(To be continued)

(Continued)

Variable	Mean	Median	Max value	Min value	S.D.
<i>NCFE</i>	0.006	0.000	0.221	-0.190	0.027
<i>FCF</i>	-0.049	-0.043	0.741	-0.832	0.109
<i>Grow</i>	0.377	0.142	86.380	-0.970	3.047
<i>Control</i>	0.253	0	1	0	0.435
<i>Governance</i>	9.888	9	19	5	2.268
<i>Ownership</i>	0.035	0	4.902	0	0.18
<i>Lev</i>	0.502	0.501	0.990	0.009	0.224
<i>Size</i>	21.139	21.094	24.330	17.890	0.888
Observed values			1 393		
Panel C Sample Type III—Samples of managerial overconfidence					
Variable	Mean	Median	Max value	Min value	S.D.
<i>Over-investment</i>	0.012	-0.006	0.361	-0.203	0.081
<i>Confidence</i>	1	1	1	1	0.000
<i>NCFE</i>	0.007	0.002	0.220	-0.050	0.031
<i>FCF</i>	-0.057	-0.043	0.190	-0.690	0.104
<i>Grow</i>	0.743	0.181	77.810	-0.932	5.977
<i>Control</i>	0.191	0	1	0	0.394
<i>Governance</i>	10.282	10	15	6	2.082
<i>Ownership</i>	0.059	0.012	1.150	0	0.147
<i>Lev</i>	0.512	0.512	0.974	0.081	0.183
<i>Size</i>	21.215	21.293	24.170	18.960	0.953
Observed values			189		

4 Results

Before conducting the regression analysis, we firstly test possible multilinear problems. The method of variance inflation factors is adopted to detect potential multi-linearity. Results show that all variance inflation factors are smaller than 10, indicating that there is no multi-linearity among all independent variables.

Then, we run regression analysis on the model. The regression results of sample type I (all 895 sample companies) are presented in Table 3. The variable *NCFE* is firstly tested by introducing in variables step by step to ensure the robustness of regression results. As shown, with the loading of more variables, the coefficients of overconfidence remain positive in Model 1–Model 4, showing that there is a significantly positive relationship between overconfidence and

over-investment. The H1 is supported. In addition, the regression coefficient of *Confidence*NCF* (i.e. the interaction variable of managerial overconfidence and *NCF*) is significantly positive at 1% level of confidence, showing a higher sensitivity of over-investment to cash flow generated by financing activities for firms with overconfident managers. Such a finding is consistent with our prior assumption that when a company obtains more cash flow out of financing activities, overconfident managers are more inclined to over-invest. Then, we replace the *NCF* with *FCF* and repeat the above regression. And results show that the regression coefficient of overconfidence is positive and significant at 5% level of confidence in Model 6 and 8, and at 10% in Model 7. Such a finding also supports H1. Meanwhile, no significant regression coefficients of *Confidence*FCF* (i.e. the interaction variable of managerial overconfidence and cash flow generated by production and operating activities) are found, showing a low sensitivity of over-investment to *FCF* for firms with overconfident managers. Therefore, H2 is supported.

In addition, the regression results also demonstrate that the coefficients for both *NCF* and *FCF* remain significantly positive at 1% level, showing that over-investment behaviors of Chinese listed companies is greatly influenced by their cash flow. The more cash flow a company has, the higher its over-investment level.

Table 3 Regression analysis results (Sample type I—The whole sample)

Variable	Cash flow variable = <i>NCF</i>				Cash flow variable = <i>FCF</i>			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>NCF</i>	0.359*** (19.25)	0.358*** (19.21)	0.373*** (19.07)	0.379*** (19.13)				
<i>Confidence</i>		0.034* (1.84)	0.045** (2.35)	0.041** (2.16)		0.047** (2.35)	0.029* (1.76)	0.021** (1.91)
<i>Conf*NCF</i>			0.051*** (2.56)	0.057*** (2.82)				
<i>FCF</i>					0.112*** (5.63)	0.113*** (5.70)	0.123*** (5.95)	0.123*** (5.94)
<i>Conf*FCF</i>							-0.040 (-1.41)	-0.043 (-1.43)
<i>Grow</i>				0.004 (0.19)				0.001 (0.01)
<i>Owp</i>				0.012* (1.65)				0.023* (1.73)
<i>Control</i>				-0.014 (-0.71)				-0.020 (-0.96)

(To be continued)

(Continued)

Variable	Cash flow variable = <i>NCF</i>				Cash flow variable = <i>FCF</i>			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>Governance</i>				0.006 (0.31)				0.002 (0.08)
<i>Lev</i>				0.002 (0.12)				0.007 (0.32)
<i>Size</i>				-0.013* (-1.68)				-0.010 (-0.48)
<i>Year</i>				Controlled				Controlled
<i>Ind</i>				Controlled				Controlled
Observed values	2 685	2 685	2 685	2 685	2 685	2 685	2 685	2 685
<i>F</i>	370.7	187.3	127.3	34.979	31.75	18.68	13.45	3.814
Adj- <i>R</i> ²	0.128	0.129	0.13	0.13	0.012	0.014	0.015	0.012

Note: *** indicates significant at 1% level; ** indicates significant at 5% level; * indicates significant at 10% level. T values (two tailed) are in parentheses. The same in tables below.

As shown in Table 4, we use Sample Type II and repeat the regression analysis on Model 1–Model 8. As noted, Type II samples are those companies who issued profit-making predictions in the observation period. Table 4 shows that, although not as high as that of in Table 3, the regression coefficients of both *Confidence* and *Confidence*NCF* are significant. In addition, the coefficients of *Confidence*FCF* remain insignificant, supporting the above hypotheses.

Table 4 Regression analysis results (Sample type II—Companies issued profit-making predictions)

Variable	Cash flow variable = <i>NCF</i>				Cash flow variable = <i>FCF</i>			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>NCF</i>	0.357*** (13.87)	0.357*** (13.85)	0.371*** (13.89)	0.371*** (13.73)				
<i>Confidence</i>		0.022* (1.83)	0.034* (1.78)	0.032* (1.77)		0.031* (1.74)	0.014* (1.66)	0.005* (1.71)
<i>Conf*NCF</i>			0.054** (1.95)	0.058** (2.08)				
<i>FCF</i>					0.137*** (5.03)	0.138*** (5.05)	0.145*** (5.19)	0.144*** (5.10)
<i>Conf*FCF</i>							-0.038 (-1.20)	-0.043 (-1.35)
<i>Grow</i>				0.03 (1.15)				0.029 (1.06)

(To be continued)

(Continued)

Variable	Cash flow variable = <i>NCF</i>				Cash flow variable = <i>FCF</i>			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>Owp</i>				0.024** (1.92)				0.037* (1.63)
<i>Control</i>				0.004 (0.16)				0.001 (0.01)
<i>Governance</i>				-0.003 (-0.09)				-0.015 (-0.52)
<i>Lev</i>				0.037* (1.78)				0.043 (1.39)
<i>Size</i>				0.002 (0.06)				0.013 (0.45)
<i>Year</i>				Controlled				Controlled
<i>Ind</i>				Controlled				Controlled
Observed values	1 393	1 393	1 393	1 393	1 393	1 393	1 393	1 393
<i>F</i>	192.6	96.61	65.81	18.32	25.33	13.33	9.368	3.186
Adj- <i>R</i> ²	0.127	0.127	0.129	0.127	0.018	0.018	0.019	0.018

5 Robustness check

To verify the robustness of the above conclusions, we introduce another proxy for managerial overconfidence. Following Malmendier and Tate (2005), we use “whether top managers increase their holdings of company share within the observation period” as a substitute variable for managerial overconfidence. Setting 2002 as a benchmark year, we choose companies in which their presidents hold company shares and these presidents remain unchanged as sample companies. If a president increased his holding of company shares in 2003–2004, we regard him as an overconfident manager.⁵ Based on this criterion, a total of 92 companies are regarded as overconfident. Hao et al. (2005) also

⁵ Contrary to Malmendier and Tate’s study, the principal-agent problem in China is not embodied as big shareholders’ usurpation upon the interests of small and medium shareholders rather than conflicts between managers and shareholders. In China’s listed companies, almost all members of the board of directors and top managers are exclusively appointed by controlling shareholders. Presidents always enjoy supreme decision-making power. Some presidents even hold the post of general manager at the same time. In addition, some presidents of private-owned listed companies in China hold their companies’ shares indirectly through another companies. Data of these presidents are hardly available in relevant database. We hence replace president with general manager and collect data of change in the percentage of shares held by general managers in sample companies.

adopted this approach in their study, whose conclusion confirmed the applicability of the substitute variable in China's capital market. With other variables remain unchanged, we use the new substitute variable to replace the overconfidence variable in Table 3 and 4 and run regression analysis again. The regression results are consistent with the previous conclusions. We do not present the new regression results in details due to space limit.

Other variables are also replaced to further test the robustness of the above conclusions. Specifically, we use two new variables, *Tobin's Q* and "the number of external and independent directors", to replace the *Grow* and the "total number of all directors", respectively. *Tobin's Q* = The arithmetic average of (the market value of all circulation shares both at the beginning and ending of the observation period) + (the book value of all non-circulation shares and debts)/(the arithmetic average of the book value of a company's total assets both at the beginning and ending of the observation period). In addition, we set up 10 more industrial dummy variables in accordance with the *Industry Classification Standard of Chinese Listed Companies*. After all these replacement, we find no significant changes in the above regression results, proving the robustness of our conclusions.

6 Conclusions

This paper uses non-financial A-shares companies (went to public before 2001) from 2002–2004 as samples and explores the relationship between managerial overconfidence and overinvestment behaviors. We regard a company's top managers as overconfident if their predicted profit level is higher than that of actual profit level for at least once during 2002–2004. We define over-investment as a greater than sustainable amount of spending on projects not for maintaining the original state of a company's assets and other than new positive NPV investments. Meanwhile, we investigate the effects of managerial overconfidence on a company's over-investment and the sensitivity of over-investment to cash flow for overconfident managers. After controlling the possible influential factors of company decision-making behaviors such as enterprise development opportunities, etc., it is found that there is a positive relationship between managerial confidence and the level of over-investment. This finding remains unchanged even after we use other substitute variables of managerial overconfidence to repeat the above testing, showing that the above conclusion is robust. Our result supports Heaton's (2002) theoretical model and provides new evidence for study on managerial overconfidence and company's over-investment behaviors.

However, different from studies of Heaton (2002), Malmendier and Tate (2003,

2005) and other domestic scholars, we find that over-investments conducted by overconfident managers are sensitive to *NCFE* rather than *FCF*. We believe this phenomenon is an inevitable result of China's unique institutional context. Chinese listed companies have long been beset by the problem of low efficiency in the use of raised funds from capital market. As a result, China's regulatory authorities have already paid close attention to the problem. Our results show that managerial overconfidence leads to company's over-investment. When listed companies successfully raise large sum of funds from the capital market, overconfident managers are more likely to over-invest by overestimating potential returns or underestimating potential risks of new projects. Therefore, some projects with negative NPV are approved with being noticed. In this sense, listed companies shall establish rigorous and effective mechanisms for investment management to prevent possible damage to the interests of shareholders and other stakeholders as a result of overconfident managers' over-investment. This is especially important for state-owned and state-controlled companies in which the principal-agent chain is usually too long to make the detection of over-investment behaviors quite difficult.

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