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# Difference Analysis in Bank Risk Attitudes: A Triple Perspectives of Bank Managers, Financial Analysts, and Credit Raters

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## Abstract

As the three important sources of information in the financial market, the textual information disclosed by bank managers, financial analysts, and credit raters conveys their respective perceptions and judgments of bank risks, which has important value in measuring bank risks. Based on the text information about bank risks disclosed by the managers, financial analysts, and credit raters, this paper studies the differences in risk attitudes in bank annual reports, financial analysts' reports, and credit rating reports from the dimension of sentiment analysis. To summarize the emotional attitude of the text, we first calculated the intonation value of each bank risk factor by counting the number of positive and negative words in the L&M dictionary, which is specially used in the field of financial accounting. Then, an emotion recognition method based on thesaurus and grammar rules -- Vader emotion score method is used to analyze the text's emotions. Then, to obtain the similarity between the text information disclosed by bank managers, financial analysts, and credit raters, an emotion vector is used to measure the text emotion similarity. In the empirical analysis, a total of 610 reports of U.S. banks from three parties over the period 2006-2023 are collected. The experimental results indicate that: First, compared with analyst reports and credit rating reports, bank annual reports tend to use a more positive tone when disclosing bank risks, showing a more optimistic mood. Second, the emotional attitude of analyst reports and credit rating reports is more consistent and similar. Third, the average level of emotional similarity among the three is high, but there are often large fluctuations and differences in the years of financial environment turbulence.

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## 1. Introduction

Bank risk measurement is of great significance for preventing the outbreak of a financial crisis. Recently, as the three major sources of information in the financial market, the textual information disclosed by the bank managers, financial analysts, and credit raters these three parties have conveyed their respective perceptions and judgment of bank risk, which is of great importance for measuring bank risk.

The annual report of enterprises has gained the favor of many domestic and foreign scholars due to its rich, comprehensive, and important textual content. Some scholars have focused on mining bank risk information from bank annual report texts [1-3]. In addition, a small number of scholars have also attempted to use textual information in annual reports for bank risk measurement [4-7] and found that compared to traditional quantitative credit risk measurement indicators, text-based credit risk indicators are more accurate in predicting bank risk. In terms of financial analyst reports, only Roeder [8] has verified through research the significant value of the textual information disclosed in analyst reports in the field of credit risk assessment, especially for the banking industry. Especially in times of greater uncertainty in the information environment of banks, financial analysts' advice on banks will become more valuable [9]. Agarwal [10] and Kiesel [11] found that the textual content of credit rating reports has a significant impact on financial markets and the evaluation of companies themselves. In the field of bank risk research, credit rating reports disclose textual information related to the overall risk situation and operational performance of banks, which has advantages in studying bank risks [12]. Independent credit rating agencies also have excellent capabilities to reflect the credit quality of banks [13]. The Basel Agreement also emphasizes the role of textual information released by external credit rating agencies in bank credit risk management. Therefore, existing research has proven that the textual information contained in bank annual reports, financial analyst reports, and credit rating reports is of great value for understanding the current situation and future development of banks, especially the risk situations faced by banks. However, most existing studies have measured bank risk based on unilateral perspective risk judgment, lacking comprehensive utilization of tripartite perspective risk judgment, and the utilization rate of text information is low. There is relatively little research on bank risk measurement, which affects the credibility of bank risk measurement results. In terms of emotional disclosure in text, many studies have shown that the results of emotional analysis can better assist enterprises in risk management. However, there is currently no research on the similarity of emotional analysis in the three types of text.

Therefore, this article aims to measure the similarity of disclosure emotions and characterize whether there are differences in the emotional attitudes of the three parties towards different bank risk factors. For this purpose, we collected approximately 610 reports, involving over 600 banks. We used the LM dictionary method and Vader sentiment score method for text sentiment analysis and measured text sentiment similarity based on sentiment vectors. Then, from the perspective of sentiment analysis, we explored the differences among bank managers, financial analysts, and credit raters in perceiving and describing bank risks.

The rest of this article is organized as follows. The second section mainly introduces the LM dictionary method and Vader sentiment scoring methods, as well as text sentiment disclosure and similarity measurement. The third section introduces the data used in this article. The fourth section is empirical analysis. The fifth section summarizes this article.

## 2. Methodology

### 2.1. Text sentiment analysis

This article uses two indicators, the net tone value obtained based on the dictionary method; the emotional score based on Vader. In the following, we introduce the calculation of these two indicators.

#### 2.1.1. Calculation of the net tone values based on LM dictionaries

Identify text emotions through the dictionary method. The principle is to measure the emotions contained in the text based on the number of positive and negative words contained. This article is based on the list of positive and negative vocabulary in the Emotional Dictionary (L&M Dictionary) specifically used in the field of financial accounting. By counting the number of positive and negative vocabulary, the intonation value of each bank risk factor

is calculated. The net intonation value can be calculated by subtracting the number of negative vocabulary from the number of positive vocabulary and then dividing it by the sum of positive and negative vocabulary. Namely:

Net Tone Value=(Number of Negative Vocabulary - Number of Positive Vocabulary)/(Number of Positive Vocabulary + Number of Negative Vocabulary)

The net tone value is between [-1, 1], and the higher the value, the more positive the overall wording of the text when describing bank risks. If the number of negative words is greater than that of positive words, the net tone value is positive, indicating that bank management, financial analysts, and credit rating professionals hold a pessimistic attitude toward the risk factor. This article mainly utilizes the Python third-party library pysentiment to obtain the net tone values of three types of text. This vocabulary is based on the financial sentiment vocabulary developed by Loughran&McDonald and returns the LM financial sentiment score (Polarity score), which is the net tone value.

### 2.1.2. Calculation of the sentiment score based on Vader

Vader is an emotion recognition method based on vocabulary and grammar rules, which manually marks emotional words. The dictionary contains over 7000 emotion words with an emotion level range of [-4,4]. In addition, it also includes facial expressions and abbreviations. Vader is also sensitive to punctuation, capitalization, degree adverbs, conjunctions, and negations. The principle is to first construct a list of emotionally related vocabulary features, and then combine the list with some descriptive rules to ultimately obtain the emotional score of the text. When tested against human evaluators, the accuracy score of VADER ranges from 84% to 96%. This paper uses the vaderSentiment tool in NLTK, a classic library in the field of natural language processing, to score the text and return the general emotion score (composite score).

### 2.2. Measurement of the sentiment similarity based on emotional vectors

After completing the emotional attitude analysis of each of the three types of texts, this article constructs the emotional vector  $E$  of the text using the net tone value and the emotional score of the text:

$E_i=(Polarity_i, compound_i)$ , where  $Polarity_i$  is the net tone value of text  $i$  and  $compound_i$  is the Vader sentiment score of text  $i$ , both of which have values ranging from [-1,1].

After obtaining the emotional vectors of three types of texts, this article calculates the cosine similarity between the vectors and performs z-score normalization to obtain the emotional similarity between these three types of texts.

## 3. Data

This article collects the text sections related to bank risk assessment from the annual reports, analyst reports, and credit rating reports of various US banks from 2006 to 2022. The bank's annual reports are obtained by crawling on the SEC official website. The step is to search for the target bank by cik on the SEC official website, and match the risk factors in 10-k to obtain the risk description text of the target bank; The acquisition of analyst reports is achieved by manually collecting and organizing the risk assessment sections of all analyst reports in the US banking industry from 2006 to 2022 through the Thomson One database, and summarizing multiple analyst reports from each bank to obtain the final text list; Credit rating reports are compiled using the MOODY database crawler to compile the risk related text sections of all Moody's credit rating reports from 2006 to 2022, summarizing multiple reports from each company's parent company.

Finally, we take the banks that can be obtained from the analyst reports, annual reports, and credit rating reports in the 17 years from 2006 to 2022 as the unbalanced panel data samples for research. Due to multiple sources of analyst reports and credit reports, the risk content of the final analyst reports and credit rating reports of each bank is summarized. We have collected approximately 192 financial reports, 210 analyst reports, and 208 credit rating reports, totaling approximately 610 reports. The three reports each involves 100-200 banks.

## 4. Empirical analysis

### 4.1. Emotional results of tone values and emotional scores

Due to the differences in bank risk perception among the three parties studied in this article, the texts related to bank risk assessment in the three types of reports were also selected. Therefore, as shown in Table 1, the average net tone values of analysts, management, and credit raters were all negative, indicating that the number of negative words used in the three types of texts was greater than that of positive words. Among them, the net tone value of management is significantly higher than that of analysts and credit raters, and the variance is relatively small. That is, compared to analyst reports and credit rating reports, the company's annual report tends to use more positive vocabulary when explaining the company's risks, revealing more positive emotions. The difference in net tone values between analysts and credit rating masters is not significant, both show more negative emotions.

Table 1. Descriptive statistics of tripartite tone values.

Index	average	standard deviation	variance
Analyst's net tone value	-0.388	0.373	0.139
Management's net tone value	-0.007	0.308	0.095
Credit rater's net tone value	-0.268	0.467	0.218

From the perspective of emotional scores, the average emotional score of bank annual reports is significantly higher than that of analyst reports and credit rating reports, and the variance is small, consistent with the results of net tone values. That is, the bank management often uses more optimistic expressions to inform the stakeholders of the company's current risk exposure by issuing annual reports, showing more confidence in the bank's development prospects. Next is the emotional score reported by analysts, with the average emotional score in credit rating reports being the lowest. As the supervision role of the financial capital market, the credit rating report, when describing the risk profile of the same bank at the same time point, will more directly and strictly reveal the relevant risk information that may lead to bank bankruptcy and default, so that the text emotion score is the lowest.

Table 2. Descriptive statistics of tripartite emotional scores.

Index	average	standard deviation	variance
The emotional score of analyst reports	0.663	0.731	0.535
The emotional score of annual reports	0.892	0.388	0.150
The emotional score of credit rating reports	0.369	0.774	0.600

### 4.2. Results of emotional similarity

Firstly, the emotional similarity among the three parties exceeds 0.6, indicating that although bank annual reports, analyst reports, and credit rating reports have different focuses in revealing bank risk situations, they have high consistency in emotional attitudes. And the emotional similarity between analyst reports and credit rating reports is 0.77, significantly exceeding the emotional similarity between analyst reports and bank annual reports and credit rating reports. The analyst report and credit rating report are more emotionally similar to the risk assessment of banks from a third-party perspective.

Table 3. Descriptive statistics of tripartite emotional similarity

Similarity	average	standard deviation	variance
Analyst-management	0.671	0.377	0.142
Analyst-credit rater	0.772	0.341	0.116

Management-credit rater	0.676	0.387	0.150
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In addition, this article analyzed the trend of changes in the similarity of tripartite emotions from 2006 to 2022. The three lines in Fig.1 respectively show the changing trend of emotional similarity between analyst reports and credit rating reports, analyst reports and annual reports disclosed by bank management, and credit rating reports and bank annual reports in the past 16 years. It can be seen that before 2008, the emotional similarity between the three parties was more than 0.7, showing strong consistency and stability. After the 2008 economic crisis, there was a significant fluctuation in the similarity between the three, and the range of similarity also increased. The emotional similarity between the credit rating report and the bank's annual report in 2009 decreased to the lowest of only 0.4. This indicates that there have been significant differences in the assessment of risks among the three parties in the context of global financial market turbulence and uncertainty, as well as potential risks.

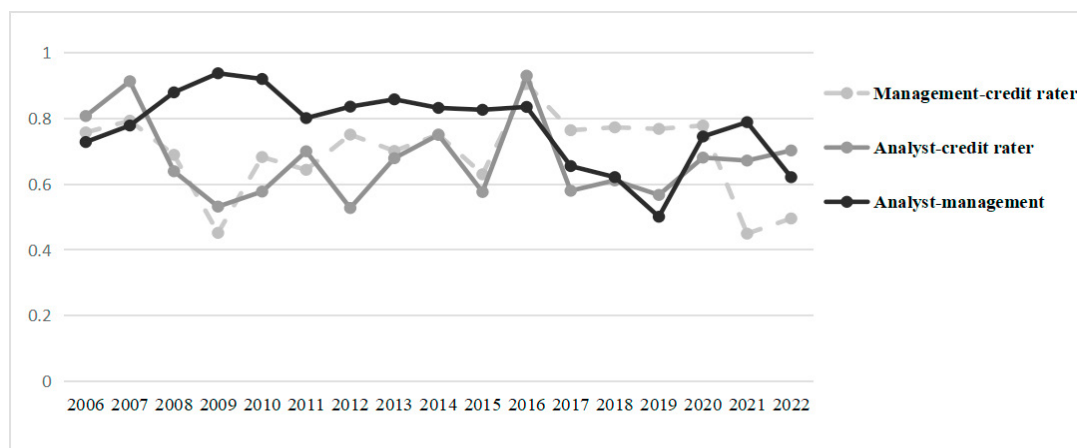


Fig. 1. Annual changes in tripartite similarity

## 5. Conclusion

This study aims to investigate the differences in emotional attitudes when evaluating bank risks in annual reports, financial analyst reports, and credit rating reports. Based on tripartite text data from Bank of America from 2006 to 2022, this article conducts sentiment analysis and constructs sentiment vectors for the text, thus obtaining the emotional similarity between the three types of texts. The empirical results show that compared to analyst reports and credit rating reports, bank annual reports often use a more positive tone when disclosing bank risks, showing a more optimistic mood. At the same time, the emotional attitude consistency and similarity between analyst reports and credit rating reports are stronger. The average level of emotional similarity among the three is high, but there are often significant fluctuations and differences in years of financial turmoil.

The special position of banks in the financial market determines the importance of risk assessment and prevention for banks, and the information disclosed in bank annual reports, financial analyst reports, and credit rating reports provides timely risk profiles for banks from different perspectives and positions. To safeguard their interests, bank management tends to provide more optimistic descriptions of the risks faced by banks in annual reports, while analyst reports and credit rating reports do not have the motivation to cover up, hide or beautify bank risks, resulting in higher emotional similarity in the text. Therefore, when considering risks for banks, it is necessary to take into account the opinions of the three parties and pay attention to their emotional similarity. Banks with low similarity and low emotional scores in analyst reports and credit rating reports should be carefully invested. At the same time, bank regulatory authorities can also use the similarity between the three to take certain punitive measures against banks that conceal risks and guide investment behavior.

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## References

- [1] Zhu X, Wang Y, Li J. What drives reputational risk? Evidence from textual risk disclosures in financial statements. *Humanities and Social Sciences Communications*, 2022, 9(1): 1-15.
- [2] Wei L, Li G, Zhu X, Li J. Discovering bank risk factors from financial statements based on a new semi-supervised text mining algorithm. *Accounting & Finance*, 2019, 59(3): 1519-1552.
- [3] Hanley K W, Hoberg G. Dynamic interpretation of emerging risks in the financial sector. *The Review of Financial Studies*, 2019, 32(12): 4543-4603.
- [4] Wei L, Li G, Li J, Zhu X. Bank risk aggregation with forward-looking textual risk disclosures. *The North American Journal of Economics and Finance*, 2019, 50: 101016.
- [5] Acheampong A, Elshandidy T. Does soft information determine credit risk? Text-based evidence from European banks. *Journal of International Financial Markets, Institutions, and Money*, 2021, 75: 101303.
- [6] Gaudio B L, Megaravalli A V, Sampagnaro G, Verdoliva V. Mandatory disclosure tone and bank risk-taking: Evidence from Europe. *Economics Letters*, 2020, 186: 108531.
- [7] Gandhi P, Loughran T, McDonald B. Using annual report sentiment as a proxy for financial distress in US banks. *Journal of Behavioral Finance*, 2019, 20(4): 424-436.
- [8] Roeder J, Palmer M, Muntermann J. Data-driven decision-making in credit risk management: The information value of analyst reports. *Decision Support Systems*, 2022, 158: 113770.
- [9] Arjan P, Luis G, Jeff M. Information content of analyst recommendations in the banking industry. *International Review of Financial Analysis*, 2017, 49:35-47.
- [10] Agarwal S, Vincent Y S C, Zhang W. The information value of credit rating action reports: A textual analysis. *Management Science*, 2016, 62(8): 2218-2240.
- [11] Kiesel F. It's the tone, stupid! Soft information in credit rating reports and financial markets. *Journal of Financial Research*, 2021, 44(3): 553-585.
- [12] Moreira F, Zhao S. Do credit ratings affect spread and return? A study of structured finance products. *International Journal of Finance & Economics*, 2018, 23(2): 205- 217.
- [13] Duff A, Einig S. Understanding credit ratings quality: Evidence from UK debt market participants. *The British Accounting Review*, 2009, 41(2): 107-119.
- [14] Kothari S P, Li X, Short J E. The effect of disclosures by management, analysts, and business press on the cost of capital, return volatility, and analyst forecasts: A study using content analysis. *The Accounting Review*, 2009, 84(5): 1639-1670.