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Annual report readability and trade credit financing: Evidence from China

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ABSTRACT

The clarity of an annual report is crucial for stakeholder understanding and trust, notably so in China, which is characterized by its unique high-context culture. This study investigates the impact of annual report readability on trade credit financing in Chinese listed companies. Beyond the measure derived from the Fog index, we employ innovative methodologies, including machine learning and the application of Chinese linguistic "hedge words", to refine the understanding of the relationship between annual report readability and trade credit financing. Our findings indicate that poor readability significantly restricts firms' access to trade credit financing, particularly for companies with limited international engagements and those with weaker product market power. These results remain consistent across different measures of report readability and trade credit financing.

1. Introduction

Information disclosure is a bridge for listed companies to communicate with investors, partners, and the public (Core, 2001). The Securities and Exchange Commission(SEC) requires public companies to file annual reports on their financial performance and operations, which requires disclosures to be as clear and concise as possible. The China Securities Regulatory Commission has also issued relevant documents requiring listed companies to release annual reports promptly and accurately. Information disclosure mainly involves three elements: content, time, and presentation mode (Courtis, 2004), among which the usefulness and effectiveness largely depend on the presentation mode (Ajina et al., 2016), and the presentation mode of information is primarily reflected in the readability of text. With the wide application of natural language processing technology, using text analysis technology to study the quality of corporate information disclosure and disclosure strategies has become a hot topic of current research (Zhang et al., 2022).

China's rapid economic growth in recent years has become a key driver of global economic growth, resulting in increased attention towards China's financial market. Effective communication among corporate partners at the domestic and international level relies heavily on the readability of Chinese business text. The status of the Chinese language is continuously increasing internationally and receiving more attention and recognition globally. However, there is relatively little attention paid to the readability of annual reports of Chinese listed companies, not to mention their impact on corporate financing. Poorly expressed or complex business documents can easily cause misunderstandings among supply chain partners, including suppliers and customers, and result in negative impacts on decision-making and cooperation. Research on the readability of Chinese listed companies' annual reports can help partners better understand operating conditions and performance, ultimately enhancing communication and facilitating stronger partnerships.

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There has been an increasing focus on the readability of text information disclosures, such as annual reports, social responsibility reports and social media messages in recent years (Bonsall et al., 2017; Soliman and Ben-Amar, 2022; Gkikas et al., 2022). A well-written report can capture stakeholders' attention and encourage them to engage with a company's content. It can also help companies build positive stakeholder relationships that promote loyalty and advocacy. The Management Discussion and Analysis (MD&A), an essential part of the annual report, contains rich information, including management's interpretation of historical financial performance, opinions on risks, opportunities, and challenges the company may face in the future. The forward-looking information in MD&A is crucial for evaluating a company's development prospects, and its disclosure content helps forecast the company's future (Sun, 2009). For instance, the tone of the text, referred to as management tone, can impact capital structure adjustment. As the annual report card of listed companies, the financial and risk information disclosed in annual reports is critical for investors, suppliers, and other stakeholders (Li, 2008). MD&A readability is just as important as the content it presents since readability affects a company's reputation and credibility. If stakeholders find the report difficult to read or understand, they may perceive the company as unprofessional or opaque, leading to a lack of trust and serious consequences such as losing investors or customers.

In the capital market, trade credit financing plays a crucial role as an informal financing channel for companies. In addition to traditional banking channels, trade credit loans can help alleviate the shortage of working capital (Allen et al., 2005). When a trade credit occurs, a supplier delivers goods to a business that promises to pay later through a commitment rather than paying upfront. This commitment represents a credit or implied financing contract (Wu et al., 2014). Compared to traditional formal financing channels like bank loans and stock financing, trade credit offers several advantages (Schwartz, 1974). For instance, it is an essential financial tool that helps companies manage cash flow and working capital efficiently. By using trade credit, companies can purchase goods or services without paying upfront, which saves cash and improves cash flow (Fisman and Love, 2003). Additionally, trade credit allows companies to build strong relationships with suppliers, leading to better terms and discounts in the future. It also helps companies avoid taking on expensive debt, saving money on interest payments and lowering overall borrowing costs. Finally, trade credits can increase a company's purchasing power by enabling them to buy more goods or services, which is especially beneficial for companies trying to expand or grow. Rapid cash flow turnover through trade credit and other financing channels helps companies gain a firm foothold in the market and stabilize their position.

Trust is crucial in interlocking credit relationships (Wu et al., 2014). Effective information delivery is the foundation for suppliers and customers to trust a company. The company's annual report, particularly the MD&A, reflects its future operating development status, corporate governance ability, and management's values and risk preferences (Lawrence et al., 2011). Therefore, upstream and downstream partners pay close attention to the annual reports of listed companies to comprehend their annual operating results and future development. In the long run, ambiguity in later stages of annual reporting may harm corporate earnings and performance sustainability (Li, 2008). To some extent, vague annual reports reflect underlying risks, and the information disclosed by the annual report should meet future expectations of customers, suppliers, and regulators (Das and Teng, 2001).

The contributions of our study are as follows. Firstly, while most readability research predominantly targets English annual reports, China's rising economic prominence makes Chinese annual reports increasingly crucial for global business interactions. These reports significantly influence both local and global stakeholders, especially non-native partners assessing collaboration risks with Chinese firms. Yet, research on Chinese commercial text readability, given its unique linguistic and cultural context, is limited. Our study fills this gap, highlighting the nuances of report readability within China's business linguistic and cultural framework. Secondly, while many studies emphasize company-specific factors such as risk disclosure (Haj-Salem and Hussainey, 2021) and ESG (Luo et al., 2023) or environmental dimensions like social trust (Wu et al., 2014) and Confucian culture (Y. Li et al., 2020; W. Li et al., 2020) affecting trade credit financing, the role of annual report readability remains underexplored. While Xu et al. (2020) investigated this for U.S. firms, focusing mainly on supplier-related accounts payable, we broaden the lens to include other key credit components like notes payable and advance receipts. This comprehensive perspective, vital for a full understanding of supply chain financing, is further enhanced by our use of advanced machine learning, such as Word2Vec, to extract detailed supply chain information from annual reports, offering a more nuanced insight into trade credit financing determinants. Thirdly, we not only employ the derived Fog index for Chinese readability but also integrate linguistic expertise with text mining technologies. By incorporating hedge words, which hint at the textual complexity but also unveil uncertainty, skepticism, or lack of confidence in a given piece of information (Farkas et al., 2010). Such linguistic nuances can be indicative of annual readability measurement to reflect a company's trustworthiness and transparency. Through this approach, we provide a deeper understanding of the subtleties in business text readability. Finally, recognizing that the influence of unreadable annual report on trade credit financing can manifest differently across firms, our study investigates this impact under varied business circumstances. We chose to analyze the proportion of overseas business and product market position as key variables to provide some insights into the effects of heterogeneity, which enriches the literature on trade credit financing by showcasing how readability interacts with business context to shape financial outcomes.

2. Literature review and hypothesis

2.1. Annual report readability

Annual reports are essential tools for companies, offering crucial financial insights to stakeholders. In today's digital age, the significance of these reports extends beyond figures to include narratives. Transparent communication is key to preserving trust with stakeholders (Sellnow and Sellnow, 2010). Leveraging big data to decipher these reports helps in swiftly pinpointing hidden risks. Readable reports reduce information asymmetry (Chung et al., 2023) and boost market appeal (Lawrence, 2013). However, complex reports can disrupt understanding, affecting stock prices (Kim et al., 2018), raising borrowing costs (Ertugrul et al., 2017), impacting

collaborations (Baxamusa et al., 2018), and diminishing firm value (Hwang and Kim, 2017).

Various studies (Moreno and Casasola, 2016; Hwang et al., 2017) have explored factors influencing report readability. Some managers may misjudge their writing quality due to overconfidence. Others might doubt the benefits of clearer reports, while some may intentionally use complex language to obscure negative details. Moreover, some reports, though complex due to intricate business operations or regulations, can still provide valuable information (Bushee et al., 2018). Drawing from the DIKW hierarchy or "Information Hierarchy" (Rowley, 2007), manipulated reports can distort data's authenticity, affecting its transformation into meaningful information. For stakeholders, a report's clarity is essential for accurate communication. Attempts to obfuscate through poor writing are counterproductive (Hwang et al., 2017).

There exists a significant volume of research on readability conducted in English and within English-speaking countries (e.g., Courtis, 1986; Li, 2008). However, studies focusing on the readability of Chinese annual reports are notably scarce, and it's imperative to acknowledge that these findings might not be universally transferable due to the influence of factors such as culture and legal systems (Guillamon-Saorin and Sousa, 2010). Hall (1976) introduced the concepts of "high context" and "low context" to distinguish communication differences between cultures. Given China's high-context cultural background, communication often tends to be implicit and ambiguous, a characteristic that directly correlates with the readability of annual reports. In the context of China's societal norms, unclear and ambiguous language can lead to increased speculation and skepticism. This is in line with the concept of impression management, which Goffman (1959) described and that holds significant cultural resonance in China. Some firms may release difficult-to-read annual reports due to motives like impression management, obfuscation, or incomplete disclosure (Li, 2008; Dempsey et al., 2012). In efforts to maintain face, companies might employ more complex language to describe adverse financial situations. Furthermore, companies in these areas with high corruption levels in China, tend to produce less transparent annual reports and are more prone to obfuscate information (Xu et al., 2022).

Regarding the measurement of annual report readability, there are various methods in English. Li (2008) incorporated the "Fog index", a readability metric in English linguistics (Gunning, 1952), into empirical research on annual reports, thereby establishing a foundational technical groundwork for future studies and advancing empirical research on the readability of textual information. The "Fog index" integrates the average number of words per sentence and the proportion of complex terms, offering a gauge of the ease with which stakeholders can comprehend annual reports. Hwang et al. (2017) and Bonsall et al. (2017) drew insights from the Plain English Handbook and utilized a software named StyleWriter. Once installed, StyleWriter scans Word documents for "writing faults", innovating readability measurements by quantifying these faults. Additionally, the Flesch formula is another widely-accepted and practical method in English (Kincaid et al., 1975). Other scholars have employed techniques like Total Words (You and Zhang, 2009) and Total File Size (Loughran and McDonald, 2014) for assessment.

In terms of Chinese readability metrics, a notable method is the one derived from the Fog index by Xu et al. (2021), with a mature application developed by Deng and Nan (2022). Chinese linguistic studies suggest that sentences with more function words correlate with greater textual complexity and increased comprehension challenges. Specifically, adverbs and conjunctions from relevant Chinese dictionaries have been used to replace the complex vocabulary in the Fog index. Given the nuances of the Chinese language, some research also considers factors like the number of strokes in Chinese characters (Qiu et al., 2016).

2.2. Trade credit financing

Accounts payable from enterprises that purchase products from suppliers on credit, as well as advance receipts from companies that receive payments in advance for products, are concrete manifestations of trade credit financing (Y. Li et al., 2020; W. Li et al., 2020). Such commercial credit financing primarily stems from upstream (suppliers) and downstream (customers) entities within the supply chain. Fabbri and Menichini (2010) note that, from a financing perspective, deposits received indicate a firm's occupation of funds or liquidity belonging to business partners. Trade credit financing provides enterprises with working capital to cater to everyday production and consumption needs, thereby positively influencing sustainable growth (Huang et al., 2019; Liu et al., 2022).

In China's developing legal and financial markets, businesses encounter financing challenges (Allen et al., 2005). Many firms, when faced with these hurdles, turn to trade credit as a substitute for bank loans (Shi et al., 2019). Relative to conventional bank financing, commercial credit is more flexible, effectively addressing financing challenges. And trade credit financing exerts effective supervisory control over corporate investment actions, alleviating agency conflicts between shareholders and creditors (Song and Su, 2022). Business partners closely monitor a firm's operational and credit status to minimize credit risk losses.

Various factors influence trade credit financing. From the company's viewpoint, Petersen and Rajan (1997) found that suppliers are more inclined to offer trade credit to companies with high credit quality and size; Bialek-Jaworska and Nehrebecka (2016) identified cash surplus as an influencing factor in trade credit financing; Zhang et al. (2023) highlighted the significant role of digital transformation in promoting trade credit financing for businesses. Additionally, ESG (Environmental, Social, Governance) factors enhance trade credit by alleviating information asymmetry, bolstering operational efficiency, and mitigating risks (Luo et al., 2023). Mateut and Chevapatrakul (2018) also discovered that companies with lower management concentration and higher market shares tend to secure more trade credit. Companies prioritizing social responsibility can attract stakeholders' attention, boost their market stance, and ultimately access more trade credit (Shou et al., 2020; Xu et al., 2020). Conversely, riskier undertakings like cross-border mergers and acquisitions can limit opportunities to obtain trade credit (Y. Li et al., 2020; W. Li et al., 2020).

Cultural variables unique to China, such as religious beliefs, also impact trade credit financing, with studies like those by Cao et al. (2019) and Li and Zhu (2021) underscoring the positive effects of religious faith on trade credit. W. Li et al. (2020); Y. Li et al. (2020) and Xiu et al. (2023) have delved into how Confucian values and chamber of commerce cultures augment trade credit. What's more, minority enterprises in China are less willing to establish inter-firm trust with business partners by offering trade credit financing (Yano

and Shiraishi, 2015).

2.3. Annual report readability and trade credit financing

An annual report acts as a window into a company, showcasing its financial health, operations, risks, and opportunities. Its readability hints at both the mindset of its leadership and deeper issues such as hidden risks, deceit, or uncertainties about the future. And a comprehensible report effectively communicates information, aiding stakeholders in understanding its content, which is necessary (Loughran and McDonald, 2014).

The foundation of trade credit financing is trust between suppliers and companies. Previous literature has demonstrated that stronger trust can lead to more generous trade credit offers (Wu et al., 2014). The importance of resource management for a company's success is highlighted by the resource dependence theory (Harjoto and Laksmana, 2018). In this context, the clarity of an annual report can attract stakeholders as important information resources, serving as a window into the company's risks and fostering business collaboration by providing partners with a clearer understanding of the company's operations and intentions. Previous research has suggested that shareholders of firms with less readable annual reports bear the increased cost of external financing (Ertugrul et al., 2017). A hard-to-read report can raise red flags about a company's stability and governance (Bajaj et al., 2023), hinting at risks in the trade credit realm. Such risk perceptions may prompt stricter contractual terms from suppliers and customers, including higher repayment costs (Cunat, 2007) or lead to funding challenges from the supply chain's upper echelons (Xu et al., 2020). And it's crucial to recognize that when downstream businesses (customers) offer trade credit financing, the costs associated with such transactions may be relatively high because of the lower market position, potentially making them more sensitive to implicit signals, including the readability of reports.

In essence, a clear report underscores good governance and low risk, fostering trust and enhancing trade credit opportunities. Conversely, a murky report can sow doubt, straining relationships (Bloomfield et al., 2015; Lo et al., 2016). Especially in China, where language nuances matter, the clarity of a report may have pronounced effects on business ties and financing. Given these considerations, the study postulates:

Poor readability of an annual report is negatively correlated with trade credit financing.

3. Research design

3.1. Data

This paper takes China's A-share listed companies as the research object, and the annual observation data range is from 2007 to 2020. As the main and important text part of the annual report, the Management Discussion and Analysis(MD&A) text comes from the CNRDS database, and other financial data comes from the CSMAR database. Based on the initial sample, we conducted data cleaning according to the following criteria:(1) due to the particularity of the industry, we excluded financial and insurance companies; (2) and we eliminated ST and *ST companies; (3) to avoid the influence of outliers, this paper winsorized all continuous variables with 1% quantile. In the end, a total of 18888 observations were collected.

3.2. Variables

3.2.1. The measurement of annual report readability in Chinese

3.2.1.1. Fog in Chinese. Li (2008) introduced the "Fog index", a readability index in English linguistics (Gunning, 1952), into the empirical research on annual reports, creating an operable technical basis for subsequent relevant research and thus promoting the empirical research on the readability of information text. The "Fog index" comprises the number of words in each sentence and the proportion of complex expressions. Other scholars (e.g., Loughran and McDonald, 2014; Hwang and Kim, 2017)used the computer storage size of financial reports or set readability indexes of 5 different dimensions according to *Plain English Handbook* (Securities and Exchange Commission (SEC), 1998) to measure readability.

As a main measurement, the calculation of the annual report readability index in this paper is based on the characteristics of the Chinese language and refers to the research results of previous scholars (Li, 2008; Xu et al., 2021). As we know, the first part of Fog in English is words_per_sentence and the second is the percent_of_complex_words. Specifically, corresponding to the first part of the fog index, we use the number of words contained in a clause in Chinese as one of the basic component readability measurements. The second corresponding part considers the logical structure of a single Chinese sentence. The number of adverbs and conjunctions in the sentence increases the analytic relationship, making discourse understanding more difficult. At the operational level, we use a professional Python library for Chinese text mining, CNTEXT (Deng and Nan, 2022), to calculate the annual report readability in Chinese. The specific calculation formula is as follows:

$$Fog\_Chinese = (words\_per\_sentence + percentage\_of\_complexwords) * 0.5/100$$

3.2.1.2. Supply chain information extraction. To better reflect the risks behind the annual report related to trade credit financing and provide a more granulated result, we extracted only the supply chain-related information from the MD&A section of annual reports and recalculated its readability:

First, based on the entire supply chain process, we constructed a seed lexicon (Stevens, 1989) with terms like "supplier," "customer," "demand," "production," "procurement," "processing," "transportation," "inventory," "sales," and "supply chain"; next, using the Word2Vec model, we expanded the seed lexicon and selected the top 100 similar terms from the annual report text corpus; then, we located supply chain information in the original text, extracting sentences containing this information; finally, we calculated the readability of the disclosed supply chain-related text information to enhance the specificity and robustness of the conclusions.

The core steps involved include:

- Seed Lexicon Construction:

$$S = \{s_1, s_2, \ldots s_n\}$$

Where S represents the seed lexicon, and *si* represents the terms within the lexicon.

- Word2Vec Similarity Expansion

Word2Vec (Mikolov et al., 2013; Li et al., 2021) is a two-layer neural network model trained on large-scale text data. Its purpose is to transform high-dimensional word space into a lower-dimensional vector space, where semantically similar words are close in vector space. The model optimizes the prediction of the center word for a given context ("CBOW architecture").

$$W_i = TopN\_Similar\_Words(s_i, 100)$$

Where *Wi* represents the top 100 supply chain-related similar terms from the MD&A text corpus for seed word *si*.

- Supply Chain Information Extraction and Recalculation

$$T = \{t | t \quad contains \quad w \quad for \quad any \quad w \in Wi\}$$

Where T represents the set of sentences containing supply chain information. Finally, the readability of the extracted sentences with supply chain information (SPC_Fog) is measured with Fog_Chinese.

3.2.1.3. Ambiguity measurement in Chinese. Ambiguity or vagueness is an inherent property of various natural languages. In Chinese, hedges refer to a category of words with vague semantic characteristics, deliberately used to make matters unclear or ambiguous (Chen and Li, 1994). Pragmatics primarily studies the intentions and underlying rules that influence human language application and understanding, which can subsequently decrease text readability. In both pragmatics and NLP literature (e.g., Lakoff, 1970; Farkas et al., 2010), these ambiguous modifiers are used to express uncertainty, possibility, caution, or hesitancy in words or phrases concerning the rest of the sentence, rather than absolute precision, certainty, confidence, or decisiveness. Such modifiers have broad pragmatic value across various domains. For instance, Light et al. (2004) utilized a manually curated list of vague cues to identify speculative sentences in MEDLINE abstracts. In the context of business documents where accuracy and clarity are sought, management might resort to these ambiguous modifiers when they cannot or choose not to provide a precise explanation. When considering the relationship between the ambiguity in the MD&A section of annual reports and the company's trade credit financing, the underlying significance surpasses mere financial number analysis. It encompasses judgments about the company's trustworthiness, transparency, and authenticity. In the business realm, these elements are crucial for establishing robust partner relationships.

We synthesized a dictionary of 100 Chinese ambiguous modifiers by collecting and organizing ambiguous modifiers commonly used in both Chinese and English literature; subsequently, we translated frequently used English ambiguous words into their Chinese counterparts; experts from business schools and Chinese literature departments were then invited to verify and adjust the dictionary; we calculated the frequency of these ambiguous modifiers within the MD&A section of all listed company annual reports over the data's year range and ranked them, selecting the top 100 most frequently occurring words in the business annual report context, such as "可能" (maybe), "估计" (estimate), "大部分" (most), "一些" (some), "通常" (usually), "很多" (many), "大概" (probably), "大约" (approximately), "有证据" (evidence suggests), and so forth; based on these feature words, we conducted searches, matches, and frequency counts, leading to the construction of an ambiguity index.

3.2.2. Trade credit financing

According to our research motive and hypothesis, this study focuses on the impact of annual report readability on the ability to obtain cash flow from upstream and downstream partners in the supply chain. This can also be interpreted as the receipt of trade credit financing from suppliers and customers. Following the literature (Y. Li et al., 2020; W. Li et al., 2020; Bai et al., 2021; Li and Liu, 2022; Zhou and Li, 2023), we measure trade credit financing as the ratio of the sum of accounts payables, notes payable, and accounts collected in advance to the total assets at the end of the year. In a robustness test, we use an alternative definition of trade credit financing, TC_1, calculated as the ratio of total accounts payable over total assets (Fisman and Love, 2003; Xu et al., 2022).

3.2.3. Control variables

To control the influence of other factors on the trade credit of listed companies, this paper sets the common control variables used in previous literatures: the size of the company (Size), financial leverage (Lev), profitability (ROA), majority shareholder shareholding (Top1), company growth (Growth), and industry (Industry) and year (Year) dummy variables are also added. Table 1.

3.2.4. Model design

To investigate the relationship between annual report readability and trade credit, the baseline model is established by using panel data:

$$TC_{i,t} = \alpha_0 + \alpha_1 Readability_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 Top1_{i,t} + \alpha_6 Growth_{i,t} + \Sigma Year + \Sigma Ind + \varepsilon$$

Where i represents the listed company and t represents the year. TC_{it} represents the trade credit financing obtained by company i in year t. Moreover, readability is the fog index (Li, 2008; Xu et al., 2021) in the MD&A section in annual reports of listed companies. And the rest is the control variable. Both year and industry effects are controlled. What is more, ε is a random error term, α_0 is the constant term, and α_1 is the regression coefficient, which is the focus of the regression result.

4. Results

4.1. Summary statistics

As can be seen from Table 2, the average readability of all samples is 0.3775, indicating that the annual report readability of Chinese listed companies is generally poor. And the standard deviation of the readability index is about 12.31, compared with the index in America is 2.55 (Li, 2008). Although the time range is different, it basically shows that the difference between the readability of annual reports of Chinese listed companies is larger than that of listed companies in America. In addition, the standard deviation of trade credit financing is 0.1173, and the discrete distribution of variables is small, indicating that Chinese listed companies' trade credit financing level is not much different. In addition, from the maximum and minimum values of financial indicators such as asset-liability ratio and return on total assets, it can be found that the overall risk level and profitability of Chinese listed companies differ significantly.

4.2. Correlation analysis

Table 3 lists the correlation coefficients and significance strength of the variables. As can be seen from the table, the correlation coefficients are small, which preliminarily proves that there is no collinearity problem. The correlation between readability and trade credit is negative, and relevant control variables should be added for regression fitting to obtain further support.

4.3. Regression analysis

We first examine whether annual readability (Fog_Chinese) influences trade credit financing using the fixed effects model. The regression result of the impact of annual report readability on trade credit financing is shown in Table 4, where the coefficient of readability is negative, and it is significant at the 1% significance level. This indicates that the complexity of the text language of the annual report significantly reduce the trade credit of listed companies, and the hypothesis is verified.

4.4. Robustness checks

4.4.1. Alternative measures of annual report readability

To further fortify the strength and reliability of our findings, we introduced two innovative methods by concentrating on the readability of supply chain-specific information and ambiguity in the annual reports. Firstly, we posit that supply chain partners are likely to be more concerned with supply chain-related information when evaluating creditworthiness, making this information particularly pertinent for our study. By focusing on the clarity and fuzziness of such information with Word2Vec and text extracting, we ensure a sharper, more tailored examination of the relationship between report readability and trade credit financing. Secondly, our decision to incorporate the measure of linguistic "hedges" or ambiguity markers in the annual reports serves as a pioneering approach. Ambiguity could be seen as a red flag by potential creditors, as it might indicate underlying risks or managerial reservations about future prospects.

The regression results presented in Table 5 corroborate our primary findings. Just as observed in Table 4, the coefficients remain

Table 1
Variable description.

Variable type	Variable name	Variable description
Dependent variable	Readability(Fog_Chinese)	Refer to "Fog index"(Li, 2008)
Independent variable	TC	(Accounts payable + notes payable + accounts collected in advance)/ total assets
	Size	The natural log of the company's total assets
	Lev	Total liabilities/total assets
	ROA	Net profit/ total assets
Control variable	Top1	share ratio of the largest shareholder
	Growth	Operating revenue growth rate
	Year	Dummy variable
	Industry	Dummy variable

Table 2
Descriptive statistics.

Variable	Obs	Mean	Std Dev.	Min	Max
TC	18888	0.1876	0.1173	0.0245	0.5414
Readability	18888	0.3775	0.1231	0.1942	0.8136
Size	18888	22.2818	1.2610	20.0260	26.0041
Lev	18888	0.4716	0.1928	0.0916	0.8884
ROA	18888	0.0362	0.0566	-0.2176	0.1878
Growth	18888	0.1764	0.3734	-0.4818	2.2531
Top1	18888	34.5921	14.6832	8.9300	73.9000

Table 3
Correlation analysis.

Variables	TC	Readability	Size	Lev	ROA	Growth	Top1
TC	1.0000						
Readability	-0.0674 * **	1.0000					
Size	0.1478 * **	0.0178 * *	1.0000				
Lev	0.4895 * **	-0.0969 * **	0.4739 * **	1.0000			
ROA	-0.0734 * **	-0.0497 * **	-0.0005	-0.3507 * **	1.0000		
Growth	0.0500 * **	-0.0358 * **	0.0413 * **	0.0286 * **	0.2671 * **	1.0000	
Top1	0.0780 * **	-0.1218 * **	0.1957 * **	0.0694 * **	0.1166 * **	0.0198 * **	1.0000

Note: (1)The correlation matrix is calculated using the Pearson correlation analysis; (2)* , * *, and * ** represent significance at the 10%, 5%, and 1% levels, respectively

Table 4
Baseline regression result.

	TC
Readability (Fog_Chinese)	-0.0518 * **
	(−6.01)
Size	-0.0100 * **
	(−14.41)
Lev	0.3476 * **
	(72.36)
ROA	0.2303 * **
	(16.39)
Growth	0.0022
	(1.16)
Top1	0.0006 * **
	(12.40)
_Cons	0.1527 * **
	(9.56)
Year	Control
Industry	Control
Observations	18888
Adj R-squared	0.3679
F-test	306.40

Note: * , * *, and * ** represent significance at the 10%, 5%, and 1% levels, respectively.

negative, pointing to an inverse relationship between poor report readability and trade credit financing. The consistent significance levels across these measures further bolster our confidence in the conclusions drawn.

What is particularly noteworthy is the consistent negative relationship, even when the lens is narrowed down to supply chain specifics. This not only underscores the universal importance of clear disclosure in all aspects of operations but also suggests that clarity in supply chain disclosures might be especially crucial given its direct implications for business operations and risk evaluation by trade partners. In essence, our robustness checks not only reaffirm our main findings but also illuminate the profound impact of clear, unambiguous supply chain-related disclosures on trade credit financing potential. This has broad implications for both corporate disclosure practices and credit evaluations in the world of trade finance.

4.4.2. Redefining trade credit financing

To further ensure the robustness of our research conclusions, this study has prudently replaced the quantification method of the dependent variable. We opted for another metric, TC_1, for trade credit financing and conducted regression analysis again to further validate the robustness of our findings. The specific quantification for TC_1 is calculated by dividing accounts payable by total assets.

Table 5
Replacement of Fog_Chinese.

	TC	
SPC_Fog	-0.0146 * **	
	(−4.94)	
Ambiguity_Chinese		-0.0002 * **
		(−6.57)
Size	-0.0098 * **	-0.0093 * **
	(−14.15)	(−13.38)
Lev	0.3483 * **	0.3464 * **
	(72.51)	(72.02)
ROA	0.2288 * **	0.2286
	(16.27)	(16.27)
Growth	0.0020	0.0024
	(1.02)	(1.22)
Top1	0.0006 * **	0.0006 * **
	(12.53)	(12.78)
_Cons	0.1379 * **	0.1267 * **
	(8.82)	(8.13)
Year	Control	Control
Industry	Control	Control
Observations	18888	18888
Adj R-squared	0.3675	0.3682
F-test	305.89	306.71

Note: * , * *, and * ** represent significance at the 10%, 5%, and 1% levels, respectively.

The results in Table 6 indicate that the regression coefficient of the substitute metric is also negative and is statistically significant at the 1% level. Consequently, our conclusion that poor readability of annual reports reduces trade credit financing has been further affirmed as robust.

4.4.3. Additional tests

By opting for a t + 1 period for the dependent variable in our robustness check, we have ensured that this relationship isn't merely short-lived or coincidental. Upon examining the relationship between Fog_Chinese, SPC_Fog, and Ambiguity with TC_{t+1}, we found that all three indicators exhibit a significant negative correlation with TC_{t+1} at the 1% significance level. We can see the results from the Table 7.

This suggests that the harder the report is to read and the more ambiguous it is, the more likely the trade credit financing will decrease in the subsequent period. This approach heightens the rigor of our study, as it accounts for potential anticipatory effects and other latent lagged effects.

Table 6
Replacement of trade credit financing.

	TC_1		
Fog_Chinese	-0.0298 * **		
	(−5.47)		
SPC_Fog		-0.0082 * **	
		(−4.38)	
Ambiguity_Chinese			-0.0001 * **
			(−3.80)
Size	-0.0058 * **	-0.0057 * **	-0.0055
	(−13.15)	(−12.90)	(−12.41)
Lev	0.1551 * **	0.1555 * **	0.1549 * **
	(51.11)	(51.25)	(50.92)
ROA	0.0883 * **	0.0875 * **	0.0879 * **
	(9.94)	(9.84)	(9.89)
Growth	0.0008	0.0006	0.0008
	(0.66)	(0.53)	(0.62)
Top1	0.0003 * **	0.0003 * **	0.0003 * **
	(10.67)	(10.79)	(11.01)
_Cons	0.0987 * **	0.0901 * **	0.0848 * **
	(9.79)	(9.12)	(8.61)
Year	Control	Control	Control
Industry	Control	Control	Control
Observations	18888	18888	18888
Adj R-squared	0.2683	0.2679	0.2677
F-test	193.37	192.96	192.78

Note: * , * *, and * ** represent significance at the 10%, 5%, and 1% levels, respectively.

Table 7
Trade Credit Financing in t + 1 Period.

	TC_{t+1}		
Fog_Chinese	-0.0505 * **		
	(−4.45)		
SPC_Fog		-0.0103 * **	
		(−2.66)	
Ambiguity_Chinese			-0.0002 * **
			(−6.53)
Size	-0.0099 * **	-0.0097 * **	-0.0091 * **
	(−11.87)	(−11.61)	(−10.89)
Lev	0.3165 * **	0.3172 * **	0.3151 * **
	(54.75)	(54.88)	(54.47)
ROA	0.1489 * **	0.1482 * **	0.1457 * **
	(8.09)	(8.05)	(7.92)
Growth	-0.0015	-0.0019	-0.0015
	(−0.67)	(−0.84)	(−0.64)
Top1	0.0006 * **	0.0006 * **	0.0006 * **
	(10.44)	(10.58)	(10.75)
_Cons	0.1728 * **	0.1566 * **	0.1461 * **
	(8.94)	(8.31)	(7.80)
Year	Control	Control	Control
Industry	Control	Control	Control
Observations	14397	14397	14397
Adj R-squared	0.3286	0.3280	0.3297
F-test	202.34	201.80	203.32

4.5. Endogeneity concerns

In order to alleviate the possible endogeneity problems in the model and enhance the robustness, the two-stage least square method (IV-2SLS) was further used for regression estimation. The selected instrumental variable (IV) is the year-industry mean except itself of the readability (Luo et al., 2018; Wang et al., 2021). Kleibergen-Paap rk LM and Wald F are tested respectively. The results in Table 8 show that the null hypothesis about the instrumental variable validity is rejected, which proves that there is no problem of under-recognition and weak instrumental variables in IV, and the selection of IV is appropriate. And the conclusion is robust.

4.6. Heterogeneity analysis

4.6.1. Heterogeneity analysis of overseas business

We use the median of foreign revenue divided by total revenue as an indicator to determine the size of a company's overseas operations The result in Table 9 clearly shows that unreadable annual report has a negative impact on trade credit financing, both in companies with a high or low proportion of overseas business. And the influence of readability on trade credit financing of with less overseas business is significantly greater than that of listed companies with more overseas business. Companies with less overseas business may have limited sources of income, smaller market sizes, and lower brand awareness or business reputation. Therefore, it's important for them to produce accurate and reliable information in their annual reports. If the reports are difficult to read or understand, business partners may assume that the company didn't put enough effort into creating them or intentionally withheld information. This can lead to a lack of trust in the company, which can ultimately affect their willingness to work with them. Additionally, it's worth noting that local partners can easily identify readability issues in their native language.

4.6.2. Heterogeneity analysis of product market power

In this part, we calculate the product market power by referring to previous literature (Kale and Loon, 2011). According to the median of the index, high market position companies and low market position companies are divided. From Table 10, we can see that the regression coefficient is not significant in the high market position group, while that of low market position group is significantly negative. Companies with high product market power are often considered to be more reliable and financially stable by their suppliers, investors, and other stakeholders. This is because they have established a strong reputation in the market, have loyal customers, and have demonstrated consistent financial performance over time. The result indicates that the negative impact of poor annual report readability may be mitigated by the overall strength of their reputation and financial position.

In contrast, companies with weaker product market positions may be more dependent on trade credit to finance their operations and thus may be viewed as having a higher default risk by their suppliers. As a result, these companies may be more vulnerable to the negative consequences of poor annual report readability, which may signal a lack of transparency or poor financial performance, and therefore lead to suppliers being less willing to extend trade credit.

Table 8
Endogeneity Analysis.

	1st-stage	2nd-stage
	Fog_Chinese	TC
Fog_Chinese_mean	0.5974 * **	
	(9.20)	
Fog_Chinese		-0.1924 *
		(−1.94)
Size	-0.0052 * **	-0.0107 * **
	(−8.38)	(−12.10)
Lev	-0.0137 * **	0.3456 * **
	(−3.45)	(66.07)
ROA	-0.0211	0.2270 * **
	(−1.62)	(16.01)
Top1	-0.0004 * **	0.0006 * **
	(−9.11)	(8.91)
Growth	0.0088 * **	0.0035
	(5.47)	(1.51)
_Cons	0.2416 * **	0.2096 * **
	(10.49)	(4.83)
Year	Control	Control
Industry	Control	Control
Kleibergen-Paap rk LM		78.628
		[0.000]
Kleibergen-Paap rk Wald F		84.631
F-test		277.47

Note: * , * *, and * ** represent significance at the 10%, 5%, and 1% levels, respectively.

Table 9
Heterogeneity analysis of overseas business.

	Overseas business	
	High	Low
Fog_Chinese	-0.0445 * **	-0.0867 * **
	(−3.07)	(−5.56)
Size	-0.0096 * **	-0.0083 * **
	(−7.84)	(−6.91)
Lev	0.3308 * **	0.3630 * **
	(40.04)	(43.17)
ROA	0.1845 * **	0.2316 * **
	(7.95)	(9.51)
Top1	0.0006 * **	0.0004 * **
	(6.94)	(4.58)
Growth	-0.0046	0.0032
	(−1.38)	(0.92)
_Cons	0.1558 * **	0.1784 * **
	(5.60)	(5.99)
Year	Control	Control
Industry	Control	Control
Observations	6028	6028
Adj R-squared	0.3283	0.3808
F-test	90.28	110.04
Difference in p-value	0.0498 * *	

Note: * , * *, and * ** represent significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusions and suggestions

5.1. Conclusions

The clarity of annual reports is pivotal to facilitating stakeholder understanding and trust. Ambiguous and complex reports can lead to misinterpretation, erroneous decision-making, and even erosion of stakeholder confidence. Recognizing the burgeoning relevance of China in the global economic landscape and its high-context cultural background, which emphasizes implicit communication and relational understanding. Our study sheds light on the crucial, yet previously under-explored, domain of readability in Chinese annual reports. Such reports hold profound implications for both local and international business partners, especially when assessing collaboration risks with Chinese firms.

Drawing from a comprehensive dataset of A-share listed companies in China from 2007 to 2020, our investigation, backed by

Table 10
Heterogeneity analysis of product market power.

	Product market power	
	High	Low
Fog_Chinese	-0.0053	-0.0846 * **
	(−0.52)	(−5.95)
Size	-0.0115 * **	-0.0096 * **
	(−12.46)	(−9.23)
Lev	0.3252 * **	0.3510 * **
	(48.79)	(49.84)
ROA	0.2765 * **	0.4009 * **
	(12.76)	(17.97)
Top1	0.0005 * **	0.0007 * **
	(7.93)	(9.88)
Growth	0.0038	0.0065 * *
	(1.60)	(2.05)
_Cons	0.1502 * **	0.1622 * **
	(6.67)	(6.82)
Year	Control	Control
Industry	Control	Control
Observations	9059	9059
Adj R-squared	0.3451	0.3758
F-test	133.58	152.48
Difference in p-value	0.0000 * **	

Note: * , * *, and * ** represent significance at the 10%, 5%, and 1% levels, respectively.

advanced text mining and regression analysis, affirms a pronounced negative correlation between the poor readability of annual reports and trade credit financing. This relationship remains robust, even upon varying the quantification of our primary variables and opting for a $t + 1$ period for trade credit financing. What's more, we also find that for companies with limited overseas business, unreadable annual reports have a greater negative impact on trade credit financing. And the impact of low readability on trade credit is more pronounced in companies with a lower product market power.

Specially with the measurement of annual report readability, we harness the potential of machine learning tools, like Word2Vec, to glean intricate supply chain data from annual reports, which enriches our understanding of the determinants governing trade credit financing. And our innovative approach to readability assessment with a linguistic emphasis on hedge words in Chinese, provides nuanced insights into the underlying uncertainties or apprehensions they may convey. These linguistic elements could not only be a new measurement of annual readability but also a pivotal indicator of a company's trustworthiness and transparency.

5.2. Suggestions

Firstly, the annual report serves as a pivotal tool granting business partners an insight into a company's financial health, strategic decisions, and overall performance. Beyond providing mere financial details, the report is a key barometer for gauging reputation and potential risks. This additional knowledge augments their capacity to discern and assimilate report content more effectively. Additionally, by cross-referencing information, stakeholders can derive precise insights. Supply chain partners can utilize this information to optimize their business strategies, such as adjusting payment terms and formulating more flexible cooperation agreements.

Secondly, regulatory authorities should champion the cause of report standardization and decluttering. In this digital age, adopting big data technologies can be instrumental in facilitating evaluations of corporate transparency and the caliber of information disclosures. It's imperative to note that while poor readability isn't equivalent to financial deceit, it often doesn't lead to default penalties. As such, regulatory bodies need to formulate and enforce comprehensive guidelines that obligate firms to produce transparent, lucid, and accessible annual reports. Such initiatives aim to democratize information access and elevate transparency standards for all stakeholders.

Thirdly, company management must prioritize the creation of clear and comprehensible annual reports. When stakeholders encounter convoluted annual reports, it may foster skepticism and diminish trust in the organization and its leadership. Enhancing report transparency can be achieved by delivering concise, logically structured, and lucid documents. This involves leveraging simple language, maintaining optimal sentence lengths, and adopting clear typography. Furthermore, to improve the efficiency of information transmission, it's essential to incorporate content that's beneficial for stakeholders. This, in turn, fosters greater confidence in the company.

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CRediT authorship contribution statement

Hong-Quan Li: Conceptualization, Methodology, Supervision. **Yang Yang**: Data curation, Writing – original draft preparation. **Feng-Wan Xue**: Data analysis, Writing – reviewing and editing. **Zhi-Yi Liu**: Investigation, Validation.

Declaration of Competing Interest

None.

Data availability

I have shared the link to my data/code at the Attach File step.

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