Managerial Overconfidence, Industry Supporting Policy and Merger and Acquisition Performance: An Empirical Study Based on Stata Multiple Linear Regression Model

Qun Hong[1,a], Shuzhen Wang[1,b], Jing Peng[1,c], and Yilin Hong[2,d]

373961394@qq.com[a], wangshuzhen7106@163.com[b], pjsinger@163.com[c], yilin_hong@smail.swufe.edu.cn[d]

Xiamen University of Technology, Xiamen, China[1]
Southwestern University of Finance and Economics, Chengdu, China[2]

Abstract. Considering the interaction between managers' irrational characteristics and the external economic environment, this paper selects A-share listed companies with M&A performance from 2014 to 2020 as the research object, and establishes multivariate linear regression model to empirically study the impact of managerial overconfidence and industry supporting policy on M&A performance by using Stata software. The results show that managerial overconfidence has a significant negative impact on M&A performance, and the industry supporting policy strengthens the negative influence of managerial overconfidence on M&A performance. The research results have implications for enterprise to make objective investment decisions.

Keywords: Multiple Linear Regression Model · Stata software · Managerial Overconfidence · M&A Performance · Industry Supporting Policy

1 Introduction

Present literature shows that M&A performance is mainly influenced by the characteristics of the enterprise such as internal control, the characteristics of M&A such as payment method and M&A strategy, and the characteristics of the relationship between the M&A buyers and sellers such as director connection, space distance and industry connection. Specially, the increasingly development of behavioral finance theory makes scholars to consider the influence of decision-makers' irrational characteristics and their interactions with economic conditions and business environments. Roll (1986) [1] first put forward the 'Hubris Hypothesis', and believed that managers were overconfident, which was psychologically irrational. Due to overconfidence, managers might overestimate the benefits brought by the M&A behavior and the synergy effect accompanying with M&A, so as to promote the M&A decision at a price higher than the market price. In fact, the M&A activities could not provide good performance for enterprises due to the purchase of target companies. Since then, plenty of empirical studies had been done to confirm the above conclusions.

Most scholars believed that managerial overconfidence would have a negative impact on corporate M&A performance. Malmendier and Tate (2005) [2] found that overconfident managers

had higher M&A frequency than ordinary managers, since they tended to overestimate themselves and the ability of M&A projects to generate returns, which resulted in a price higher than the market value for the target company. Brown and Sarma (2007) [3] also reached a similar conclusion through empirical research, that was, they affirmed the role of managers' overconfidence and dominance in the company's acquisition decision. Croci and Petmezas (2010) [4] believed that a company would be better off without overconfident managers, and managers' overconfidence is negatively related to the company's M&A performance. Liu and Guo (2019) [5] pointed out that the M&A implemented by overconfident executives would lead to a decline of the acquirer's performance, the more modest and prudent managers, the less inefficient M&A. He and Gan (2019) [6] believed that overconfident managers would make excessive expectations on the M&A performance, and made inefficient decisions that led to low efficiency of enterprise M&A. Wang and Yang (2021) [7] also found the relationship between managerial overconfidence and irrational M&A decisions, and pointed out that the board size and the separation of chairman and CEO could effectively mitigate the negative impact of managerial overconfidence on M&A performance. Others believed that there was a nonlinear relationship between managerial overconfidence and M&A performance. For example, Zhao (2010) [8] found that after overconfident managers implemented M&A, the performance of enterprises would change from 'up peak down', that was, an inverted 'U' shape.

Recently, more and more scholars have begun to focus on the relationship between the external governance environment and M&A performance. Hoberg and Phillips (2010) [9] found that firms merge and buy assets to exploit synergies to create new products that increase product differentiation. Chen and Ma (2017) [10] conducted a quasi natural experiment on the policy of short selling deregulation in China's stock market, and found that short selling deregulation can improve short-term and long-term M&A performance. Cai and Tian (2019) [11] analyzed the 'policy arbitrage' behavior in M&A activities and found that the merging enterprises were more likely to initiate cross industry M&A with the target enterprises supported by industrial policies. Based on the behavioral finance theory, Xu and Hu (2019) [12] started to investigate the impact of macro-monetary policy and managers' overconfidence on M&A performance from the perspective of the interaction between managers' irrational characteristics and the external economic environment.

In all, existing researches confirm that the irrational characteristics of managers' overconfidence have a significant correlation with M&A performance, more and more attention should be paid to the interaction between the internal managers' characteristics and the changes in the external economic environment. In recent years, since China's government gives strong support to the industry of environmental protection and culture, the market has witnessed a 'wave of environmental protection M&A' and 'hot cultural M&A', and the industrial policies play an important and positive role in guiding market M&A activities. Consequently, focusing on Chinese listed firms with M&A performance on Shanghai or Shenzhen stock exchange from 2014 to 2020, this paper aims to study the impact of managerial overconfidence and industry supporting policy on M&A performance from a new perspective of the interaction between decision-makers' individual characteristics and macroeconomic policies by establishing multivariate linear regression models and using the Stata software.

2 Research Hypothesis

2.1 Managerial overconfidence and M&A performance.

In behavioral finance, enterprise managers are considered as incompletely rational person and will be affected by their own psychological characteristics when making investment decisions. On the one hand, superior personal conditions, more rights and higher status in the enterprise make managers more likely to have overconfidence than ordinary people. The overconfident managers often overestimate their knowledge, experiences and skills, and fail to comprehensively measure all influencing factors according to the actual situation. As a result, they will underestimate the risk losses brought by M&A activities, and even promote the implementation of M&A activities with negative net present value, and then bring about unexpected reduction of M&A performance. On the other hand, managers will be too optimistic about the synergy effect between the merging company and the target company due to their overconfidence. They often fail to accurately evaluate the market value of the target company and overestimate the probability of successful M&A transactions, which leads to excessive market premium in the final M&A, increases the risks faced by the merging company after M&A, and even damages the performance of the acquiring company. Therefore, managers who are overconfident tend to make decisions that are not objective, and implement inappropriate M&A activities that are not conducive to the promotion of enterprise value. Based on the above analysis, the first research hypothesis is proposed:

Hypothesis 1: the M&A performance is negatively associated with managerial overconfidence.

2.2 The influence of industry supporting policy on the relationship between managerial overconfidence and M&A performance.

Based on the current economic development and industrial structure, the industrial policy aims to guide the direction of industrial development, and adjust the industrial structure and industrial organization form to satisfy them with the inherent requirements of national economic development. The introduction of industrial policy often causes concern and hot discussion in society, such as positive media reports and positive public opinion. Enterprises with industry supporting policy can often enjoy government subsidies, financial discount, preferential taxation, more access to finance, lower financing costs and other benefits, and will also receive preferential treatment in project approval, market access and other aspects. When the enterprise is supported by industrial policy, there will be positive signals with good development prospects in a company, and overconfident managers tend to over invest and have a greater probability to engage in M&A activities. At the same time, they will adopt more aggressive M&A payment methods because of their optimistic estimation of their own capabilities and biased expectations of synergies. The tendency to overpay the target enterprises may result in a decline in long-term M&A performance. Based on these discussions, the second research hypothesis is proposed as follows:

Hypothesis 2: the relationship between managerial overconfidence and M&A performance is stronger for companies supported by industry policy.

3 Research Design

3.1 Data and sample selection

The data on M&A performance, managerial overconfidence and other controlling variables are obtained from the database of CSAMAR, which is widely used in the research on Chinese listed firms. In order to collect industry supporting policy data, we conduct mainly by hand from the outline document of China's 13th Five-Year Plan.

The initial sample of this study includes all Chinese listed firms of A-shares with M&A performance on Shanghai or Shenzhen stock exchange from 2014 to 2020. There are two reasons for the target year. First, this study attempts to examine the influence of industry supporting policy in China's 13th Five-Year Plan (2016-2020). Second, when measuring the M&A performance, this paper analyzes the performance of the two years before and after the M&A activities, which happen from 2016 to 2018.

Following is the sample selection process. First, firms with finance and insurance industries are excluded, as they have different firm attributes in operation, business mode and financial structure. Second, companies delisted during the observed period are removed. Third, for the data integrity and importance, M&A with a total amount of less than 1 million yuan or failed transactions are also excluded. Fourth, if a listed company conducts multiple M&As in a year, only the biggest transactions will be studied Finally, observations with unavailable or missing data are deleted.

3.2 Research model and measurement of variables

In order to test the research hypothesis, tow multivariate linear regression models are established. Model (1), shown below, is designed to test the effect of managerial overconfidence on M&A performance after controlling other variables including firms' attributes, year effects and industry effects. If managerial overconfidence has a negative impact on M&A performance, the coefficient α_1 of OC will be significantly negative.

$$\Delta ROE = \alpha_0 + \alpha_1 OC + \alpha_2 Contrls + Year + Industry + \varepsilon \tag{1}$$

Model (2), shown below, is designed to test the role of industry supporting policy. If the negative relation between managerial overconfidence and M&A performance is strengthened for enterprises supported by industrial policy, the coefficient β_3 of $OC \times IP$ will be significantly negative.

$$\Delta ROE = \beta_0 + \beta_1 OC + \beta_2 IP + \beta_3 OC \times IP + \beta_4 Contrls + Year + Industry + \varepsilon \tag{2}$$

The variables used in this empirical study are shown in Table 1.

Table 1. Variable definition table

Variable	Variable symbol	Variable description
Dependent variables	$\Delta ROE_{t-1,\ t+1}$	ROE_{t+1} - ROE_{t-1}, change of returns on equity in one year before and after M&A
	$\Delta ROE_{t-2,\ t+2}$	$[ROE_{t+2} + ROE_{t+1}]/2$ - $[ROE_{t-1} + ROE_{t-2}]/2$, change of returns on equity in two years before and after M&A
Independent variable	OC	The value is 1 when the ratio of total compensation of top three executives to total compensation of all executives is greater than its median; otherwise, the value is 0.
Moderating variable	IP	The value is 1 when the sample enterprise is supported by industrial policy; otherwise, the value is 0.
Control variables	Size	The natural logarithm of the company's total assets
	Grow	The growth rate of operating income
	Lev	The ratio of total liabilities to total assets
	Nature	The value is 1 when the sample enterprise is state-owned; otherwise, the value is 0.
	Top	The shareholding ratio of the biggest shareholder
	Year	Year dummies
	Industry	Industry dummies

4 Empirical Results

4.1 Descriptive statistics

Table 2 summarizes the key variables of descriptive statistics by using Stata software. The total number of samples is 673. It can be seen from the table that the mean value of M&A performance (ΔROE) is negative, showing that the performance of most sample companies after M&A activities has declined. The mean value of OC is 0.499, revealing that managerial overconfidence is common among listed companies with M&A in China.

Table 2. Descriptive statistics results of the main variables

Variable	N	Mean	Sd	Min	Max
$\Delta ROE_{t-1,\ t+1}$	673	-0.0528	0.317	-4.437	0.618
$\Delta ROE_{t-2,\ t+2}$	673	-0.0796	0.447	-9.956	0.852
OC	673	0.499	0.500	0	1
IP	673	0.547	0.498	0	1
Size	673	21.87	1.064	19.29	27.46
Grow	673	0.415	3.415	-0.873	87.48
Lev	673	0.369	0.182	0.0174	0.916
Nature	673	0.162	0.369	0	1
Top	673	32.20	13.73	5.280	80.02

4.2 Multivariate analysis

Table 3 provides the empirical results of two multiple linear regression models by using the Stata software. Column (1) and column (2) list the regression results of managerial overconfidence and M&A performance after adding the control variables. The correlation coefficient of OC and $\Delta ROE_{t-1,\ t+1}$ is negative but not significant, while the correlation coefficient of OC and $\Delta ROE_{t-2,\ t+2}$ is negative and significant at the 5% level. It can be seen from the above two columns that the negative impact of managerial overconfidence on M&A performance is long-term rather than short-term, and the Hypothesis 1 is supported.

Table 3. Regression results of managerial overconfidence and M&A performance

Variable	$\Delta ROE_{t-1,\ t+1}$			$\Delta ROE_{t-2,\ t+2}$		
	(1)	(2)	(3)	(4)	(5)	(6)
OC	-0.037	-0.074**	-0.002	-0.089**	-0.077**	-0.091**
	(-1.51)	(-2.13)	(-0.06)	(-2.16)	(-2.23)	(-2.21)
IP					-0.043	-0.039
					(-1.23)	(-0.96)
OC*IP					-0.028	-0.035*
					(-1.64)	(-1.72)
Size	-0.008	-0.019	-0.007	-0.025	-0.020	-0.024
	(-0.56)	(-0.96)	(-0.59)	(-0.93)	(-0.98)	(-0.91)
Grow	0.002	0.002	0.014	0.002	0.002	0.002
	(0.43)	(0.33)	(0.70)	(0.30)	(0.37)	(0.35)
Lev	-0.057	0.016	0.002	0.016	0.009	0.018
	(-0.71)	(0.14)	(0.03)	(0.11)	(0.08)	(0.13)
Nature	0.037	0.074			0.076	
	(1.02)	(1.44)			(1.47)	
Top	0.002*	0.003**	0.001	0.003*	0.003**	0.003*
	(1.78)	(2.12)	(1.60)	(1.92)	(2.08)	(1.90)
Year	Control	Control	Control	Control	Control	control
Industry	Control	Control	Control	Control	Control	Control
Constant	0.156	0.301	0.104	0.416	0.340	0.423
	(0.52)	(0.71)	(0.44)	(0.74)	(0.81)	(0.76)
N	673	673	109	564	673	564
R^2	0.030	0.019	0.049	0.018	0.026	0.024
R^2_a	0.0182	0.0075	-0.0171	0.0052	0.0109	0.0086

Note: t-values in parentheses, ***, **, and * indicate that the correlation coefficient is significant at 1%, 5%, and 10%.

Since Chinese listed companies have a relatively large proportion of state-owned shares within a highly concentrated ownership structure, the difference in the proportion of state-owned shares will affect managers' discretion in corporate operation decision, and thus have an impact on the relationship between managerial overconfidence on M&A performance. Therefore, column (3) and column (4) provide the regression results in the samples of state-owned enterprises (SOE) and non-state-owned enterprises (non-SOE) respectively, and the significantly negative relationship between managerial overconfidence and M&A performance only exist in the non-state-

owned enterprises sample. This may be due to the fact that managers of SOEs face the intervention and restriction of policy burden when making M&A decisions, thus reducing the negative impact of managerial overconfidence on M&A performance.

As it has been confirmed that managerial overconfidence does not have a significant impact on the M&A performance of SOEs, the moderating effect of industry supporting policy only considers the full sample and the sample of non-SOEs. Column (5) and column (6) present the multiple regression analysis of the role of industry supporting policy in full sample and non-SOEs sample, respectively. The coefficients of OC are negative and significant at the 0.05 level, providing additionally strong and robust support to Hypothesis 1. More importantly, the coefficient of OC × IP is negative but not significant for the full sample, while the coefficient of OC × IP is negative and significant at the 0.10 level for non-SOEs, suggesting that there is a stronger negative relation between managerial overconfidence and M&A performance in SOEs, and the Hypothesis 2 is partially supported.

Table 4. Regression results of robustness test

Variable	$\Delta ROA_{t-2, t+2}$	
	(1)	(2)
OC	-0.031*	-0.031*
	(-1.96)	(-1.96)
IP		-0.004
		(-0.26)
OC*IP		-0.017**
		(-2.12)
Size	-0.016	-0.016
	(-1.55)	(-1.53)
Grow	0.001	0.001
	(0.25)	(0.34)
Lev	-0.004	0.000
	(-0.08)	(0.01)
Top	0.001**	0.001**
	(2.00)	(2.00)
Year	Control	Control
Industry	Control	Control
Constant	0.281	0.275
	(1.29)	(1.26)
Observations	565	565
R^2	0.032	0.039
R^2_ajusted	0.0194	0.0239

Note: t-values in parentheses, ***, **, and * indicate that the correlation coefficient is significant at 1%, 5%, and 10%.

4.3 Robustness checks

In order to test whether the conclusion of this paper is reliable, we use the change of returns on assets in two years before and after M&A ($\Delta ROA_{t-2, t+2}$) to replace the change of returns on equity in two years before and after M&A ($\Delta ROE_{t-2, t+2}$), and delete the control variable Nature.

The regression results are shown in Table 4. It is found that the coefficients of OC are negative and significant at the 0.10 level, and the coefficient of OC × IP is negative and significant at the 0.05 level. The empirical results still show that M&A performance is negatively associated with managerial overconfidence, and the relationship is stronger for companies supported by industry policy. Therefore, the regression results of this study are robust.

5   Conclusions

Prior studies have stressed the importance of managers' psychological characteristics in company investment decision and performance. Based on the behavioral finance theory, this study investigates how M&A performance is influenced by managerial overconfidence and industry supporting policy in China by establishes two multivariate linear regression models and using the Stata software. After controlling for factors that may affect investment performance suggested by prior studies, M&A performance is significantly negatively correlated with managerial overconfidence. Furthermore, the results of subsample analysis further demonstrate that the effect of managerial overconfidence on M&A performance is stronger for non-SOEs. Moreover, we find that the negative relationship between managerial overconfidence and M&A performance is stronger for companies supported by industry policy.

The empirical results can provide some important and relevant practical implications. First, in order to ensure that various investment decisions and strategic choices of enterprises are objective and reasonable, enterprises should improve their internal governance mechanisms and combine them with external governance mechanisms such as third-party evaluation to avoid behavior and decision biases caused by managers' self-cognition deviation.

Second, when engaging in major M&A activities, enterprises should comprehensively consider the characteristics and the interaction effect of internal and external influence factors, and form a more full-featured and accurate economic evaluation and effect expectation. At the same time, is particularly important to prevent the negative impact of managers' irrational characteristics when the enterprises have favorable industrial policies.

Finally, it is important for stakeholders to understand that the negative impact of managerial overconfidence on M&A performance is long-term, and different firms are exposed to different impacts from managers' irrational characteristics. As a result, they need to collect more relevant information (such as M&A timing, pricing, and payment method) before and after investment decision and prepare for the possible act accordingly.

References

[1]   Roll, R. (1986). The hubris hypothesis of corporate takeovers. Journal of Business, 59(2): 197-216. http://www.jstor.org/stable/2353017.

[2]   Malmendier, U., Tate, G. (2005). CEO overconfidence and corporate investment. Journal of Finance, 60(6): 2661-2700. https://doi.org/10.1111/j.1540-6261.2005.00813.x.

[3]   Brown, R., Sarma, N. (2007). CEO overconfidence, CEO dominance and corporate acquisitions. Journal of Economics and Business, 59(5): 358-379. https://doi.org/10.1016/j. jeconbus.2007.04.002.

[4]   Crocia, E., Petmezasb, D., Vagenas-Nanosc, E. (2010). Managerial overconfidence in high and low valuation markets and gains to acquisitions. International Review of Financial Analysis, 19(5): 368-378. https://doi.org/10.1016/j.irfa.2010.06.003.

[5]   Liu, Z., Guo, F. (2019). Executive overconfidence, executive stock ownership and merger and acquisition performance. Communication of Finance and Accounting, (6): 49-52. https://doi.org/10.16144/j.cnki.issn1002-8072.2019.06.010.

[6]   He, R., Gan, R. (2019). Academic independent directors, managerial overconfidence and the performance of mergers and acquisitions: empirical evidence from China's private listed companies. Communication of Finance and Accounting, (1): 40-48. https://doi.org/ 10.19641/j.cnki.42-1290/f.2019.01.006.

[7]   Wang, S., Yang, Z. (2021). Research on the influence of managers' overconfidence on M&A performance: based on the regulatory role of the governance mechanism of the board of directors. The World of Survey and Research, (4): 56-60. https://doi.org/10.13778/j.cnki.11-3705/c.2021.04.008.

[8]   Zhao, Y. (2010). A study on the decision and performance of mergers and acquisitions: based on the managerial overconfidence. Hunan University. https://kns.cnki.net/ KCMS/detail/detail.aspx?dbname=CMFD2012&filename=1012327694.nh.

[9]   Hoberg, G., Phillips, G. M. (2010). Product market synergies and competition in mergers and acquisitions: a text-based analysis. Review of Financial Studies, 23(10): 3773-3811.https://doi.org/10.2139/ssrn.1181022.

[10]   Chen, S., Ma, H. (2017). Short selling pressure and corporate mergers and acquisitions: quasi natural experimental evidence from the deregulation of short selling. Journal of Management World. https://doi.org/10.19744/j.cnki.11-1235/f.2017.07.012.

[11]   Cai, Q., Tian, L. (2019). Industrial policy and cross-industrial M&As: market orientation or policy arbitrage. China Industrial Economics, 370(1): 81-99. https://doi.org/10.19581/j. cnki.ciejournal.2019.01.005.

[12]   Xu, Y., Hu, J. (2019). Monetary policy, managerial overconfidence and M&A performance. Contemporary Finance & Economics, 416(7): 85-95. https://doi.org/10.13676/j.cnki.cn36-1030/f.2019.07.008.