



Research article

Moderating effects of technological innovation and information environment on market response to information disclosure reforms

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ABSTRACT

Constructing an institutional environment centered around information disclosure (ID) is the direction of development for capital market reforms. This paper innovatively explores the stock market response (MR) to companies' enhanced ID due to institutional changes. Using data from Chinese companies listed on the Sci-Tech Innovation Board (STIB) from 2019 to 2023, the study employs Information Asymmetry Theory and Stakeholder Theory to analyze the relationship between ID levels and MR. The empirical analysis reveals a "U-shaped" relationship between ID level and MR. Furthermore, by introducing variables related to the information environment (IE) and technological innovation (TI), the study finds that their signaling effects vary among different audiences. High transparency in the IE and strong TI capabilities significantly mitigate the negative MR effects caused by revealing deficiencies during the enhancement of ID. This paper provides theoretical support and empirical evidence for capital market reform, improved financial regulation, enhanced credit quality of listed companies, and investor protection.

1. Introduction

China's economy is currently undergoing a critical transition from investment-driven high-speed growth to innovation-driven high-quality growth [1]. However, the existing financing structure has not adapted to the demands of industrial structural upgrading. The reform of the registration system in the A-share market is expected to significantly change this situation and further channel funds towards enterprises listed on the STIB. The STIB is designed for enterprises that align with national development strategies and possess core technologies, with their technological advantages and high industry barriers being crucial for maintaining competitiveness. Nevertheless, innovation activities face challenges such as high initial investment, high risks, and information asymmetry, which hinder their rapid acceptance in the market [2]. Therefore, under the background of the registration-based initial public offering (IPO) system reform in the A-share market, the transformation of ID system has become an urgent research issue.

The ID improves the firm's IE and stock liquidity [3,4]. Farooq, Hamouda [5] found that in emerging markets, a transparent IE improves stock price efficiency and leads to prompt consideration of information. However, recent studies have also discussed the potential negative impacts of ID [6], increased levels of ID may impede operation and production efficiency. Excessive ID is disadvantageous to a firm in terms of the price or expenditure competition with the goal of forcing a rival to exit. An increased level of ID may destabilize stock prices and lead to higher volatility. Timelier disclosure may increase stock volatility and result in higher costs of

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capital [7]. Research on the MR to increased ID following the IPO reform in the STIB of the Chinese stock market remains limited. Insufficient detailed ID by companies seeking to list may result in their failure to pass the review by the China Securities Regulatory Commission. Furthermore, such disclosure can lead to effects like "price pressure" and "reduced liquidity" [8].

Consequently, companies are likely to adopt a conservative disclosure strategy. Thus, there is a conflict between the positive signaling effect of increased ID due to capital market reforms and the risk signals that discourage companies from disclosing more. The research gap highlights the importance of exploring whether the uncertainties introduced by the ID reforms in STIB have a positive or negative impact on the capital market.

The ID behavior of a single company is influenced by its IE. When making disclosure decisions, companies consider their own needs and capabilities, as well as the actions of neighboring organizations in their geographic area. For example, knowledge spillovers from nearby firms and improved audit quality from local audit institutions can impact these decisions [9,10]. Companies may be motivated to increase their ID when they observe that mimicking neighboring firms enhances legitimacy and provides compensatory and masking effects. Therefore, we pose the question: Does the IE of a company affect its own disclosure behavior and the resulting stock MR? Does operating in a high-disclosure environment help mitigate the risks associated with increased disclosure and the conflicts arising from the STIB disclosure reforms?

The companies listed on STIB are innovative and technology-oriented with growth potential. These companies disclose their innovation activities from various dimensions, providing the capital market with comprehensive information about their innovation capabilities. Some scholars suggest that the ambiguity of R&D-active firms might be amplified through disclosure [11–13], exacerbating the negative MR due to increased information risk. Conversely, reducing the ambiguity of R&D activities might lead to uncontrollable impacts due to the inherent risk characteristics of innovation activities. Therefore, we pose the question: Does increasing R&D disclosure by companies reduce the ambiguity and improve market acceptance of risk information, or does it exacerbate negative MR? Existing literature has limited exploration of these issues. It is crucial to examine how the IE and TI attributes of companies moderate the stock market's feedback to increased ID.

Existing research has explored various methods of measuring the level of ID. For example, studies have examined the qualitative attributes of company communication, such as tone and readability [14], and their affect the decision-making of investors and information intermediaries. Other researchers have focused on existing readability measures, based on writing clarity and disclosure quantity, such as the file size of the filing [15,16]. We attempted to introduce a new ID measure for STIB listed companies. By employing text analysis methods and constructing a specific lexicon for ID in the STIB, we can comprehensively and scientifically measure the extent of companies' ID. This approach goes beyond merely assessing the size of disclosure documents or the clarity of writing, allowing for a more nuanced understanding of the actual content and quality of information disclosed.

This study empirically examines the capital MR effects resulting from changes in the level of ID due to regulatory reforms, utilizing data from the period 2019 to 2023. The potential contributions of this paper are outlined as follows:

Firstly, by investigating the ID system and corporate disclosure behavior within the context of the STIB, this study enhances our understanding of the registration-based IPO system and the evolving landscape of corporate ID. Distinguished from previous studies that predominantly focused on the Main Board and the Growth Enterprise Market [17,18], our research provides an in-depth analysis of the MR to the STIB listing companies following increased disclosure requirements under financial regulatory reforms, and thus bridges the knowledge gap in this relationship.

Secondly, we construct a lexicon to evaluate the level of STIB-listed companies. Drawing on relevant domestic laws, regulations, and institutional documents on ID, we employ text analysis methods to evaluate the ID practices of companies subsequent to the issuance system reform.

Thirdly, this study constructs an IE rating system, addressing previous shortcomings in explaining the process of corporate disclosure behavior concerning the positive impact of external IE and TI attributes in mitigating negative signals. This expands the perspective of existing literature. By integrating stakeholder theory, information asymmetry theory, and signaling theory into our study, we present a theoretical framework that elucidates the intricate relationship between ID and MR. Our research contributes to the broader literature by providing theoretical insights into the mechanisms through which signals from IE and TI influence capital market responses.

The rest of the paper is organized as follows. In Section 2, we discuss the measurement of ID, as well as the MR it generates, and for which variables that play a moderating role. The methodology employed is outlined in the third section. The fourth section presents the empirical results, followed by a discussion and conclusions in the final section.

2. Literature review and hypothesis development

2.1. Theoretical foundation

In 1984, Freeman formally introduced the Stakeholder Theory [19], which posits that a company's management should consider the interests of all parties connected to and potentially affected by the company's actions, not just its shareholders. This theory marked a significant shift in understanding corporate and political behavior, moving beyond the singular pursuit of profit to acknowledge the multifaceted relationships driving decision-making in a rapidly changing world [20]. In our research on ID, we integrate Stakeholder Theory to extend its understanding beyond the impact of a company's operational activities on stakeholders [21,22]. We argue that from the outset of establishing relationships with stakeholders, companies can use ID to demonstrate their competitive advantages, attract resources, facilitate effective communication, and reduce the risk of losing these resources [23].

The understanding that stakeholders can enhance competitive advantage by increasing ID stems from the discrepancies in the

quantity and quality of information accessible to investors in capital markets and corporate managers. These discrepancies arise due to differences in environments, positions, and the presence of managerial "moral hazard" [24,25]. All of these factors contribute to information asymmetry between stakeholders [26]. Organizations use ID to convey their image, intentions, actions, and performance, with the goal of reducing information asymmetry—a key concept in signaling theory [27]. This theory underscores the importance of companies communicating relevant information about their social commitments to stakeholders and the market, which in turn can improve collaboration efficiency among stakeholders and reduce social costs. In China's capital markets, such exploration has already begun on the STIB. This paper constructs a research framework based on stakeholder theory and information asymmetry theory to discuss the significant impact of changes in ID systems on the capital market.

2.2. Information disclosure

Efficient securities markets highly dependent on information, as it plays a crucial role in their operations. Myers, Majluf [28] illustrate the existence of information asymmetry, resulting in varying levels of investment-related information between internal managers and external investors [29,30]. Enhancing ID mitigates information asymmetry between internal and external capital providers [31,32], attracting institutional investors and analyst coverage by enhancing securities liquidity. There is a growing emphasis on using plain English in scientific communication to enhance the understanding of scientific findings among both specialized and general audiences, as well as interdisciplinary researchers. This approach has extended to capital markets, where scholars in accounting and finance are increasingly examining qualitative aspects of corporate communication, such as tone and readability, and their influence on the decision-making of investors and information intermediaries [33,34]. Text readability can be evaluated through linguistic attributes like tone [35], or through established metrics such as the Shenzhen Stock Exchange's Information Disclosure Ratings, which aim to promote higher ID quality [36].

Our research aims at assessing the MR resulting from increased ID by companies after the reform of the registration and review system in the STIB. To achieve this objective, we propose a novel method utilizing text analysis to construct a comprehensive and rigorous ID lexicon. By examining the word frequency of this lexicon in companies' IPO prospectuses, we aim to provide a robust and academically sound evaluation of their ID practices. Diverging from previous studies [37], our aim is to employ text analysis methods and innovatively construct an ID lexicon. By calculating the frequency of occurrence of the lexicon's terms in companies' IPO prospectuses, we strive to achieve a more accurate and scientific evaluation of the level of ID [17].

2.3. Information disclosure and market response

Investors heavily rely on publicly available information to assess a company's core competencies [38]. The quality of this disclosed information significantly influences investors' perceptions of the firm's competitive advantage. Companies often disclose average information while withholding either bad or good news [39], which complicates investors' ability to make rational decisions and increases the likelihood of herd behavior. Business managers can bridge this gap and reduce agency costs by maximizing ID [40]. According to information asymmetry theory, increasing the level of ID reduces the information gap between the company and investors [40], thereby lowering information gathering costs and allowing investors to more accurately assess the company's risk.

To explore the motivation behind ID, it is found that firms with good business performance are motivated to adopt an active disclosure strategy to show the value of the company to external investors. Signaling theory suggests that disclosing organizational activities reduces estimated risk and information asymmetry [41], thereby minimizing the gap between parties. This should benefit companies by lowering capital costs [42]. However, Hermalin, Weisbach [43] argue that excessive disclosure can decrease firm value. Additionally, well-performing companies may lack the willingness to voluntarily disclose information due to a "less is more" attitude.

Previous research on ID in the Chinese stock market has primarily examined the effects of disclosing specific types of information, such as environmental [44,45], innovation [46], social [38], and risk information [34], driven by policy changes or industry characteristics. These studies explore the impact on internal financial performance [46,47], stock price synchronicity [5], and liquidity [48, 49], as well as the risk of stock price crashes due to increased disclosure [50]. Some scholars have also investigated the factors influencing voluntary disclosure [51]. However, there is limited empirical research on the MR effects of enhanced ID following the listing system reforms in China's capital market. Most studies focus on the positive or negative effects of increased disclosure, with few examining the moderating roles of the IE and TI capability.

In summary, the MR resulting from increased ID cannot be described by a single change; it is a complex process influenced by multiple factors such as the company's development stage, the IE, and TI capabilities. Existing studies have not reached a consensus on the positive or negative feedback resulting from increased ID, leading to an insufficient understanding of the MR. This lack of understanding reduces the willingness of listed companies to disclose information. Therefore, considering both positive and negative feedback effects, we propose the following hypothesis:

Hypothesis 1. The level of ID by listed companies exhibits a "U-shaped" relationship with MR, with negative effects at low levels and positive effects at high levels of disclosure.

2.4. Information environment and market response

Listed companies have discretion in disclosing information beyond regulatory requirements [52]. When making ID decisions, companies not only consider their own needs and capabilities but also take into account the behavior of other organizations located in

close proximity [53]. The geographical location of a firm partly determines its IE. Various local stakeholders, including regulatory agencies, news media, and business transaction partners, exert different levels of pressure on firms to disclose more comprehensive information [54,55]. Companies turn external pressure to disclose information into internal motivation to meet social expectations and build a good corporate reputation by increasing the transparency of their production and operations. Different regions exhibit significant spatial variations in resource endowments, with financially developed areas often concentrating more talent. This migration trend contributes to the professionalism of ID practices by companies and fosters heightened awareness of ID in financially advanced regions [56]. Therefore, this paper constructs the IE Index encompassing three dimensions, which considers the financial development level of the geographical location where the enterprise operates and the external pressures affecting information disclosure practices.

In further literature research we found that listed companies have a leading role in disclosure behavior and that geographically close companies exert a subtle and mutual influence on each other in terms of disclosure awareness and disclosure behavior. Investors place greater trust in listed companies that demonstrate an attitude of integrity and responsibility in their ID. High levels of transparency in production and operations alleviate investors' anxiety stemming from information asymmetry [57,58]. Hence, we believe that the disclosure behavior of other organizations in geographical proximity to the enterprise positively influences its level of ID.

In the past, scholars have understood that companies willing to hire highly specialized audit firms signal high-quality ID. More specialized audit firms are expected to provide clients with more professional knowledge and advice when dealing with disclosure-related issues [59]. Therefore, this study aims to investigate the correlation between the density of regional audit firms and corporate disclosure behavior. A higher concentration of audit firms in a region indicates increased demand for audit services, which often correlates with greater specialization. Such specialization is likely to create a more favorable environment for improved ID.

More accurate and higher-quality analyst earnings forecasts are crucial for improving the IE in capital markets and optimizing resource allocation. Chen, Xie, Zhang [60] demonstrate that higher analyst forecast quality alleviates over-investment and under-investment of the underlying firm, implying that analyst forecast accuracy benefits corporate investment efficiency [61]. Simultaneously, the interference of low-quality information and cognitive biases can disrupt analyst forecasting behavior [62]. High-quality disclosure provides more detailed information, reducing analysts' tendency toward overly optimism [63,64]. Analysts can identify and utilize it to confirm details not explicitly disclosed in standard disclosures by comparing it with standard disclosures of listed companies. The quality of ID affects the ability of analysts to predict earnings and serves as a regulator of potential information asymmetry [35]. The above studies indirectly indicate that being in a high ID environment affects corporate disclosure behavior and is correlated with the resulting MR. However, direct empirical evidence is still lacking. Therefore, this paper proposes the hypothesis:

Hypothesis 2. Establishing a transparent IE benefits mitigating the negative impact of the extent of disclosure by listed companies on the MR to corporate information. The regulatory effects of IEs across different dimensions exhibit heterogeneity.

2.5. Technology innovation and market response

Companies with robust innovation capabilities are more likely to bring stable returns to investors in the long-term, and the ability of companies to maintain their innovation dynamics has become an important factor in the market's assessment of corporate value [65]. Given investors' constraints in time and attention, they are unable to thoroughly gather all relevant information for their investment decisions [66,67]. According to the "focus principle," investors tend to concentrate on critical and impactful core points to enhance decision-making effectiveness and resource allocation efficiency [50]. Firms with higher levels of innovation demonstrate a stronger inclination to disclose information compared to those with lower levels of innovation. Notably, disclosing R&D information offers valuable insights to investors regarding a firm's innovative capabilities [68]. Enhanced ID by companies reduces investors' information acquisition costs and elicits more favorable responses from institutional investors [69]. However, innovation activities face challenges in information transmission and agency issues [70]. Encouraging innovative firms to disclose relevant information regarding their R&D personnel and investments, which reflect their TI capabilities, serves as an effective approach to mitigate the trust crisis arising from information asymmetry and lower the cost of equity financing [71]. At the same time, corporate innovation inputs have high economic risk, risk information is usually regarded as bad news, and capital markets tend to react more strongly to bad news than to good news [72,73]. Investment psychology suggests that most recipients of bad news will choose to believe it outright [74,75], resulting in risk-sensitive investors making cautious investment decisions due to receiving new risk information and thus changing their capital investment, leading to a short-term inability of innovative companies to obtain positive MR [76]. From the perspective of investor decision-making, ID serves as a signaling mechanism [69,77], which can have both positive and negative effects.

Market actors favor clear and unambiguous information in their valuations of companies [78,79]. For investors, then, increasing transparency related to paradoxical rationales of innovation [80,81], may convey contradictory expectations of business risk [82], profitability and future growth prospects [83], and estimates of future cash flows. That is, disclosure of different innovation activities may have different effects on investors' information risk (i.e., information asymmetry and estimation risk), leading to conflicting market expectations of the firm's value [84]. However, the existing literature has not thoroughly investigated the signaling effect of disclosing different types of innovation activities for research-intensive companies and the extent to which it influences capital MR. Thus, we develop hypotheses:

Hypothesis 3. Companies with strong innovation capabilities are conducive to mitigating the negative impact of the disclosure level on MR for listed companies. The moderating effects generated by disclosing different types of innovation information vary heterogeneously.

Based on the above hypotheses, the theoretical model of this paper is depicted in Fig. 1.

3. Research design

3.1. Methods for measuring the level of information disclosure

This study draws on the research conducted by Lahmar, Piras [85] and Chang, Li, Xiao, Yang [35], and applies text analysis methods to examine the ID level in STIB. We established a comprehensive lexicon for ID specific to the STIB and calculated the level of ID for these companies. The textual data used in the analysis are sourced from the prospectuses and annual reports of the listed companies. The data processing procedure is shown in Table 1.

3.2. Capital market response effects

We choose two variables, price volatility and institutional ownership, to represent the market response generated by the level of ID by companies, as shown in Fig. 2. Since stock market price fluctuations are typically related to trading volume and stock liquidity, we consider only price fluctuations in this study. We select price volatility as it better reflects the magnitude and characteristics of changes in ID costs compared to the "cost-benefit" variable. Institutional investors typically have the advantage of access to professional information and pay more attention to corporate disclosure practices than most individual investors [86]. However, based on the characteristics of the Chinese capital market, which has a higher proportion of individual investors than mature capital markets [17]. Focusing on a single variable is insufficient to fully capture the MR resulting from ID. We have extended the existing research framework by incorporating measures of stock market price efficiency and institutional ownership to represent the market response to ID.

With reference to current scholarly research [48], the average price change since the IPO is computed by considering the daily price fluctuations of STIB-listed companies on an annual basis. As these companies on the STIB are innovative and entrepreneurial enterprises that align with national development strategies, they exhibit significant price volatility in the stock market. Therefore, a single-day price fluctuation is insufficient to reflect the overall market response after a company's listing. Hence, this study adopts the concept of averaging, and the calculation formula is as follows: $\frac{\sum (P_1 - P_0) / P_0}{N}$, Where P_1 is the daily high price, P_0 is the daily closing price and N is the number of days in issue.

Institutional ownership refers to the holdings of funds [87], QFII (Qualified Foreign Institutional Investors), securities firms, insurance companies, social security funds, trusts, financial companies, and banks. It excludes non-financial corporate shareholders and general legal entities. To measure institutional ownership, the average institutional ownership is calculated for the following year based on mid-year and year-end data.

3.3. Information environment variable group

3.3.1. Disclosing environmental effects (DEF)

The sample consists of 310 companies listed on the STIB, representing 21 provinces across China. Using provinces (regions, cities) as a unit of measurement, we calculate the 'Listed Company Information Disclosure Evaluation' information already disclosed by companies listed on the main board in neighboring geographical locations, considering both proximity and distance. This calculation results in the Regional Disclosure Effect Index.

3.3.2. Analyst focus (AF)

This passage describes the use of analyst earnings forecast accuracy to indicate analyst attention to companies (Analyst Focus). Analyst earnings forecast accuracy is measured by analyzing the difference between analyst j 's per-share earnings forecast for listed company i and the actual per-share earnings during period t . The lagged absolute value of this difference is then calculated, divided by the actual per-share earnings of company i during period t .

3.3.3. Audit organization density (AOD)

Specialized accounting firms provide clients with professional knowledge and advice when dealing with disclosure-related issues [59,88]. Companies willing to engage highly specialized audit firms signal a commitment to disclose high-quality information [89]. As regional audit firms become more concentrated, their professionalism increases due to heightened competition. This increased density

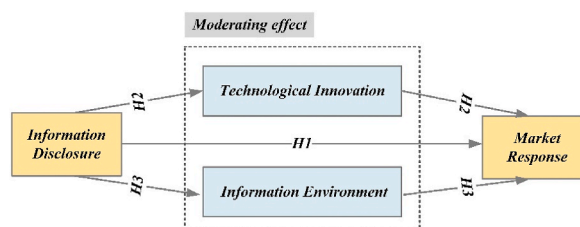


Fig. 1. Theoretical research framework.

Table 1
Data processing process of ID.

Step 1	Scope of reference documents	
Identification of textual search term sources	The study primarily relies on the specific disclosure requirements outlined in the "Guidelines for the Content and Format of Company ID of Securities No. 41 - Prospectus of Companies Listed on the STIB" published by the CSRC in March 2019. Additionally, it references the following ID-related documents as supplements: "Implementation Opinions on Setting Up the STIB and Piloting the Registration System at the Shanghai Stock Exchange," "Regulations for the Registration and Management of Initial Public Offerings on the STIB," "Business Guide No. 1 for the Issuance and Listing of STIB Stocks - Application Documents," and "Review Rules for the Issuance and Listing of Stocks on the Shanghai Stock Exchange."	
Step 2 Establish a STIB ID lexicon	Method Jieba algorithm in Python	Description Segmenting Sentences into Phrases Using Jieba in Precise Mode; After segmentation, remove stopwords, which are irrelevant expressions, symbols, or punctuation marks. This includes words such as "也" (also), "是" (is), "不" (not), "2019年" (the year 2019), etc. These stopwords do not contribute meaningful information and are usually removed in text processing;
Step 3 Matching listed companies' annual reports with the STIB ID lexicon	Method TF-IDF algorithm	Description Utilization of the TF-IDF algorithm module: The study captures the term frequency of keywords related to the "STIB ID lexicon" in the prospectuses and annual reports of listed companies between 2019 and 2023. Each keyword is assigned a weight of 1, and the sum of the term frequencies determines the level of ID for each company.
Step 4 Calculate the level of corporate ID	Method Log transformation	Description The ID level of companies is measured using \ln (the frequency of keywords from the "STIB ID lexicon" disclosed by listed companies + 1).



Fig. 2. Two descriptions of market response.

indicates greater demand for audit services in the region, particularly among the mentioned companies. The likelihood of higher audit quality contributes to fostering a favorable IE [88].

3.4. Technology innovation variable group

3.4.1. R&D expenses (RDE)

In line with previous studies, RDE is employed as a proxy variable to characterize a company's TI capabilities [41,90].

3.4.2. Patent license (PL)

Acknowledging the high-risk nature of actual TI activities and the challenges in effectively translating R&D investment into innovation output [91,92], this study additionally utilizes data on a company's patented innovations to measure its TI capabilities.

3.4.3. Joint R&D relationships (JRDR)

The National Innovation System heavily relies on Public Research Institutions in China [93]. Over the past decade, China's R&D investment has surged by over 20 % annually, second only to the United States [94]. The innovation capacity of enterprises is partially influenced by their collaborative relationships with stakeholders to acquire external resources. Thus, assessing the ability of enterprises to collaborate with public research institutions or universities for technology transfer is crucial for characterizing enterprise TI. Building upon the characteristics of companies listed on the STIB, this study innovatively selects collaborative research relationships as a proxy variable to represent enterprise TI capacity, providing multiple perspectives on understanding enterprise TI within the external innovation environment.

3.5. Control variables

Higher ID quality has been shown to enhance market performance and bolster a firm's financial indicators [14,95,96]. Larger firms are subject to greater public scrutiny compared to smaller ones, leading investors to demand higher quality information [10,72]. Therefore, we include controls for enterprise size (ES) and issue size (OS) in this study. Following Liu, Anbumozhi [97], we use the Price-to-Earnings ratio (PER) and Return on Assets (ROA) to assess the economic performance of listed companies. The Turnover Rate (TR) measures the level of market trading activity for a company post-initial public offering. ID mitigates leverage risk [98], while the

Debt-to-Assets Ratio (DAR) indicates the company's capital structure and its ability to meet obligations [99]. Executives with an academic background (AB) significantly enhance ID quality in listed companies, exhibiting conservative financial decision-making behavior that strengthens corporate accounting robustness. According to He, Zhou, Liu, Yang [100], more specialized accounting firms offer professional knowledge and advice, which encourages firms to disclose high-quality information. Therefore, the reputation of underwriting (UR) institutions also affects the extent of ID. Table 2 presents all variables.

3.6. Econometric model setting

As indicated by Healy, Palepu [3], ID presents significant endogeneity; for instance, firms may increase disclosure when they are performing well. To validate the impact of ID on the stock market performance and address potential endogeneity issues in ID behavior, a two-stage regression approach is adopted. In the initial stage, we investigate the factors that influence the level of ID, taking into account variables such as the company's developmental stage and business characteristics. These factors help us determine a reasonable level of ID'. In the subsequent stage, we integrate the residuals (ID') obtained from the first-stage regression into the regression analysis. The residuals (ID') from the first-stage regression are then included in the second-stage regression. In the second-stage model, the market effects are regressed on the ID level obtained by controlling for the variables in the first stage. By incorporating quadratic terms in our empirical research, we enhance the model's comprehensiveness and improve the explanatory power of the residuals of ID' on stock market performance. We control for various factors such as the operational characteristics of companies at different development stages, underwriting and issuance information, as well as economic development indicators of the regions where the companies are located, and investigate the MR influenced by the different levels of ID. The model consists of a first-stage regression (1) and a second-stage regression (2) to test hypothesis 1. In Equation (2), MR represents the market response resulting from different levels of ID, i.e., SMPF and IIOP.

$$ID = a_0 + a_1ES + a_2OS + a_3PER + a_4ROA + a_5DAR + a_6IF + a_7EL + a_8UR + a_9TR + a_{10}AB + \sum control + \varepsilon \quad (1)$$

$$MR = a_0 + a_1ID' + a_2ID'^2 + a_3ES + a_4OS + a_5PER + a_6ROA + a_7DAR + a_8IF + a_9EL + a_{10}UR + a_{11}TR + a_{12}AB + \sum control + \varepsilon \quad (2)$$

To further investigate the positive moderating effects of information environment (IE) and technological innovation (TI) on capital MR, we introduce the interaction terms Disclosure \times IE and Disclosure \times TI. Building on the first-stage regression model as the basis, we augment Model 1 with these interaction terms and conduct a two-stage regression as outlined in Formulas (3) and (4) to test Hypotheses 2 and 3:

Table 2

The definition of variable.

Variables	Definition	Description
Independent Variable		
ID	Information Disclosure	Level of information disclosure by listed companies
Dependent Variable		
Market Response (MR)	Stock Market Price Fluctuations (SMPF)	Average daily increase or decrease since IPO
	Institutional Investor Ownership Percentage (IIOP)	Institutional investor ownership/total shares in the company
Moderating Variable		
Information Environment (IE)	Disclosing environmental effects (DEF)	The information disclosure environment is constituted by the average level of ID of A-share listed companies in relation to the geographical location of the companies.
	Analyst focus (AF)	Analyst Forecast Accuracy
	Audit organization density (AOD)	Density of regional audit bodies
Technological Innovation (TI)	Joint R&D relationships (JRDR)	The capability of enterprises to establish collaborative research and development relationships with universities or research institutions.
	Patent license (PL)	Number of patents granted by enterprises per year
	R&D expenses (RDE)	R&D expenses
Control variables		
ES	Enterprise Size	Total assets of the enterprise
OS	Offer Size	Total Funds Raised divided by Post-IPO Total Share Capital
PER	PE ratio	Price-to-Earnings per Share
ROA	Return on Total Assets	Net profit/total asset balance
DAR	Debt-to-Assets Ratio	Total liabilities/total assets
IF	Issuance Fees	Issue costs as published in the listing prospectus
EL	Economic Level	Regional GDP
UR	Underwriter Reputation	The top 10 underwriters take the value 1, the others 0
TR	Turnover Rate	Average annual turnover rate, calculated as at September 2022
AB	Academic Background	Number of executives with a background in teaching at universities, research institutions or associations

Note: The above data are obtained from the Wind database or extracted from prospectuses of listed companies. The data have been processed and presented in logarithmic form. Please refer to the respective explanations for specific details.

$$MR = a_0 + a_1 ID' + a_2 ID'^2 + a_3 ID' \times IE + a_4 ES + a_5 OS + a_6 PER + a_7 ROA + a_8 DAR + a_9 IF + a_{10} EL + a_{11} UR + a_{12} TR + a_{13} AB + \sum control + \varepsilon \quad (3)$$

$$MR = a_0 + a_1 ID' + a_2 ID'^2 + a_3 ID' \times TI + a_4 ES + a_5 OS + a_6 PER + a_7 ROA + a_8 DAR + a_9 IF + a_{10} EL + a_{11} UR + a_{12} TR + a_{13} AB + \sum control + \varepsilon \quad (4)$$

3.7. Sample selection and data source

In this paper, 310 listed Chinese companies on the STIB were selected as the research sample after the registration system reform from 2019 to 2023. The financial data and company characteristics data used in the calculation were obtained from WIND and CSMAR databases, and the data on the degree of ID were obtained from the manually collected listing prospectuses and annual reports of STIB enterprises, which were downloaded from the official website of the CSRC, the disclosure level data were computed using Python text analysis.

4. Empirical results and analyses

4.1. Information disclosure and the market response

To address concerns regarding endogeneity between ID and the SMPF, this study employs a two-stage regression approach. In the first stage, residuals from the regression are used to calculate the ID level in the second stage, effectively removing the potential influence of control variables on the model system. This analytical method allows for the examination of the association between ID and SMPF. The regression results presented in Table 3, reveal that the coefficients of the main and quadratic terms are -0.300 and 0.015 , respectively. These results indicate a non-linear relationship, specifically a "U-shaped" pattern, between the level of ID and the SMPF since their IPO. Accordingly, there exists a positive relationship between ID and SMPF. Moreover, even when ID levels are low, there is a negative impact on SMPF.

The regression in column (4) on institutional investors' ownership percentage and ID levels reveals a significant linear and quadratic impact of ID. Importantly, the relationship exhibits a "U-shaped" pattern, thereby validating hypothesis 1. The study suggests that the market response to increased ID differs among companies at varying developmental stages. Early-stage enterprises with governance improvements needed might face negative MR due to exposed deficiencies. In contrast, mature companies with robust governance standards experience positive MR, enhancing investor confidence.

We observed that institutional investors exhibit a more sensitive response to companies increasing ID compared to the magnitude of capital market price fluctuations (the absolute value of the coefficient for the square term of institutional investors is larger, $0.300 < 0.345$). This sensitivity could be influenced by the investor composition structure in the Chinese capital market. Institutional investors possess mature coping abilities regarding risk information. In contrast to individual investors, institutional investors are more adept at recognizing heightened risk following increased risk disclosure and possess superior capabilities in interpreting company disclosures, as suggested by previous research. For example, Ke, Ramalingegowda [101] illustrate that institutional investors excel in comprehending earnings news and exploiting the drift subsequent to earnings announcements. Thus, the response to augmented risk disclosure may diverge based on investor maturity, with institutional investors more prone than individual investors to acknowledge an amplified risk after enhanced risk disclosure.

Table 3

The regression result of the ID and the MR.

Variables	SMPF (1)	SMPF (2)	IOP (3)	IOP (4)
ID'	0.433** (0.204)	$-0.300^{**} (0.112)$	$0.519^{***} (0.000)$	$-0.345^{**} (0.129)$
ID' ²		$0.015^{***} (0.000)$		$0.021^{***} (0.002)$
ES	0.094 (0.512)	$0.082 (0.342)$	$0.137 (0.597)$	$0.301 (0.313)$
OS	$0.012^{***} (0.000)$	$-0.013^{***} (0.000)$	$-0.010 (0.754)$	$-0.028^{***} (0.000)$
PER	$0.886^{***} (0.000)$	$0.556^{***} (0.000)$	$0.117^{***} (0.002)$	$1.243^{***} (0.000)$
ROA	$0.024^{***} (0.000)$	$0.040^{***} (0.000)$	$0.080^{**} (0.026)$	$0.065^{***} (0.000)$
DAR	$0.439^{***} (0.006)$	$-0.188^{***} (0.006)$	$-0.007 (0.993)$	$-0.516^{***} (0.006)$
IF	$0.812^{***} (0.000)$	$0.589^{***} (0.000)$	$0.380^{***} (0.061)$	$1.617^{***} (0.000)$
EL	$-0.023 (0.407)$	$-0.038 (0.611)$	$0.345 (0.366)$	$-0.083 (0.465)$
UR	$-0.060 (0.315)$	$-0.099 (0.115)$	$0.001 (0.098)$	$-0.188 (0.332)$
TR	$0.063^{*} (0.034)$	$0.026^{*} (0.014)$	$0.340^{*} (0.180)$	$0.061^{**} (0.033)$
AB	$-0.041 (0.110)$	$-0.024 (0.110)$	$0.091 (0.321)$	$-0.054 (0.076)$
Intercept	$5.351^{***} (0.003)$	$3.244^{***} (0.007)$	$5.210^{***} (0.880)$	$4.701^{***} (0.008)$
Ind/Year	YES	YES	YES	YES
R-squared	0.443	0.567	0.522	0.580
Adj R-squared	0.419	0.531	0.489	0.536

Note: P values are in parentheses; *p < 0.1, **p < 0.05, ***p < 0.01.

4.2. The moderating effect of the IE

Table 4 represents the moderating effects of the IE variables on the capital MR resulting from increased ID by companies. Columns (2)–(4) respectively denote the moderating effects of disclosure environment, analyst attention, and regional audit firm density. The significant positive interaction terms indicate that the IE in which companies operate positively moderates the negative feedback from increased ID, yielding positive impact effects. Companies situated in high-IEs attenuate the downward arc of the "U-shaped" curve and elevate the value of the curve's nadir. This weakens the negative feedback between ID levels and the capital market, mitigating the adverse effects of disclosure behavior resulting from the exposure of operational deficiencies and shortcomings. Hypothesis 2 is thus validated.

Fig. 3 presents representative data plotted to visually illustrate the moderating effects of IE, based on regression coefficients. The three variables representing IE demonstrate distinct effects on moderating stock market fluctuations and institutional ownership percentages.

When a company's ID level is low, the disclosure environment effect exerts a significant influence. This indicates that companies are influenced by neighboring firms' ID levels due to geographic proximity. This could be attributed to the fact that companies perceive mimicking neighboring firms in enhancing ID as a means to gain more legitimacy and potentially compensate for development shortcomings, thereby strengthening their motivation for disclosure. Bernile, Kumar, Sulaeman [102] highlight that the dispersion of corporate economic interests leads to information asymmetry issues, influencing institutional investors' portfolio decisions and performance. This study further affirms that in the presence of low ID, the disclosure environment effect arising from geographic clustering effectively mitigates information asymmetry issues.

Conversely, when a company's ID level is high, analysts' attention moderates the MR effect to a greater extent. This may stem from analysts' advantage in processing vast amounts of information and their ability to deeply interpret information. Analyst earnings forecasts with higher accuracy and better quality are crucial for the improvement of the IE as well as the optimization of resource allocation in the capital market. More accurate and higher-quality earnings forecasts by analysts contribute to improving the IE in the capital market [60,103]. From another perspective, this study confirms the signaling effect of analyst attention, highlighting the importance of optimizing resource allocation. Furthermore, high-quality ID reduces the accuracy of analysts' forecasts [104],

Table 4
The moderating function of the information environment.

Variables	SMPF	SMPF	SMPF	SMPF	IOP	IOP	IOP	IOP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ID'	−0.277** (0.109)	−0.317*** (0.005)	−0.281*** (0.002)	0.383*** (0.029)	−0.317** (0.119)	−0.280*** (0.003)	−0.247*** (0.021)	−0.219*** (0.000)
ID' ²	0.015*** (0.005)	0.012** (0.005)	0.022*** (0.000)	0.009*** (0.000)	0.025*** (0.003)	0.018** (0.008)	0.021*** (0.001)	0.009*** (0.002)
ID' × DEF		0.051*** (0.007)				0.013*** (0.001)		
ID' × AF			0.040*** (0.002)				0.006*** (0.001)	
ID' × AOD				0.171*** (0.012)				0.153*** (0.034)
ES	0.082 (0.525)	0.168* (0.089)	0.163 (0.552)	0.137 (0.625)	0.305 (0.313)	0.274* (0.143)	0.526 (0.623)	0.438 (0.613)
OS	−0.015*** (0.000)	−0.020*** (0.000)	−0.020 (0.422)	−0.082 (0.068)	−0.048*** (0.000)	−0.040*** (0.000)	−0.052 (0.526)	0.029 (0.451)
PER	0.654*** (0.000)	0.569*** (0.000)	0.453*** (0.010)	0.837*** (0.037)	1.343*** (0.000)	1.254*** (0.000)	0.625 (0.421)	1.265*** (0.004)
ROA	0.037*** (0.000)	0.029*** (0.000)	0.139** (0.058)	0.097 (0.639)	0.075*** (0.000)	0.072*** (0.000)	0.066 (0.054)	0.106* (0.059)
DAR	−0.183*** (0.005)	−0.201*** (0.002)	−0.634 (0.429)	−1.059* (0.569)	−0.435*** (0.006)	−0.405*** (0.004)	−0.333 (0.619)	−0.837*** (0.192)
IF	0.842*** (0.000)	0.720*** (0.000)	0.648* (0.372)	2.158*** (0.636)	1.627*** (0.000)	1.565*** (0.000)	−0.113 (0.957)	−0.693 (0.565)
EL	−0.036 (0.517)	−0.033 (0.610)	−2.550 (2.157)	2.116 (2.024)	−0.083 (0.565)	−0.062 (0.460)	0.185 (0.824)	1.607 (1.131)
UR	−0.099 (0.209)	−0.093 (0.208)	−0.463** (0.210)	−1.791** (0.836)	−0.196 (0.232)	−0.218 (0.174)	0.607** (0.294)	−0.520** (0.210)
TR	0.026* (0.015)	0.034* (0.018)	0.169 (0.502)	0.039 (0.859)	0.061** (0.025)	0.061** (0.029)	0.096 (0.486)	0.065 (0.492)
AB	−0.022 (0.111)	−0.027 (0.154)	0.104 (0.298)	0.168 (0.506)	−0.054 (0.076)	−0.051 (0.065)	−0.048 (0.795)	−0.045 (0.593)
Intercept	4.143*** (0.006)	4.139*** (0.004)	10.290** (5.072)	4.691*** (0.480)	−16.618*** (0.009)	−13.499*** (0.000)	−9.669*** (0.401)	3.794*** (0.700)
Ind./Year	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.550	0.574	0.512	0.492	0.556	0.583	0.449	0.478
Adj R-squared	0.530	0.566	0.200	0.238	0.537	0.556	0.397	0.259

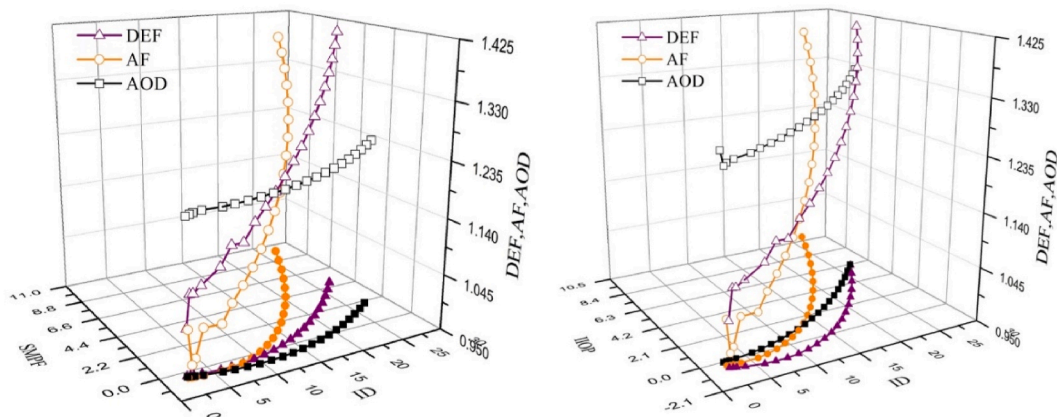


Fig. 3. Information environment moderating effect curve.

effectively mitigating the negative feedback effect of companies enhancing ID.

We further find that the moderating effect of regional audit firm density on the ownership proportion held by institutional investors is more pronounced compared to its effect on stock market price volatility. The density of regional audit firms can to some extent characterize the financial development level of the region, reflecting the demand of listed companies in that region for audit services and the ability of audit firms to faithfully present the operational information of companies. The clustering effect of companies with audit firms can mitigate information asymmetry [102], and when regional audit firms enhance their ability to capture firm value information, it significantly influences investment behavior and moderates the negative feedback effects in the capital market.

Table 5
The moderating function of technological innovation.

Variables	SMPF	SMPF	SMPF	SMPF	IOP	IOP	IOP	IOP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ID'	−0.298** (0.131)	−0.323*** (0.003)	−0.266*** (0.010)	−0.133 (0.198)	−0.347*** (0.019)	−0.411*** (0.006)	−0.369** (0.156)	−0.457 (0.413)
ID' ²	0.013*** (0.005)	0.018** (0.007)	0.011*** (0.001)	0.017 (0.345)	0.022*** (0.000)	0.031*** (0.004)	0.022*** (0.001)	0.033 (0.298)
ID' × RDP		0.017** (0.001)				0.019 (0.210)		
ID' × PL			0.052*** (0.000)				0.041*** (0.003)	
ID' × JRDR				0.110*** (0.002)				0.051*** (0.001)
ES	0.072 (0.343)	0.076 (0.521)	0.206** (0.024)	0.029 (0.075)	0.305** (0.123)	0.125 (0.621)	0.343* (0.190)	0.144*** (0.020)
OS	−0.015*** (0.000)	−0.026*** (0.000)	−0.023*** (0.000)	−0.015*** (0.000)	−0.048*** (0.000)	−0.042*** (0.000)	−0.047*** (0.000)	−0.037*** (0.025)
PER	0.653*** (0.000)	0.625*** (0.000)	0.608*** (0.000)	0.497*** (0.000)	1.343*** (0.000)	1.303*** (0.000)	1.270*** (0.005)	1.700*** (0.000)
ROA	0.038*** (0.000)	0.037*** (0.000)	0.037*** (0.000)	0.129*** (0.000)	0.073*** (0.000)	0.072*** (0.000)	0.080** (0.007)	0.180 (0.304)
DAR	−0.167*** (0.006)	−0.232*** (0.001)	−0.176*** (0.006)	−0.154*** (0.001)	−0.395*** (0.007)	−0.433*** (0.002)	−0.357*** (0.007)	0.119 (0.177)
IF	0.741*** (0.000)	0.780*** (0.000)	0.752*** (0.000)	0.090 (0.150)	1.527*** (0.000)	1.530*** (0.000)	1.336*** (0.000)	1.023*** (0.000)
EL	−0.036 (0.607)	−0.025 (0.457)	−0.032 (0.639)	−0.045 (0.027)	−0.083 (0.565)	−0.091 (0.424)	−0.059 (0.690)	−0.081 (0.690)
UR	−0.100 (0.215)	−0.089 (0.210)	−0.080 (0.133)	−0.043 (0.410)	−0.198 (0.212)	−0.226 (0.192)	−0.217 (0.187)	−0.332*** (0.098)
TR	0.026* (0.013)	0.060** (0.028)	0.031* (0.017)	0.033** (0.013)	0.061* (0.034)	0.064** (0.026)	0.065** (0.029)	0.005 (0.023)
AB	−0.033 (0.110)	−0.029** (0.013)	−0.038* (0.021)	−0.027* (0.014)	−0.054*** (0.006)	−0.059 (0.089)	−0.049 (0.063)	−0.065 (0.046)
Intercept	4.047*** (0.006)	5.158*** (0.001)	3.677*** (0.012)	3.112*** (0.001)	−6.018*** (0.009)	−2.417*** (0.001)	−4.465*** (0.000)	−3.450*** (0.000)
Ind./Year	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.560	0.580	0.577	0.523	0.563	0.567	0.591	0.328
Adj R-squared	0.534	0.553	0.501	0.436	0.509	0.520	0.553	0.313

4.3. The moderating effect of the TI

The establishment of the STIB in China, implementing a registration-based IPO system, is an important measure to promote the deep integration of technology and capital and facilitate the transformation towards innovation-driven development. Building on the distinctive features of firms listed on the STIB, this study incorporates the variable of corporate innovation capability to explore its impact on the interplay between ID levels and capital MR.

Table 5 displays coefficients indicating the MR effect when firms enhance ID, considering their TI capabilities. The coefficients for the interaction between ID levels and TI capabilities are both significantly positive. RDE, among the factors moderating market price volatility from increased ID, exhibit the most pronounced impact. Unlike investments in R&D personnel and joint research relationships, R&D expenditure provides a straightforward expression of TI capabilities, serving as a potent signaling mechanism.

Processing innovation-related information is inherently complex, requiring the application of theories that address fundamental economic shifts [65]. In markets dominated by individual investors, such as China, there is a tendency to overlook complex information. Consequently, robust RDEs play a critical role in mitigating adverse MR to increased information disclosure, due to their stronger signaling capabilities.

Fig. 4 indicates consistent moderating effects from the three TI variables. Institutional investors, with their superior ability to process information related to corporate TI, exhibit more agile responses in their ownership proportion compared to individual investors [105,106]. They demonstrate comprehensive understanding across various aspects of corporate ID, including RDE, PL and JRDR, and the capacity to establish JRDR with universities or research institutions. Furthermore, we observe that JRDR effectively moderate the negative feedback effects of ID. To our knowledge, this is one of the few studies that explore the moderating role of external collaborative relationships in adjusting MR. Investors apply more professional and meticulous standards in their evaluation, showcasing greater rationality and organization than individual investors in the secondary market. This effectively mitigates the negative impact on capital markets resulting from potential misinterpretation or misunderstanding of disclosed risk information during the disclosure process for STIB-listed companies.

5. Robustness tests

This study conducted robustness tests from two perspectives to ensure the reliability of its conclusions. Firstly, the method of measuring corporate ID level was adjusted by adopting a metric from previous research, specifically using the count of regulatory inquiry letters as a proxy for ID level [107]. Regulatory inquiry rounds (RI) represent the total number of regulatory inquiry letters that issuers respond to from the IPO pre-disclosure stage to the review stage [108]. Companies typically face heightened regulatory scrutiny prior to IPO, weighing the costs and benefits of transparent ID practices during the regulatory inquiry process. This increases the likelihood that companies will respond candidly to regulatory inquiries and amend disclosure documents as necessary, thereby enhancing their ID level.

Based on this analysis, the natural logarithm of the total number of audit query letters responded to by issuers from the IPO pre-disclosure to the listing stage was utilized as a variable to measure the extent of corporate disclosure. The hypothesis was then retested, and the coefficients and results in Table 6 were found to be consistent with the signs of coefficients observed in Table 3.

Secondly, to replace the post-IPO MR variables, the return on equity (ROE) was chosen to measure the post-IPO performance of firms, and the signaling theory was applied to explain the disclosure behavior of managers, firms with better performance often willing to disclose more information on earnings forecasts, and the regression results in Table 7 were consistent with the above.

Although the robustness tests for the above replacement indicators have been passed, considering the influence of geopolitical events, the COVID-19 pandemic, and other macroeconomic changes on the Chinese stock market during the period from 2019 to 2023, these variations in the macro environment may affect the correlation between ID levels and MR [109]. Therefore, the interaction

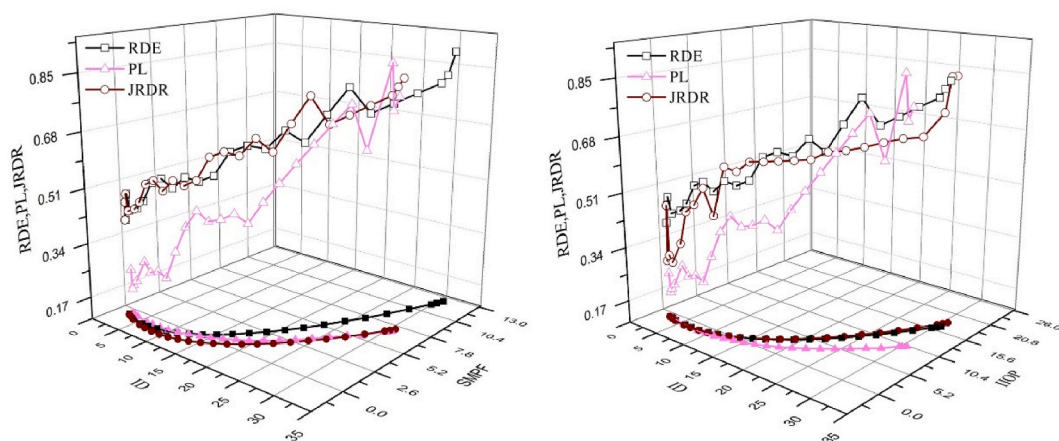


Fig. 4. Technological innovation moderating effect curve.

between year and industry is still included in the model, as shown in Table 8. The sign and significance level of the ID coefficient are consistent with the conclusions of the previous studies, indicating the robustness of the research findings.

6. Discussion

6.1. Theoretical implications

Our study makes theoretical contributions in the following three respects.

Firstly, this study explores the MR effects, both positive and negative, resulting from changes in listing regulations, thereby complementing and extending the literature on ID. Previous research has predominantly focused on whether disclosures related to corporate value [110] and environmental aspects [97] help alleviate firms' financing constraints [111]. Consistent with prior findings [45,112], our study confirms a positive relationship between the extent of ID and MR, indicating that higher disclosure levels are associated with better performance. Building on this foundation, we adjust the model settings and reveal that companies undergo a "painful period" before experiencing positive MR following enhanced ID, likely due to the financial constraints companies face post-disclosure improvement. Existing literature exploring the negative feedback resulting from enhanced ID is limited, and our findings contribute to expanding this area of research.

Secondly, this study constructs a theoretical research framework integrating stakeholder theory and signaling theory to explain how the IE influences stakeholder behavior and moderates the negative MR on ID. By introducing geographical variables reflecting variations in IEs across firms, we find that the signaling effect of ID alters the firms' IEs, thereby moderating the capital MR resulting from enhanced ID. This research examines the IE and TI environment of listed companies from three dimensions. Our study provides robust evidence that different dimensions of IE and TI variables exhibit distinct signaling effects, which manifest differently among various stakeholders. Previous scholars have argued that transparent IEs enhance stock price efficiency and prompt timely consideration of information [110], or have applied information risk theory to explain the signaling effects of different categories of risk information on capital markets [5]. Unlike previous studies [44,48,87], our research is the few to consider the effects of geographic clustering on the EI and the moderating role of TI on MR. These findings contribute significantly to expanding the application of stakeholder theory and signaling theory.

Thirdly, this study enriches existing literature by introducing innovative variables focused on IE and TI. It demonstrates that the positive moderating effects of the IE and TI can mitigate the negative MR resulting from institutional reforms and increased ID by enterprises, thereby alleviating losses from disclosing negative information. Bernile, Kumar, Sulaeman [102] argues that information asymmetry issues are influenced to some extent by geographical dispersion. Based on the core focus of the STIB information disclosure reforms on creating a transparent capital market IE, this study proposes that the characteristics of an enterprise's external IE are influenced by its geographical location, thus expanding the research perspectives of existing literature. Further, we find that institutional investors are more sensitive to and exhibit a more pronounced moderating effect on companies improving ID compared to individual investors. While previous studies suggest that institutional investors encourage firm disclosure [38] and possess stronger risk perception abilities [34], this study proposes that institutional investors play a more significant moderating role in the process of enterprises enhancing ID, presenting a novel research perspective.

In addition, this study finds that the density of audit firms located near enterprises contributes to a more robust information cycle. Geographic dispersion may hinder effective information gathering and reporting compared to audit firms concentrated in specific locations [113,114]. Moreover, our research confirms that analyst coverage moderates the content of negative MR. Existing literature indicates that broader analyst coverage and accurate forecasts enhance the quality of corporate ID [115]. In contrast to prior studies, this paper proposes the signaling effect of analyst coverage, affirming that higher analyst attention attracts investors [116,117], thereby positively moderating the adverse MR mechanism in capital markets.

6.2. Practical implications

The implementation of the registration-based IPO system for companies on the STIB is a significant financial market reform in China, following the pilot program of the New Third Board. This reform aims to reconstruct and improve the ID system of listed companies in China. However, the impact of this reform on institutional requirements, managerial behavior, and investor response to

Table 6
Changing proxy variables for information disclosure.

Variables	SMPF	SMPF	IIOP	IIOP
	(1)	(2)	(3)	(4)
RI ¹	2.263*** (0.000)	3.177*** (0.011)	2.344** (0.930)	2.004*** (0.034)
RI ¹⁻²		0.022*** (0.003)		0.037*** (0.002)
Intercept	0.783 (0.791)	1.650 (0.463)	0.895 (0.426)	0.669 (0.401)
Ind/Year	YES	YES	YES	YES
Control	YES	YES	YES	YES
R-squared	0.362	0.473	0.308	0.453
Adj R-squared	0.246	0.381	0.200	0.397

Table 7

Changing proxy variables for capital market feedback effects.

Variables	ROE	ROE	ROE
	(5)	(6)	(7)
ID [*]	−0.180** (0.074)	−0.140** (0.058)	−0.217*** (0.004)
ID ²	0.026*** (0.003)	0.009*** (0.002)	0.012*** (0.003)
ID [*] × IE		0.005** (0.002)	
ID [*] × TI			0.013** (0.006)
Intercept	6.248* (3.063)	4.272 (5.243)	1.308 (1.156)
Control	YES	YES	YES
Ind/Year	YES	YES	YES
R-squared	0.452	0.565	0.581
Adj R-squared	0.433	0.543	0.559

Table 8

Interaction effects of year * ind.

Variables	SMPF	SMPF	IIOP	IIOP
	(8)	(9)	(10)	(11)
ID [*]	0.253** (0.117)	−0.149** (0.062)	0.270*** (0.000)	−0.128** (0.049)
ID ²		0.015*** (0.000)		0.021*** (0.002)
Intercept	8.115*** (0.003)	5.201*** (0.007)	6.311*** (0.880)	6.427*** (0.008)
Ind/Year	YES	YES	YES	YES
Year * Ind	YES	YES	YES	YES
R-squared	0.511	0.572	0.552	0.558
Adj R-squared	0.504	0.513	0.539	0.537

increased corporate disclosure remains uncertain. Therefore, studying the market effects of ID systems is crucial for transforming regulatory agencies, shaping the behavior of listed companies, and improving investor perceptions and decision-making. It plays a vital role in reducing information asymmetry between companies and stakeholders.

Firstly, the government should advance financial regulatory reforms, enhance ID frameworks, and improve the quality and timeliness of disclosures. Leveraging the STIB platform, more outstanding enterprises can be showcased to investors, fostering an investor-oriented disclosure regime to bolster the effectiveness of information supply in the securities market. Policymakers should anticipate potential negative feedback from intensified disclosure efforts by companies and define reasonable disclosure scopes accordingly. They should also acknowledge temporary resistance faced by firms in enhancing disclosures, providing policy support and encouragement to facilitate smoother transitions. Simultaneously, stricter penalties should be imposed on listed companies that withhold information, and external investors should be encouraged to participate in regulatory oversight, ensuring standardized disclosure practices through combined internal and external efforts.

Secondly, for corporate managers, this study emphasizes the importance of aligning disclosure strategies with the expectations and needs of different stakeholder groups. Managers should determine the level and nature of disclosures based on their IE and market positioning, understanding the heterogeneous market feedback from disclosing different dimensions of TI information to various audiences. This research assists managers in balancing ID and MR, rationalizing negative market reactions during enhanced disclosure periods, and understanding how improving IE and TI disclosures can mitigate negative feedback. Consequently, this study helps listed company managers effectively manage disclosures to balance investor and corporate interests while maintaining market efficiency.

Thirdly, this study helps investors enhance their awareness and capabilities in investment decision-making and rights protection. Investors should rationally assess the value of disclosed information and fully understand the risks disclosed by companies, thereby promoting higher disclosure quality. External investors and analysts play a key role in information transmission. Analysts and journalists should improve their professionalism, develop market understanding, and remain vigilant about potential false disclosures. This study emphasizes the importance of investors actively participating in information oversight rather than overly relying on regulatory authorities, becoming a powerful force in improving the disclosure system.

6.3. Limitations and future research

Limitations of this study include methodological constraints in measuring corporate disclosure, resulting in limitations in the methodology of the disclosure lexicon and text analysis constructed; and the lack of more detailed intra-corporate information on disclosure in the data acquisition aspect of the study. Addressing these limitations, we indicate some avenues for future research. To enhance our analytical methods, future studies could employ survey methodologies to capture internal attitudes toward ID within companies, their perceptions of their own disclosure practices, and the gaps between market expectations and actual responses following enhanced disclosure practices. Such subjective and micro-level approaches through surveys can complement the limitations of the analytical methods utilized in this study.

Given the dynamic nature of the business environment, public pressures may evolve over time, influencing firms' environmental

disclosure strategies from various perspectives. Future research could consider including other external stakeholders such as suppliers, customers, and communities, potentially through longitudinal observations of corporate practices.

Finally, while we focus on a single market, we advocate for future research that compares the impact of different institutional environments on listed companies [118]. Future studies should also extend their time horizons and consider the influence of long-term trends and market cycles to mitigate sample selection biases. This approach aims to provide more insightful research that contributes to the development of China's capital markets.

7. Conclusions

This study investigates how the IE and TI influence ID among 310 companies listed on the STIB from 2019 to 2023. It introduces these factors and empirically examines their impact on ID and the resulting MR. Key findings include: (1) A "U-shaped" relationship is identified between the ID level of listed companies and their stock market performance. Initially, enhancing ID at lower levels results in negative MR. However, as the ID level rises further, positive effects on the capital market become apparent. This suggests that the upward pressure on prices due to increased business transparency outweighs the downward pressure from the "market pressure hypothesis." (2) Institutional investors show more sensitive responses to companies' efforts to enhance ID compared to fluctuations in market prices. (3) Companies operating in transparent IEs and possessing high TI capabilities significantly mitigate the negative MR caused by the exposure of deficiencies and shortcomings in their development processes resulting from increased ID. (4) The moderating effects of IE and TI on the potentially negative MR resulting from companies continuing to enhance their ID level have heterogeneity across different levels of ID.

CRedit authorship contribution statement

Danlei Feng: Writing – original draft, Software, Methodology, Data curation, Conceptualization. **Lingdi Zhao:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization.

Data availability

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical statement

This manuscript does not involve any ethical issues.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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