Does MD&A Tone Predict R&D Investment? -- The Moderating Effect Based on Financing Constraints

Yifang Li, Xin Zhang
407977897@qq.com, 1072173647@qq.com

Bohai University, Jinzhou, Liaoning, China, Bohai University, Jinzhou, Liaoning, China

Abstract. Management Discussion and Analysis (MD&A), as a supplement to traditional digital information of companies, has yet to form a unified view on the effectiveness of its information increment. Based on the MD&A text information in the annual reports of Shanghai and Shenzhen A-share listed companies from 2010 to 2020, we employ text analysis technology and multivariate linear regression method to examine the association between MD&A tone and R&D investment. The results show that the association between R&D investment and MD&A tone is positive, and this association is moderated by financing constraints. Moreover, the research shows that when the company's debt ratio is high, the negative moderating effect of financing constraints is more significant. We explore the information content of MD&A tone from the perspective of R&D investment, which broadens the scope of information encapsulated by MD&A tone.

Keywords: MD&A tone; R&D investment; financing constraints

1 INTRODUCTION

The report of the Communist Party of China’s 20th National Congress stressed that innovation would remain at the heart of China’s modernization drive. We must show firm resolve in implementing the innovation-driven development strategy and enhance the capacity for independent innovation. As the micro subject of the national innovation strategy system [1], enterprises occupy a dominant position in national innovation activities, and research and development(R&D) investment is an inexhaustible source of enterprise innovation activities. Therefore, it is of great immediate importance to explore the influencing factors of enterprise R&D investment to inspire greater creativity in companies.

With the rapid development of computer text analysis technology, the features of textual information can be better described, providing feasible access to the management mental world. While the annual report of listed companies is long, MD&A is the "core and soul" of the annual report, which not only reviews the company's performance, but looks into the company's future strategic planning. MD&A could be a powerful reflection of the management attitudes and be helpful for market participants to make a judgment on the company's future investment planning in line with expectations. Durnev and Mangen (2020) document that MD&A disclosures have spillover effects for investment that can improve investment efficiency [2]. Unlike traditional fixed asset investment, R&D investment requires a large amount of capital, a long duration, and a high risk of failure. The difficulty for companies to obtain adequate financial support limits the companies' development of innovation activities to a great extent. Therefore, the primary goal of this paper is to identify the relationship between MD&A tone and R&D investment based

MSIEID 2022, December 09-11, Chongqing, People's Republic of China

DOI 10.4108/eai.9-12-2022.2327589

on prior research and explores the moderating effect of financing constraints on the relationship between MD&A tone and R&D investment. It offers further insight into our comprehension of tonal cues and company R&D investment activity. Specifically, our research extends prior work by focusing on the role of financing constraints.

2 HYPOTHESIS PROPOSAL

According to the signaling theory, MD&A is informative for information users, which is conducive to information users to alleviate information asymmetry and improve investment environment. According to Xie Deren et al. (2015) [3], the tone of management can correctly predict the future performance of companies, indicating that the tone of management of Chinese listed companies has incremental information and credibility. Thus, we conjecture MD&A tone offers meaningful signals of corporate business strategy, with positive tone suggesting that the management foresees bright development prospects for the company. When management is confident about the company's prospects, they are more willing to engage in exploratory and high-risk activities to search for opportunities, such as R&D activity. A more positive tone indicates that management is more optimistic about the company’s prospects. They tend to be adventurous and willing to undertake R&D activities related to new technologies. Therefore, we hypothesize that the more positive the MD&A tone, the higher the R&D investment.

H1: MD&A tone can predict R&D investment activity, and the more positive the MD&A tone, the higher the R&D investment.

While profound and convincing, previous research fails to ascertain the relationship between MD&A tone and R&D investment, specifically, the financing constraint on its investment activities. Innovation is an activity with high risk, long duration and great uncertainty, which often requires a large amount of long-term financial support. High financing constraints are one of the key indicators that restrict company R&D activities and will directly affect the psychological activities of the management. When external funds are short, even if optimistic management is bullish about the future development of the company, considering the high risk, long time and capital turnover of the company, the management tends to reduce R&D investment. Our second hypothesis, stated in the alternate form, is as follows.

H2: The association between MD&A tone and R&D investment varies with financing constraints. The lower the degree of corporate financing constraints, the more significant the impact of MD&A tone on R&D investment.

Although debt financing can save tax to a certain extent, excessive debt also increases the uncertainty of a company's future operation and growth [4]. At present, debt financing is the main financing method of Chinese companies. When companies obtain a large number of financing funds, their debt level will also increase significantly. When facing huge debt repayment pressure, companies tend to reserve a large amount of cash to repay debts and reduce funds for R&D activities. In addition, to recover the principal and interest, creditors will supervise the allocation of company funds strictly to restrain excessive investment. When the corporate debt ratio is high, it is hard to meet the need to obtain funds through debt financing in the future. Our third hypothesis, stated in the alternate form, is as follows.

H3: Compared to companies with low debt ratio, the moderating effect of MD&A tone on R&D

investment in companies with high debt ratio is more significant.

3 RESEARCH DESIGN

3.1 Sample Selection and Data Source

The sample used for this empirical analysis includes Shanghai and Shenzhen A-share listed companies during the period from 2010 to 2020. After eliminating the samples of financial industry, ST, PT, and other specially treated listed companies and missing financial data, we ultimately obtained 15681 observations. In addition, to overcome the influence of extreme values, we winsorize all continuous variables at the 1% and 99% levels. Python software, STATA software, Jieba and Mysql database are respectively used for data processing and text information extraction. Except for the data of MD&A text that results from the annual report of the sample company, the remaining research data were collected from China Stock Market & Accounting Research (CSMAR) database.

3.2 Definition of variables

R&D investment: To increase the comparability of R&D investment of different listed companies, this research draws on the calculation method of Zhou Mingshan et al. (2017) [5], measures R&D investment by the ratio of corporate R&D input to operating revenue (RD), and takes the evaluation method of the ratio of R&D input to total assets as the substitute variable of R&D investment in the robustness test.

MD&A tone (TONE1 and TONE2): The Loughran McDonald word list has been developed for the text of accounting and financial reports [6], and You and Zhang (2017) constructed a vocabulary suitable for the analysis of the tone of Chinese text on this basis [7]. Consequently, we use You and Zhang word list to distinguish the frequency between positive and negative words appearing in MD&A. First, the location rule of MD&A section was located from the PDF of annual reports of Shanghai and Shenzhen A-share listed companies from 2010 to 2020, and the MD&A section extracted from annual reports each company-year was stored in Mysql database. Then we use Python to parse MDSA sections, segment every word, and measure each section's tone. Finally, we create the variables TONE1 and TONE2 as the ratio of the difference between positive and negative words to the number of MD&A text words and the sum of positive and negative words respectively, representing the positive and negative tone degree of each MD&A text.

By referring to Kaplan et al. (1997) [8], The KZ index was preliminarily obtained by dividing the operating net cash flow, cash dividends, cash holdings, asset-liability ratio, and Tobin's Q of the whole sample into two groups according to the industry and annual median scores. The regression coefficients of each variable were estimated by sequencing logistic regression. The financing constraint KZ index is calculated according to the estimation model.

In addition to the independent variable of MD&A tone, there are many other factors affecting company R&D investment. In order to accurately obtain the influence effect of MD&A tone, the control variables selected in this research are as follows: Age of listing (AGE), return on total assets (ROA), the concentration of ownership (FIRST), duality (PLU), growth rate of revenue (GROWTH), audit opinion (OPINION), return on net assets (ROE), turnover of assets (CURR),

and turnover of total assets (A_Asset).

3.3 Model design

We examine the above hypotheses in the following regressions. Regression 1 is used to test H1, that is, to test whether MD&A tone is associated with R&D investment. In order to test H2 and H3, the moderating variable and the interaction between the independent variable and the moderating variable are added on the basis of regression 1 to build regression 2.

$$RD = \alpha_0 + \alpha_1 \text{Tone} + \alpha_2 Controls + Year + Ind + \varepsilon \quad (1)$$

$$RD = \beta_0 + \beta_1 \text{Tone} + \beta_2 KZ + \beta_3 \text{Tone} \times KZ + \alpha_2 Controls + Year + Ind + \varepsilon \quad (2)$$

4 EMPIRICAL ANALYSIS

4.1 Descriptive statistics

Table 1 shows descriptive statistical results of variables in the full sample. The mean value of TONE1 is 0.026, the standard deviation is 0.013, the maximum value is 0.059, and the minimum value is 0.001, indicating that the variable basically follows the normal distribution and the tone of the management tends to be positive. TONE1 and TONE2 have a certain difference in value, but the distribution is similar, indicating that the two measurement methods can be effectively supplemented. From the perspective of R&D investment, the mean value of RD is 4.805, the standard deviation is 4.826, the maximum value is 27.798, and the minimum value is 0.025, indicating a large gap between the R&D investment of Chinese companies. The mean value of the KZ index is 1.205, the maximum value is 7.111, and the minimum value is -6.484, indicating that there is a gap between companies in the degree of financing constraints.

Table 1. DESCRIPTIVE STATISTICS

Variable	N	Mean	P50	Sd	Min	Max
RD	15681	4.805	3.637	4.826	0.025	27.798
TONE1	15681	0.026	0.027	0.013	0.001	0.059
TONE2	15681	0.694	0.763	0.204	0.026	0.937
KZ	15681	1.205	1.406	2.180	-6.484	7.111
LEV	15681	0.415	0.405	0.204	0.052	0.979
AGE	15681	1.936	2.053	0.824	-1.994	3.281
ROA	15681	0.038	0.039	0.074	-0.307	0.233
FIRST	15681	32.817	30.390	14.377	8.600	74.990
PLU	15681	0.316	0	0.465	0	1
GROWTH	15681	0.188	0.115	0.482	-0.658	3.864
OPINION	15681	0.042	0	0.200	0	1
ROE	15681	1.046	0.980	0.183	0.767	1.300
CURR	15681	2.545	1.684	2.683	0.258	18.181
A Asset	15681	0.656	0.565	0.422	0.035	2.636

4.2 Correlation analysis

Table 2 lists the correlation analysis results of variables. The Spearman correlation coefficients between MD&A tone and R&D investment are -0.049 and -0.015, respectively, with a significant negative correlation at the 1% level, which is consistent with hypothesis 1. The correlation coefficient between TONE1 and TONE2 is 0.766, indicating that TONE1 and TONE2 are consistent.

Table 2. CORRELATION ANALYSIS

	RD	TONE1	TONE2	KZ	LEV
RD	1				
TONE1	-0.049***	1			
TONE2	-0.015*	0.766***	1		
KZ	-0.164***	-0.072***	-0.108***	1	
LEV	-0.303***	0.020***	-0.055***	0.681***	1

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

4.3 Analysis of regression results

Table 3 reports the regression results of the impact of MD&A tone on R&D investment. The regression results in columns (1) and (2) show that TONE1, TONE2, and RD are significantly positively correlated at the 1% level, indicating that MD&A tone has a significant positive impact on R&D investment, and H1 is verified. The regression results of columns (3) and (4) show that after the addition of KZ×TONE, the regression coefficients of TONE1, TONE2 and RD are still significantly positive at the 1% level, while the regression coefficients of KZ×TONE1, KZ×TONE2 and RD are significantly negative, indicating that only if obtaining financial support can optimistic management have the confidence to carry out R&D activities. That is, financing constraints have a negative moderating effect on the relationship between MD&A tone and R&D investment. H2 has been verified. In addition, the median debt ratio is taken as the grouping standard, and the samples are divided into groups with high debt ratio and groups with low debt ratio for grouping test. According to the regression results of the high-debt group reported in columns (5) and (7) of Table 3, KZ×TONE and RD are significantly negatively correlated at the level of 1%. Financing constraints weakened the positive impact of management tones on R&D investment. Columns (6) and (8) of Table 3 report the regression results of the low-debt group, the regression coefficient of KZ×TONE and RD is not significant, that is, the moderating effect of financing constraints is not significant, and H3 is verified.

Table 3. ANALYSIS OF REGRESSION RESULTS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
KZ			-0.004	0.043	0.100**	0.081	0.221***	0.115
			(-0.12)	(0.85)	(2.07)	(1.32)	(3.05)	(1.26)
Tone1	7.903***		10.384***		20.071***	12.411***		
	(3.11)		(3.67)		(4.50)	(2.96)		
Tone1×KZ			-2.450**		-6.929***	-2.074		
			(-2.22)		(-4.50)	(-1.04)		
Tone2		0.672***		0.830***			1.443***	1.061***
		(4.26)		(4.76)			(4.85)	(4.23)
Tone2×KZ				-0.158**			-0.433***	-0.123
				(-2.37)			(-4.46)	(-1.03)

Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	15681	15681	15681	15681	7840	7841	7840	7841
Adj. R^2	0.392	0.392	0.393	0.393	0.355	0.376	0.355	0.377

Note: t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.4 Robustness test

To make the test results more accurate, we adopt two methods for the robustness tests. One is to replace the dependent variable, and define R&D investment as the ratio of R&D input to total assets. The second is the lag variable. Considering that companies need time to carry out R&D activities after making decisions, we set the other variables to use the data of T year, while the dependent variable used the data of T+1 year. The conclusion is still valid after the regression.

5 CONCLUSIONS

Based on the historical background of technological innovation-driven economic growth, this paper makes an empirical analysis of the relationship between MD&A tone and R&D investment. Our results show that MD&A tone has positive predictive effects on R&D investment. Moreover, a lower degree of financing constraints is conducive to strengthening the predictive effect of MD&A tone on R&D investment, and this effect is more significant in companies with a high debt ratio. Therefore, investors can judge the enthusiasm for R&D activities based on the company's actual innovation ability and MD&A tone, so as to improve the effectiveness of investors' decisions. Besides, in order to adapt to the uncertain external environment, the company should improve the effectiveness of text information disclosure. MD&A tone can be used by the company to properly demonstrate the willingness of the company to carry out R&D activities and attract financial support from investors, so as to reduce the pressure of insufficient funds. Meanwhile, the company can take the opportunity to carry out high-quality R&D activities oriented to the long-term development of the company.

REFERENCES

[1] LI Shu, DU Yaguang, ZHANG Xiaozhe. The spillover effect of MD&A tone on enterprise innovation investment[J]. China Industrial Economics,2021(03):137-155.

[2] Durnev, A., and C. Mangen. The Spillover Efects of MD&A Disclosures for Real Investment: The Role of Industry Competition[J]. Journal of Accounting and Economics, 2020,70(1):101299.

[3] XIE Deren, LIN Le. Do management tones help to forecast firm's performance: a textual analysis based on annual earnings communication conferences of listed companies in China. Accounting Research，2015(2) : 20－27.

[4] LI Zhisheng, SU Cheng, LI Hao, et al. Excess leverage and region -based corporate peer effects. Journal of Financial Research, 2018(9): 74-90.

[5] Zhou Mingshan, Zhang ienglan, Yang Dan. The relatonship between imnovation invesiment and stock market perormane for GEM fims: based on the ompanvs intema and exema persecive. Economic Researah fouma -2017,52(11):135-149.

[6] Loughran T, McDonald B. Measuring Readability in Financial Disclosures[J]. Journal of Finance,

2014a, 69(4):1643–1671.
[7] You J, Zhang B, Zhang L. Who captures the power of the pen? [J]. Review of Financial Studies. 2018, 31(1):43–96.
[8] Steven N. Kaplan and Luigi Zingales. Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? [J]. The Quarterly Journal of Economics, 1997, 112(1): 169-215.