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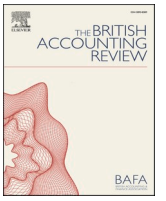

Signals from CSR competition: The influence of relative CSR performance on analysts' recommendations

Jun Zheng [a], Majid Ghorbani [b,*], Yan Yan [a], Ying Cao [a]

[a] Business School, Renmin University of China, 59 Zhongguancun Street, Haidian District, Beijing, 100872, China
[b] China Europe International Business School (CEIBS), 699 Hongfeng Road, Pudong, Shanghai 201206, China

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ABSTRACT

Due to the institutionalization of corporate social responsibility (CSR) and its integration into firm strategy, firms are engaged in fierce competition, which has gained stakeholders' attention. As intermediary stakeholders, security analysts screen information on firms' CSR activities to make more accurate investment recommendations. Integrating signaling through CSR competition and screening theory, we develop a framework wherein firms' relative CSR performance and improvement across two years are viewed as complementary signals reflecting their ability and intent to engage in CSR and affect analysts' recommendations. Using a panel of Chinese listed firms from 2011 to 2019 (n = 15,735 firm-year observations), we find that analysts respond positively to firms' relative CSR performance. Further analyses show that firms' CSR performance improvement has a decreasingly positive effect on analysts' recommendations, and this effect is more pronounced for firms with higher relative CSR performance. Our study contributes to the literature on CSR and screening theory by highlighting the value of comparative CSR signals and generates practical implications for participants in CSR competitions.

1. Introduction

In recent decades, a growing number of firms are engaging in corporate social responsibility (CSR) and disclosing them actively to relieve institutional pressure (Campbell, 2007; Luo, Wang, & Zhang, 2017; Marquis & Qian, 2014) or achieve their financial goals (McWilliams & Siegel, 2001; Porter & Kramer, 2006; Wang & Qian, 2011). This engagement decreases information asymmetry between firms and their external stakeholders and leads to security analysts' better (Dhaliwal, Radhakrishnan, Tsang, & Yang, 2012) and more accurate (Bernardi & Stark, 2018) evaluation of firms. To this effect, analysts show greater interest in evaluating firms that socially behave more responsibly (Dhaliwal, Li, Tsang, & Yang, 2011). To obtain competitive advantages through enhanced CSR compliance signals to external stakeholders (Lys, Naughton, & Wang, 2015), firms attempt to conduct more CSR strategies such as participation in certification (Bansal & Hunter, 2003), award events (Sterbenk, Champlin, Windels, & Shelton, 2022), political activities (Mellahi, Frynas, Sun, & Siegel, 2016), and third-party rating (Chatterji & Toffel, 2010; Zaman, Atawnah, Haseeb, Nadeem, & Irfan, 2021). Among them, independent third-party influential organizations' evaluation, rating, and ranking of firms that provide information on their relative CSR performance, improvements, or decline compared to their peers has garnered particular attention from security analysts (Chatterji & Toffel, 2010; Ioannou & Serafeim, 2015; Zhang, Wang, & Zhou, 2020), because the third-party rating and ranking of firms' CSR performance have become critical to stakeholders engrossed in the current world of information

* Corresponding author.
E-mail addresses: joey_zheng@ruc.edu.cn (J. Zheng), majidghorbani@ceibs.edu, majidghorbani@gmail.com (M. Ghorbani).

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(Sharkey, Kovács, & Hsu, 2023) and are often used to gauge firms' CSR performance by many scholars (Huang, 2013).

Firms' engagement in these nonmarket CSR strategies to emphasize their relative position or competitive advantages compared to rivals (Barney, 1991; Porter & Kramer, 2006) inevitably engenders fierce competition among firms. However, the current state of research, with minor exceptions (Zhang, Qian, & Shi, 2020), neglects security analysts' evaluation of firms' relative advantages or disadvantages in CSR performance compared with competitors (Wang, Tong, Takeuchi, & George, 2016; Wang, Wijen, & Heugens, 2018). On the one hand, the lack of sufficient research endures our unfamiliarity with the inherent competitive and imitative attributes of CSR (Freeman & Audia, 2006; Marquis, Glynn, & Davis, 2007; Useem, 1988), which consequently results in scholars over-emphasizing the importance of firms' strategies in isolation and without enough concern about competitors' relative performance (Dhaliwal et al., 2012). On the other hand, despite extensive literature (e.g., Bernardi & Stark, 2018; Zaman et al., 2021; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020) arguing that external stakeholders tend to compare the performance of firms with their peers to make recommendations (Best & Zhang, 1993; Dhaliwal et al., 2011; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020), scholars' lack of comparative ranking analysis between competitors may produce incomplete conclusions.

To fill these gaps in the context of CSR competition, utilizing screening theory, we regard analysts' recommendations as a screening process in which analysts collect and analyze signals reflecting firms' ability and intent to engage in CSR. Following previous scholars, we consider CSR rating and ranking a proxy for relative CSR performance (Chatterji & Toffel, 2010; Huang, 2013) and calculate its variations. Specifically, we answer how a third party's relative rating of firms' CSR performance and their changes influence security analysts' evaluation and recommendation of focal firms. To do so, we develop a theoretical framework in which analysts screen the relative CSR performance and its variation separately and together as essential signals to shape their recommendations.

We constructed a panel of 3116 A-share listed firms in China between 2011 and 2019 (15,735 firm-year observations). As an important emerging economy, China offers an ideal setting to test our theoretical framework about signals from CSR competition for two reasons. First, firms in China are experiencing the institutionalization process of CSR as China facilitates this by issuing a range of laws, regulations, and plans (Kao, Yeh, Wang, & Fung, 2018), highlighting the importance of environmental and social criteria for firms' performance (Li & Lu, 2020; Luo et al., 2017). Thus, the trend that more firms participate in the CSR competition under compulsion is present. Second, there are only a few established and reputable third-party CSR rating organizations in China (Kao et al., 2018), resulting in firms making more efforts to attract analysts' attention in these limited jockeying "tracks" and leading to an emerging and fiercer CSR competition or tournament. Indeed, the CEO of Southern Weekly, in his opening address at the 13th China CSR Annual Conference in 2021 in Guangzhou, stated that due to national requirements and social demand, CSR for firms has developed into a new competition ground (Zhong, 2021).

Our results show that relative CSR performance is positively associated with analysts' recommendations, and CSR performance improvement has a decreasingly positive effect on analysts' recommendations. The outcome of CSR performance improvement is more substantial for firms with higher relative performance compared to lower ones. Post-hoc cross-sectional analysis also shows that the effect of relative CSR performance would be strengthened when firms' information is less available, the analysts following firms have more overall work experience, or CSR is more driven by firms' competitive purposes than institutional pressure. The non-linear impact of CSR performance improvement would be steepened with the increase of firms' resources or competitive pressure. Our findings are robust to a range of sensitivity tests.

Our study makes various theoretical and practical contributions. First, this study primarily proposes and focuses on the emergence of CSR competition, which provides a fresh perspective to study the effect of firms' CSR actions and performance. Second, we integrate screening theory into CSR competition and regard analysts' recommendation process as a screening system. This integration helps us identify two related and critical signals about firms' ability and intent in CSR competition. We find and show that they have separate and joint effects on analysts' recommendations, and signalers', receivers', and the environment's characteristics would influence their impact. Thus, this paper enriches the screening theory about which intentional and unintentional signals would make a difference and how they work. Third, our findings also have considerable practical implications for players in the CSR competition. For instance, firms should not only comprehend that maintaining a good (i.e., high) relative CSR ranking is important where CSR is an area of competition, but also must formulate adequate CSR strategies to reap the promising benefits of CSR based on their characteristics to avoid lower evaluations from analysts in the long run.

2. CSR competition and screening

In line with the growing consideration for CSR by scholars, policy-makers, and practitioners (Porter & Kramer, 2006), firms make more effort to signal their engagement to their crucial audience (Parsa, Dai, Belal, Li, & Tang, 2021). In return, many audiences, such as security analysts, also actively screen for firms' CSR efforts (Dhaliwal et al., 2012). From the firm's side, the instrumental view of CSR argues that devoting additional resources to CSR is beneficial for achieving firms' goals (e.g., Kao et al., 2018; Lin, Tan, Zhao, & Karim, 2015), while the injunctive perspective attributes reasons for CSR to institutions' coercive or normative elements (Borghesi, Houston, & Naranjo, 2014; Lins, Servaes, & Tamayo, 2017). While these two perspectives are essentially irreconcilable when explaining reasons for firms' CSR activities (Mitnick, Windsor, & Wood, 2021), they collectively indicate that CSR performance recognition is developing into fierce competition.

The pathway to competition has two plausible logics. First, regardless of CSR practices diffusion, CSR becomes a necessary part of firms' strategy and goes through the process of institutionalization (Ioannou & Serafeim, 2015; Tolbert & Zucker, 1983), which leads to a heightened expectation of all companies to alleviate social problems (Rehbein, Waddock, & Graves, 2004). In this context, firms that previously neglected CSR adjust their attitude toward CSR and take adequate measures to maintain or obtain the necessary legitimacy (Campbell, 2007). Therefore, whatever the CSR activities' reason, the fact is that a growing number of firms pay more attention to CSR

strategies as part of their overall corporate strategy and competitive advantage (Porter & Kramer, 2006), creating intensified competition to outperform competitors. Second, although instrumental and injunctive perspectives propose different CSR objectives, they converge on the importance of CSR communication with external stakeholders to eliminate information asymmetry (Barber & Odean, 2008; Dhaliwal et al., 2012; Lys et al., 2015). However, a challenge arises from the reality that since specific CSR activities vary with the industry classification (Amato & Amato, 2007; Zhang, Rezaee, & Zhu, 2010), geographical location (Marquis & Tilcsik, 2016), and punctuated events (Tilcsik & Marquis, 2013), it is not easy for the audience (e.g., security analysts) to compare firms' CSR performance across different dimensions (Bernardi & Stark, 2018; Luo, Wang, Raithel, & Zheng, 2015). Investors and analysts need this additional information to better (Dhaliwal et al., 2012) and more accurately (Bernardi & Stark, 2018) evaluate firms. Thus, authoritative third-party organizations become virtual channels to assess firms' CSR activities with standardized rating systems that make ranking and comparison easier for interested parties. This has gained popularity among scholars and practitioners to equate CSR ratings by these third-party organizations with firms' CSR performance (e.g., Chatterji & Toffel, 2010; Huang, 2013). However, the paucity of reliable third-party rating organizations (Kao et al., 2018), similar to the limited number of "race tracks" in a tournament, intensifies firms' competition to signal their CSR's relative ranking among a high number of tournament participants (Lys et al., 2015).

While firms signal their intentions and ability by implementing CSR practices, security analysts are on the lookout to screen for firms' comparative efforts through similar sources. Screening theory, as "the mirror image of signaling theory" (Sanders & Boivie, 2004, pp 169), holds that the uninformed parties would actively collect and interpret signals inferring firms' capability and intent to sort unobservable differences (Connelly, Certo, Ireland, & Reutzel, 2011; Qian, Crilly, Wang, & Wang, 2021; Stiglitz, 1975). Since the evaluation process of firms is complex for most final investors, security analysts are considered crucial intermediary audiences who screen financial and non-financial information to make accurate recommendations (Luo et al., 2015; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020). Whether firms are aware of and disposed to participate in CSR competition, we believe that analysts' recommendations based on CSR signals in the same industry are the result of a screening process and offer three reasons.

First, CSR engagement partially reveals firms' financial performance (Lins et al., 2017; Wang & Qian, 2011) and caters to the expectations of stakeholders (Ioannou & Serafeim, 2015; Rehbein et al., 2004); thus, CSR becomes a critical source of nonmarket information disclosure for analysts' evaluation (Dhaliwal et al., 2012). In practice, CSR behavior always plays a crucial role in analysts' research reports. For example, analysts (Luo, 2022) accepted Red Star Macalline' rent reduction during COVID-19 lockdowns as their CSR fulfillment and made the investment recommendation of "buy". The analyst of Cinda Securities (Ji, 2022) also analyzed the competitive advantages of the Holley Group based on its CSR report. Second, the tendency to compare the performance of firms with similar peers to mitigate the disturbance from environmental factors and to compare firms' differences effectively (Sharkey et al., 2023) makes analysts prefer adjusted relative performance signals in CSR competition rather than firms' absolute CSR scores (Bouwman, Frishkoff, & Frishkoff, 1987). For example, scholars (Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020) find that analysts consider the extent and focus of a company's CSR practices relative to its industry. Finally, growth indicators are vital for analysts to accurately predict companies' development trends (Bradshaw, 2004; Jegadeesh, Kim, Krische, & Lee, 2004; Lys et al., 2015). Therefore, improvements or declines in rankings in CSR competition in different years help analysts grab information about the stability and sustainability of firms' CSR strategies. Hence, due to the strong evidence that analysts screen and consider firms' CSR performance (Bouwman et al., 1987; Dhaliwal et al., 2012), we posit that in CSR competition, relative CSR performance and its improvement and decline can make an essential impact on analysts' recommendations.

3. Hypotheses development

3.1. Relative CSR performance and capacity

Security analysts improve the efficiency and accuracy of their recommendations experimentally and develop their evaluation protocols partly based on comparison within industries (Bouwman et al., 1987). Due to the complexity of measurement and assessment of CSR practices, the conformity and differentiation of firms' CSR compared with their peers in the same industry make a significant difference to analysts' coverage and recommendation (Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020). Therefore, when evaluating a firm's CSR performance with quantitative data, analysts tend to use information from reliable third parties and screen all signals inferring the relative performance of the focal firm rather than absolute behavior or score. As the number of firms from diverse industries jockeying to magnify their signals and CSR competition intensifies, analysts' reliance on standardized and relative ranking becomes more crucial (Sharkey et al., 2023).

By screening firms' CSR performance, analysts can observe firms' compliance with socio-political injunctions, determine their legitimacy, and discern firms' superior capabilities (Su, Peng, Tan, & Cheung, 2016). Prior literature has documented that firms can obtain critical resources by conducting CSR actions (McWilliams & Siegel, 2001; Orlitzky, Schmidt, & Rynes, 2003). For one thing, because firms with superior CSR performance tend to deliver more transparent information and are assessed with lower assumed default risk and higher financial performance (Bernardi & Stark, 2018; Dhaliwal et al., 2012), they would enjoy lower loan costs and more financial resources (Borghesi et al., 2014; Goss & Roberts, 2011; Lys et al., 2015) and become more attractive to investors (Dhaliwal et al., 2011; Wang et al., 2016). For another thing, firms' CSR commitment, as a way to tackle social problems and satisfy social needs, improves stakeholder engagement (Rehbein et al., 2004). By responding to the community and government's call, enhancing employees' treatment and product quality, firms could establish positive relationships with a variety of stakeholders and thus acquire more non-financial resources such as social capital (Lins et al., 2017; Shirodkar, Beddewela, & Richter, 2018) and reputation (Lins et al., 2017; Marquis & Qian, 2014; Qian et al., 2021).

Therefore, from an analyst's perspective, firms' higher relative performance in CSR competition is a vital signal because it shows

that the focal firm can take advantage of existing and potential resources to implement its CSR strategy and gain a competitive edge. Hence, we propose the first hypothesis as the following:

Hypothesis 1. Firms' relative CSR performance positively affects analysts' recommendations.

3.2. CSR performance improvement and intent

In addition to assessing firms' competitive advantages through comparison with firms in the same industry, as one of the primary determinants of favorable recommendations, analysts also screen for firms' potential for growth and decline trends (Bradshaw, 2004; Jegadeesh et al., 2004; Kim & Youm, 2017). Accordingly, the range of improvement and deterioration of the relative performance and ranking each year, in other words, the level of surpassing or being surpassed by competitors each year, is an important signal about a firm's intent to engage in CSR and conform to external expectations. In this respect, we suggest that analysts consider the positive and negative growth in CSR ranking in the screening process to make recommendations. However, stakeholders are not concerned with all types of improvement, only the reasonable improvements that correspond with the focal firm's resources (McWilliams & Siegel, 2001). Specifically, an increase (decrease) in relative CSR performance compared to the previous year emanates a signal that the focal firm is (not) pursuing a long-term strategy to integrate CSR performance improvement and intends to invest more (less) resources in CSR activities (Jhunjhunwala, 2014; Zaman et al., 2021). Accordingly, it is beneficial to the intermediaries to show more optimism about firms' engagement in CSR (Durand, Paugam, & Stolowy, 2019). However, there is no guarantee that they would always view the intent to engage more in CSR as a positive signal. Hence, we posit a direct but non-linear association between CSR performance improvement and analysts' recommendations for two reasons.

On the one hand, investment in CSR as a nonmarket strategy does not directly increase organizational performance (Mellahi et al., 2016), but continuously consumes firms' existing resources. Moreover, if a firm takes a big step in CSR when facing non-trivial costs or lacking resources, investors would challenge whether the money is well spent or whether there is an agency issue (Kao et al., 2018; Muller & Kräussl, 2011). Furthermore, despite the institutionalization of CSR, not all industries and investors are interested in allocating considerable resources (Su & He, 2010; Wang et al., 2018; Zhang, Marquis, & Qiao, 2016). In other words, if a noticeable increase not aligned with the entire industry is observed in a firm's relative CSR performance, the focal firm's motivations and potential waste of firm resources would be questioned, and analysts would not look at this increase and agentic behavior favorably (Ioannou & Serafeim, 2015).

We, thus, hypothesize that while CSR ranking as a signal of CSR performance is viewed positively by analysts, this optimistic view gradually subsides as the ranking improvement becomes more extensive than expected:

Hypothesis 2. Firms' CSR performance improvement has a decreasingly positive effect on analysts' recommendations.

3.3. Joint effects of two CSR signals

We argue that as signals displaying a firm's relative position (i.e., ability) and growth potential (i.e., intent) in CSR competition, relative CSR performance and CSR performance improvement would have a combined effect on analysts' recommendations. Relevant supplementary signals disseminated via corporate actions as proofs or presages could highlight the impact of the core signal by enhancing its visibility (Lee, 2001). Signals a firm disseminates by its actions may reinforce or diminish the focal firm's other signals (Balboa & Martí, 2007; Connelly et al., 2011). Signal effectiveness would be strengthened directly if more similar signals are observed (Janney & Folta, 2003) or if various types of signals from one or multiple sources are consistent and converging (Connelly et al., 2011; Gao, Darroch, Mather, & MacGregor, 2008). Following this evidence, we also suggest that a firm's relative CSR performance would intensify the relationship between CSR performance improvement and analysts' recommendations in the following ways:

First, a firm's high relative CSR ranking indicates the abundance of financial and non-financial resources (McWilliams & Siegel, 2001), which can help the firm accomplish ambitious CSR strategies and make them more visible (Marquis & Qian, 2014). As argued in H2, significant improvements in CSR performance may raise concerns among analysts about the viability and consistency of a company's strategy. However, this concern can be alleviated to some extent by signals indicating that the company is competing effectively in the CSR space and has adequate resources at its disposal, both presently and in the future (McWilliams & Siegel, 2001; Orlitzky et al., 2003). Meanwhile, the same CSR effort for firms with a lower relative ranking could be viewed with some skepticism. Besides, firms with higher relative performance enjoy better reputations, attracting more public attention (Rhee & Valdez, 2009). Analysts also screen their signals more closely to cater to investors' needs and avoid blunders (Rehbein et al., 2004).

Second, firms with higher relative CSR performance need to put in more effort compared to lower ranked peers to achieve improvements to the next level. Competition at the higher ranking levels is also fiercer because firms at that level devote ample resources, protect their ranking positions, and search for greater returns on investment in CSR. Indeed, studies on tournaments (Connelly, Tihanyi, Crook, & Gangloff, 2014; Lambert, Larcker, & Weigelt, 1993; Lazear & Rosen, 1981) show that participants with higher rankings are often confronted with competitors who scrutinize the results more vigorously and show hawkish behavior. Correspondingly, the relative performance increase in this competitive environment proves players' ability and determination. Likewise, we suggest that higher ranked firms prioritize and even lead CSR action improvements, regardless of the focal industry's general attitudes towards CSR. Thus, the concern for wasting resources on meaningless CSR competitions would be eased, and the swifter speed of surpassing stronger competitors infers a clearer and more valuable CSR strategy. Therefore, we propose:

Hypothesis 3. Firms' relative CSR performance moderates the inverted U-shape (i.e., decreasingly positive) relationship between

CSR performance improvement and analysts' recommendation such that the relationship between moderate levels of CSR performance improvement and analysts' recommendation will be stronger (vs. weaker) when relative CSR performance is high (vs. low).

4. Research design

4.1. Data and sample

We used data from 2010 to 2019, corresponding with the start of Hexun CSR Ratings' availability and ending before 2020 to avoid possible COVID-19 effects. We collected and merged data from three sources. First, our initial sample for this study consists of all Chinese A-share listed firms with Hexun's (i.e., Hexun Information Network) CSR performance scores. Second, following prior research (Marquis & Qian, 2014; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020), we obtained information on analysts' coverage, star brokerage houses and investment recommendations from the China Listed Firm Financial Analyst Forecasting Database, a sub-database of the China Stock Market and Accounting Research (CSMAR). Finally, information on firms' financial performance and corporate governance was based primarily on other sub-databases of CSMAR. We exclude financial firms because of their different regulations and market trading mechanisms (Chen, Hung, & Wang, 2018). After merging multiple databases, lagging relevant variables, and deleting observations with missing values, our final sample consists of 3116 unique firms and 15,735 firm-years between 2011 and 2019.

4.2. Variable measurements

A list of all variables and their brief measurement descriptions are provided in Appendix A, and the processes of obtaining and measuring variables are detailed below.

4.2.1. Dependent variable

CSMAR database offers standardized ratings of analysts' investment recommendations in five levels: buy, outperform, neutral, underperform, and sell. Following previous research (Luo et al., 2015; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020), first, we coded recommendations as 1 for sell, 2 for underperform, 3 for neutral, 4 for outperform, and 5 for buy. Then, since some analysts issued recommendation information for the second or subsequent years, of which accuracy might be influenced by forecast horizons (Cotter, Tuna, & Wysocki, 2006; Richardson, Teoh, & Wysocki, 2004), we only selected the evaluation results for the years analysts made a recommendation for a given firm *i*. Finally, we calculated the mean of all recommendations published in year $t + 1$ by all analysts about firm i with equal weight to measure our dependent variable, *Analyst Recommendation*.

4.2.2. Independent variables

To measure our two independent variables, the relative rating and variation of CSR performance, we gathered CSR ratings provided by Hexun. Hexun operates a professional financial website that increasingly attracts scholars' attention (Zhao, Fang, & Zhang, 2022; Zhu, Pan, Qiu, & Xiao, 2022). As disclosed on its website (Hexun CSR Ratings 2013), Hexun has developed a comprehensive rating system based on a theoretical stakeholder framework, with five first-level indicators (i.e., responsibility toward: shareholders; employees; suppliers, customers, and consumers rights; environment; and society) and 13 second-level and 37 third-level indicators. Hexun collects information on firms' CSR activities from numerous sources and combines all third-level indicators and corresponding weights to generate a final score. Appendix B displays more detailed information on the dimensions and weighting system of the Hexun CSR index.

We utilized ratings published by Hexun rather than other independent rating agencies for three reasons. First, other CSR ratings (e.g., RKS) are valuable proxies for CSR report quality based on the content of firms' voluntary disclosure of CSR activities and techniques (Luo et al., 2017), while Hexun ratings are designed to measure CSR performance and behavior. Second, Hexun employs a broader source of information beyond CSR reports, which RKS solely relies on. Thus, unlike RKS, Hexun covers listed firms that do not produce CSR reports, eliminating potential sample selection bias caused by whether a firm issues a CSR report. Third, Hexun ratings are publicly available on its official website. Despite some missing data, Hexun shows a firm's CSR ranking among all sample firms and firms belonging to the same industry, which may reduce security analysts' effort to obtain information on target firms' relative positioning in CSR competition when making investment recommendations (Bouwman et al., 1987).

Therefore, we use Hexun's ranking of firms' CSR as a proxy for a firm's relative CSR performance (Huang, 2013). As many previous studies found that CSR performance has apparent characteristics of industries (Orlitzky et al., 2003; Su & He, 2010), and analysts tend to compare firms with their peers from the same industries (Bouwman et al., 1987; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020), we calculate firm *i*'s relative CSR performance in year *t* in its industry rather than among the entire sample. For neither all firms' relative CSR performance in their industries are calculated, nor criterion for classifying industries is disclosed in Hexun, we identified 19 industry sectors using the Directory of Industry Classification for Listed Companies issued by China Securities Regulatory Commission in 2012. We calculated each firm's ranking in its respective industry sector. Furthermore, to remove the interference from the differences in the number of competitors in an industry (i.e., industry size) and ensure better rankings take larger values, we finally calculate the *Relative CSR Performance* as the number of firms whose CSR performance is inferior to the focal firm *i* divided by the total number of firms in the same industry in the year *t*.

For the second independent variable, we construct *CSR Performance Improvement* by calculating the difference between a firm's relative CSR performance in year *t* and year $t - 1$. We undertake this approach following Tseng and coauthors (2007) who measure

positive and negative growth in international business across two years. Therefore, a positive value indicates a relative increase, while a negative value means a decrease from year $t-1$ to year t. In addition, the greater the value, the greater the upward or downward change in relative CSR performance.

4.2.3. Control variables

We control for a series of factors that prior research suggests affect securities analysts' investment recommendations. Following previous studies (Ioannou & Serafeim, 2015; Zuckerman, 1999), we include *Analyst Coverage* to control for the total number of analysts who cover firm *i* in year $t+1$. Considering analysts serving in high- and low-status houses differ in analytical ability and risk appetite (Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020), we also control *High-status Houses Coverage* measured by the ratio of brokerage houses that have at least one analyst team on the Best Analyst List selected by the *New Fortune* magazine to the total number of houses that cover firm *i*.

Other typical firm characteristics include *Firm Size,* which refers to the logarithm of the firm *i*'s total assets in year *t*. *Financial Leverage* is measured by the ratio of total debts to assets. *ROA* (Return on assets) is an accounting measure of a firm's profitability and is calculated by dividing firm *i*'s operating return by its total assets. *Slack Resources* is the sum of cash flow from a firm's operating, financing, and investing activities scaled by its total assets, and serves as a proxy for available resources to fulfill discretionary decisions like devoting to CSR activities (Marquis & Qian, 2014). We construct *Share Price Fluctuation,* which can trigger changes in analysts' recommendations to reflect the difference in share prices between year *t* and year *t - 1*. Likewise, we include *EPS Fluctuation*. To ensure results are free from the effects of outliers, we winsorized all these financial variables at the 1 percentile in each tail.

Besides, we also control some corporate governance characteristics in year *t*. We code the dummy variable *SOE* 1 if a firm is state-owned and 0 otherwise. *Ownership Concentration* is operationalized as the proportion of total equity shares held by the ten largest shareholders. *Independent Directors Ratio* measures the strength of internal corporate governance (Kim, Kitsabunnarat-Chatjuthamard, & Nofsinger, 2007). Furthermore, because chairpersons of boards have more power than CEOs in China (Jiang & Kim, 2015; Zhang et al., 2016), we control for three chairperson-related, instead of CEO-related variables, that tend to show influence (Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020): *Chairperson Gender* is coded 1 for male and 0 otherwise; *Chairperson Age* is measured in years; and *Chairperson Turnover* takes the value of 1 for years in which the chairperson changed and 0 otherwise.

Considering the interference from industry and year factors, we also control them using dummy variables. As noted above, to reduce potential endogeneity concerns generated from reverse causality between firm characteristics and analysts' recommendations and to ensure that late released firm information was also certainly considered by analysts, all independent variables and firm-level controls are lagged by one year.

Table 1
Descriptive statistics and correlation matrix. This table reports the descriptive statistics and correlation matrix.
Detailed descriptions of variables are provided in Appendix A. The number of observations is 15,735. Correlations $\geq |0.02|$ are significant at $p < 0.05$.

Variables	Mean	S.D.	1	2	3	4	5	6	7
1 Analyst Recommendation	4.36	0.44							
2 Relative CSR Performance	0.59	0.28	0.11						
3 CSR Performance Improvement	0.00	0.22	0.05	0.38					
4 Analyst Coverage	21.39	26.44	0.27	0.30	0.04				
5 High-status Houses Coverage	0.55	0.34	0.02	0.03	0.00	0.02			
6 Firm Size	8.60	1.32	0.03	0.20	0.00	0.27	0.02		
7 Financial Leverage	0.43	0.20	−0.02	−0.11	0.00	0.01	0.06	0.58	
8 ROA	0.05	0.05	0.18	0.51	0.18	0.37	−0.02	−0.14	−0.41
9 Slack Resources	0.00	0.08	0.08	0.06	0.08	0.08	0.00	0.12	0.10
10 Share Price Fluctuation	−1.79	8.33	0.08	−0.01	0.08	0.07	0.09	0.10	0.11
11 EPS Fluctuation	0.00	0.36	0.11	0.10	0.33	0.12	−0.04	0.08	0.08
12 SOE	0.36	0.48	−0.13	0.05	0.00	−0.03	0.06	0.41	0.31
13 Ownership Concentration	0.60	0.15	−0.01	0.19	0.02	0.11	0.02	0.15	−0.05
14 Independent Directors Ratio	0.37	0.06	0.04	0.01	−0.01	0.04	0.00	0.03	0.00
15 Chairman Gender	0.94	0.24	−0.01	−0.01	−0.01	−0.02	0.00	0.02	0.01
16 Chairman Age	49.51	6.40	0.01	0.07	−0.01	0.04	−0.02	0.14	0.04
17 Chairman Turnover	0.12	0.32	−0.02	−0.04	0.03	−0.05	0.01	0.11	0.10
	9	10	11	12	13	14	15	16	17
9 Slack Resources	0.10								
10 Share Price Fluctuation	0.00	0.13							
11 EPS Fluctuation	0.26	0.14	0.30						
12 SOE	−0.16	0.05	0.11	0.05					
13 Ownership Concentration	0.18	−0.04	−0.07	−0.01	0.00				
14 Independent Directors Ratio	0.00	0.00	0.01	0.00	−0.05	0.06			
15 Chairman Gender	−0.02	0.00	0.00	−0.02	0.05	−0.04	−0.05		
16 Chairman Age	0.01	0.02	0.01	0.02	0.13	0.03	0.02	0.03	
17 Chairman Turnover	−0.06	0.04	0.07	0.04	0.20	0.00	0.00	0.01	−0.03

4.3. Empirical methods

Using the panel data from 2011 to 2019, we test our hypotheses with the fixed-effect ordinary least squares (OLS) models to alleviate endogeneity from omitted variables. Before that, we applied Hausman tests to examine the validity of fixed-effects models. The results reject the null hypothesis that the error terms are uncorrelated with the regressors, thereby supporting our choice.

To check the robustness of our empirical results and findings, first, we measure our independent variables based on 90 sub-industries (also from the same source, China Securities Regulatory Commission) instead of 19 industry sectors to eliminate the interference of industry classification. Second, considering that performance change may be taken into consideration by analysts only when its range reaches a certain threshold rather than when it fluctuates slightly from its absolute value (McNichols & O'Brien, 1997), we divide *Relative CSR Performance* into 10 and 15 levels, and measure *CSR Performance Improvement* as ranking changes from one of these levels to another. Third, we also verify hypotheses by a) constructing *Relative CSR Performance* by other CSR ratings; b) examining the moderating effect of characteristics of signalers, receivers, and the signal environment in the baseline model through cross-sectional analysis (Connelly et al., 2011); and c) utilizing proxies for firms' resources and industry CSR competition to test the signal mechanism of *Relative CSR Performance*. Finally, although, to some extent, fixed-effect models and one-year lagged independent

Table 2
Relative CSR Performance and Analyst Recommendation – fixed effect models.
This table reports the regression results about the effects of Relative CSR Performance, CSR Performance Improvement and their interaction on Analyst Recommendation, using fixed effects models. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	Analyst Recommendation			
	(1)	(2)	(3)	(4)
Relative CSR Performance		0.039**	0.016	0.022
		(0.016)	(0.024)	(0.023)
CSR Performance Improvement			0.024	0.012
			(0.021)	(0.036)
CSR Performance Improvement Squared			−0.070***	0.059
			(0.022)	(0.036)
Relative CSR Performance × CSR Performance Improvement				0.118**
				(0.050)
Relative CSR Performance × CSR Performance Improvement Squared				−0.359***
				(0.070)
Analyst Coverage	0.005***	0.005***	0.005***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
High-status Houses Coverage	0.120***	0.120***	0.120***	0.120***
	(0.020)	(0.020)	(0.019)	(0.019)
Firm Size	−0.029*	−0.033*	−0.031*	−0.032*
	(0.017)	(0.017)	(0.017)	(0.017)
Financial Leverage	0.158***	0.164***	0.163***	0.164***
	(0.042)	(0.042)	(0.042)	(0.042)
ROA	0.648***	0.549***	0.561***	0.571***
	(0.065)	(0.065)	(0.062)	(0.060)
Slack Resources	0.036	0.038	0.035	0.032
	(0.022)	(0.022)	(0.023)	(0.023)
Share Price Fluctuation	−0.000	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)
EPS Fluctuation	0.047***	0.048***	0.045***	0.045***
	(0.008)	(0.008)	(0.009)	(0.009)
SOE	−0.065**	−0.065**	−0.066**	−0.065**
	(0.028)	(0.027)	(0.027)	(0.028)
Ownership Concentration	0.267***	0.264***	0.266***	0.266***
	(0.040)	(0.039)	(0.038)	(0.039)
Independent Directors Ratio	0.186	0.184	0.182	0.184
	(0.110)	(0.109)	(0.109)	(0.107)
Chairman Gender	−0.000	−0.000	0.001	0.001
	(0.021)	(0.022)	(0.022)	(0.022)
Chairman Age	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Chairman Turnover	0.008	0.008	0.008	0.008
	(0.008)	(0.008)	(0.008)	(0.008)
Constant	3.866***	3.881***	3.878***	3.873***
	(0.133)	(0.133)	(0.134)	(0.135)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	15,735	15,735	15,735	15,735
Adjusted R^2	0.392	0.393	0.393	0.393

variables alleviate the potential endogeneity problem, we further apply other estimation methodologies, including 2SLS and PSM.

5. Results

5.1. Descriptive statistics

Table 1 presents the descriptive statistics for 15,735 firm-year observations from 2011 to 2019. The average value of *Analyst Recommendation* is 4.36, indicating that, in general, analysts are optimistic about A-share listed firms. The mean and standard deviation of *Relative CSR Performance* are 0.59 and 0.28, suggesting that the disparity of CSR performance between firms is relatively large. On average, *CSR Performance Improvement* is 0.00, inferring that in CSR competition, a firm's improvement often accompanies other firms' decrease in CSR ranking.

In our sample, the mean and standard deviation of *Analyst Coverage* are 21.39 and 26.44, and 55% of followed analysts serve in high-status brokerage houses. The average *Firm Size*, *Financial Leverage*, *ROA*, and *Slack Resources* are 8.60, 0.43, 0.05, and 0.00, respectively. Generally, almost all controls are comparable with prior literature (e.g., Wang & Qian, 2011; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020).

Table 1 also reports the Pearson correlation matrix. The results suggest that the correlation coefficient of all explanatory variables is less than 0.60, which preliminarily confirms that multicollinearity is not an issue. Besides, we also compute variance inflation factors (VIFs) for all variables, which range from 1.01 to 2.17 – well below the cutoff of 10 (Ryan, 2008). Thus, multicollinearity among the variables is not a concern.

5.2. Regression results

Table 2 reports all regression results using fixed-effect models. Column (1) only includes control variables. We find evidence that *Analyst Coverage* and *High-status Houses Coverage* are positively related to *Analyst Recommendation*. These results are aligned with the literature (Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020). In terms of firm characteristics, the results suggest that firms with higher *Financial Leverage*, *ROA*, or increasing EPS are more likely to enjoy more positive *Analyst Recommendation*. By contrast, *Analyst Recommendation* decreases for firms with larger assets, which is somewhat counterintuitive. However, similar findings have also been reported in other studies (e.g., Li, Lin, & Lin, 2021; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020). We infer that the optimistic recommendation tendency is originated from the higher potential returns earned by small firms than large firms (Jegadeesh et al., 2004). We also document that non-SOEs and firms with more concentrated ownership structures significantly receive higher *Analyst Recommendation*.

H1 predicts a positive relationship between *Relative CSR Performance* and *Analyst Recommendation*. As shown in Columns (2) in Table 2, the coefficient of the independent variable is significantly positive ($b = 0.039$, s.e. $= 0.016$, $p < 0.05$), thus H1 is supported. Considering the non-linear effect of *CSR Performance Improvement* on *Analyst Recommendation*, we further examine whether the relationship would be inverse U-shape or S-shape. The results from Table 3 show that both squared term ($b = -0.036$, s.e. $= 0.036$, $p > 0.10$) and cubed term ($b = -0.263$, s.e. $= 0.204$, $p > 0.10$) are not significant, which excludes the attribution of non-linear effects of *Relative CSR Performance*.

The squared term of improvement was predicted in H2, which expects a decreasingly positive effect of *CSR Performance Improvement* on *Analyst Recommendation*. In Column (3) of Table 2, the coefficient of the squared term is negative and significant ($b = -0.070$, s.e. $= 0.022$, $p < 0.01$), implying an inverted U-shape, as shown in Fig. 1. A noteworthy point here is that the slope of the linear relationship at the high end (i.e., the mean plus 1 standard deviation of *CSR Performance Improvement*) is positive and insignificant ($b =$

Table 3
Test for non-linear relationship between Relative CSR Performance and Analyst Recommendation.
This table reports the regression results about the possible non-linear effects of Relative CSR Performance on Analyst Recommendation, using fixed effects models. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

Dependent Variable	Analyst Recommendation		
	(1)	(2)	(3)
Relative CSR Performance	0.039**	0.079**	−0.111
	(0.016)	(0.035)	(0.149)
Relative CSR Performance Squared		−0.036	0.387
		(0.036)	(0.320)
Relative CSR Performance Cubed			−0.263
			(0.204)
All Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Observations	15,735	15,735	15,735
Adjusted R^2	0.393	0.393	0.393

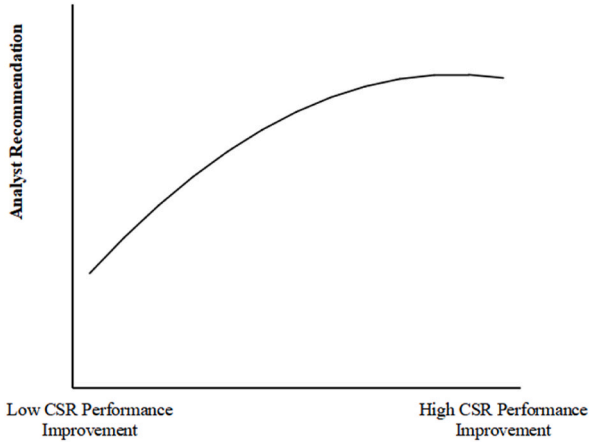

Fig. 1. The inversed U-shaped effect of CSR Performance Improvement.

0.027, s.e. = 0.058, p > 0.10), though the slope at the low (i.e., the mean minus 1 standard deviation of *CSR Performance Improvement*) end is significantly positive (b = 0.070, s.e. = 0.027, p < 0.05), as displayed in Table 4. Therefore, H2 receives support.

Column (4) in Table 2 indicates that the strengthening moderating effect of *Relative CSR Performance* on the relationship between *CSR Performance Improvement* and *Analyst Recommendation* is significant (b = −0.359, s.e. = 0.070, p < 0.01) as predicted in H3. As depicted in Fig. 2, the decreasingly positive effect of *CSR Performance Improvement* on *Analyst Recommendation* is steeper for firms with higher *Relative CSR Performance*. Therefore, H3 is also verified.

5.3. Robustness tests

We perform a range of tests to check the robustness of our findings. First, we examine the sensitivity of results to alternative industry classifications. Instead of 19 industries, we measure our independent variables based on 90 sub-industries provided by the Directory of Industry Classification for Listed Companies. As shown in Table 5, all hypotheses are supported.

It is argued (McNichols & O'Brien, 1997) that analysts only consider performance change when its range reaches a certain threshold. In line with this, we divide *Relative CSR Performance* into intervals at 10 and 15 levels, and measure *CSR Performance Improvement* using change from one of these levels to another, and employ fixed-effect models to test our hypotheses. In Table 6, the results show that all hypotheses receive support regardless of whether relative performance is classified into 10 or 15 intervals.

Third, although in Section 4.2.2, we have discussed the reasonability and justification for using Hexun CSR ratings, the CSR performance rating is relatively flexible and there are other sources. Therefore, as an alternative proxy in the baseline model, we measure *Relative CSR Performance* and *CSR Performance Improvement* based on RKS CSR ratings, a ranking that is widely used in CSR literature (e.g., Li & Lu, 2020; Marquis & Qian, 2014). Columns (1) to (3) in Table 7 show that the results support H2 and H3 again, but do not support H1. We attribute this outcome to the number of firms covered by RKS, which is nearly a quarter of that of Hexun and only includes self-selected firms that provide information on their CSR activities. To test this assumption, we match firms covered in

Table 4
The effect of CSR Performance Improvement on Analyst Recommendation at the high and low end.
This table reports the regression results about the effects of CSR Performance Improvement on Analyst Recommendation at the high and low ends, using fixed effects models. Column (1) shows the results at the low end and Column (2) at the high end. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

Dependent Variable	Analyst Recommendation	
	(1)	(2)
Relative CSR Performance	0.020	−0.014
	(0.028)	(0.041)
CSR Performance Improvement	0.070**	0.027
	(0.027)	(0.058)
All Controls	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Observations	13,428	2307
Adjusted R^2	0.405	0.269

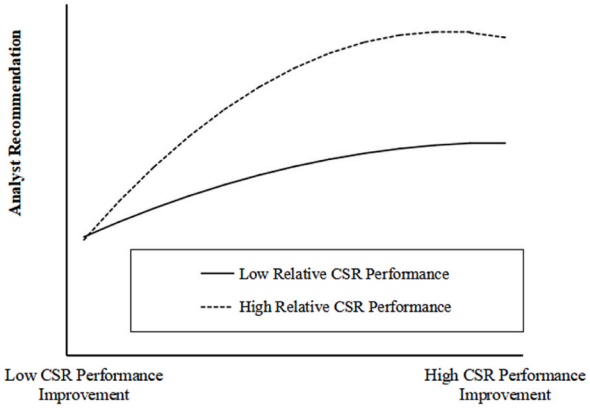

Fig. 2. The moderating effect of Relative CSR Performance.

Table 5
The effect of Relative CSR Performance and CSR Performance Improvement based on sub-industries.
This table reports the regression results about the effects of Relative CSR Performance and CSR Performance Improvement constructed based on 90 sub-industries provided by the Directory of Industry Classification for Listed Companies on Analyst Recommendation, using fixed effects models. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the sub-industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

Dependent Variable	Analyst Recommendation		
	(1)	(2)	(3)
Relative CSR Performance	0.044**	0.023	0.031
	(0.019)	(0.032)	(0.032)
CSR Performance Improvement		0.023	0.024
		(0.025)	(0.051)
CSR Performance Improvement Squared		−0.062*	0.097
		(0.032)	(0.074)
Relative CSR Performance × CSR Performance Improvement			0.076
			(0.077)
Relative CSR Performance × CSR Performance Improvement Squared			−0.372***
			(0.128)
All Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Observations	15,735	15,735	15,735
Adjusted R^2	0.393	0.393	0.393

the RKS sample with that of Hexun CSR ratings and test all hypotheses with fixed-effect models again on this reduced sample size. Columns (4) to (6) of Table 7 juxtapose the results of the reduced Hexun sample size to that of RKS, which reconfirms that empirical results using the RKS sample might be distorted due to the omission of many firms that did not produce CSR reports. Hence, our findings are robust to the change in CSR ratings.

Furthermore, we conduct a series of cross-sectional tests on the baseline model to see whether the characteristics of signalers, receivers, and signaling environment affect the effect of signals (Connelly et al., 2011). First, analysts also screen for other information to make accurate recommendations, which may influence the weight they attach to CSR (Qian et al., 2021). Additional signals to indicate their advantages or disadvantages for more transparent signalers, measured by *Analyst Coverage*, weaken the effect of CSR signals (Lang, Lins, & Maffett, 2012). Second, receivers' attention varies with their working experience (Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020). *Analysts Experience*, measured by the number of their working seasons, can be an indication of their enriched ability and risk appetite to identify and utilize CSR signals separate from the usual financial signals. Third, the signal environment also plays an important role in the effectiveness of signals, for it determines the extent to which observed signals fit with and are preferred by the receivers (Connelly et al., 2011). We utilize *Industry CSR* (the average CSR level in the focal industry) and *Social Organizations* (the number of social organizations in the region) to represent the competitive and institutional environment of the signal. Respectively, they suggest that analysts regard CSR as a more common positive signal for firms' competitive purposes in the industry and more negative when firms are forced by social organizations.

Columns (1) to (4) in Table 8 depict the interaction terms of *Relative CSR Performance* and *Analyst Coverage*, *Analyst Experience*, *Industry CSR,* and *Social Organizations,* respectively. The results indicate that the moderating effect of *Analyst Coverage* is significantly

Table 6
The effect of Relative CSR Performance and CSR Performance Pmprovement based on different ranking levels.
This table reports the regression results about the effects of Relative CSR Performance and CSR Performance Improvement divided into 10 and 15 levels on Analyst Recommendation, using fixed effects models. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

Threshold	Rankings in 10 Levels			Rankings in 15 Levels		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative CSR Performance	0.037**	0.015	0.020	0.035**	0.013	0.019
	(0.016)	(0.024)	(0.024)	(0.017)	(0.024)	(0.023)
CSR Performance Improvement		0.021	−0.004		0.024	0.029
		(0.020)	(0.037)		(0.021)	(0.035)
CSR Performance Improvement Squared		−0.075***	0.028		−0.065***	0.094**
		(0.020)	(0.040)		(0.022)	(0.037)
Relative CSR Performance ×			0.109**			0.078
CSR Performance Improvement			(0.048)			(0.047)
Relative CSR Performance ×			−0.278***			−0.360***
CSR Performance Improvement Squared			(0.071)			(0.066)
All Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,735	15,735	15,735	15,735	15,735	15,735
Adjusted R^2	0.393	0.393	0.393	0.393	0.393	0.393

Table 7
The effect of Relative CSR Performance and CSR Performance Improvement based on different CSR ratings.
This table reports the regression results about the effects of Relative CSR Performance and CSR Performance Improvement measured by different CSR scores on Analyst Recommendation, using fixed effects models. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

CSR Ratings	RKS			Hexun		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative CSR Performance	0.002	0.056	0.063	0.036	−0.021	−0.004
	(0.044)	(0.048)	(0.047)	(0.053)	(0.047)	(0.047)
CSR Performance Improvement		−0.087**	0.014		0.048*	0.230**
		(0.030)	(0.056)		(0.026)	(0.096)
CSR Performance Improvement Squared		−0.130**	0.330**		−0.077**	0.354***
		(0.050)	(0.139)		(0.034)	(0.106)
Relative CSR Performance ×			−0.080			−0.080
CSR Performance Improvement			(0.139)			(0.143)
Relative CSR Performance ×			−0.798***			−0.743***
CSR Performance Improvement Squared			(0.162)			(0.089)
All Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4151	4151	4151	4151	4151	4151
Adjusted R^2	0.442	0.443	0.444	0.443	0.443	0.446

negative (b = −0.003, s.e. = 0.001, p < 0.01), which proves that other signals sent by transparent signalers can alleviate information asymmetry and partially mitigate the effect of CSR signals. The moderating effect of *Analysts Experience* reflecting analysts' preference for CSR is significantly positive (b = 0.058, s.e. = 0.018, p < 0.01). We incorporate *Industry CSR* and *Social Organizations* as moderators to measure the competitive and institutional environment firms are embedded in. The effect of *Industry CSR* is positive (b = 0.007, s.e. = 0.003, p < 0.05), and the effect of *Social Organizations* is negative (b = −0.014, s.e. = 0.005, p < 0.05). Both are significant, which supports our conjectures.

Finally, to prove that *Relative CSR Performance* works as a signal reflecting a firm's resources and competition pressure to engage in CSR, as discussed in H3, we test the moderating role of *Slack Resources* and *Political Connection* as proxies for firms' financial and political resources, and *Industry CSR* and *Industry Concentration Ratio* as proxies for industry competition in non-market and market field. Detailed descriptions of these variables are provided in Appendix A. The results in Column (1) and (2) of Table 9 show that *Slack Resources* (b = −1.063, s.e. = 0.497, p < 0.05), *Political Connection* (b = −0.252, s.e. = 0.118, p < 0.05), *Industry CSR* (b = −0.010, s.e. = 0.003, p < 0.01) and *Industry Concentration Ratio* (b = −0.234, s.e. = 0.101, p < 0.05) all steepen the relationship between *CSR Performance Improvement* and *Analyst Recommendation*, and all results are robust to the full model in Column (3), which support our

Table 8
Signalers, receivers, signaling environment and signals.
This table reports the regression results about the moderating effects of Analyst Coverage, Season, Industry CSR and Social Organizations on the relationship between Relative CSR Performance and Analyst Recommendation, using fixed effects models. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

Dependent Variable	Analyst Recommendation			
	(1)	(2)	(3)	(4)
Relative CSR Performance	0.091***	−0.103**	−0.119	0.112**
	(0.025)	(0.042)	(0.069)	(0.040)
Analyst Coverage	0.007***			
	(0.001)			
Analyst Coverage ×	−0.003***			
Relative CSR Performance	(0.001)			
Season		−0.033**		
		(0.012)		
Season ×		0.058***		
Relative CSR Performance		(0.018)		
Industry CSR			−0.004**	
			(0.002)	
Industry CSR ×			0.007**	
Relative CSR Performance			(0.003)	
Social Organizations				0.014***
				(0.004)
Social Organizations ×				−0.014**
Relative CSR Performance				(0.005)
All Controls	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	15,735	15,064	15,735	15,735
Adjusted R^2	0.394	0.404	0.393	0.393

core logic.

5.4. Identification strategies

To further rule out endogeneity, we apply other estimation methodologies, including 2SLS and PSM regressions. First, we utilize 2SLS regression to mitigate the endogeneity issue from any omitted variables that may be correlated with both the independent variable (*Relative CSR Performance*) and the dependent variable (*Analyst Recommendation*). The ideal instrumental variables should have an impact on *Relative CSR Performance* but be exogenous to *Analyst Recommendation*. Therefore, we include *Social Organizations*, i.e., the number of social organizations in the province scaled by regional population, and the *Number of IPC*, i.e., the number of International Patent Classification types that a firm's invention patents cover as instrumental variables. Prior literature (Marquis et al., 2007; Tilcsik & Marquis, 2013) suggests that local social organizations play important roles in fostering CSR activities, and as two essential differentiation strategies, innovation and CSR are alternatives (McWilliams & Siegel, 2001). Hence, we argue that social organizations may positively affect relative CSR performance, while the relationship between the number of IPCs and relative CSR performance may be negative.

Table 10 displays the results of 2SLS regression. In our model, the p-value of the Anderson canonical correlation LM statistic is significant, the Cragg-Donald Wald F statistic is larger than Stock-Yogo weak ID test critical values in 15% maximal IV size, and the p-value of the Sargan statistic is insignificant, all of which ensure under-identification, weak identification and overidentification are not concerns. Therefore, the selected instrumental variables are valid in the 2SLS regression. Column (1) in Table 10 shows the first-stage regression results with *Relative CSR Performance* as the dependent variable. As predicted, the coefficient of *Social Organizations* is positive and significant ($b = 0.008$, s.e. $= 0.003$, $p < 0.05$), and the effect of *Number of IPC* is significantly negative ($b = -0.002$, s.e. $= 0.000$, $p < 0.01$). Column (2) reports the results from the second-stage regression with the fitted value of *Relative CSR Performance* from the first-stage regression ($b = 0.946$, s.e. $= 0.261$, $p < 0.01$), which is again highly consistent with our baseline result.

Second, we conduct PSM regression to further alleviate the endogeneity concern produced by the potential confounding effect of the covariates between firms with high and low *Relative CSR Performance*. Firms whose *Relative CSR Performance* is higher than the mean value of our sample (0.59) are included in the treatment group; the others are in the control group. We employ the one-to-four matching for all controls across treatment and control groups within a caliper of 0.0001 with a replacement. Table 11 reports the results for PSM regression. Panel A compares the mean of covariates and standard bias of the treatment and control group firms before and after PSM. The absolute values of standard bias of covariates are all less than 5% after PSM, which suggests that the matching process has effectively removed the differences between the treated and untreated observations to a great extent. Panel B shows the PSM regression results implying that high *Relative CSR Performance* has a significantly positive relationship with analyst recommendation, proving that our baseline results are unlikely to be subject to endogeneity.

Table 9

The moderating effects of proxies for firms' resources and industry CSR competition.

This table reports the regression results about the moderating effects of Slack Resources, Political Connection, Industry CSR and Industry Concentration Ratio on Analyst Recommendation, using fixed effects models. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

Dependent Variable	Analyst Recommendation		
	(1)	(2)	(3)
CSR Performance Improvement	0.031	0.010	0.012
	(0.024)	(0.082)	(0.078)
CSR Performance Improvement Squared	−0.047**	0.337**	0.344***
	(0.019)	(0.122)	(0.114)
Slack Resources	0.086***		0.084**
	(0.029)		(0.029)
Slack Resources ×	0.007		0.017
CSR Performance Improvement	(0.100)		(0.095)
Slack Resources ×	−1.063**		−1.056**
CSR Performance Improvement Squared	(0.497)		(0.479)
Political Connection	0.008		0.006
	(0.017)		(0.017)
Political Connection ×	−0.026		−0.025
CSR Performance Improvement	(0.059)		(0.057)
Political Connection ×	−0.252**		−0.221*
CSR Performance Improvement Squared	(0.118)		(0.118)
Industry CSR		0.001	0.001
		(0.001)	(0.001)
Industry CSR ×		0.005*	0.005*
CSR Performance Improvement		(0.002)	(0.002)
Industry CSR ×		−0.010***	−0.010***
CSR Performance Improvement Squared		(0.003)	(0.003)
Concentration Ratio		−0.202	−0.197
		(0.148)	(0.147)
Concentration Ratio ×		−0.131	−0.127
CSR Performance Improvement		(0.081)	(0.078)
Concentration Ratio ×		−0.234**	−0.226**
CSR Performance Improvement Squared		(0.101)	(0.094)
All Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Observations	15,735	15,735	15,735
Adjusted R^2	0.393	0.394	0.394

Table 10

Relative CSR Performance and Analyst Recommendation – 2SLS methods.

This table reports the regression results about the effect of Relative CSR Performance on Analyst Recommendation, using Two-stage Least Ordinary Method (2SLS). Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Control variables include all those listed in Table 2.

Dependent Variables	Relative CSR Performance	Analyst Recommendation
	(1)	(2)
Social Organizations	0.008**	
	(0.003)	
Number of IPC	−0.002***	
	(0.000)	
Predicted Relative CSR Performance		0.946***
		(0.261)
All Controls	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Anderson canon. corr. LM statistic (p value)	–	0.000
Cragg-Donald Wald F statistic	–	14.270
Sargan statistic (p value)	–	0.887
Observations	15,735	15,735
Adjusted R^2	0.639	0.393

Table 11
Relative CSR Performance and Analyst Recommendation – PSM analysis.
This table reports the regression results for the relationship between Relative CSR Performance and Analyst Recommendation, using the Propensity Score Matching (PSM) based on Relative CSR Performance. Firms are included in the treatment group if Relative CSR Performance is higher than its mean (0.59), while firms with Relative CSR Performance lower than its mean are included in the control group. Panel A reports the mean comparisons between treatment and control firms' characteristics and standard bias before and after PSM. Panel B reports the results of regression on the matched sample. Detailed descriptions of variables are provided in Appendix A. The t-statistics are based on standard errors clustered at the industry level reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A Comparison of Treatment and Control Firms

	Before			After		
	Treated	Control	% bias	Treated	Control	% bias
Analyst Coverage	27.61	13.94	54.50	21.81	21.59	0.90
High-status Houses Coverage	0.56	0.53	8.20	0.55	0.55	−0.40
Firm Size	8.80	8.36	33.30	8.70	8.75	−3.60
Financial Leverage	0.41	0.45	−19.40	0.43	0.43	−1.70
ROA	0.07	0.03	95.40	0.06	0.06	2.40
Slack Resources	0.01	0.00	8.20	0.00	0.00	0.60
Share Price Fluctuation	−1.86	−1.71	−1.90	−1.94	−2.04	1.30
EPS Fluctuation	0.02	−0.03	14.20	0.01	−0.01	3.60
SOE	0.38	0.34	8.50	0.38	0.40	−2.80
Ownership Concentration	0.62	0.58	33.00	0.61	0.61	−1.50
Independent Directors Ratio	0.38	0.37	1.60	0.37	0.37	0.00
Chairman Gender	0.94	0.94	−2.10	0.94	0.94	−1.70
Chairman Age	49.86	49.09	12.10	49.63	49.50	2.00
Chairman Turnover	0.11	0.13	−5.30	0.12	0.12	−0.30

Panel B Relative CSR Performance and Analyst Recommendation – PSM regression

Dependent Variable	Analyst Recommendation
	(1)
Treated	0.019**
	(0.009)
All Controls	Yes
Firm Fixed Effects	Yes
Year Fixed Effects	Yes
Industry Fixed Effects	Yes
Observations	9391
Adjusted R^2	0.401

6. Discussion and conclusion

Integrating screening theory in CSR competition, our research provides a framework in which security analysts screen for the relative CSR performance and its improvement as essential signals reflecting the ability and intent of firms to focus on CSR competition. In support of our hypotheses, we found that analysts favorably recommend firms with higher or growing relative CSR performance, though the latter's effect gradually declines. Besides, the two signals have joint effects on analysts' recommendations. Specifically, the decreasingly positive impact of CSR performance improvement is augmented for firms with higher rankings than competitors in the same industry.

Our post-hoc analyses show that the characteristics of signalers, receivers, environment, and other supplementary signals can influence analysts' evaluation of the focal CSR signal. We found that the positive effect of relative CSR performance can be strengthened when a focal firm is covered by fewer analysts or the analysts following the firm have more average work experience, but weakened when the firm confronts weaker competitive pressure or stronger institutional pressure. Finally, we find that the decreasingly positive effect of CSR performance improvement can be steepened when the firm has enough financial or political resources to support its CSR actions or are in fierce CSR or market competition.

The findings of this study generate interesting theoretical and practical implications. First, we contribute to the CSR literature by treating the process in which firms continuously devote resources to their CSR activities as a form of competitive behavior or a tournament. Scholars have been using a variety of theories, including stakeholder theory (Kölbel, Busch, & Jancso, 2017), institutional theory (Campbell, 2007; Li & Lu, 2020; Luo et al., 2017), and resource-based theory (Russo & Fouts, 1997) to analyze firms' motivation to engage in CSR. Most previous studies overlook or ignore CSR as a source of competition among all firms and assume it to be an isolated strategic choice for some firms (e.g., Kölbel et al., 2017; Li & Lu, 2020; Russo & Fouts, 1997). Only some recent studies (e.g., Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020) raise firms' competitive efforts to be similar or distinct in the scope and focus of their CSR performance. We contribute to this promising literature by clarifying this competition and pointing out that regardless of the purpose of CSR strategies, fierce competition is enacted among firms, and relative ranking and comparative ranking changes in this competition are regarded as valuable signals for external audiences. This perspective transformation calls for more attention to the relationships and interplays among firms in their CSR efforts and signaling rather than assuming the implementation and influence of CSR strategies are firms' simple isolated behaviors and outcomes.

Second, we utilize screening theory to examine how analysts evaluate firms based on signals in CSR competition. Although many scholars (e.g., Lys et al., 2015; Su et al., 2016) treat CSR performance as important signals conducive to reducing information asymmetry, they mostly assume that firms deliberately transmit signals about financial prospects or comply with stakeholders' wishes. As the mirror of signaling theory (Qian et al., 2021), the screening view explores the influence of unintended signals on uninformed signal receivers (Bouwman et al., 1987). This transformation cannot only contribute to theoretically analyzing how all kinds of unintended information is integrated into signals, but also explains the mechanism of how signals take effects objectively rather than on the foundation of firms' goals (Bradshaw, 2004; Connelly et al., 2011). For instance, we indicate that compared with absolute CSR scores evaluated by third parties, since security analysts tend to collect more information about firms' counterparts and growth indicators according to professional habits (Bouwman et al., 1987; Jegadeesh et al., 2004; Zhang, Qian, et al., 2020; Zhang, Wang, et al., 2020), their recommendations would be affected by relative performance and improvements that respectively infer information about ranking and trend in the CSR competition. Besides, we also develop a more comprehensive theory by analyzing the influence of characteristics of signalers, receivers, and signaling environment on receivers' attitudes or evaluations of focal signals, which extends the boundaries of screening theory.

Our research also brings significant implications for practitioners. First, regarding relative CSR ranking, we have shown that analysts prefer firms with higher relative CSR performance. This finding ought to serve as an enlightenment for organizations that even if they are coerced to participate in CSR competition rather than doing it out of efficiency goals (Jeong & Kim, 2019), they still need to devote part of their resources to CSR to maintain roughly satisfying rankings among their competitors. This is also true where CSR is just developing into an institutionalized force, and firms' performance in CSR competition would be seen as essential signals by a relatively uninformed external audience. Otherwise, firms might lose their legitimacy or be deemed undesirable for investment because of their lower relative performance (Chatterji & Toffel, 2010; Rowley, Shipilov, & Greve, 2017).

Second, we found that in addition to relative performance, improving the ranking range also affects analysts' recommendation. Additionally, this impact is asymmetric, meaning that the impact of a firm's relative CSR performance improvement on analysts' recommendations is weaker than that of the same extent of deterioration. Accordingly, if the firm is in pursuit of a rapid rise of relative CSR performance in the short term to gain a higher ranking advantage but is unable to maintain this high level across consecutive years, it would take a hit of adverse reaction from analysts compared with keeping rankings constant, i.e., disadvantages of changes. In other words, if a firm has not prepared sufficient resources for sustained, long-term CSR initiatives that require a continuous flow of resources, it would be wiser to pursue alternative strategies while stabilizing CSR ranking instead of haphazardly investing in CSR.

Third, signals from a relative position and improvement trends in CSR competition have combined effects on analysts' recommendations. Therefore, firms should attach greater importance to their own characteristics, such as resources and competitive pressure, when adjusting or developing their CSR strategies. For example, when firms face a situation wherein they need to reallocate CSR resources to formulate alternative strategies, the removal of CSR resources could be an optional tactic for those ranked low, because lower relative performance weakens the negative effect of CSR performance decreasingly. This approach, however, might produce intense adverse reactions from analysts for the top-ranking firms, if the firm cannot continue devoting adequate, and likely increasing, resources to maintain their higher position in CSR competition.

As with any empirical study, ours has some limitations pointing to avenues for improvements by future research. First, while CSR competition in China, where firms are experiencing the institutionalization of CSR and where the number of authoritative CSR rating organizations is limited, provides an ideal setting for testing our theoretical framework, research studying signals in other contexts is needed to assess the robustness and generalizability of our findings. Second, our study focuses on the screening process from the perspective of security analysts, but there might be other points to enrich this topic further. Future research can explore how other signal receivers, such as the government and third-party organizations, screen the data. Third, though we pointed out that competition among firms is in progress in the CSR realm, we acknowledge that some firms vigorously pursue strategic cooperation in CSR. Therefore, how external audiences filter CSR cooperation information to rank sort firms may be a good choice for a new research direction.

Declaration of competing interest

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Data availability

Data will be made available on request.

Appendix A. Brief Measurement Description

Description of all variables.

Variables	Descriptions

(*continued on next page*)

(*continued*)

Variables	Descriptions
Dependent Variable	
Analyst Recommendation	The mean of all recommendations published by all analysts who followed firm i with equal weight
Independent Variables	
Relative CSR Performance	The portion of firms whose Hexun CSR performance is inferior to the focal firm in the same industries
CSR Performance Improvement	The difference between a firm's relative CSR performance in year t and year t - 1
Control Variables	
Analyst Coverage	The total number of analysts who cover the firm
High-status Houses Coverage	The portion of analysts serving in the brokerage house which has at least one analyst team granted Best Analyst by New Fortune Magazine
Firm Size	The logarithm of total assets
Financial Leverage	The ratio of total debts to assets
ROA	Operating return of firm i scaled by its total assets
Slack Resources	The sum of cash flow from a firm's operating, financing, and investing activities scaled by total assets
Share Price Fluctuation	The difference of share price between year t and year t - 1
EPS Fluctuation	The difference of EPS between year t and year t - 1
SOE	Takes value of 1 if a firm is state-owned and 0 otherwise
Ownership Concentration	The proportion of total equity share held by the ten largest shareholders
Independent Directors Ratio	The ratio of independent directors of the board
Chairman Gender	Takes value of 1 if a chairperson is male and 0 otherwise
Chairman Age	Measured in year
Chairman Turnover	Recorded as 1 for years in which the chairperson changed and 0 otherwise
Other Variables	
CSR Performance Improvement Squared	The squared term of CSR performance improvement
Relative CSR Performance Squared	The squared term of relative CSR performance
Relative CSR Performance Cubed	The cubed term of relative CSR performance
Analysts Experience	The logarithm of the average working seasons of analysts making a recommendation in year t
Industry CSR	The average CSR performance at the industry level
Social Organizations	The number of social organizations in Chinese provinces scaled by regional population
Political Connection	Recorded as 1 if chairman of board was a member of national people's congress (NPC) or the Chinese people's political consultative conference (CPPCC) and 0 otherwise
Industry Concentration Ratio	Calculated as 1 – the combined market share of the 4 largest firms within the industry counted by their total revenue
Number of IPC	The number of IPC types that a firm's invention patents cover
Predicted Relative CSR Performance	Fitted value of relative CSR performance in the first-stage regression
Treated	Recorded as 1 if relative CSR performance is higher than its mean and 0 otherwise

Appendix B. Hexun CSR Index

Dimensions	Weights	Second-level Indicators	Weight
Shareholders	30%	Profitability	10%
		Debt paying	3%
		Return	8%
		Credit	5%
		Innovation	4%
Employees	15%	Performance	5%
		Safety	5%
		Caring for employees	5%
Suppliers, customers and consumer rights	15%	Product quality	7%
		Customer service	3%
		Mutual good faith	5%
Environment	20%	Environmental governance	20%
Society	20%	Contribution	20%

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