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Better or worse? Revealing the impact of common institutional ownership on annual report readability

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Based on the data on Chinese listed companies over the period from 2007–2021, the relationship between common institutional ownership (CIO) and annual report readability (ARR) is revealed in this paper. The results show that CIO reduces ARR. After a series of robustness tests, this conclusion continues to hold. Further analyses indicate that in situations where analyst attention, industry concentration, and media coverage are high, the above negative relationship is more significant. In addition, operational risks play a mediating role between CIO and ARR. This study enriches the evidence supporting the collusive manipulation effect of CIO.

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Introduction

In the information age, economic growth and technological progress have brought great challenges to the stability of the capital market. To improve the capital market system, enterprises must strengthen their understanding of all types of capital. As one of the most comprehensive and credible channels for obtaining data on corporate profitability and risk levels, corporate annual reports provide investors with important incremental information. In addition to numerical information, the abundant narrative text in corporate annual reports also contains a wealth of information that can serve as supplementary material for corporate financial figures (Li, 2010). However, the current capital market's integrity mechanisms are still underdeveloped, and external regulatory frameworks remain incomplete. For external investors, who generally lack access to in-depth internal corporate information (Yin et al., 2023), it becomes challenging to accurately assess a company's true strength, management quality, and future growth prospects. Compared with the more demanding numerical information, there is obviously more space for the manipulation of narrative text in annual reports. When firms perform poorly, managers may intentionally use complex statements and differentiated writing styles to obfuscate information, which leads to a reduction in annual report readability (ARR) (Bushee et al., 2018). Ineffective financial information hinders external stakeholders from discerning pertinent details, thereby obstructing access to valuable insights and limiting investment decisions. In the prevailing regulatory climate, the textual readability of listed companies' annual reports garners close attention from regulators. This trend underscores a wider acknowledgment of the vital role that transparent and intelligible financial reporting plays in safeguarding investor interests and enhancing market efficiency. Consequently, delving into the potential motivations that prompt enterprises to modify the readability of their annual reports not only sheds light on inherent corporate governance challenges but also offers empirical evidence to inform the development of regulatory policies.

As a pivotal aspect of corporate governance, the readability of annual reports influences firm's investment decisions (Huong Dau et al., 2024), equity mispricing (Chen et al., 2023) and stock return synchronicity (Gangadharan and Padmakumari, 2023). The mechanisms of corporate governance which can ensure the transparency and accuracy of information play a key role in improving the readability of corporate annual reports. As China's economy enters a new stage, institutional investors become increasingly active in the stock market. This leads to the emergence of common institutional ownership (CIO), which means that an institutional investor holds shares of multiple companies in an industry at the same time. CIO, endowed with a wealth of industry practices, operational experience and professional insights, possesses the capacity to participate in corporate governance and influence business decisions. These institutional investors are capable of supervising management through their profound understanding of the industry and can also impact crucial corporate strategic decisions through their shareholding proportions. While CIO is important for modern corporate management, its effects are not always positive and effective, sometimes leading to complex outcomes that are not anticipated. In capitalist economic systems, the profit-oriented character of capital may lead joint institutional investors to leverage their informational and scale advantages across firms within the same industry. These advantages stem not only from their profound industry insights and substantial capital investments but also from their frequent interactions with corporate management. As highlighted in the study of Wang et al. (2023), such factors may increase the likelihood of collusion between joint institutional investors and management, potentially giving rise to what is termed an 'interest alliance'.

On one hand, compared to individual institutional investors who invest in a single enterprise and retail investors who may lack professional financial knowledge and the ability to discern the true state of affairs within a company, common institutional investors can establish equity connections between enterprises, possessing more industry-specific information advantages and robust capabilities for integrating information resources, thereby leveraging the synergistic effects of information. Concurrently, CIO exerts stronger supervisory capabilities and lower monitoring costs, enabling effective oversight of held companies and enhancing governance effects (Du et al., 2021). On the other hand, CIO might also exert negative influences on corporate governance. Based on the manipulation-collusion hypothesis, unlike institutional investors in a single enterprise, common institutional investors can exploit channels and opportunities to obtain proprietary information, promoting collusive fraud among enterprises within their investment portfolio. Furthermore, according to the limited attention theory, holding shares in multiple enterprises could dilute an institutional investor's supervisory efficiency over individual companies (Astvansh et al., 2023), thereby diminishing corporate oversight and reducing the readability of annual reports. In the context of China's emerging capital markets, the impact of CIO on the readability of corporate annual report narratives is a subject of inquiry. Does it drive firms towards more transparent financial reporting strategies, or does it reduce the readability of annual reports for private gains? The mechanisms underlying these effects are also of interest. The multifaceted nature of corporate behaviour in manipulating the readability of annual reports suggests the interplay of diverse factors. Research into the precursors of textual readability remains nascent, with the academic discourse yet to fully address the influence of the emergent construct of CIO on this aspect of corporate reporting. This study endeavours to address this lacuna by probing the nexus between CIO and ARR.

The contributions of this study are manifested in three key areas. First, this work deepens the understanding of the economic consequences of CIO. The literature has mainly explored the effect of CIO on digital transformation, share price collapse risk, information quality disclosure and earnings management, and most of these studies support the collaborative governance hypothesis (Chen et al., 2021). From the perspective of information disclosure, the influence of CIO on the readability of annual reports is investigated in this paper, and the results support the collusive manipulation hypothesis, thus extending the understanding of academia on the association of CIO and non-digital information behaviour manipulation in the Chinese capital market. Second, this work provides a new perspective for regulating the quality of corporate annual reports. Previous studies have predominantly examined the readability of annual reports from the perspective of single internal factors within enterprises. However, there has been scant scholarly exploration of the antecedents of ARR from a network perspective. This paper focuses on this issue by exploring a pair of competitive hypotheses, which supplements the extant research on the factors influencing the readability of the annual reports. Third, in the context of the new normal of China's economy, the intermediate mechanism and boundary conditions between CIO and ARR are deeply examined. This not only provides a reference for guiding Chinese enterprises to optimize corporate governance and equity relations but also aids regulatory authorities in enhancing their focus on the newly emerged phenomenon of institutional co-holding. It assists individuals in comprehending and addressing the complexities and dynamic changes of the capital market.

Theory and hypothesis

Literature review

Economic consequences of CIO. In terms of corporate governance theory, we have reviewed the literature and found that research on the impact of CIO on microenterprises can be divided into two categories: the synergistic governance perspective and the collusive manipulation perspective. Proponents of the collaborative governance view argue that CIO fosters compatibility among interconnected firms. He and Huang (2017) proposed that common institutional investors have a stronger ability and motivation to participate in the governance of peer enterprises, thus affecting corporate behaviour and decision-making. Recent research suggests that CIO not only intervenes in corporate governance through voice and exit mechanisms, thereby mitigating the degree of firms' earnings management (Ramalingegowda et al., 2021), but also collaborates to constrain managerial rent extraction (Chen et al., 2023), effectively suppress improper corporate behaviour (Wang et al., 2023), improve investment efficiency (Bai et al., 2023), and promote corporate innovation (Li and Liu, 2023).

The literature advocating the collusion manipulation perspective indicates that, under the goal of maximizing the interests of affiliated enterprises, CIO may induce collusive fraudulent behaviours among companies within certain industries. This can enhance the product value and pricing power of the industry's overall portfolio, potentially leading the product market towards monopoly. Ultimately, this results in economic damage and adverse effects on consumers (Azar et al., 2018), hampers the digital transformation of enterprises (Wang et al., 2023), and reduces the corporate social responsibility (CSR) of the investment portfolio (Cheng et al., 2022).

Studies related to ARR. In recent years, the nonfinancial information contained in annual reports has received increasing attention as the Securities Supervision Commission continuously revises the content and format requirements for corporate disclosures. Under this background, the readability of annual reports, which is a key factor in determining whether the narrative texts of reports can be effectively understood, has gradually become a focus issue in academia. Regarding the impact of ARR, scholars suggest that reports with poor readability may conceal more negative information, potentially leading to a series of adverse consequences. These include inducing insiders to engage in more opportunistic sales (Yin et al., 2023), increasing equity mispricing (Chen et al., 2023), severely narrowing the avenues for firms to obtain financing through trade credit (Li et al., 2024), and lowering stock return synchronicity (Gangadharan and Padmakumari, 2023), among others. In terms of the influencing factors for ARR, the existing research mainly discusses the perspectives of board independence (Rahman and Kabir, 2023), organizational capital (Panta and Panta, 2023), CEO power (Sun et al., 2022) and the corporate social responsibility (Soliman and Ben-Amar, 2022). In general, there is still a large gap in the study of the antecedents of ARR, and few studies analyse this issue from the perspective of corporate shareholder characteristics. Therefore, the aim of this study is to reveal the influence mechanism of common institution ownership on ARR.

Theoretical analysis and research hypothesis

The positive impact of CIO on ARR. The positive impact of CIO on ARR can be attributed to the 'synergistic governance effect', which enhances the governance of listed companies and, in turn, the ARR. In concrete terms, this can be divided into two governance mechanisms: information synergy effect and supervisory governance effect.

Information synergy effect: In today's volatile market, with accelerated technological innovation and stiff competition, external collaboration is crucial for business development. There is a positive association between collaborative efforts and a company's capabilities for growth (Chen and Yu, 2022). However, in reality, firms competing in the same industry face the pressure of market elimination. Due to future uncertainties and information asymmetry, it is challenging for firms to formulate exhaustive contracts, leading to low-level and inefficient cooperation. Firms become cautious and inefficient in collaboration due to the fear of risk spillover caused by the counterpart's lack of commitment to the contract, reducing transaction efficiency. To maximize profits, intense competition often exists among firms within the same industry. When a firm releases a high-quality annual report, it can positively affect the capital costs of other companies within the industry (Huong Dau et al., 2024). Consequently, firms may choose to conceal or obfuscate proprietary information to maintain their competitive position, reducing the readability of annual reports to disrupt competitors' information acquisition. CIO can build a network of connections between different firms, playing a role in integrating information in economic activities, effectively alleviating the problem of information asymmetry within the portfolio, and reducing the intentional lowering of ARR by firms within the same industry to interfere with competitors' production, operation, and investment decisions. At the same time, to maximize the value of the investment portfolio, associated firms within the portfolio can leverage their abundant resources and other advantages to obtain heterogeneous information from the shareholder network (Wu et al., 2023). As major shareholders of the firms, common institutional investors have sufficient capacity to influence the decisions of the board of directors and management, coordinate the vicious competition between firms, promote communication, cooperation, and information sharing among their invested firms, reduce the opacity of corporate information, and improve ARR.

Supervisory governance effect: From the perspective of identification ability, in comparison with general institutional investors and other shareholders, common institutional investors accumulate extensive regulatory experience, management wisdom, and diverse information in the operations and management of different firms within the same industry. This benefits them in identifying behaviours that reduce ARR, allowing them to provide feedback to the firms. From the perspective of monitoring costs, firms within the same industry often exhibit comparable business backgrounds and financial reporting patterns, which enables common institutional investors to identify and interpret firms' annual reports at lower monitoring costs. Moreover, with their industry-wide experience advantage, common institutional investors wield greater influence. When managers use obscure language to reduce the readability of annual reports for personal gain or to conceal true intentions, ordinary institutional investors can leverage their informational edge and expertise in governance to oversee and regulate the entities in question, thereby reducing the risk of agency problems (Backus et al., 2019).

The negative impact of CIO on ARR

Manipulative collusion effect: Research in the field of industrial organization suggests that common institutional investors possess strong motives for collusion and deception. For instance, Azar et al. (2018) argue that common institutional investors, with their resources and capabilities, can lead the establishment of "collusive alliances" by implementing earnings management, concealing true accounting information, and creating industry information asymmetries within their investment portfolios. The formation of such alliances can effectively maximize the value of connected

firms, augment the bargaining leverage of portfolio entities within the marketplace, and enhance their potential for favourable outcomes. Within the alliance, firms often share common interests and, under the temptation of collusive profits, common institutional investors are unlikely to expose the self-serving actions of alliance members. In pursuit of maintaining information advantages and maximizing benefits, common institutional investors may tend to reduce the quality of corporate information disclosure. This is because, over the years, the intricacy inherent in business decision-making processes has progressively escalated, a reflection of the multifaceted nature of contemporary commercial environments. To make informed decisions, managers must have a comprehensive understanding of the business environment (Sigari and Gandomi, 2022). Meanwhile, other institutional investors often have relatively limited access to information on corporate investment decisions and operational management. Competitors within the same industry frequently rely on a company's annual reports to identify profitable opportunities. By reducing the readability, misleading signals can be emitted to some extent, constructing "information barriers" for the firm, thereby affecting the investment decisions of other institutional investors. Moreover, in the institutional investment industry, performance competition is a common phenomenon; institutional investors are regularly assessed, and their performance is often publicly ranked. Common institutional investors seeking an advantage in performance comparisons may collude with the management of their holding companies, prioritizing short-term interests over the pursuit of long-term performance. Consequently, they may reduce the intensity of company oversight, weaken corporate governance, engage in myopic behaviour, and lower the readability, thereby disrupting the decision-making of other peer companies and minority shareholders.

The theory of limited attention: Investor attention is limited, especially for common institutional investors who, as their portfolio size increases, find it difficult to allocate equal attention to all held companies (Gilje et al., 2020). Astvansh et al., 2023 study delves into the social repercussions of investor distraction, particularly highlighting how cross-blockholding can sidetrack institutional investors. Due to limited attention, the interaction between institutional investors and management may be affected, leading to reduced intervention in corporate behaviour. Additionally, this constraint on attention may weaken institutional investors' active participation in corporate governance and decision-making processes, such as electing board members and oversight committees, participating in shareholder assemblies, and advancing shareholder motions, thus diminishing their oversight of firms. For companies experiencing a decline in attention, the cost for management to engage in self-serving behaviour is relatively reduced, providing an opportunity for management to extract private benefits. In such instances, management may lower the readability of annual report texts to conceal negative news or reduce investor focus on unfavourable situations, thereby decreasing the transparency of the company's financial health to market participants and exacerbating agency conflicts. Therefore, drawing from the theory of limited attention, CIO may inadvertently lead to less readable annual report narratives.

In summary, CIO presents a dichotomy in its impact on ARR. On one side, CIO may enhance the readability of corporate annual report texts through the synergistic effects of information coordination and governance oversight, thereby attracting more investors. Conversely, it might also foster collusive and manipulative behaviours, dilute the attention and oversight of common institutional investors towards individual firms, leading to more ambiguous and complex corporate disclosures, thus further reducing the readability of corporate annual reports and deterring potential investors. Reflecting upon the theoretical discourse previously articulated, we posit the ensuing competing hypothesis:

H1a: Holding other factors constant, CIO increases ARR.
H1b: Holding other factors constant, CIO decreases ARR.

Research design

Samples and data. To mitigate the influence of the Accounting Standards for Business Enterprises (ASBE) implemented in 2007[1], this study selects a dataset comprising Chinese listed companies from 2007 to 2021 as the foundational research sample and the following processing have been conducted on the original data: (1) financial industry samples have been deleted; (2) ST and *ST enterprises[2] have been deleted; (3) samples missing significant data have been deleted. After processing, a total of 35916 observations are obtained. The sample data was taken from the CSMAR database[3] and the WinGo financial text database[4]. In addition, to neutralize the effects of outliers, the continuous variables used in this paper have been winsorized by 1% before and after.

Variable definition

Annual report readability. The readability of an annual report directly correlates with its comprehensibility; a highly readable report simplifies understanding, while a report with low readability complicates the absorption of its contents. This paper used the sentence production probability method developed by Shin et al. (2020) to measure readability indicators. The formula for calculation is as follows:

$$Readability = \frac{1}{N}\sum_{s=1}^{N}\log P_s(P_w) \quad (1)$$

where $P_s(P_w)$ denotes the probability of generating the entire sentence by multiplying the probabilities of each word. *Readability* is the index of how readable the annual report is, and the higher this value is, the more readable the corporate annual report.

Common institutional ownership. In this paper, CIO is measured at three levels, following the constructs of Ramalingegowda et al. (2021) and Du et al. (2021), as follows: (i) the first is a dummy variable (*Coz1*) indicating whether the firm has common institutional investors; (ii) next is the degree of the linkage of CIO (*Coz2*); and (iii) the last is the proportion of CIO shareholding (*Coz3*). Table 1 summarizes the variable definitions and calculation methods.

Control variables. Considering other factors that may affect the ARR, two positions in one (*dual*), growth (*growth*), firm size (*size*), board size (*BoardSize*), the proportion of independent directors (*Indep*), institutional investor shareholding (*Insit*), free cash flow (*cfo*), the proportion of fixed assets (*ppe*), gearing ratio (*lev*), book-to-market ratio (*btm*), the proportion of shares held by the company's largest shareholder (*Shrcr1*), whether Big 4 audit (*Big4*), and the nature of ownership (*soe*) as control variables, based on the literature (Du et al., 2021; Sun et al., 2022). Finally, to eliminate the errors caused by year and industry, the fixed effect in terms of year and industry is set. The detailed descriptions are shown in Table 1.

Model setting. Considering that the readability of corporate annual report texts is a continuous variable, this study employs Ordinary Least Squares (OLS) as the baseline regression analysis. Referring to the view of Li and Liu (2023), to avoid the time-varying nature of

Table 1 Variable definition summary.

Variable Name	Variable Symbols	Variable Description	Data source
ARR	*Readability*	The mean of the logarithm of the conditional generation probability of sentences in the report text. The higher the value, the higher the frequency of word pair collocations in the corpus, and the higher the readability of the text; conversely, the lower the readability of the text.	WinGo financial text database
Existence of CIO	*Coz1*	Calculate whether the company has common institutional investors (institutional investors holding more than 5% of shares in other listed companies in the same industry hold more than 5%) in each quarter, and take value 1 if yes, otherwise take value 0.	Calculated by authors with reference to Ramalingegowda et al. (2021) and Du et al. (2021)
Degree of CIO linkage	*Coz2*	Calculate how many common institutional investors each listed company has in each quarter, then take the annual average of this data, and take the natural logarithm plus 1.	
CIO shareholding ratio	*Coz3*	Calculate the sum of shareholding ratios of all common institutional investors in each quarter, and then take the annual average.	
Two positions in one	*Dual*	If the chairman and general manager are the same person, take value 1, otherwise take 0	CSMAR database
Growth	*growth*	Enterprise operating income growth rate	
Enterprise size	*Size*	Natural logarithm of enterprise employees	
Board Size	*BoardSize*	Natural logarithm of number of directors	
Proportion of independent directors	*Indep*	Ratio of number of independent directors to number of board members	
Institutional investor shareholding	*Insit*	Ratio of institutional investor shareholding to total share capital	
Free cash flow	*cfo*	Ratio of net cash flow generated by operating activities to total assets	
Fixed asset ratio	*ppe*	Ratio of net fixed assets to total assets	
Asset-liability ratio	*lev*	Total liabilities to total assets at the end of the year	
Book-to-market ratio	*btm*	Net assets to equity value	
Company's largest shareholder shareholding ratio	*Shrcr1*	Ratio of shares held by the company's largest shareholder to total share capital	
Whether Big 4 audit	*Big4*	If the annual report auditor is one of the Big Four accounting firms, take value 1, otherwise take value 0.	
Nature of ownership	*soe*	If the company's actual controller is state-owned, the variable value is taken as 1, otherwise it is taken as zero	

ARR and corporate heterogeneity, this study sets a fixed effect model with the control of time and industry[5]:

$$Readability_{it} = \beta_0 + \beta_1 Coz_{it} + \gamma CV_{s_{it}} + \sum_j Industry_j + \sum_t Year_t + \varepsilon_{it} \quad (2)$$

where $Readability_{it}$ is the readability of annual report of enterprise i in year t; Coz_{it} is the common institutional ownership of enterprise i in year t, including *Coz*1, *Coz*2 and *Coz*3; and $CV_{s_{it}}$ represents a set of control variables. $\sum_j Industry_j$ and $\sum_t Year_t$ denote the two kinds of fixed effects of industry and time; ε_{it} is the error term.

Results

Basic descriptive analysis. Table 2 shows the descriptive statistics for each variable. The mean value of *Readability* is −19.04, the standard deviation is 2.477, and it varies from −51.69 to −13.95. These empirical indicators demonstrate that the ARR exhibits considerable heterogeneity across Chinese publicly traded corporations. For the explanatory variables, the means of the linkage and shareholding of CIO are 0.075 and 0.027, and the standard deviations are 0.221 and 0.097, which shows that Chinese listed companies have significant differences in the characteristics of institutional ownership. The maximum value of *Coz3* reaches 57.0%, suggesting that a portion of common institutional investors in the sample can exert significant influence on corporate operations. The correlation coefficient test indicates that the indicators of CIO and ARR are all negatively correlated at the 1% level. This supports the claim that CIO lowers ARR.

Regression analysis. Table 3 presents the basic regression results for the main effect. Models (1) - (3) show that the presence of common institutional investors can reduce the ARR of listed companies by 0.230 units on average, while corporate ARR decreases by 0.322 units on average for every increase in the degree of linkage, and ARR decreases by 0.709 units on average for every increase in the percentage of joint ownership. Thus, the results of the benchmark regression support the collusive manipulation hypothesis that CIO reduces the readability of corporate annual reports.

Robustness tests. To verify the accuracy of the above conclusions, the following methods have been adopted as robustness tests.

Propensity score matching method. To alleviate the selection bias, we referred to Du et al. (2021), and used the propensity score matching (PSM) method to conduct robustness test. First, we set firms with CIO as the treatment and control groups for matching the variables of *dual, growth, size,*

Table 2 Descriptive statistical characteristics of variables.

Variable Name	Sample size	Average value	Standard deviation	Minimum value	Maximum value	Correlation coefficient *Readability*
Readability	35,916	−19.04	2.477	−51.69	−13.95	
Coz1	35,916	0.103	0.304	0	1	−0.091***
Coz2	35,916	0.075	0.221	0	0.997	−0.093***
Coz3	35,916	0.027	0.097	0	0.570	−0.069***
Big4	35,916	0.059	0.235	0	1	−0.146***
cfo	35,916	0.046	0.073	−0.194	0.256	0.002
ppe	35,916	21.89	16.52	0.140	71.14	0.071***
lev	35,916	0.432	0.216	0.0514	1.037	−0.124***
btm	35,916	113.3	117.5	9.517	1062	−0.139***
size	35,916	7.579	1.306	3.932	11.29	−0.140***
growth	35,916	0.195	0.483	−0.629	3.287	−0.063***
dual	35,916	0.730	0.444	0	1	−0.0004
Insit	35,916	46.56	25.24	0.396	98.26	−0.080***
Shrcr1	35,916	35.06	14.83	8.497	74.82	0.024***
BoardSize	35,916	2.135	0.200	1.609	2.708	−0.036***
Indep	35,916	0.374	0.053	0.308	0.571	−0.027***
soe	35,916	0.390	0.488	0	1	−0.020***

*** indicates significant at the 1% level.

Table 3 Benchmark test of the impact of CIO on ARR.

Variables	Model (1)	Model (2)	Model (3)
	Readability	Readability	Readability
Coz1	−0.230*** (−5.532)		
Coz2		−0.322*** (−5.603)	
Coz3			−0.709*** (−5.354)
dual	0.089*** (3.145)	0.089*** (3.137)	0.091*** (3.202)
growth	−0.243*** (−9.642)	−0.243*** (−9.644)	−0.244*** (−9.648)
size	−0.280*** (−21.878)	−0.280*** (−21.873)	−0.282*** (−22.044)
BoardSize	−0.229*** (−3.128)	−0.226*** (−3.098)	−0.231*** (−3.161)
Indep	−1.260*** (−4.601)	−1.254*** (−4.576)	−1.267*** (−4.620)
Insit	−0.005*** (−7.338)	−0.005*** (−7.299)	−0.005*** (−7.569)
cfo	0.790 (1.390)	0.790 (1.385)	0.774 (1.297)
ppe	0.013* (1.758)	0.013* (1.770)	0.013* (1.708)
lev	−0.784*** (−11.618)	−0.785*** (−11.622)	−0.781*** (−11.571)
btm	−0.001** (−2.114)	−0.001** (−2.182)	−0.001** (−2.157)
Shrcr1	0.011*** (11.812)	0.011*** (11.781)	0.012*** (12.370)
Big4	−0.956*** (−15.898)	−0.955*** (−15.870)	−0.962*** (−15.972)
soe	0.406*** (13.620)	0.406*** (13.615)	0.408*** (13.685)
_cons	−17.615*** (−66.431)	−17.624*** (−66.444)	−17.615*** (−66.339)
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
N	35916	35916	35916
r2_a	0.238	0.238	0.238

***, ** and * indicate significant at the 1%, 5% and 10% levels, respectively; *t*-values in parentheses, using robust standard errors.

BoardSize, Indep, Insit, cfo, ppe, lev, btm, Shrcr1, Big4 and *soe*. Then, we used a one-to-one nearest neighbour matching method to find control group firms with similar characteristics as those of the treatment group. The matching balance test indicates that there is no systematic difference between these two groups and that the covariate selection for the PSM-OLS test is appropriate. The PSM test results show that the average treatment effect of ARR (*Readability*) is −0.214 with a significance level of 1%. This suggests that compared with other listed firms with similar characteristics, CIO leads to lower ARR. Then, we performed a regression analysis on the treatment group and control group, and the results are shown in Table 4. The coefficients of *Coz2* and *Coz3* are both significantly negative at the 1% level, which is consistent with the results of the basic regression Model (1).

Two-stage least squares method. In the foundational regression model, a scenario is conceivable wherein the textual readability of corporate annual reports may exert an influence on joint institutional ownership. To tackle the potential endogeneity issue stemming from 'reverse causality' within the baseline model, the present research introduced an instrument variable to facilitate a two-stage least squares regression analysis (2SLS). Following the study of Gao et al. (2019), the indicator of CIO may be affected by whether the company belongs to the CSI 300 index[6]. Therefore, we selected whether the listed company belonged to the CSI 300 index (*HS300*) as an instrumental variable and set the dummy variable *HS300*. If the listed company belongs to the CSI 300 index in that year, *HS300* is set to 1 and to 0 otherwise.

The results of the first-stage regression show that CSI 300 index constituent stocks are positively correlated with *Coz1*, *Coz2* and

Table 4 The results of PSM-OLS and two-stage least squares.

PSM-OLS			Instrumental variables and two-stage least squares		
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
	Readability	**Readability**	**Readability**	**Readability**	**Readability**
Coz1			−12.968*** (−6.979)		
Coz2	−0.266*** (−3.270)			−17.148*** (−7.126)	
Coz3		−0.529*** (−2.912)			−52.432*** (−5.233)
CVs	Yes	Yes	Yes	Yes	Yes
Year fe	Yes	Yes	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes	Yes	Yes
N	5593	5593	35916	35916	35916

***indicates significant at the 1%; *t*-values in parentheses, using robust standard errors; regression results for control variables (CVs) and constant terms are omitted.

Table 5 The result of PSM-difference.

Variables	**(1)**	**(2)**
	DReadability	**DReadability**
DCoz2	−0.231*** (−2.585)	
DCoz3		−0.610** (−1.979)
CVs	Yes	Yes
Year fe	Yes	Yes
Industry fe	Yes	Yes
N	7008	7008
r2_a	0.187	0.187

*** and ** indicate significant at the 1% and 5%; *t*-values in parentheses, using robust standard errors; regression results for control variables (CVs) and constant terms are omitted.

Coz3 at the 1% statistical level, indicating that the instrumental variable selection is appropriate. The results of the second-stage regression are shown in Table 4. It can be seen that *Coz1*, *Coz2* and *Coz3* are all significantly negatively correlated with *Readability*, implying that after eliminating the endogeneity problem caused by reverse causality to some extent, the results of the benchmark regression model of this paper still hold.

Difference model. To further test the omitted variable problem in Model (1), we examined how changes in ARR affect CIO and control variables, constructing the following model:

$$DReadability_{it} = \beta_0 + \beta_1 DCoz_{it} + \gamma DCV_{s_{it}} + \sum_j Industry_j + \sum_t Year_t + \varepsilon_{it} \quad (3)$$

where *D* equals the current year value minus the previous year value. After eliminating selection bias, frequency weighting was used to perform sample regression. The results displayed in Table 5 show that for *DReadability*, the regression coefficient of *DCoz2* is −0.231 and is significantly negative at the 1% statistical level, while the regression coefficient of *DCoz3* is −0.610 and is significantly negative at the 5% statistical level. This indicates that the ARR of listed companies decreases with an increase in the connection degree of CIO' and the shareholding ratio, which verifies the collusive manipulation hypothesis.

T+1 period dependent variable. To avoid the impact of time lag, t + 1 period ARR ($Readability_{t+1}$) was used to replace *Readability* for testing. The results displayed in Table 6 show that the regression coefficients of CIO on ARR are all negative and significant at the 1% statistical level, which further indicates that after eliminating the endogeneity problem caused by possible reverse causality in the model Hypothesis H1b is still supported.

Shorten the sample period. Given the sample period extends from 2007 to 2021, the regression outcomes could be influenced by the financial disruptions stemming from the 2008 crisis. Therefore, to ensure the robustness of the results, the samples of 2007 and 2008 were excluded and the regression was reconducted. The results are shown in Table 6. We can see that *Coz1*, *Coz2* and *Coz3* are all significantly negative at the 1% statistical level, thus supporting Hypothesis H1b.

Further analyses

Moderating effect of analyst attention. Bowers et al. (2014) highlighted the pivotal role of analysts in capital markets, noting that the dissemination of their adverse findings can precipitate notable market responses and captivate investor interest. Analyst attention mainly influences firms through the supervision effect and pressure effect. The supervision effect hypothesis claims that analyst attention can increase the information transparency of the capital market and thus alleviate the information asymmetry problem (Jiraporn et al. 2012). However, based on the pressure effect hypothesis, when the firm's operating performance and financial condition decline, heightened analyst scrutiny tends to amplify investor interest, which may incite a sell-off in stocks. This dynamic can exert undue pressure on corporate management, incentivizing a shift in focus towards short-term financial metrics at the expense of long-term strategic development.

The collusive manipulation hypothesis argues that common institutional investors prefer to see covert communication among invested firms, such as information used to control product output, to seek excess returns. Managers who collude with each other may lower the quality of annual report text information to disrupt the incremental information that relevant report users can obtain to avoid having their self-interested behaviour discovered by analysts. Therefore, if the collusive manipulation hypothesis of CIO holds, then the negative effect of CIO on ARR increases with increasing analyst attention. In contrast, if the collaborative governance hypothesis is verified through this path, the negative correlation between CIO and ARR remains significantly unchanged when more analysts follow.

Based on the review, a new variable *Atten*, which is measured by the annual count of analysts monitoring the firm, is incorporated into the model. For the analyst following metric, we draw on the existing research (Jo and Harjoto, 2014) and measure this indicator using the natural logarithm of the number of analysts following the company in that year. If the number of analysts following the company is higher than the median of the year and industry, *Atten* is set to 1 and to 0 otherwise. The results displayed in Table 7 show that in the group with more analysts following (*Atten* = 1), the coefficients of the effect of the CIO shareholding ratio on ARR are all significantly negative at the 1%

Table 6 The results of test with T+1 period dependent variable and shortened sample.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable for T + 1 period			Shortened sample space		
	$Readability_{t+1}$	$Readability_{t+1}$	$Readability_{t+1}$	Readability	Readability	Readability
Coz1	−0.222***			−0.232***		
	(−4.923)			(−5.376)		
Coz2		−0.313***			−0.329***	
		(−5.008)			(−5.526)	
Coz3			−0.650***			−0.772***
			(−4.721)			(−5.689)
CVs	Yes	Yes	Yes	Yes	Yes	Yes
Year fe	Yes	Yes	Yes	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes	Yes	Yes	Yes
N	31323	31323	31323	33246	33246	33246
r2_a	0.226	0.226	0.226	0.241	0.241	0.241

***indicates significant at the 1%; *t*-values in parentheses, using robust standard errors; regression results for control variables (CVs) and constant terms are omitted.

level, while in the low analyst attention group (*Atten* = 0), the coefficients of the effect of the CIO shareholding ratio on ARR increase and pass the intergroup coefficient difference test. Moreover, the full sample regression results indicate that the coefficient of *Coz3*×*Analyst* is −0.038 and significant at the 1% level. This means that analyst attention serves as a moderating factor in the interplay between CIO and the readability; that is, in firms that garner heightened scrutiny from analysts, the adverse effects of CIO on the readability are more pronounced than in firms with less analyst coverage. This suggests that analyst attention may exacerbate the challenges associated with institutional ownership in maintaining transparent reporting practices.

Moderating effect of industry concentration. As one of the important factors influencing firm behaviour, industry concentration can affect the subjective motivation of corporate information disclosure (Ali et al., 2014). If the collusive manipulation effect and the limited attention theory of CIO holds, then this negative effect may be more obvious when industry concentration is high. This is because under high industry concentration, common institutional investors can influence the invested firms and cause them to achieve higher returns for themselves by controlling product output and other means, and they can go on to conceal their self-interested behaviour by lowering the readability.

To verify whether this moderating mechanism exists, we referred to the previous perspective applied and utilized the Herfindahl-Hirschman Index (HHI) to quantify industry concentration, providing a robust measure of market competitiveness and firm dominance within the sector. The specific calculation formula is:

$$\mathrm{HHI} = \sum_{i=1}^{N} (X_i/X)^2 \quad (4)$$

Where N denotes the number of enterprises in the industry (where the manufacturing industry is classified according to secondary codes), X_i represents the operating income of the corresponding firm in the industry, and X denotes the total operating income of the industry. Then, we set a dummy variable *Concern* for industry concentration according to the median of *HHI* in each year. If the *HHI* of the industry where the firm belongs is higher than the median of *HHI* in that year, *Concern* is set to 1; otherwise, *Concern* is set to 0. After adding *Concern* and the interaction term between *Concern* and CIO (*Coz3*) to the basic regression model, we can see the results in Table 7 that the coefficient of *Coz3*×*Concern* is significantly negative at the 5% level, which indicates that as industry concentration increases, corporate ARR decreases more obviously. This finding verifies that CIO leads to a higher collusion tendency among firms in the same industry.

Moderating effect of media coverage. Extensive research shows that media coverage exerts a significant influence on the capital market. The higher that the media coverage a firm receives is, the more likely it is to be noticed by outsiders. If empirical evidence supports the notion of collusive manipulation by common institutional owners to diminish the transparency of firm annual reports, it would suggest that these investors may be conspiring with executives to veil self-interested activities through the obfuscation of textual disclosures. In this case, the negative correlation between CIO and ARR is more significant. In contrast, if the synergistic governance effect holds, even if media attention increases, corporate ARR does not decrease significantly with the increase in CIO.

To verify whether this moderating mechanism exists, we introduced a dummy variable *News* into the baseline model. If the number of newspaper and online media reports on listed firms is higher than the median of the same industry, then *News* is set to 1; otherwise, *News* is set to 0. The results displayed in Table 7 show that compared with the high media coverage group (*News* = 1), the absolute value of the coefficient of CIO in the low media coverage group (*News* = 0) is lower; in addition, the coefficient of the interaction term of *Coz3* and *News* is negative and significant at the level of 10%. This suggests that the management may be intentionally reducing the quality of textual information in annual reports, influencing the user's ability to obtain incremental information and thereby intensifying the negative correlation between CIO and report readability. It implies a strategic manipulation of disclosures to potentially obscure details that might be pertinent to investors' decision-making processes.

Mediating effect of operating risk. Cai et al. (2018) found that external investors can exert substantial influence on listed firms by participating in corporate governance. Common institutional investors, driven by the goal of maximizing their portfolio returns, may seek to sway corporate operational and investment strategies by appointing senior managers to the firms that they hold shares of in the same industry. They may indeed have the incentive to prompt collusion among large shareholders, potentially to the detriment of smaller stakeholders. This deteriorates the agency conflict between large shareholders and small and

Table 7 The results of moderating effect tests.

Variables	(1) Readability	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	High Analyst Focus	Low Analyst Focus	Full sample	High industry concentration	Low industry concentration	Full sample	High Media Coverage	Low Media Coverage	Full sample
Coz3	−0.820*** (−4.197)	−0.513* (−1.931)	−0.200 (−0.910)	−0.865*** (−4.377)	−0.527*** (−2.853)	−0.364** (−2.033)	−0.775*** (−5.117)	−0.611** (−2.197)	−0.356 (−1.394)
Coz3×Analyst			−0.038*** (−2.928)						
Analyst			−0.012*** (−7.353)						
Coz3×Concern						−0.638** (−2.467)			
Concern						−0.084* (−1.692)			
Coz3×News									−0.498* (−1.736)
News									−0.073** (−2.320)
CVs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	11856	11743	25278	18779	15666	34445	27446	8284	35730
r2_a	0.288	0.220	0.254	0.243	0.236	0.238	0.245	0.198	0.238

***, ** and * indicate significant at the 1%, 5% and 10% respectively; *t*-values in parentheses, using robust standard errors; regression results for control variables (CVs) and constant terms are omitted.

Table 8 The mediating effect of operational risk.

Variables	(1) Readability	(2) Risk	(3) Readability
Coz3	−0.673*** (−4.791)	0.042** (2.362)	−0.651*** (−4.622)
risk2			−0.525*** (−10.449)
CVs	Yes	Yes	Yes
Year fe	Yes	Yes	Yes
Industry fe	Yes	Yes	Yes
N	26663	26663	26663
r2_a	0.224	0.098	0.227

*** and ** indicates significant at the 1% and 5%; *t*-values in parentheses, using robust standard errors; regression results for control variables (CVs) and constant terms are omitted.

medium shareholders to some extent, thereby increasing the firm's operating risk. On the other hand, common institutional investors may also collude with management for their own interests. In this context, management increases their own interests in the collusion process and relaxes the supervision of common institutional investors on themselves to some extent, which increases the firm's operating risk. When firms face a higher operating risk, it triggers management's self-interested behaviour, thus leading to lower ARR. Therefore, the mediating effect of corporate operating risk on the relationship between CIO and ARR is further explored in this paper. The regression models for the test are as follows:

$$Risk_{it} = \beta_0 + \beta_1 Coz3_{it} + \beta_i CV_{s_{it}} + \sum_j Industry_j + \sum_t Year_t + \varepsilon_{it} \quad (5)$$

$$Readability_{it} = \gamma_0 + \gamma_1 Coz3_{it} + \gamma_2 Risk_{it} + \gamma_i CV_{s_{it}} + \sum_j Industry_j + \sum_t Year_t + \varepsilon_{it} \quad (6)$$

where $Risk_{it}$ represents operational risk. The research of Wang et al. (2017), which was conducted to measure the degree of profit fluctuation by calculating the cumulative distribution probability of the standard deviation of the rolling values of the pretax depreciation and amortization profit margin for the previous four years, is referenced in this study. Table 8 shows the results of the mediation effect test of operational risk. First, the regression coefficient between *Coz3* and *Readability* is −0.673, and it is significant at the 1% statistical level, indicating that there is a direct effect of *Coz3* on *Readability*. Thus, H1b is further confirmed. Second, the regression coefficient between *Coz3* and *Risk* is 0.042, and it is significant at the 5% statistical level. Additionally, the coefficient between *Risk* and *Readability* is −0.651 and is negative at the 1% statistical level, indicating that there is a partial mediation effect. That is, as the shareholding ratio of CIO increases, the operational risk of enterprises increases, which in turn reduces the readability of annual reports.

Conclusion

Findings and implications for research. The readability of annual reports is indeed a critical area of study when assessing the textual characteristics of corporate annual disclosures. Lower readability in annual reports may suggest an intention by management to manipulate information, potentially obscuring complex or unfavourable details from stakeholders. The readability of annual reports is a significant research direction for assessing the textual characteristics of corporate annual reports. Lower readability may be a result of managerial manipulation. Evidence provided by Boubaker et al. (2019) suggests that annual reports that are challenging to comprehend impede investors' capacity to interpret and evaluate the information. Compared to the mature economic systems of the West, individual investors hold a

considerable stake in China's capitalist market. Lacking the professional financial knowledge and the ability to discern the true state of enterprises that common institutional investors possess, individual investors rely more on the clarity of the text to understand the operational status of enterprises and are more susceptible to the influence of the readability of corporate annual reports.

At present, in the capital market, CIO is now a widespread occurrence in capital markets. This trend reflects the growing influence of institutional investors on market dynamics and corporate governance. However, the academic community has not given enough attention to the influence of CIO on ARR. In this paper, Chinese listed companies from 2007 to 2021 were taken as the research sample and the impact of CIO on ARR and its impact mechanism were revealed. The results of this study corroborate the 'collusive manipulation' hypothesis, indicating that CIO is associated with a decrease in the readability of corporate annual reports. After conducting several robustness tests, the conclusion of this paper still holds. Further analysis shows that the negative impact of CIO on ARR is more significant in enterprises with higher analyst attention, higher industry concentration, and higher media coverage. Moreover, it is found that corporate operational risk serves as a mediating factor in the relationship between CIO and ARR.

This study fills some gaps in the existing literature. First, it extends the literature on the economic consequences of CIO. Previous research has mainly discussed the effect of CIO on corporate operation from the perspectives of digital transformation, share price collapse risk and information quality disclosure, and most of these studies testify to the collaborative governance view of CIO (Chen et al., 2021). This research, grounded in corporate governance theory, substantiates the adverse effects of CIO on the readability of annual reports. It enriches the academic perspective on the potential drawbacks associated with CIO, thereby contributing to a more nuanced understanding of its implications for corporate transparency. Second, it reveals the mediating mechanism and boundary conditions between CIO and ARR. The literature has shown that business strategy, organizational structure and audit effort might play indirect roles during corporate information disclosure (Lim et al., 2018; Blanco et al., 2021), but these studies do not discuss this issue from the perspective of ARR. Our research explores the mediating and moderating effects between CIO and ARR, which supplements this gap and provides new directions for scholars regarding ways to refine corporate information disclosure practices.

Implications for practice. The findings of this paper can also provide some implications and suggestions for enterprises, regulatory departments and investors. First, enterprises themselves should strengthen the supervision and management of their daily business activities and avoid enterprises with a high degree of CIO linkage or a high proportion of CIO shareholding using their collusion means to damage the interests of enterprises. Enterprises can strengthen their internal and external governance to guide common institutional investors in utilizing their resources, information advantages and rich management experience, thus helping enterprises improve their competitiveness and achieve steady and healthy development. Second, the reason for the complex and vague description of annual report text may be related to the insiders and related power strata who use CIO to manipulate and collude to pursue their own interest appropriation. Therefore, supervision departments need to pay more attention to the readability of annual reports. On the one hand, they should focus on whether enterprises with a high proportion of CIO shareholding engage in opportunistic behaviour and guard against the manipulation and collusion that can hinder the healthy development of the capital market. On the other hand, it is important to encourage listed companies to simplify the language of annual report text and enhance the readability. Third, investors ought to be vigilant regarding the low readability of annual reports which may obscure critical information and impede informed decision-making and distinguish whether enterprises are using CIO to seize private interests. For mature investment institutions, assembling a dedicated team of analysts is advisable to mitigate the adverse effects of CIO on ARR.

Limitations and directions for further research. While this paper sheds light on the collusive manipulation effect of CIO through the lens of ARR, it acknowledges certain limitations. First, since most of the academic research on ARR is based on the English context, it is slightly difficult to measure ARR in the Chinese context. The construction of the readability index in this paper may lack a more complete linguistic theoretical basis, which also serves as a future research direction. Second, the fact that CIO leads to the "collusive manipulation" phenomenon among enterprises in the same industry, thus resulting in lower ARR, is verified in this paper; however, the economic ramifications of diminished ARR merit further investigation. The current research on the impact of ARR within the Chinese milieu is somewhat limited, and further exploration can be conducted in the future.

Data availability

The data generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Notes

1 Chinese listed companies began to implement the 'Corporate Accounting Standards' from 2007. To avoid the impact of changes on the calculation of relevant variables, the starting time for the samples is selected as 2007.
2 ST marks two years of losses, triggering regulatory oversight. *ST signals three years of losses and a delisting alert.
3 The CSMAR database is a Chinese financial database modelled on global benchmarks like CRSP and Compustat.
4 WinGo is China's pioneering AI financial data platform, leveraging NLP and deep learning to analyse listed companies' disclosures and offer insights like word frequency and text features.
5 This study employs the GB/T 4754-2017 classification to account for industry-specific effects, using 2-digit codes for manufacturing and 1-digit codes for non-manufacturing sectors to address industry heterogeneity.
6 The CSI 300 index, launched on April 8, 2005, tracks the performance of 300 top-performing and liquid securities from the Shanghai and Shenzhen stock markets.

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Author contributions

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The authors declare no competing interests.

Ethical approval

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Informed consent

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