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Text analysis based on Ask the director module of Oriental Fortune website

Zhuoyi Xiao, Jianzhuang Sun, Huixin Yu, Guanlin Lu

Shandong University of Finance and Economics, Shandong, Jinan, 250000, China

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Abstract: In recent years, equity pledges have been widely used as a financing method by major shareholders of listed companies and have become the norm in the Chinese stock market, while at the same time, the risks they entail are part of the picture that cannot be ignored. In order to explore whether there is tone manipulation by management and its impact on investors. First, this study uses python to crawl the contents of the "Ask the director" module of 720 companies on the Oriental Fortune website between 2018 and 2020, and uses LM sentiment analysis and LDA topic model to process and analyze the crawled director's responses and obtain the management tone of each company in different years as research data. In addition, we use the data in the Guotaian database. In addition, the OLS model was established using the data of relevant listed companies in the Guotaian database to conduct empirical analysis. The research in this paper has implications for investors' investment decisions and for securities regulators' intelligent monitoring of the content of board secretaries' communication with investors.

1. Introduction

In order to study the influence of equity pledges of listed companies on the tone manipulation behavior of "board secretaries", we first need to consider the selection of variables. Considering that the management of private enterprises has more influence on the tone of text messages than the management of state-owned enterprises, this study takes the private listed companies with equity pledges in A-shares in China for three consecutive years from 2018 to 2020 as the research sample, and the data collection process is as follows: first, we download the stock codes of private listed companies in A-shares, the data related to equity pledges and their stock prices in the observation period from the Guotaian database (CSMAR). The stock codes of companies with equity pledges and their data related to equity pledges and stock prices are downloaded from the Guotaian database, and 720 observations are finally obtained by writing python codes to filter out the stock codes of companies that meet the conditions. Secondly, we use crawler technology to crawl the content of the "Ask the director" module of the 720 companies in the observation period on the Oriental Fortune website

Related theories are.

Reputation constraint view: from the perspective of overall corporate reputation, although management tone manipulation can bring benefits to companies, such as raising corporate stock prices to match stock increases, corporate mergers and acquisitions, option exercises, and insider

trading, etc., as the nature of information becomes apparent and investors return to rationality, such behaviors that harm investors' interests may be identified and companies may suffer condemnation from market participants as well as lead to This could lead to negative press coverage and ultimately have a negative impact on the overall reputation of the company[1].

Attention Hypothesis (AH): It assumes that investors are irrational, have limited cognition, and only respond to information that attracts their attention[2].

2. Empirical model design

2.1 Variable Selection

To study the effect of pledging on the tone manipulation behavior of "board secretaries" of listed companies, we need to consider the choice of variables first. Considering that the management of private enterprises has a greater influence on the tone of text messages than the management of state-owned enterprises, this study takes the sample of A-share private listed companies in China from 2018 to 2020. Therefore, this study takes the A-share private listed companies in China from 2018 to 2020 as the research sample, and downloads the stock codes of A-share private listed companies, the stock codes of companies with equity pledges during the observation period and the related data of their equity pledges, and the stock prices in the Cathay Capital database (CSMAR), and filters the stock codes of A-share private listed companies by writing python codes, and finally 720 observations were obtained. Secondly, we use crawler technology to crawl the content of "Ask the director" module of these 720 companies in the observation period on the Oriental Fortune website[3].

2.2 Empirical model

In this paper, we propose to construct the following OLS model to test the effect of pledging on the tone manipulation behavior of "board secretaries" of listed companies.

$$Tone_{i,t}/Abtone_{i,t} = \beta_0 + \beta_1 PLG_{Dum_{i,t}}/PLG_{Ratio_{i,t}} + \beta_2 Lev_{i,t} + \beta_3 Top1_{i,t} + \beta_4 Roa_{i,t} + \beta_5 Age_{i,t} + \beta_6 Size_{i,t} + \beta_7 Capital_{i,t} + \beta_8 Mnfee_{i,t} + \beta_9 Loss_{i,t} + \sum Year + \varepsilon_{i,t} \quad (1)$$

Lev, Top1, Roa, Age, Size, Capital, Mnfee, and Loss are control variables to control for the effect of the idiosyncratic differences in the corporate base on the tone manipulation behavior of the "board secretary". Year is a year dummy variable to control for the effect of macro-environmental changes in different years on the relationship between the tone manipulation behavior of "board secretaries". In order to reduce the impact of outliers on the test results, all continuous variables in this paper are shrunken at the 1% and 99% quartiles.

2.3 Main technologies – python

The main technology - python web crawler (also known as web spider) is a program or script that automatically crawls the World Wide Web according to certain rules. This project uses python language in window10/python 3 environment to crawl some data of "Ask the Director" module of Oriental Fortune[4].

First, we use the link of each enterprise "ask the director" page to build the header, and the data interface provided by the website as the url. Using the request library to achieve http get request, data for the request parameters, pass in the content of the site to return data, the use of json function parsing, to obtain the contents of the corresponding tag, including the nickname of each shareholder, the question asked, the content of the secretary's answer and time.

The threading library provides an API for managing multiple threads of execution, allowing programs to run multiple operations concurrently in the same process space. Since a large amount of data needs to be crawled, improving the crawler code with multi-threading techniques through python's threading library can shorten the time it takes to crawl large amounts of data.

2.4 LM Sentiment Analysis

Loughran and McDonald (2011) used 10-K documents from 1994 to 2008 as a research sample and found that the Harvard Dictionary definitions of negative words used in previous tone studies were not fully applicable to the tone analysis of financial reports, so they created a new list of negative words applicable to the text analysis of financial reports and demonstrated that the new list of words matched better with stock compensation, trading volume, and stock compensation volatility in 10-K documents[5].

2.5 LDA Theme Model

LDA thematic analysis is performed on the sentiment words after sentiment analysis of companies where equity pledges occur, and a lexicon and corpus are built based on positive and negative words to construct a topic number finding function and calculate the average cosine similarity[6].

$$\cos(X,Y) = \frac{\sum_{i=1}^{n}(X_i Y_i)}{\sqrt{\sum_{i=1}^{n}(X_i)^2}\sqrt{\sum_{i=1}^{n}(Y_i)^2}} \tag{2}$$

From Figure 1 and Figure 2, it is clear that the optimum is reached when the number of themes of both positive and negative vocabulary is 2. As can be seen from the theme composition, the two themes of the positive vocabulary are biased to indicate the strengths, the ability to grow and the good condition of the company, while the two themes of the negative vocabulary are biased to the risks and the declining condition of the stock price.

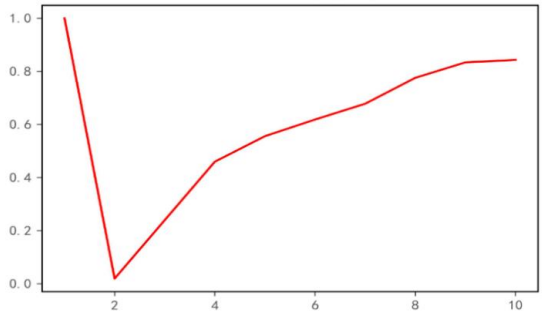

Figure 1 Positive vocabulary LDA topic number search superiority

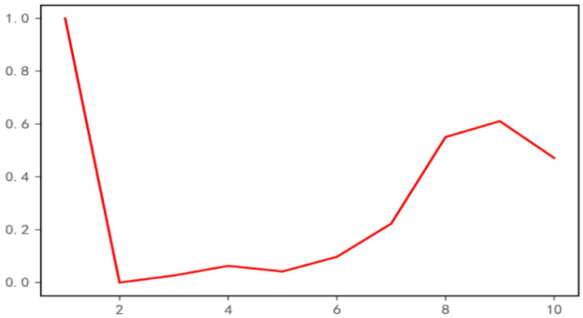

Figure 2 Negative vocabulary LDA topic number seeking superiority

2.6 OLS Model

The basic principle of the OLS model (least squares linear regression model) is that the best-fit curve should minimize the sum of squares of the distances from each point to the line (residual sum of squares RSS).

$$RSS = \sum_{t=1}^{T}(y_t - \hat{y_t})^2 = \sum_{t=1}^{T}(y_t - \hat{a} - \hat{\beta}x_t)^2 \quad (3)$$

The estimates of α, β are obtained by using the minimization first-order condition and taking partial derivatives of the parameters.

$$\hat{\beta} = \frac{\sum x_t y_t - T\bar{x}\bar{y}}{\sum x_t^2 - T\bar{x}^2} \quad (4)$$

$$\hat{\alpha} = \bar{y} - \hat{\beta}\bar{x} \quad (5)$$

In this paper, we construct an OLS model to examine the effect of pledging of listed companies' equity on the tone manipulation behavior of "board secretaries". Through the empirical evidence, we conclude that the pledging of listed companies' equity will prompt the board secretaries to manipulate the tone of voice in order to cover up the bad news and disclose the good news.

3. Analysis of empirical test results

3.1 Descriptive Statistics

The descriptive statistics of the main variables in this paper are shown in Table 1, from which it can be seen that the mean value of net optimistic tone of board secretaries (Tone) is 0.531 and the median value is 0.583, indicating that board secretaries tend to use more positive language when communicating with investors, which is consistent with reality and shows that the calculation process of board secretary tone in this paper has credibility; listed companies[7] The mean value of whether there is equity pledge variable (PLG_Dum) is 0.808, which indicates that the samples with equity pledge account for more than 80% of the total samples, indicating that the phenomenon of equity pledge is more common among listed companies. The mean value of the equity pledge ratio (PLG_Ratio) is 0.0451 and the maximum value is 0.625, indicating that there is a wide variation in the equity pledge of the sample companies.

Table 1 Descriptive statistics table

Variables	N	mean	p50	sd	max	min
Tone	2116	0.531	0.583	0.304	1	-0.478
Abtone	2045	0	0.0468	0.302	0.612	-1.050
PLG_Dum	2160	0.808	1	0.394	1	0
PLG_Ratio	2160	0.0451	0.0219	0.0647	0.625	0
Lev	2160	0.456	0.454	0.205	1.050	0.0624
Top1	2160	29.40	27.80	12.80	65.70	8.730
Roa	2160	0.000606	0.0271	0.138	0.212	-0.797
Age	2160	11.80	10	7.250	27	1
Size	2160	22.30	22.30	1.170	25.90	19.70
Capital	2160	0.148	0.124	0.101	0.529	0.0108
Mnfee	2160	0.103	0.0667	0.150	1.260	0.00733
Loss	2160	0.205	0	0.404	1	0

3.2 Test for differences in means between groups

In this paper, the sample is divided into two groups of "no equity pledge" and "equity pledge", and the results of the between-group difference test between key variables are shown in Table 2. Mean1

and Mean2 refer to the mean value of the sample in the group without equity pledge and the group with equity pledge, respectively. Mean refers to the difference in mean value between groups, and p-Value refers to the statistical significance level of the difference in mean value between groups. As can be seen from Table 2, the mean value of net optimistic tone in the presence of equity pledge group is greater than the mean value of net optimistic tone in the absence of equity pledge group and is significant at the 5% level; the mean value of tone manipulation in the presence of equity pledge group is greater than 0 and the mean value of tone manipulation in the absence of equity pledge group is less than 0. This indicates that the sample firms in the presence of equity pledge group have a higher possibility of positive tone manipulation[8]. The above results tentatively suggest that when listed companies have equity pledges, their board secretaries will have the possibility of tone manipulation when communicating with investors.

Table 2 Table of mean difference test between groups

Variables	No equity pledge	Mean1	Presence of equity pledge	Mean2	MeanDiff	p-Value
Tone	410	0.499	1706	0.539	-0.0402	0.0163**
Abtone	410	-0.0190	1635	0.00480	-0.0238	0.154

Note: *, **, *** indicate statistically significant at the 10%, 5%, and 1% levels, respectively.

3.3 Analysis of multiple regression results

The results of the multiple regression are shown in Table 3 below The results in the first and third columns show that the coefficients of PLG_Dum are both positive at the 10% level of significance, which means that, relative to firms without equity pledges, the greater the net optimistic tone (Tone) of their board secretaries and the greater the tone manipulation (Abtone) when firms have equity pledges; the results in the second and fourth columns of Table 4 show that the PLG_Ratio The above empirical results can show that the equity pledges of listed companies motivate the board secretaries of companies to engage in tone manipulation in order to conceal the bad news of companies and disclose the good news, which proves the theoretical analysis in the previous section[9].

Table 3 Table of regression results

	(1) Tone	(2) Tone	(3) Abtone	(4) Abtone
PLG_Dum	0.033*		0.029*	
	(1.90)		(1.70)	
PLG_Ratio		0.234**		0.216**
		(2.18)		(1.99)
Lev	-0.060	-0.067*	0.046	0.040
	(-1.53)	(-1.70)	(1.16)	(1.01)
Top1	-0.001	-0.001	-0.001	-0.001*
	(-1.20)	(-1.47)	(-1.50)	(-1.73)
Roa	0.201***	0.199***	0.188***	0.185***
	(2.88)	(2.85)	(2.69)	(2.65)
Age	-0.002**	-0.003***	-0.000	-0.001
	(-2.24)	(-2.75)	(-0.18)	(-0.62)
Size	0.022***	0.026***	0.001	0.005
	(3.17)	(3.57)	(0.18)	(0.62)
Capital	0.183***	0.182***	0.159**	0.158**
	(2.66)	(2.64)	(2.23)	(2.21)
Mnfee	0.045	0.045	0.061	0.060
	(0.92)	(0.90)	(1.22)	(1.21)
Loss	0.007	0.008	0.037	0.037*
	(0.32)	(0.36)	(1.63)	(1.66)
_cons	0.032	-0.016	-0.104	-0.150
	(0.22)	(-0.11)	(-0.68)	(-0.96)
Annual Effect	Yes	Yes	Yes	Yes
N	2116	2116	2045	2045
r2_a	0.020	0.021	0.005	0.005

3.4 Further analysis: the impact of tone manipulation by board secretaries on investors

The above results have demonstrated that equity pledges do prompt the board secretaries of companies to engage in tone manipulation in their communication with investors. So, does this tone manipulation by board secretaries mislead investors' investment decisions? This paper conducts an empirical test based on the manifestation of investors' investment decisions - share price changes[10]. When the tone manipulation behavior of the board secretary is not recognized by investors, investors will believe that the abnormally positive tone of the company is true, and in this way, the company's share price will rise. In this paper, we use the average annual share price increase of listed companies to measure the share price change (Davg_price). The results of the empirical tests are shown in Table 4 below.

The coefficient of tone manipulation (Abtone) is significantly positive at 5% level of significance. In other words, the tone manipulation behavior of the secretary of the board of directors has a positive impact on the share price of the company and misleads the investment decision of investors.

Table 4 Further analysis of the results

	(1) Davg_price
Abtone	0.042**
	(2.23)
Lev	-0.154***
	(-4.52)
Top1	-0.002***
	(-3.29)
Roa	0.290***
	(4.84)
Age	0.001
	(0.56)
Size	0.042***
	(6.81)
Capital	0.222***
	(3.62)
Mnfee	-0.063
	(-1.48)
Loss	-0.047**
	(-2.45)
_cons	-1.143***
	(-8.79)
Annual Effect	Yes
N	2045
r2_a	0.354

4. Conclusion

This paper analyzes the tone of listed companies' board secretaries' responses to investors by crawling the text information of 720 companies' "Ask the secretary" section on Oriental Fortune website, and empirically tests the tone manipulation behavior of board secretaries by using econometric and statistical methods. The results of the study found that when the listed companies have equity pledges, the board secretaries have tone manipulation behaviors to mislead investors in the process of communication with investors, and the greater the percentage of equity pledges, the greater the tone manipulation behaviors of the board secretaries in the process of communication with investors. When the tone manipulation behavior of the secretary of the board of directors is not recognized by investors, investors will believe that the abnormally positive tone of the company is true, and in this way, the share price of the company will rise. In other words, the tone manipulation behavior of the secretary of the board of directors positively influences the share price of the company and misleads the investment decision of investors.

Numerous studies have demonstrated that tone manipulation by the management of listed companies can mislead investors and make them suffer from losses in their investment decisions. The research in this paper enriches the ways of tone manipulation by management and misleading investors, which is important for the internal governance of enterprises, the external supervision of relevant departments and the investment decision of investors.

Compared with other studies on management tone manipulation that focus on standardized annual reports, this paper takes a different approach by analyzing non-standardized texts such as stock commentaries. Due to the low reading threshold and wide audience of stock commentaries, the behavior of management tone manipulation can be fully reflected, which ensures the authenticity and reliability of the research results to a certain extent. It provides a new perspective for understanding management tone manipulation in the Chinese scenario, helps investors to correctly understand management tone and judge the possibility of tone manipulation, helps stakeholders to use public information more rationally, and provides new evidence for research on tone manipulation and stock price changes.

Using a crawler to retrieve the stock review data of A-share private listed companies with equity pledging behaviors during the three years from 2018 to 2020, after splitting words by jieba to obtain positive and negative words to improve data processing efficiency.

In this paper, in order to make the results more clear and more intuitive, we use a combination of machine learning and traditional models to make the article pulse more clear.

The management tone measured in this paper is still experimental in nature, and still has room for improvement and refinement.

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