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Noise from online discussion forums: Evidence from IPOs in China

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ABSTRACT

In this study, we use initial public offerings (IPOs) in China to investigate how online stock forums influence information asymmetry and IPO valuation. The empirical analysis isolates the underpricing and overvaluation components of initial returns. The number of forum comments, postings, and readings are positively associated with initial returns and the degree of underpricing, implying that forums create noise that exacerbates information asymmetry during IPOs. This effect is amplified by the quiet period regulation, which drives investors to rely on online discussion forums to obtain information. Through sentiment analyses of forum posts and media coverage, we find that the negative effect of online forums is more prominent when bad news prevails. We clarify the role of online stock forums in IPO pricing and information asymmetry by separating underpricing from overvaluation in initial returns.

1. Introduction

With the development of Internet technology in China, online stock forums are increasingly popular among investors. However, whether investors benefit from online postings and comments is unclear, and testing this issue is challenging under normal circumstances. Therefore, we use initial public offering (IPO) data to investigate how online stock forums influence information asymmetry and IPO valuations. The theoretical support for this study is partially from IPO rational theory. In the rational theory framework, underpricing is caused by information asymmetry and uncertainty (Rock, 1986; Benveniste and Spindt, 1989; Loughran et al., 1994; Chen et al., 2004). Lower levels of IPO underpricing indicate greater information transparency. The relation-

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ship between information in online forums and IPO underpricing is tested to investigate the research topic. Unlike in other mature capital markets, an IPO's first-day return in China is not a good proxy for underpricing. Therefore, we must isolate the underpricing component of the first-day return before conducting the empirical analyses.

The research design considers the feasibility of using the level of IPO underpricing as a proxy for information asymmetry. Chinese IPO initial returns are both attention driven and information based (Gao, 2010; Song et al., 2014). An IPO offer price is often below its fair market price, whereas the short-run aftermarket equilibrium price is often above market value because investor sentiment is generally high in China. Therefore, rational theory alone cannot explain first-day returns that contain both under- and overpricing components. Behavioral theory that focuses on investor sentiment is thus appropriate (Ritter and Welch, 2002). Considering both rational and behavioral theories, we isolate the underpricing and overvaluation components to conduct the empirical analyses. Given the once fairly high level of IPO first-day returns in China, it is practical to test the influence of online discussions in an IPO setting.

Online discussion forums provide investors with places to converse by posting articles and comments. Forum information is one of the determinants of stock trading (Wysocki, 1999; Spiegel et al., 2010; Delort et al., 2011), but its effects on IPO under- and overpricing are unclear. Both rational and behavioral explanations are given regarding online postings (Wysocki, 1999). We investigate whether online discussions alleviate or exacerbate information asymmetry and investor sentiment. With underpricing and overpricing isolated from initial returns, the effect of online forums on the two components of initial returns are tested. We find that the number of forum comments, article postings, and article readings are positively related to initial returns and the level of underpricing. This result confirms our hypothesis that online forums create noise that exacerbates information asymmetry during IPOs.

On May 1, 2009, the China Securities Regulatory Commission (CSRC) started requiring IPOs in the ChiNext sector to follow the quiet period regulation.[1] On May 18, 2012, the CSRC introduced the quiet period regulation[2] to the main stock exchange. During the quiet period, issuers are not allowed to release information or opinions about the firm. We propose that the quiet period makes investors rely on stock forums for information, which amplifies the impact of online discussions. A split-sample design is used to test the influence of online forums on firms subject to the quiet period regulation versus those not subject to it. Consistent with our hypotheses, forum information is more influential on the IPO observations subject to the regulation.

In additional analyses, we test the influence of the sentiment conveyed by online postings using a split-sample design. A tone variable for online forum postings is constructed as the basis for splitting the sample. To further support the idea of tone information, we construct a tone variable for media coverage, which we also use to split the sample. The results imply that the negative effect of online forums is more prominent when bad news prevails, probably because negative information ferments and spreads to a greater extent.

Our findings indicate that online discussion forums create noise during IPOs that leads to greater underpricing. Firms with high information asymmetry may drive investors to online forums to gather information and discuss the firm. Therefore, reverse causality is a potential endogeneity concern. We test the correlation between online discussions and media coverage in the same period and find a significantly positive relationship, which means that less media coverage does not drive investors to online forums, thereby alleviating this endogeneity concern. In addition, we view the quiet period regulation as a shock to investors' dependence on external unofficial information sources and apply the difference-in-differences method to further alleviate concerns about reverse causality.

Our key contribution is our use of an IPO setting to investigate whether online forum discussions in China improve information transparency. We contribute to the literature by shedding new light on the interaction between Internet information and IPO pricing, and we provide a clearer picture of this interaction by isolating the under- and overpricing components. The evidence of noise in forums suggests that investors should not put too much faith in stock forum discussions. The implication for regulatory authorities is that firms need channels through which they can provide accurate information and respond to rumors and fake news during

[1] http://www.csrc.gov.cn/pub/shanghai/ztzl/ggpx/zcfg/200906/t20090614_107440.htm
[2] http://www.csrc.gov.cn/pub/zjhpublic/G00306201/201205/t20120521_210397.htm

IPOs to alleviate information asymmetry. Also, better supervision and self-correction mechanisms for online forums are necessary to protect investors.

The remainder of this paper is organized as follows. Section 2 provides the institutional background of IPOs in China. Section 3 discusses the related literature and development of the hypotheses. Section 4 introduces the data and research methods. Section 5 presents and discusses the empirical results. Section 6 concludes the paper.

2. Institutional background of IPOs in China

To better understand IPO pricing in China, we must consider its institutional background. China's IPO pricing mechanism has experienced several stages of government regulation. In 1990, Chinese investors began trading shares in domestic stock markets. At the time, IPOs followed a fixed-price system under strict government control. Until 1996, IPO pricing was decided by the government based on book value. From January 1996 to June 1999, a controlled P/E ratio pricing model was used. Thus, China's IPO pricing was not market driven at that stage.

The Securities Law was the first law in China to specifically regulate the securities market. It plays an important role in promoting the development of the capital market. From 2000 to 2001, after the law's formal implementation, the CSRC issued new rules allowing issuing firms to negotiate pricing with underwriters. China thus began exploring market-oriented pricing.

In practice, market-oriented pricing reform did not achieve its goal. The original intention of implementing market-based pricing was to issue new shares at a price that reduced the profit from subscription and reduced secondary market speculation. However, the secondary market experienced even greater price speculation.

To alleviate this problem, from 2002 to 2004, China's IPOs reverted to a controlled P/E ratio pricing scheme. The P/E ratio of IPOs was required to be no more than 20. Obviously, returning to controlled P/E ratio pricing interrupted the market-oriented reform and induced disadvantages. For issuing firms with good growth prospects, this pricing mechanism often leads to underpricing.

In 2005, the book-building system was introduced to the primary market. In this system, the issuing firm and underwriter decide the initial offer price range. Then the underwriters determine institutional investors' demand for the stock and revise the final offer price according to that demand. The price had to be approved by the CSRC and the P/E ratio was limited to less than 30. Although pricing was still not totally market driven at this stage, more market forces were involved.

From June 2009, the CSRC launched IPO reforms to relax the constraints in the inquiry process. The controlled P/E ratio regulation was lifted. The CSRC reduced its administrative guidance for IPO pricing. However, the new reform resulted in pricing below the offer price and high P/E ratios in new markets. Thus, the CSRC began to reimpose price controls on new issues. In 2014, issue price was controlled within a P/E ratio of 23. Given this institutional background, to ensure our empirical analysis is comparable to those in the literature regarding other markets, we limit our IPO sample to before 2014.

3. Related literature and hypothesis development

3.1. Rational and behavioral theories

The most commonly used theoretical models for research on underpricing are based on rational theories. Information asymmetry theory is among the most popular of such theories. Rock (1986) and Benveniste and Spindt (1989) believe that IPOs are deliberately underpriced to compensate investors for information asymmetry. Uncertainty about the IPO firm is considered the most important factor in underpricing. It is well documented that ex ante uncertainty and underpricing are positively related (Loughran et al., 1994; Chen et al., 2004). Hanley (1993) provides empirical support to Benveniste and Spindt (1989) by showing that IPOs with upward offer price adjustments tend to have higher levels of underpricing, which implies that investors are compensated by greater initial returns. Issuers and underwriters offer IPO shares at a discount to encourage participation and price adjustment. The findings of Hanley and Hoberg (2010) and Loughran and McDonald

(2013) in the U.S. market provide empirical evidence for the theoretical models of uncertainty, book-building, and prospect theory.

However, another branch of the literature uses irrational theory based on investor sentiment to explain abnormal IPO initial returns (Ritter and Welch, 2002; Song et al., 2014; Mumtaz et al., 2016). The anticipation of a positive trend increases the demand for IPO stocks, which in turn leads to a high closing price. Ritter and Welch (2002) believe that future progress on this issue will be generated from the irrational and agency conflict explanations. Abundant evidence indicates that an IPO's closing price may not reflect its fair value and that overreaction may result in a high closing price. For instance, Miller (1977) develops a model under short-selling constraints and finds that divergence in investor opinions drives an IPO's price higher than its intrinsic value because of optimism. Ritter (1991) and Loughran and Ritter (1995) provide empirical evidence that long-term investors who buy shares of a firm immediately after its IPO may realize abnormal negative returns. Purnanandam and Swaminathan (2004) find that some U.S. IPO firms are overpriced; however, their research method is contradicted by Zheng (2007). As mentioned by Zheng (2007), to demonstrate overpricing, they should not focus on the difference of long-run risk-adjusted returns between high and low overpricing firms. Instead, one should compare the long-run risk-adjusted returns of overpricing IPOs with their peer firms. Cornelli et al. (2006) document that individual investor demand results in high first-day abnormal returns and low long-run returns in Europe. Using the actual when-issued trades of a sample of clients at a large German retail brokerage during 1999 and 2000, Dorn (2009) finds that IPOs that are aggressively bought by individuals driven by sentiment exhibit high first-day returns and poor aftermarket returns compared with similar stocks. Mezhoud and Boubaker (2011) find that the initial returns during the listing period can explain not only IPO underpricing but also overpricing. To date, consensus on whether an IPO's initial return represents rational underpricing, irrational sentiment, or both has not been reached.

3.2. China's online stock forum environment and first-day returns

With the development of Internet technology in China, more and more financial websites, such as Eastmoney, Snowball, and Hexun, have set up stock forums for investors to discuss securities investment. Browsing and posting on stock forums has become a daily routine for many investors, which demonstrates investors' demand for in-time information. When information disclosure is not standard or complete, investors use stock forums to reduce the cost of information collection. Online forums allow individual investors to exchange opinions. We build on the literature that examines the effect of online forums in the context of market trading (Wysocki, 1999; Antweiler and Frank, 2004; Spiegel et al., 2010; Delort et al., 2011; Dong and Wu, 2019; Yang et al., 2020).

The opinions of other investors can affect an individual's decision-making and lead to converging viewpoints and behaviors (Das and Sisk, 2005). Online discussion forums can facilitate information dissemination and reduce information asymmetry. Investors with rational incentives read and post online to gather information (Wysocki, 1999). Using online forums for discussion allows investors with common interests to exchange ideas quickly. Therefore, online stock forums have the potential to alleviate information asymmetry and, according to rational theory, reduce first-day returns.

H1a: Online forum discussions tend to alleviate information asymmetry, reducing IPO first-day returns.

However, stock forums are imperfect as informal information release and dissemination platforms. For instance, an endless stream of irrelevant advertising and fraud have emerged in stock forums, making the overall information quality relatively low. Stock price manipulation can be achieved through online forums by disseminating false information. Furthermore, online forums lack effective self-correction mechanisms. As long as a posting does not involve plagiarism, personal attacks, or other negative content, it is allowed. Hence, forums have perhaps played a role in increasing information asymmetry by amplifying sentiment and accelerating rumor dissemination.

Sentiment information can spread quickly through online forums. Wysocki (1999) examines whether variation in message-posting volume is noise or is related to firm characteristics and stock market activity. Online discussions can be sentiment driven. The high posting volume for certain "glamour stocks" is probably driven by irrational fixation. With public information announcements controlled, Yang et al. (2020) find that sentimental information from investors can trigger abnormal trading and significantly affect stock price crashes. Among recent studies, Dong and Wu (2019) examine whether investor attention to online forums is a risk pricing factor.

Even worse, rumors can spread quickly through online forums and affect abnormal stock returns (Spiegel et al., 2010). The market reacts to rumors, and the impact is stronger for single, initial, or realized rumors. Delort et al. (2011) test manipulation in online forums and the associated market reactions. Consistently, they find that even with manual supervision of stock discussions, Internet users are not effectively protected from message manipulation. Even if the listing firms want to dispel rumors with explanations, disagreement among the posted messages is associated with increased trading volume and market volatility (Antweiler and Frank, 2004). Thus, forum postings and discussions can create noise that increases first-day returns.

H1b: Online forum discussions exacerbate information asymmetry, increasing IPO first-day returns.

3.3. IPO under- and overpricing in China

China's market experienced fairly high IPO first-day returns before the first-day return restriction was issued. Investment behavior in China differs from that in other major markets (Tang and Li, 2013; Jiang and Akbar, 2018; Jiang et al., 2018). According to the classic rational theories (Rock, 1986; Benveniste and Spindt, 1989; Benveniste and Wilhelm, 1990), there must be a large degree of information asymmetry to cause such a substantial discount to the initial price. An assumption underlying this viewpoint is that the first-day closing price represents the fair value of the IPO firm. However, China's market differs because it is full of irrational investors. The initial price following an IPO is always inflated by overreaction in the secondary market and corrects to its fundamental level in the long run. Therefore, information asymmetry theory is inadequate to explain a first-day return that contains both overpricing and underpricing.

Research on the Chinese IPO market reveals strong evidence of overpricing in the secondary market. For example, Gao (2010) provides strong evidence supporting the behavioral argument regarding overpricing in the Chinese IPO market. Using a sample of 506 Chinese IPOs issued during the 1998–2003 period, Shen et al. (2014) find that the offer price can reflect underpricing, whereas the short-run equilibrium price in the aftermarket can reflect overvaluation due to investor sentiment. Song et al. (2014) document that value uncertainty in IPOs is positively related to both underpricing and overvaluation and that investor sentiment has a positive effect on overvaluation but has no effect or a negative effect on underpricing. Huang et al. (2018) build regression models to explore the determinants of IPO overpricing and find that Internet data, such as online stock forums and search engines, contribute to an increase in the adjusted R^2 value of the model. Therefore, according to the literature, both under- and overpricing compose China's IPO first-day returns.

This dilemma encourages us to follow Song et al. (2014) and find a way to isolate these two components and empirically analyze their effects. After decomposing IPO first-day returns into the under- and overpricing components, we extend our hypotheses to the component level. If the information posted in stock forums is real and valid instead of sentiment driven, according to behavioral theory, forum information can reduce overpricing. Otherwise, the sentiment information and rumors tend to reduce information transparency and lead to greater under- and overpricing.

H2a: Online forum discussions alleviate information asymmetry and investor sentiment, thereby reducing underpricing and overpricing.

H2b: Online forum discussions exacerbate information asymmetry and investor sentiment, thereby increasing underpricing and overpricing.

4. Methods

4.1. Model specification

To test the first parts of our hypotheses, we first examine the effect of online forums on initial returns. The model is as follows:

$$IR = \beta_0 + \beta_1 ComList + \alpha.FirmIPO + \gamma.Rational + \theta.Behavioral + \varepsilon \quad (1)$$

In model 1, the dependent variable is initial return (*IR*) and the key independent variable is the number of online forum discussions before the listing date (*ComList*), which is expressed as *ComList1*, *ComList2*, and *ComList3*. Following the literature, we include three groups of control variables, which are defined in Section 4.2 and Table 1. The regression includes *Industry* and *Year* dummies.

Rational theory indicates that high initial returns imply information asymmetry and uncertainty (Rock, 1986; Benveniste and Spindt, 1989; Loughran et al., 1994; Chen et al., 2004). As discussed in Section 3, if an IPO's initial return is an appropriate proxy for underpricing and if online forum discussions exacerbate information asymmetry, the coefficient of *ComList* should be significantly positive. However, the initial returns of Chinese IPOs may not be a good proxy for underpricing because overpricing also constitutes part of the initial return. Hence, the coefficient of *ComList* contains both under- and overpricing. If online forum

Table 1
Variable definitions.

Variable	Definition
Dependent variables	
IR	Initial returns = (first-day closing price – offer price)/offer price
Underpricing	Underpricing = (intrinsic price – offer price)/offer price
Overpricing	Overpricing = (closing price – intrinsic price)/offer price
Independent variables	
ComList1, *ComList2*, *ComList3*	Number of comments within 7, 14, and 60 days before the listing date
ComIssue1, *ComIssue2*, *ComIssue3*	Number of comments within 7, 14, and 60 days before the offer price declaration date
Posting1, *Posting2*, *Posting3*	Number of forum articles posted within 7, 14, and 60 days before the listing date
Reading1, *Reading2*, *Reading3*	Number of times articles read within 7, 14, and 60 days before the listing date
News1, *News 2*, *News3*	Number of news articles within 7, 14, and 60 days before the listing date
Control variables	
Gap	Natural logarithm of the number of days between the issue date and listing date
IssueSize	Ln (funds raised through IPO)
Underwriter	Whether the IPO is underwritten by the top 10 underwriters
EPS	Earnings per share reported in the annual report before an IPO
Board	Whether the firm lists in the small and medium-sized enterprise sector or the ChiNext sector
PriceRange	(upper price limit – lower price limit)/(mid-range price) Mid-range price = mean value of upper and lower price limits
Revision	(offer price – mid-range price)/(mid-range price)
Prospectus	Ln (number of sentences in the IPO prospectus)
NewsListing	(positive news – negative news)/(positive news + negative news) before the listing date
NewsIssue	(positive news – negative news)/(positive news + negative news) before the offer price declaration date
Oversubscription	Ln [(number of shares effectively subscribed)/(number of shares issued)]
Volume	Trading volume in tens of millions on the listing date
MomentumList	Market returns over the 30 days before the listing date
MomentumIssue	Market returns over the 30 days before the offer price declaration date
Quiet	Whether the IPO firm is subject to the quiet period regulation
SentiPosts1, *SentiPosts2*, *SentiPosts3*	(positive posts – negative posts)/(positive posts + negative posts) within 7, 14, and 60 days before the offer price declaration date
SentiNews1, *SentiNews2*, *SentiNews3*	(positive news – negative news)/(positive news + negative news) within 7, 14, and 60 days before the offer price declaration date
Industry	Dummy variables for industry effects
Year	Dummy variables for year effects

discussions exacerbate information asymmetry, investor sentiment, or both, the coefficient should be positive. Models 4 and 5 should provide a clearer picture.

To test the second parts of the hypotheses, we must isolate overpricing to explore the link between online forum information and first-day valuation. Overreaction on the first day typically results in a high closing price far beyond the IPO's intrinsic value (Loughran and Ritter, 1995; Cornelli et al., 2006). We believe that the Chinese IPO market provides an ideal setting in which to investigate this topic. Separating underpricing from overpricing is econometrically unmanageable in developed markets in which IPO initial returns are relatively small. However, it is manageable in China's market. To isolate under- and overpricing, the closing price 6 months post-IPO is used as a proxy for intrinsic value. Under- and overpricing are calculated as follows:

$$Underpricing = (Intrinsic\ \ price - Offer\ \ price)/Offer\ \ price \tag{2}$$

$$Overpricing = (Closing\ \ price - Intrinsic\ \ price)/Offer\ \ price \tag{3}$$

To explore the effect of online forums on under- and overpricing, we use the following models:

$$Underpricing = \beta_0 + \beta_1 ComIssue + \alpha.FirmIPO + \gamma.Rational + \theta.Behavioral + \varepsilon \tag{4}$$

$$Overpricing = \beta_0 + \beta_1 ComList + \alpha.FirmIPO + \gamma.Rational + \theta.Behavioral + \varepsilon \tag{5}$$

where the dependent variables are the under- and overpricing components. The key independent variable is the number of relevant comments before the offer price declaration date (*ComIssue*), which is expressed as *ComIssue1*, *ComIssue2*, and *ComIssue3*. The regressions include *Industry* and *Year* dummies.

According to our theoretical analysis, both rational theory and behavioral theory are relevant. Under rational theory, a high level of underpricing implies information asymmetry and uncertainty (Rock, 1986; Benveniste and Spindt, 1989; Loughran et al., 1994; Chen et al., 2004), whereas under behavioral theory, investor sentiment and divergence in investor opinions can result in overpricing (Miller, 1977; Ritter and Welch, 2002; Cornelli et al.; 2006; Mumtaz et al., 2016). Therefore, if online forum discussions exacerbate information asymmetry and investor sentiment, *Underpricing* and *Overpricing* should have positive coefficients.

In additional analyses, we use a split-sample design to test the effect of the quiet period regulation. *Quiet* is a dummy variable that is coded as 1 if the IPO observation is subject to the quiet period regulation. We compare the coefficients of *ComIssue* for the IPOs subject to the quiet period regulation with those not subject to the regulation. As the regulation restricts IPO firms from releasing information, investors may rely more on unofficial information sources, such as online forums, which increases the influence of online forum discussions. We thus conjecture a more significant effect of online discussions on IPOs that are subject to the quiet period regulation.

In addition to the influence of the amount of information available, we also consider the effect of sentiment information conveyed by online postings using a split-sample design. As shown in model 6, *SentiPosts* is constructed as a proxy for tone. It is measured as the difference between the number of positive and negative postings, scaled by the sum of positive and negative postings. We compare the coefficients of *ComIssue* for IPOs in the sample with *SentiPosts* values above and below its median value. According to the assumption that online forums tend to create noise, negative information ferments and spreads to a larger extent, increasing the effect of online comments. Therefore, we expect the coefficients of *ComIssue* to be more significant when the IPOs in the sample are exposed to negative tone.

$$SentiPosts = (Positive\ \ posts - Negative\ \ posts)/(Positive\ \ posts + Negative\ \ posts) \tag{6}$$

To further explore the idea regarding the tone of postings, we also construct a tone variable for media coverage. As shown in model 7, *SentiNews* is constructed as a proxy for media tone. It is measured as the difference between the number of positive and negative news articles, scaled by the sum of positive and negative news articles. Similarly, we compare the coefficients of *ComIssue* for IPOs in the sample with *SentiNews* values above and below its median value.

$$SentiNews = (Positive\ \ news - Negative\ \ news)/(Positive\ \ news + Negative\ \ news) \tag{7}$$

Furthermore, as a robustness test, the number of forum postings (*Posting1*, *Posting2*, and *Posting3*) and amount of browsing (*Reading1*, *Reading2*, and *Reading3*) are substituted for the number of comments as independent variables. To analyze sensitivity, we also use an alternative sample of under- and overpricing that excludes IPOs with negative under- or overpricing observations. Additionally, the relationship between online discussions and media coverage is tested, and the difference-in-differences method is used to alleviate endogeneity concerns.

4.2. Variable definitions

4.2.1. IPO initial returns

Following Loughran and McDonald (2013), Bajo and Raimondo (2017), Song et al. (2014), and Gao (2010), initial return (*IR*) is defined as the percentage of change from an IPO's offer price to its first-day closing price, which is the difference between the first-day closing price and the offer price, divided by the offer price. We then use the following variables from the literature to test our hypotheses.

4.2.2. IPO underpricing and overpricing

Following Song et al. (2014), we calculate underpricing as the difference between intrinsic value and offer price, scaled by offer price. We compute overpricing as the difference between first-day closing price and intrinsic value, scaled by offer price. The sum of the two is the IPO's initial return.

4.2.3. Online forum discussions

We use the number of relevant online forum comments to measure forum discussion. *ComList* is the number of comments posted within 7 days (*ComList1*), 14 days (*ComList2*), or 60 days (*ComList3*) before the listing date. *ComIssue* is the number of comments posted within 7 days (*ComIssue1*), 14 days (*ComIssue2*), or 60 days (*ComIssue3*) before the offer price declaration date.

4.2.4. Control variables to capture IPO characteristics (FirmIPO)

Gap is the natural logarithm of the number of days between the issue and listing dates. Unlike the U.S. market in which the IPO offer price is set 1 day before listing, China's market has a significant time lag between an IPO's offering date and its listing date. This longer processing time gives investors more time to collect and digest information, thereby reducing information asymmetry.

IssueSize is the natural logarithm of the funds raised through an IPO. Beatty and Ritter (1986) argue that smaller issues are subject to more uncertainty and find that issue size is negatively correlated with an IPO's initial return. Small firms may attract less attention, which leads to more information asymmetry during an IPO.

Underwriter is a dummy variable that is coded as 1 if the IPO is underwritten by a top 10 underwriter, which are those that raise the most funds. Individual investor attention can influence underwriters' offer price adjustment behavior (Huang and Zhang, 2020). Carter and Manaster (1990) find that in the 1980 s, IPOs underwritten by high-quality underwriters were less underpriced. However, Beatty and Welch (1996) find an inverse relationship between the two.

EPS is the earnings per share reported in the annual report before an IPO. Following Loughran and McDonald (2013), we include *EPS* to control for the historical performance of the IPO company.

Board is a dummy variable that is coded as 1 if a firm lists in the small and medium-sized enterprise or ChiNext sector. Firms in the small and medium-sized enterprise sector are smaller and have greater growth uncertainty, so investors and analysts tend to be more cautious, which pushes them to collect more information regarding the target firm. The ChiNext sector has a strict regulation regarding information disclosure. The greater growth uncertainty of ChiNext firms makes investors and analysts more discreet.

4.2.5. Control variables to test rational theory (Rational)

PriceRange is the initial offer price range (Hanley, 1993). It is defined as the difference between the upper and lower price limits, scaled by the mean value of the upper and lower price limits (mid-range price). During book-building, upper and lower limits are set as the initial price range for the offer price, which is the basis for

the IPO's book-building. After book-building, a final offer price is set. A wider range indicates more uncertainty regarding the IPO's valuation. Hanley (1993) finds that a wider price range is associated with higher IPO initial returns.

Revision is the offer price adjustment measured as the difference between the offer price and mid-range price, scaled by the mid-range price. *Revision* is used as strong evidence to support the book-building theory developed by Benveniste and Spindt (1989).

Prospectus denotes the length of an IPO prospectus measured as the natural logarithm of the number of sentences, which captures the amount of official information released by the IPO firm. Loughran and McDonald (2013) find that the information in an IPO prospectus affects investors' ability to precisely assimilate value-relevant information and thus influences pricing.

NewsListing is the tone of media coverage before the listing date. *NewsIssue* is the tone of media coverage before the offer price declaration date. Media coverage acts as an information intermediary to reduce information asymmetry (Bushee et al., 2010) and shapes the attitudes of society (Shaw, 1979). A positive tone sends a strong signal to investors regarding the expected riskiness and valuation of an IPO in the book-building process, and in turn it reduces information asymmetry (Hanley and Hoberg, 2010).

4.2.6. Control variables to test behavioral theory (Behavioral)

Oversubscription is the natural logarithm of the oversubscription ratio measured as the number of shares effectively subscribed, scaled by the number of shares issued. IPOs subject to strong individual investor demand have higher initial returns and suffer lower long-term returns, indicating that these IPOs are overvalued (Derrien, 2005; Cornelli et al., 2006).

Volume is the trading volume (in tens of millions) on the listing date. Cornelli et al. (2006) find that the aftermarket total IPO trading volume is positively correlated with individual investor sentiment, which leads to high IPO first-day prices and low long-run returns. Ofek and Richardson (2003) show that high initial returns occur when institutions sell IPO shares to retail investors on the first day. The total trading volume is an indicator of individual investor behavior, especially given that China's market is largely driven by individual investors.

Momentum is calculated in two ways. *MomentumList* is the market returns over the 30 days before the listing date. *MomentumIssue* is the market returns over the 30 days before the issue date. *MomentumIssue* is controlled in the underpricing model, whereas *MomentumList* is controlled in the overpricing model. Classic rational theory implies that public information, such as market momentum, should not affect IPO underpricing. The underwriter should fully adjust the offer price to eliminate the effect of public information. However, Loughran and Ritter (2002) use prospect theory to explain that underwriters only partially adjust the offer price for public information on market momentum, and IPOs in high-momentum markets are more underpriced.

4.3. Data and descriptive statistics

4.3.1. Data collection

As the data for the initial pricing range are only available after November 2010, the sample starts from 2010. In 2014, IPO pricing in China was limited to a P/E ratio of less than 23, which limits the IPO sample before 2014. In fact, from November 2012 to December 2013, IPO activity in China stagnated under the CSRC rule. The final sample is from 2010 to 2012 and includes 430 IPOs. The data for the IPOs are obtained from WIND, a leading capital market information provider in China. Information about the online discussion forums, media coverage, and underwriters is retrieved from the Chinese Research Data Services (CNRDS) platform. The IPO prospectuses are obtained from the Cninfo website. The other market- and firm-level data are obtained from the China Stock Market and Accounting Research (CSMAR) database.

Specifically, the key independent variables of forum comments, posts, and readings are calculated using information from the CNRDS's subdatabase, Stocks Comments of Chinese Listed Companies. This database is a professional database of Internet financial and economic texts, providing text analysis and the quantitative statistics of forum comments and postings regarding listed firms in China. We first obtain the statistics for

each natural day from the database and then calculate the statistics for the required time windows (7, 14, and 60 days).

The sentiment information provided by the Stocks Comments of Chinese Listed Companies database is used to calculate *SentiPosts*. The database uses a supervised learning model to judge the emotion of a comment or posting. Sentiment predictions are divided into three categories according to the emotional tendency of the text: positive, negative, or neutral. After labeling training materials, a support-vector machine algorithm is used to train and obtain the classification model. The trained model is then used to label all of the texts. Table 2 shows examples of the sentiment classification, which are obtained from the CNRDS database specifications. We use an asterisk to hide the names of the stocks.

The sentiment information from the CNRDS subdatabase Financial News Database of Chinese Listed Companies is used to calculate *SentiNews*, *NewsListing*, and *NewsIssue*. Similarly, this database uses a support-vector machine algorithm to analyze the financial news of listed firms. The database includes information from more than 400 major online media outlets and more than 600 major newspapers. We first obtain the number of news articles in the three sentiment categories for each natural day and then calculate the variables.

In addition, one of the control variables, *Prospectus*, is constructed by collecting the IPO prospectuses of the firms in the sample and conducting textual analysis with Python. The IPO prospectuses are obtained from the Cninfo website, which is designated by the CSRC as an information disclosure website for listed firms in China. We use Python to automatically crawl and download the prospectuses and then calculate the number of sentences in each prospectus to measure its length.

4.3.2. Descriptive statistics

Table 3 presents the summary statistics of the sample. On average, more than 2000 (1000) comments are posted within 7 days before a listing (issue) date. The mean value of *IR* is 25.9%. The mean value of *Quiet* is 0.512, suggesting that approximately 50% of the observations are subject to the quiet period regulation. The mean values of *SentiPosts* (0.406, 0.426, and 0.427) are higher than those of *SentiNews* (0.333, 0.333, and 0.143), indicating that online forums produce more sentiment information than media news reports produce. On average, *NewsListing* (0.133) is higher than *NewsIssue* (0.084), implying that media coverage produces more positive news as the IPO listing date approaches.

Table 4 shows the correlation coefficients and their significance at the 1% confidence level. The Spearman correlation coefficients are on the upper right triangle, and the Pearson correlation coefficients are on the lower left triangle. Both the Pearson and Spearman correlation coefficients show that initial return (*IR*) is positively and significantly associated with *ComList1*, indicating that online forum comments are positively associated with information asymmetry or investor sentiment. In addition, *Underpricing* has a positive relationship with *ComList1* and *ComIssue1*, further confirming the conjecture that online forum discussions create noise. The coefficients between *Overpricing* and forum comments are not significant, suggesting that forum information does not further increase investors' enthusiasm. The results of the correlation analysis are consistent with hypotheses *H1b* and *H2b* concerning the negative influence of online forums.

Table 2
Examples of sentiment classification.

Posting title	Sentiment classification
*, restructuring resolution passed, is about to soar	Positive
A broken stock, identification completed	Negative
Civilized Posting, put an end to abuse	Neutral
Let me tell you another joke today	Neutral
Ha (laugh), I yesterday at the end whole warehouse into *, today up! rich!	Positive
You should stop arguing about trifles, really not clear	Neutral
Never saw a stock as disgusting as * again	Negative
It will fall sideways!!! Quick out!!!	Negative
* is soft!!	Negative
!!!	Neutral
At last there was something to look forward to, and it began to rise gradually	Positive

Table 3
Summary statistics.

Variable	Obs.	Mean	SD	P25	Median	P75
IR	430	0.259	0.444	0.004	0.171	0.371
Underpricing	430	−0.024	0.459	−0.270	−0.110	0.151
Overpricing	430	0.283	0.364	0.108	0.299	0.499
ComList1	430	2339	3320	860.0	1522	2791
ComList2	430	4585	6060	1864	3160	5151
ComList3	430	5418	10,609	2251	3486	5663
ComIssue1	430	1255	3687	187.0	420.0	1174
ComIssue2	430	1408	4296	219.0	468.5	1230
ComIssue3	430	1425	4330	224.0	470.5	1237
Posting1	430	333.1	382.2	149.0	237.5	400.0
Posting2	430	555.0	667.2	259.0	388.0	628.0
Posting3	430	633.8	1101	289.0	419.5	679.0
Reading1 (millions)	430	0.501	0.773	0.210	0.345	0.590
Reading2 (millions)	430	1.052	1.239	0.494	0.768	1.213
Reading3 (millions)	430	1.226	1.893	0.580	0.874	1.312
Gap	430	2.286	0.216	2.079	2.197	2.398
IssueSize	430	20.319	0.689	19.846	20.229	20.682
Underwriter	430	0.474	0.500	0.000	0.000	1.000
EPS	430	0.872	0.502	0.560	0.780	1.010
Board	430	0.858	0.349	1.000	1.000	1.000
PriceRange	430	0.737	0.160	0.636	0.723	0.832
Revision	430	0.102	0.120	0.026	0.094	0.183
Prospectus	430	7.704	0.188	7.593	7.703	7.814
NewsListing	430	0.133	0.357	−0.136	0.128	0.385
NewsIssue	430	0.084	0.467	−0.259	0.042	0.385
Oversubscription	430	4.465	0.915	3.951	4.625	5.112
Volume	430	2.769	7.917	1.019	1.503	2.419
MomentumList	430	−0.018	0.056	−0.058	−0.029	0.025
MomentumIssue	430	−0.012	0.063	−0.059	−0.025	0.035
Quiet	430	0.512	0.500	0.000	1.000	1.000
SentiPosts1	430	0.406	0.255	0.333	0.456	0.560
SentiPosts2	430	0.426	0.212	0.357	0.465	0.561
SentiPosts3	430	0.427	0.206	0.366	0.463	0.555
SentiNews1	430	0.333	0.000	0.333	0.333	0.333
SentiNews2	430	0.333	0.000	0.333	0.333	0.333
SentiNews3	430	0.143	0.000	0.143	0.143	0.143

Notes. The table provides the summary statistics of the variables for the 2010–2012 period. *Reading1*, *Reading2*, and *Reading3* are in millions.

To understand the distribution of IPO first-day returns among the groups, Fig. 1 depicts the average first-day returns of each group according to the percentile rank of the number of comments. The low group contains IPO observations for which the number of comments is below the 20th percentile. The high group includes IPO observations for which the number of comments is above the 80th percentile.

Fig. 1 illustrates the power of online forum discussions in explaining differences in first-day returns without the IPO control variables. The figure plots IPO first-day returns sorted by the number of comments posted before the listing date. Each IPO observation in our sample is placed in one of five groups based on its number of comments. The figure shows a monotonic increase in initial returns from the group with least comments to the group with the most comments. For example, IPOs in the low 7-day comment (*ComList1*) group have average first-day returns of 13.35% compared with 45.11% for the high 7-day comment (*ComList1*) group, which is a difference of 31.76% between the extreme groups. This large difference indicates a positive relationship between online forum discussions and IPO first-day returns.

Table 4
Correlation analysis.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. *IR*	1	0.468*	0.396*	0.262*	0.047	0.026	−0.354*	−0.016	−0.285*	0.046	0.108	−0.066	0.049	−0.035
2. *Underpricing*	0.676*	1	−0.539*	0.148*	0.033	−0.086	−0.429*	−0.040	−0.200*	0.049	0.117	0.013	0.073	−0.110
3. *Overpricing*	0.366*	−0.438*	1	0.098	−0.011	0.131*	0.115	0.026	−0.060	−0.019	−0.022	−0.090	−0.042	0.046
4. *ComList1*	0.245*	0.186*	0.064	1	0.491*	−0.246*	0.145*	0.005	−0.167*	−0.312*	0.116	0.079	0.148*	−0.132*
5. *ComIssue1*	0.136*	0.154*	−0.028	0.557*	1	0.038	0.229*	0.103	−0.049	−0.430*	0.089	0.150*	0.105	−0.204*
6. *Gap*	−0.005	−0.082	0.097	−0.194*	0.048	1	0.037	0.061	−0.027	−0.093	0.024	−0.065	0.012	0.000
7. *IssueSize*	−0.363*	−0.403*	0.065	0.243*	0.298*	0.086	1	0.098	0.131*	−0.426*	0.063	−0.026	−0.060	0.122
8. *Underwriter*	−0.015	−0.032	0.021	0.034	0.114	0.063	0.117	1	0.050	−0.108	0.003	0.056	−0.098	0.005
9. *EPS*	−0.182*	−0.182*	0.007	0.010	0.034	−0.030	0.187*	0.045	1	0.176*	−0.155*	0.008	−0.040	−0.074
10. *Board*	0.007	0.024	−0.023	−0.354*	−0.482*	−0.103	−0.496*	−0.108	0.115	1	−0.094	−0.028	−0.020	0.006
11. *PriceRange*	0.149*	0.177*	−0.042	0.101	0.085	0.033	0.033	0.018	−0.075	−0.055	1	0.177*	−0.027	0.001
12. *Revision*	−0.232*	−0.151*	−0.093	0.025	0.075	−0.090	0.002	0.063	−0.006	−0.001	0.171*	1	0.001	−0.190*
13. *Prospectus*	−0.029	0.005	−0.042	0.126*	0.103	0.043	−0.007	−0.088	−0.009	0.009	0.019	−0.005	1	−0.070
14. *NewsListing*	−0.114	−0.161*	0.065	−0.152*	−0.201*	0.004	0.099	0.010	−0.094	−0.001	−0.022	−0.144*	−0.084	1

Notes. This table presents the correlation matrix for the key variables. The Spearman correlation coefficients are on the upper right triangle, and the Pearson correlation coefficients are on the lower left triangle. * denotes significance at the 1% confidence level.

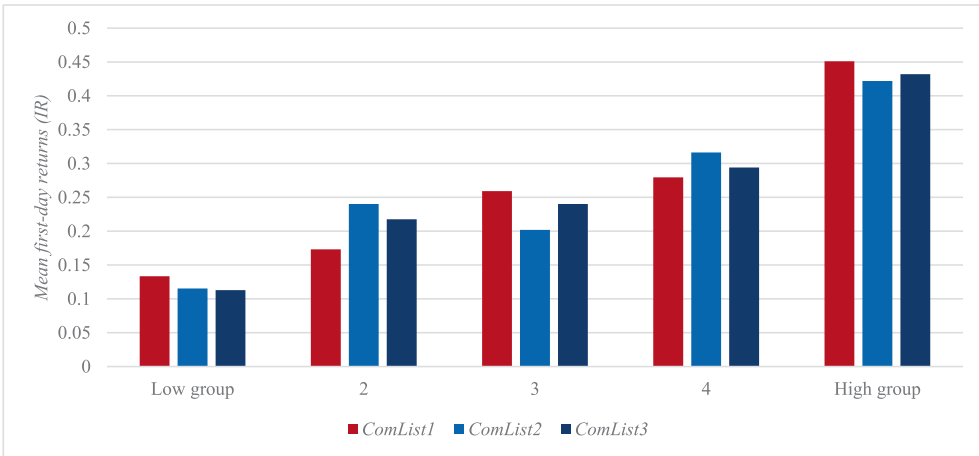

Fig. 1. Mean IPO first-day returns sorted by the number of comments posted before the listing date.

5. Empirical results

5.1. Online forum discussions and initial returns

Table 5 presents the regression results of model 1. Columns (1), (3), and (5) report the regression results with the traditional IPO control variables, whereas columns (2), (4), and (6) include individual investor oversubscription, trading volume, and momentum, respectively, which support the behavioral theory explanation.

In all of the columns, *ComList1*, *ComList2*, and *ComList3* are positively and significantly related to *IR* (p-value < 0.01), which indicates that online forums produce noise that increases information asymmetry, produces sentiment that affects investors' trading behavior, or both. As IPO initial returns are not an appropriate proxy for underpricing in the Chinese market, it is unclear which effect dominates. Models 4 and 5 isolate under- and overpricing, which should provide a clearer picture.

The adjusted R^2 values in columns (1), (3), and (5) are 38.4%, 40.0%, and 40.5%, respectively. When oversubscription, trading volume, and market momentum are added in columns (2), (4), and (6), the adjusted R^2 values all increase to approximately 45%, indicating the additional explanatory power of the variables in the behavioral framework. Therefore, the empirical results do not entirely support the rational underpricing argument in China's IPO market. The complexity of the Chinese market inspires us to decompose first-day returns into the components of underpricing by issuers or underwriters and overpricing by investors, which contributes to the high initial returns in the Chinese market.

The control variables are also of interest. *IssueSize* is negatively associated with *IR*, which is consistent with the idea that smaller issues are subject to more uncertainty (Beatty and Ritter, 1986). In line with the findings of Hanley (1993), the coefficients of *PriceRange* are positive and significant, suggesting that a wider price range indicates more information asymmetry. The coefficients of *Prospectus* are all negative and significant, which we interpret as implying a positive role of IPO prospectuses in reducing information asymmetry. *NewsListing* also has negative coefficients. Similarly, this shows that the positive signal of media coverage increases information transparency. *MomentumList* is positively and significantly correlated with *IR*. Rational theory implies that underwriters fully adjust the offer price using market information, such as momentum. However, Loughran and Ritter (2002) explain that underwriters only partially adjust the offer price. IPOs in high-momentum markets are significantly underpriced. The results suggest that both rational and behavioral variables have explanatory power. Further regressions are performed on the separated components to provide a clearer picture.

Table 5
Online forum discussions and initial returns.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
ComList1	0.170***	0.158***				
	(4.74)	(3.72)				
ComList2			0.198***	0.201***		
			(3.53)	(2.87)		
ComList3					0.212***	0.214***
					(3.39)	(2.73)
Gap	0.140	0.097	0.046	0.021	−0.081	−0.104
	(1.43)	(0.93)	(0.46)	(0.21)	(−0.64)	(−0.78)
IssueSize	−0.405***	−0.437***	−0.398***	−0.442***	−0.409***	−0.452***
	(−4.36)	(−3.54)	(−4.48)	(−3.49)	(−4.52)	(−3.48)
Underwriter	0.059	0.048	0.043	0.035	0.043	0.035
	(1.08)	(0.88)	(0.86)	(0.69)	(0.87)	(0.69)
EPS	0.001	0.035	−0.003	0.022	−0.004	0.021
	(0.02)	(1.16)	(−0.10)	(0.66)	(−0.14)	(0.60)
Board	−0.217***	−0.262***	−0.187***	−0.219***	−0.188***	−0.227***
	(−3.19)	(−3.96)	(−2.83)	(−3.38)	(−2.86)	(−3.56)
PriceRange	0.495**	0.533**	0.478**	0.498**	0.476**	0.499**
	(2.13)	(2.30)	(2.23)	(2.45)	(2.26)	(2.50)
Revision	−0.813	−0.778	−0.829*	−0.771	−0.805*	−0.754
	(−1.55)	(−1.52)	(−1.68)	(−1.63)	(−1.68)	(−1.65)
Prospectus	−0.236*	−0.217*	−0.242*	−0.225*	−0.238*	−0.212*
	(−1.88)	(−1.81)	(−1.87)	(−1.90)	(−1.84)	(−1.82)
NewsListing	−0.135**	−0.144**	−0.125**	−0.136***	−0.117**	−0.129***
	(−2.16)	(−2.59)	(−2.23)	(−2.66)	(−2.15)	(−2.60)
Oversubscription		0.005		−0.015		−0.013
		(0.15)		(−0.34)		(−0.29)
Volume		0.004		0.004		0.003
		(1.37)		(1.41)		(1.27)
MomentumList		1.456***		1.766***		1.649***
		(2.98)		(4.13)		(3.74)
MomentumIssue		0.549		0.345		0.483
		(0.96)		(0.64)		(0.84)
Constant	8.914***	9.525***	8.567***	9.432***	8.927***	9.674***
	(3.67)	(3.16)	(3.91)	(3.28)	(4.00)	(3.31)
Observations	430	430	430	430	430	430
Adj. R^2	0.384	0.436	0.400	0.456	0.405	0.461

Notes. This table shows the results for model (1). The regressions include industry and calendar year dummies. *ComList* is in log form. The *t* statistics are reported in parentheses and are based on robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

5.2. Online forum discussions and IPO valuation components

As under- and overpricing coexist on the first day of an IPO, we examine the link between online forum comments and each pricing component. Table 6 reports the regression results for models (4) and (5). According to rational theory, IPOs are deliberately underpriced to compensate investors for information asymmetry (Rock, 1986; Benveniste and Spindt, 1989). Thus, if forum comments play a positive role in information transparency, its coefficients should exhibit negative signs. Table 6 indicates a positive relationship between forum comments and *Underpricing*, but there is no significant relationship between comments and *Overpricing*. *ComIssue1*, *ComIssue2*, and *ComIssue3* in columns (1) to (3) are all positively and significantly related to *IR* (p-value < 0.05), suggesting that forum comments before the issue date play a negative role in information symmetry. However, the coefficients of *ComList1*, *ComList2*, and *ComList3* in columns (4) to (6) are insignificant, which we interpret as indicating that Chinese investors' IPO enthusiasm cannot be further increased by forum information given its already high level. As a belief in undefeated new shares is deeply rooted in Chinese investors' ideas, additional forum information has little influence on this belief.

Table 6
Online forum discussions and IPO valuation components.

	Underpricing			*Overpricing*		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
ComIssue1	0.098**					
	(2.32)					
ComIssue2		0.104**				
		(2.22)				
ComIssue3			0.109**			
			(2.34)			
ComList1				0.007		
				(0.27)		
ComList2					0.025	
					(0.77)	
ComList3						0.016
						(0.47)
Gap	−0.269***	−0.274***	−0.272***	0.220***	0.225***	0.211***
	(−2.61)	(−2.65)	(−2.65)	(2.73)	(2.99)	(2.68)
IssueSize	−0.415***	−0.418***	−0.419***	−0.016	−0.022	−0.019
	(−4.11)	(−4.09)	(−4.13)	(−0.29)	(−0.40)	(−0.34)
Underwriter	−0.012	−0.014	−0.015	0.047	0.047	0.046
	(−0.24)	(−0.29)	(−0.30)	(1.24)	(1.23)	(1.22)
EPS	−0.123***	−0.121***	−0.122***	0.171***	0.166***	0.169***
	(−2.74)	(−2.71)	(−2.76)	(5.57)	(5.32)	(5.38)
Board	−0.080	−0.072	−0.065	−0.155**	−0.142**	−0.149**
	(−1.00)	(−0.88)	(−0.81)	(−2.29)	(−2.07)	(−2.16)
PriceRange	0.574***	0.576***	0.573***	−0.019	−0.030	−0.025
	(3.16)	(3.20)	(3.19)	(−0.15)	(−0.23)	(−0.19)
Revision	−1.036**	−1.057**	−1.061**	0.204	0.211	0.208
	(−2.36)	(−2.39)	(−2.41)	(0.61)	(0.64)	(0.63)
Prospectus	−0.157	−0.161	−0.156	−0.035	−0.037	−0.035
	(−1.32)	(−1.34)	(−1.32)	(−0.31)	(−0.32)	(−0.31)
Oversubscription	−0.106***	−0.105***	−0.107***	0.140***	0.131***	0.136***
	(−2.63)	(−2.59)	(−2.62)	(3.91)	(3.70)	(3.81)
Volume	0.006*	0.006*	0.005*	0.000	0.000	0.000
	(1.82)	(1.81)	(1.76)	(0.13)	(0.02)	(0.07)
NewsListing				−0.050	−0.046	−0.048
				(−1.00)	(−0.92)	(−0.96)
MomentumList				1.182***	1.221***	1.199***
				(3.04)	(3.16)	(3.10)
NewsIssue	−0.046	−0.045	−0.045			
	(−1.09)	(−1.07)	(−1.06)			
MomentumIssue	0.804**	0.855**	0.862**			
	(2.10)	(2.16)	(2.18)			
Constant	9.600***	9.630***	9.589***	0.076	0.093	0.097
	(4.01)	(4.01)	(4.06)	(0.06)	(0.08)	(0.08)
Observations	430	430	430	430	430	430
Adj. R^2	0.377	0.377	0.381	0.275	0.277	0.276

Notes. This table shows the results for models (4) and (5). The regressions include industry and calendar year dummies. *ComList* and *ComIssue* are in log form. The *t* statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

Regarding the control variables, *EPS* is negatively associated with underpricing, whereas it is positively related to overpricing, implying that good firm performance signals positive information that reduces information asymmetry but also triggers overvaluation. *PriceRange* and *Revision* are only significant in the underpricing model, which is consistent with our conjecture that *PriceRange* and *Revision* have explanatory power within the rational framework. *Oversubscription* is positively related to overpricing, whereas it is negatively associated with underpricing. Greater individual investor demand leads to higher initial returns and overval-

uation (Derrien, 2005; Cornelli et al., 2006). The variables of market momentum are also significant and exhibit the expected signs.

5.3. Additional analyses

5.3.1. Online forum discussions during the quiet period and underpricing

Table 7 presents the results for the split-sample design. The dependent variable is *Underpricing*. *Quiet* is a dummy variable that is coded as 1 if the IPO observation is subject to the quiet period regulation. The coefficients of *ComIssue1*, *ComIssue2*, and *ComIssue3* are only positive and significant (p-value < 0.05) in columns (1), (3), and (5), respectively. This implies that the impact of stock forums is more significant on firms that are subject to the quiet period regulation.

This finding provides evidence that the quiet period regulation contravenes its goal. The regulation's aim is to protect investors from noisy information released by IPO firms. However, our results show that although issuers are not allowed to disclose promotional information during the quiet period, online forum discussions create noise that increases information asymmetry. It is natural for investors to seek information through

Table 7
Online forum discussions during the quiet period and underpricing.

Variable	(1) *Quiet* = 1	(2) *Quiet* = 0	(3) *Quiet* = 1	(4) *Quiet* = 0	(5) *Quiet* = 1	(6) *Quiet* = 0
ComIssue1	0.112**	0.033				
	(2.55)	(1.04)				
ComIssue2			0.120**	0.036		
			(2.36)	(1.10)		
ComIssue3					0.129**	0.038
					(2.57)	(1.16)
Gap	−0.019	−0.341***	−0.041	−0.341***	−0.032	−0.342***
	(−0.13)	(−3.03)	(−0.28)	(−3.03)	(−0.21)	(−3.03)
IssueSize	−0.583***	−0.344***	−0.589***	−0.345***	−0.590***	−0.347***
	(−4.29)	(−6.22)	(−4.25)	(−6.26)	(−4.31)	(−6.29)
Underwriter	−0.008	0.029	−0.007	0.028	−0.005	0.027
	(−0.11)	(0.58)	(−0.10)	(0.56)	(−0.06)	(0.55)
EPS	−0.092	−0.076	−0.092	−0.076	−0.093	−0.077
	(−1.47)	(−0.97)	(−1.45)	(−0.98)	(−1.51)	(−0.99)
Board	0.293	−0.073	0.246	−0.068	0.257	−0.064
	(0.50)	(−0.88)	(0.44)	(−0.81)	(0.46)	(−0.77)
PriceRange	0.762***	0.274*	0.772***	0.273*	0.764***	0.272*
	(3.09)	(1.72)	(3.12)	(1.71)	(3.12)	(1.71)
Revision	−1.356***	−0.246	−1.395***	−0.255	−1.408***	−0.256
	(−2.61)	(−1.15)	(−2.66)	(−1.18)	(−2.70)	(−1.19)
Prospectus	−0.410	0.115	−0.404	0.118	−0.391	0.120
	(−1.64)	(0.95)	(−1.59)	(0.99)	(−1.55)	(1.01)
NewsIssue	−0.107	−0.026	−0.104	−0.025	−0.103	−0.025
	(−1.34)	(−0.49)	(−1.31)	(−0.47)	(−1.31)	(−0.46)
Oversubscription	−0.142**	−0.115***	−0.137**	−0.116***	−0.140**	−0.117***
	(−2.13)	(−3.49)	(−2.06)	(−3.60)	(−2.08)	(−3.65)
Volume	0.032	0.008***	0.029	0.008***	0.029	0.007***
	(1.21)	(3.62)	(1.10)	(3.59)	(1.09)	(3.57)
MomentumIssue	1.297	0.634*	1.335	0.649*	1.348	0.653*
	(1.46)	(1.68)	(1.48)	(1.72)	(1.50)	(1.73)
Constant	14.027***	7.494***	14.112***	7.487***	13.942***	7.500***
	(4.12)	(5.16)	(4.09)	(5.17)	(4.15)	(5.20)
Observations	220	210	220	210	220	210
Adj. R^2	0.483	0.306	0.481	0.307	0.487	0.308

Notes. This table demonstrates the results of the split-sample design. The regressions include industry and calendar year dummies. *ComIssue* is in log form. The t statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

online discussion forums when no official information is available. This was probably not anticipated and has perhaps gone unnoticed by regulators.

Information asymmetry during the quiet period is likely to be high, so an endogeneity concern is that firms with high information asymmetry may drive investors to online forums to gather information. Thus, it is possible that investors choose to comment online because of the quiet period regulation that restricts official information supply. The significance of *ComIssue* in the split-sample design may be the result of this underlying information asymmetry instead of online discussions.

However, when testing the regression coefficient of *Quiet* with *Underpricing* as the dependent variable and with the other variables controlled, we find insignificance. This result indicates that the quiet period regulation does not increase information asymmetry. Investors are more influenced by online forums during the quiet period purely because there is less information from the firm, even if the information restricted by the regulation is also confusing and deceptive. Thus, the insignificance of *Quiet* implies that investors are confused either by the IPO firm or by the online forum. Even if the regulators stop IPO firms from excessively promoting themselves with false information, investors turn to the Internet and receive noisy information anyway.

Table 8
Online forum discussions and underpricing with different forum sentiments.

Variable	(1) *SentiPosts1 Above*	(2) *SentiPosts1 Below*	(3) *SentiPosts2 Above*	(4) *SentiPosts2 Below*	(5) *SentiPosts3 Above*	(6) *SentiPosts3 Below*
ComIssue1	0.042	0.129**				
	(1.35)	(2.50)				
ComIssue2			0.028	0.135***		
			(0.84)	(2.61)		
ComIssue3					0.021	0.153***
					(0.60)	(2.92)
Gap	−0.199	−0.231	−0.155	−0.249*	−0.092	−0.263*
	(−1.56)	(−1.63)	(−1.10)	(−1.78)	(−0.66)	(−1.94)
IssueSize	−0.372***	−0.526***	−0.422***	−0.460***	−0.398***	−0.511***
	(−4.14)	(−4.32)	(−4.79)	(−3.81)	(−4.71)	(−3.87)
Underwriter	−0.065	−0.007	−0.102	0.036	−0.085	0.037
	(−1.02)	(−0.09)	(−1.57)	(0.40)	(−1.35)	(0.43)
EPS	−0.053	−0.122**	−0.111	−0.092*	−0.085	−0.097*
	(−0.40)	(−2.09)	(−0.95)	(−1.75)	(−0.69)	(−1.81)
Board	0.142	−0.001	0.064	0.066	0.110	0.002
	(1.11)	(−0.01)	(0.44)	(0.46)	(0.78)	(0.01)
PriceRange	0.369**	0.689***	0.331	0.738***	0.318	0.693***
	(1.98)	(2.75)	(1.60)	(2.99)	(1.61)	(2.88)
Revision	−0.205	−1.476***	0.097	−1.616***	0.050	−1.524***
	(−0.83)	(−2.75)	(0.36)	(−3.03)	(0.19)	(−2.92)
Prospectus	−0.115	−0.353**	−0.215	−0.290	−0.094	−0.297
	(−0.57)	(−2.10)	(−1.09)	(−1.37)	(−0.49)	(−1.57)
NewsIssue	−0.032	0.021	−0.027	−0.017	−0.037	0.031
	(−0.54)	(0.28)	(−0.51)	(−0.21)	(−0.69)	(0.38)
Oversubscription	−0.152***	−0.119**	−0.187***	−0.080	−0.183***	−0.104*
	(−3.04)	(−2.05)	(−3.04)	(−1.41)	(−3.34)	(−1.66)
Volume	0.054**	0.006	0.052***	0.007	0.053***	0.006
	(2.44)	(1.46)	(2.72)	(1.53)	(2.92)	(1.45)
MomentumIssue	0.346	0.897	0.606	0.780	0.637	0.775
	(0.72)	(1.31)	(1.40)	(1.06)	(1.41)	(0.98)
Constant	8.704***	13.371***	10.816***	11.224***	9.231***	12.483***
	(2.93)	(4.90)	(3.77)	(3.91)	(3.36)	(4.50)
Observations	215	215	215	215	215	215
Adj. R^2	0.304	0.502	0.293	0.497	0.202	0.537

Notes. This table demonstrates the results of the split-sample design. The regressions include industry and calendar year dummies. *ComIssue* is in log form. The *t* statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

The significance of *ComIssue* in the split-sample design is not because of underlying information asymmetry but because investors rely more on information from online forums during the quiet period.

5.3.2. Effect of tone in online forum posts and news coverage

As investors' comments and opinions can have different effects on abnormal returns (Huang et al., 2018; Yang et al., 2020), we examine the influence of online comments with different sentiments using a split-sample test. To capture the sentiment information from the online forums, we construct *SentiPosts* as a proxy for forum tone, which is the difference between the number of positive and negative postings, scaled by the sum of positive and negative postings. Table 8 reports the coefficients of *ComIssue* for the observations with a *SentiPosts* value above and below its median value. To further support the conjecture regarding tone, we also construct a tone variable for media coverage, which is the difference between the number of positive and negative news articles scaled by the sum of positive and negative news articles. Table 9 reports the coefficients of *ComIssue* for the observations with a *SentiNews* value above and below its median value.

Table 9
Online forum discussions and underpricing with different news sentiments.

Variable	(1) *SentiNews1 Above*	(2) *SentiNews1 Below*	(3) *SentiNews2 Above*	(4) *SentiNews2 Below*	(5) *SentiNews3 Above*	(6) *SentiNews3 Below*
ComIssue1	0.037	0.133**				
	(1.39)	(2.05)				
ComIssue2			0.038	0.168**		
			(1.27)	(2.18)		
ComIssue3					0.035	0.147**
					(1.08)	(2.13)
Gap	−0.093	−0.328*	−0.109	−0.335**	−0.148	−0.341**
	(−0.99)	(−1.83)	(−1.07)	(−2.07)	(−1.18)	(−2.16)
IssueSize	−0.405***	−0.487***	−0.414***	−0.517***	−0.372***	−0.542***
	(−6.45)	(−2.84)	(−6.27)	(−3.17)	(−5.70)	(−3.47)
Underwriter	−0.069	0.036	−0.061	0.055	−0.047	0.008
	(−1.39)	(0.45)	(−1.16)	(0.64)	(−0.91)	(0.10)
EPS	−0.000	−0.211**	−0.052	−0.162**	−0.062	−0.099
	(−0.01)	(−2.18)	(−1.13)	(−1.98)	(−1.16)	(−1.31)
Board	0.101	−0.111	0.050	−0.115	0.165	−0.122
	(0.89)	(−0.67)	(0.43)	(−0.74)	(1.48)	(−0.83)
PriceRange	0.254	0.982***	0.202	1.076***	0.419**	0.713***
	(1.61)	(3.04)	(1.15)	(3.27)	(2.28)	(2.73)
Revision	−0.338*	−1.423**	−0.365	−1.460***	−0.356	−1.313**
	(−1.66)	(−2.35)	(−1.55)	(−2.78)	(−1.48)	(−2.54)
Prospectus	−0.064	−0.252	−0.137	−0.262	−0.206	−0.173
	(−0.55)	(−1.21)	(−1.03)	(−1.36)	(−1.46)	(−0.91)
NewsIssue	0.021	0.000	0.019	0.017	0.067	−0.082
	(0.43)	(0.00)	(0.36)	(0.15)	(0.98)	(−0.63)
Oversubscription	−0.121***	−0.168**	−0.126***	−0.160**	−0.137***	−0.146*
	(−3.06)	(−2.00)	(−3.04)	(−2.11)	(−3.54)	(−1.91)
Volume	0.064***	−0.003	0.053***	−0.004	0.071***	−0.003
	(4.02)	(−0.65)	(3.46)	(−0.87)	(3.84)	(−0.60)
MomentumIssue	0.468	1.731	0.428	1.615*	0.267	1.356*
	(1.25)	(1.65)	(1.16)	(1.68)	(0.73)	(1.68)
Constant	8.759***	11.793***	9.673***	12.124***	9.157***	12.229***
	(5.48)	(2.88)	(5.21)	(3.42)	(4.90)	(3.56)
Observations	228	202	220	210	218	212
Adj. R^2	0.358	0.439	0.336	0.450	0.340	0.458

Notes. This table shows the results for the split-sample design. The regressions include industry and calendar year dummies. *ComIssue* is in log form. The *t* statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

As shown in Tables 8 and 9, the coefficients of *ComIssue1*, *ComIssue2*, and *ComIssue3* are only positive and significant (p-value < 0.05 or p-value < 0.01) in columns (1), (3), and (5), respectively. This implies that the impact of stock forums is more significant for firms that are exposed to negative sentiment. Compared with the effects of news coverage, which is supposed to be objective, forum sentiment tends to be subjective. The results show that both objective and subjective sentiment environments show a negative impact from online forums under negative sentiment, whereas there is no significant effect under positive sentiment. In the literature, Veronesi (1999) and Epstein and Schneider (2008) show that the responses to positive and negative news are not necessarily symmetric. As investors' belief in undefeated new shares is deeply rooted, additional information has little influence. However, negative information ferments and spreads to a greater extent, giving online comments broader impact.

Table 10
Online forum discussions and initial returns using alternative independent variables.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Posting1	0.186***					
	(3.96)					
Posting2		0.222***				
		(3.71)				
Posting3			0.248***			
			(3.46)			
Reading1				0.189***		
				(3.80)		
Reading2					0.235***	
					(2.89)	
Reading3						0.271***
						(2.80)
Gap	0.125	−0.013	−0.124	0.151	0.051	−0.116
	(1.21)	(−0.11)	(−0.88)	(1.51)	(0.52)	(−0.85)
IssueSize	−0.436***	−0.443***	−0.450***	−0.432***	−0.438***	−0.450***
	(−3.57)	(−3.58)	(−3.58)	(−3.53)	(−3.46)	(−3.49)
Underwriter	0.045	0.041	0.041	0.047	0.033	0.035
	(0.84)	(0.79)	(0.78)	(0.87)	(0.65)	(0.69)
EPS	0.038	0.027	0.021	0.038	0.013	0.004
	(1.24)	(0.85)	(0.64)	(1.18)	(0.34)	(0.09)
Board	−0.249***	−0.208***	−0.205***	−0.238***	−0.174**	−0.161**
	(−3.70)	(−3.14)	(−3.13)	(−3.58)	(−2.48)	(−2.26)
PriceRange	0.517**	0.485**	0.465**	0.547**	0.516**	0.509**
	(2.26)	(2.23)	(2.26)	(2.33)	(2.44)	(2.51)
Revision	−0.758	−0.779	−0.747	−0.789	−0.783	−0.750
	(−1.50)	(−1.56)	(−1.55)	(−1.53)	(−1.62)	(−1.64)
Prospectus	−0.210*	−0.221*	−0.213*	−0.233*	−0.242**	−0.235*
	(−1.80)	(−1.92)	(−1.87)	(−1.92)	(−1.98)	(−1.95)
NewsListing	−0.134**	−0.125**	−0.118**	−0.146**	−0.135**	−0.125**
	(−2.45)	(−2.39)	(−2.33)	(−2.57)	(−2.59)	(−2.48)
Oversubscription	0.020	0.011	0.012	−0.003	−0.032	−0.040
	(0.68)	(0.37)	(0.37)	(−0.08)	(−0.65)	(−0.75)
Volume	0.004	0.004	0.003	0.003	0.003	0.002
	(1.25)	(1.35)	(1.15)	(0.87)	(1.05)	(0.85)
MomentumList	1.409***	1.648***	1.568***	1.279**	1.688***	1.535***
	(2.84)	(3.57)	(3.36)	(2.51)	(3.86)	(3.37)
MomentumIssue	0.554	0.303	0.413	0.638	0.357	0.540
	(0.97)	(0.58)	(0.76)	(1.08)	(0.66)	(0.92)
Constant	9.473***	9.660***	9.817***	8.181***	7.885***	8.002***
	(3.17)	(3.23)	(3.28)	(2.97)	(3.20)	(3.31)
Observations	430	430	430	430	430	430
Adj. R^2	0.444	0.452	0.459	0.435	0.450	0.462

Notes. This table shows the robustness test results for model (1). The regressions include industry and calendar year dummies. *Posting* and *Reading* are in log form. The t statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

5.4. Robustness tests

5.4.1. Alternative proxies for online forum information

Posting and *Reading* are used as key independent variables to test the robustness of our results. *Posting* (*Posting1*, *Posting2*, and *Posting3*) is the number of forum articles posted within 7, 14, and 60 days before the listing date, respectively. *Reading* (*Reading1*, *Reading2*, and *Reading3*) is the number of times articles

Table 11
Online forum discussions and IPO valuation components using an alternative sample.

	Underpricing			*Overpricing*		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
ComIssue1	0.153***					
	(2.65)					
ComIssue2		0.155**				
		(2.61)				
ComIssue3			0.157***			
			(2.72)			
ComList1				0.025		
				(1.12)		
ComList2					0.046*	
					(1.73)	
ComList3						0.043
						(1.51)
Gap	−0.267	−0.278	−0.275	0.195***	0.188***	0.161**
	(−1.47)	(−1.53)	(−1.53)	(2.84)	(2.95)	(2.44)
IssueSize	−0.446**	−0.459**	−0.454**	−0.052	−0.061	−0.059
	(−2.54)	(−2.57)	(−2.57)	(−1.33)	(−1.52)	(−1.47)
Underwriter	0.096	0.095	0.095	0.008	0.006	0.007
	(0.98)	(0.98)	(0.98)	(0.30)	(0.22)	(0.24)
EPS	0.006	0.012	0.008	0.104***	0.099***	0.100***
	(0.03)	(0.07)	(0.05)	(4.11)	(3.89)	(3.92)
Board	−0.122	−0.127	−0.128	−0.135**	−0.121*	−0.125**
	(−0.59)	(−0.62)	(−0.63)	(−2.20)	(−1.95)	(−1.99)
PriceRange	1.035***	1.019***	1.033***	0.061	0.043	0.046
	(2.82)	(2.81)	(2.83)	(0.52)	(0.38)	(0.40)
Revision	−1.710***	−1.706***	−1.708***	−0.030	−0.027	−0.026
	(−2.89)	(−2.88)	(−2.88)	(−0.17)	(−0.16)	(−0.16)
Prospectus	−0.608**	−0.593**	−0.581**	−0.039	−0.039	−0.039
	(−2.39)	(−2.32)	(−2.27)	(−0.46)	(−0.47)	(−0.46)
Oversubscription	−0.129	−0.132	−0.131	0.071***	0.059**	0.063**
	(−1.47)	(−1.48)	(−1.48)	(2.92)	(2.35)	(2.53)
Volume	0.001	0.001	0.000	−0.003	−0.003*	−0.003*
	(0.11)	(0.14)	(0.09)	(−1.52)	(−1.78)	(−1.77)
NewsListing				−0.042	−0.037	−0.036
				(−1.02)	(−0.89)	(−0.87)
MomentumList				0.962***	1.023***	1.010***
				(3.62)	(3.82)	(3.79)
NewsIssue	−0.171*	−0.160*	−0.162*			
	(−1.89)	(−1.80)	(−1.81)			
MomentumIssue	1.494	1.483	1.466			
	(1.58)	(1.55)	(1.55)			
Constant	13.870***	14.013***	13.797***	1.139	1.182	1.210
	(2.89)	(2.91)	(2.91)	(1.18)	(1.25)	(1.27)
Observations	162	162	162	358	358	358
Adj. R^2	0.457	0.455	0.460	0.251	0.259	0.257

Notes. This table shows the results of the robustness test using models (4) and (5). The regressions include industry and calendar year dummies. *ComList* and *ComIssue* are in log form. The *t* statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

are read within 7, 14, and 60 days before the listing date, respectively. In Table 10, the coefficients of *Posting* and *Reading* are all positive and significant (p-value < 0.01), which is consistent with the results in Table 5.

5.4.2. Alternative sample selection

To further ensure robustness and to analyze sensitivity, we use an alternative sample of under- and overpricing that excludes observations with negative under- or overpricing. Specifically, observations with a negative value for *Underpricing* or *Overpricing* are excluded. This reduces the sample size, but the results are consistent with our major findings. The regression results in Tables 11 and 12 are consistent with the results in Tables 6 to 9, confirming the robustness of our findings.

5.4.3. Reverse causality

The empirical results imply that forums create noise and exacerbate information asymmetry during IPOs. An endogeneity concern for this study is reverse causality. Instead of the noise effect, the positive link between underpricing and forum discussions may also be explained by the following logic. Firms with less public information and greater information asymmetry may drive investors to online forums to gather information and comment on IPOs, leading to the positive coefficients of *ComIssue*. Therefore, we use media coverage as a proxy for the supply of public information and test the correlation between online discussions and media coverage in the same period. If a lack of public information induces more forum comments, postings, or readings,

Table 12
Online forum discussions and underpricing using an alternative sample.

Variable	(1) *Quiet = 1*	(2) *Quiet = 0*	(3) *SentiPosts1 Above*	(4) *SentiPosts1 Below*	(5) *SentiNews1 Above*	(6) *SentiNews1 Below*
ComIssue1	0.145**	0.064	−0.029	0.209**	0.012	0.240***
	(2.62)	(1.08)	(−0.62)	(2.15)	(0.25)	(3.11)
Gap	0.256	−0.394	−0.180	−0.267	−0.236	−0.622
	(1.28)	(−1.66)	(−0.73)	(−1.09)	(−1.47)	(−1.26)
IssueSize	−0.839***	−0.153	−0.122	−0.465	−0.163	−0.708***
	(−4.06)	(−1.04)	(−0.72)	(−1.64)	(−0.85)	(−3.46)
Underwriter	−0.021	−0.085	−0.132	0.064	−0.014	0.079
	(−0.18)	(−0.83)	(−1.37)	(0.34)	(−0.18)	(0.46)
EPS	0.248	0.036	0.213	−0.134	0.165	0.109
	(1.25)	(0.15)	(0.88)	(−0.55)	(0.84)	(0.39)
Board	1.173*	0.026	−0.083	0.107	0.257	−0.414
	(1.91)	(0.11)	(−0.30)	(0.26)	(1.03)	(−1.14)
PriceRange	0.746*	0.457	−0.014	1.505***	0.334	1.247
	(1.90)	(1.11)	(−0.04)	(3.01)	(0.60)	(1.58)
Revision	−0.682	−0.523	0.342	−2.850***	0.147	−2.706***
	(−1.12)	(−1.27)	(1.05)	(−3.50)	(0.36)	(−2.98)
Prospectus	−0.897**	−0.282	−0.181	−0.608	−0.175	−0.835*
	(−2.06)	(−0.86)	(−0.62)	(−1.42)	(−0.41)	(−2.04)
NewsIssue	−0.226*	−0.033	0.011	−0.314*	−0.022	−0.052
	(−1.75)	(−0.37)	(0.15)	(−1.84)	(−0.18)	(−0.19)
Oversubscription	−0.169*	−0.007	−0.075	−0.197	−0.049	−0.290**
	(−1.82)	(−0.08)	(−1.25)	(−1.14)	(−0.56)	(−2.11)
Volume	0.180***	0.004	0.020	0.002	0.041*	0.001
	(2.96)	(0.88)	(0.80)	(0.28)	(1.87)	(0.21)
MomentumIssue	3.167**	0.164	−0.241	2.511	−0.376	4.218**
	(2.22)	(0.22)	(−0.29)	(1.42)	(−0.41)	(2.31)
Constant	20.995***	5.898	6.651	14.175*	5.043	21.417***
	(4.36)	(1.20)	(1.35)	(1.74)	(0.88)	(2.94)
Observations	94	68	78	84	83	79
Adj. R^2	0.703	0.276	0.389	0.618	−0.019	0.666

Notes. This table shows the results of the robustness test with the split-sample. The regressions include industry and calendar year dummies. *ComIssue1* is in log form. The t statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

the positive link between underpricing and forum discussions may be a result of reverse causality. Otherwise, the endogeneity concern is alleviated.

Table 13 reports the regression results for the relation between online discussions and media coverage. The number of news articles within 7, 14, and 60 days (*News1*, *News2*, and *News3*, respectively) before the listing date are positively and significantly associated with online forum comments, postings, and readings (*ComList*, *Posting*, and *Reading*, respectively) in the same period. The positive relationship between media coverage and forum discussions implies that less public information does not drive investors to online forums and thus alleviates the reverse causality concern.

5.4.4. Difference-in-differences method

The results in Table 7 indicate that the effect of online forums on underpricing is more significant during the quiet period. Although regulators stop IPO firms from excessively promoting themselves with confusing and deceptive information, investors turn to the Internet and receive noisy information anyway. Hence, investors

Table 13
Online forum discussions and media coverage.

Variable	(1) *ComList1*	(2) *ComList2*	(3) *ComList3*	(4) *Posting1*	(5) *Posting2*	(6) *Posting3*	(7) *Reading1*	(8) *Reading2*	(9) *Reading3*
News1	0.187***			0.182***			0.156***		
	(4.06)			(4.24)			(3.97)		
News12		0.261***			0.270***			0.233***	
		(4.38)			(5.58)			(4.83)	
News13			0.258***			0.268***			0.221***
			(4.40)			(5.95)			(4.79)
Gap	−1.095***	−0.309*	0.052	−1.072***	−0.100	0.116	−1.202***	−0.383***	0.081
	(−6.39)	(−1.95)	(0.35)	(−7.07)	(−0.70)	(0.97)	(−7.84)	(−2.79)	(0.67)
IssueSize	0.451***	0.362***	0.393***	0.377***	0.329***	0.331***	0.353***	0.288***	0.305***
	(5.22)	(3.95)	(4.35)	(4.65)	(4.34)	(4.62)	(5.07)	(4.06)	(4.44)
Underwriter	−0.119	−0.034	−0.027	−0.086	−0.060	−0.048	−0.097	−0.020	−0.022
	(−1.63)	(−0.49)	(−0.40)	(−1.29)	(−0.99)	(−0.83)	(−1.60)	(−0.36)	(−0.41)
EPS	0.260***	0.257***	0.247***	0.198***	0.210***	0.209***	0.203***	0.260***	0.258***
	(3.21)	(3.76)	(3.73)	(2.77)	(3.22)	(3.30)	(3.71)	(5.13)	(5.41)
Board	−0.556***	−0.647***	−0.526***	−0.538***	−0.628***	−0.529***	−0.593***	−0.742***	−0.653***
	(−4.10)	(−5.07)	(−4.26)	(−4.11)	(−5.25)	(−4.59)	(−5.40)	(−7.27)	(−6.69)
PriceRange	0.352	0.402*	0.386*	0.369*	0.403**	0.444**	0.220	0.259	0.256
	(1.45)	(1.77)	(1.73)	(1.75)	(2.15)	(2.53)	(1.10)	(1.39)	(1.45)
Revision	−0.636**	−0.475	−0.608*	−0.658**	−0.399	−0.574**	−0.472*	−0.355	−0.503*
	(−2.15)	(−1.39)	(−1.75)	(−2.42)	(−1.54)	(−2.35)	(−1.89)	(−1.30)	(−1.82)
Prospectus	0.026	0.067	−0.055	−0.015	0.039	−0.056	0.106	0.126	0.036
	(0.12)	(0.33)	(−0.28)	(−0.07)	(0.23)	(−0.34)	(0.53)	(0.75)	(0.23)
NewsListing	−0.133	−0.111	−0.110	−0.156*	−0.133	−0.119	−0.105	−0.094	−0.096
	(−1.28)	(−1.13)	(−1.24)	(−1.75)	(−1.59)	(−1.54)	(−1.23)	(−1.15)	(−1.29)
Oversubscription	0.531***	0.508***	0.472***	0.372***	0.338***	0.305***	0.486***	0.505***	0.471***
	(8.73)	(8.82)	(8.45)	(6.88)	(6.90)	(6.49)	(9.87)	(11.43)	(11.07)
Volume	0.023***	0.018***	0.019***	0.021***	0.014***	0.016***	0.027***	0.019***	0.019***
	(5.63)	(5.57)	(5.87)	(6.03)	(5.31)	(6.13)	(8.30)	(6.97)	(6.92)
MomentumList	0.275	−1.182	−0.581	0.486	−0.521	−0.157	1.169	−0.669	−0.030
	(0.32)	(−1.52)	(−0.78)	(0.58)	(−0.71)	(−0.23)	(1.61)	(−1.07)	(−0.05)
MomentumIssue	−2.412***	−0.996	−1.776**	−2.044***	−0.708	−1.282**	−2.491***	−0.901	−1.623***
	(−2.99)	(−1.36)	(−2.53)	(−2.90)	(−1.17)	(−2.29)	(−3.73)	(−1.53)	(−2.92)
Constant	−2.558	−2.189	−2.607	−1.892	−3.090	−2.837	4.977**	4.682**	4.103**
	(−1.02)	(−0.85)	(−1.05)	(−0.82)	(−1.47)	(−1.45)	(2.28)	(2.23)	(2.04)
Observations	430	430	430	430	430	430	430	430	430
Adj. R^2	0.472	0.491	0.502	0.463	0.498	0.541	0.558	0.591	0.607

Notes. This table shows the results for the relationship between online discussions and media coverage. The regressions include industry and calendar year dummies. *News*, *ComList*, *Posting*, and *Reading* are in log form. The *t* statistics are reported in parentheses and are based on the robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

Table 14
Difference-in-differences estimation results.

Panel A *ComIssue*					
Groups		*Underpricing*	S. Err.	|t|	P > |t|
Before	Control	9.875			
	Treated	9.949			
	Diff (T-C)	0.074	0.059	1.24	0.214
After	Control	9.785			
	Treated	9.999			
	Diff (T-C)	0.215	0.052	4.10	0.000***
	Diff-in-Diff	0.141	0.077	1.84	0.067*
Panel B *Reading*					
Groups		*Underpricing*	S. Err.	|t|	P > |t|
Before	Control	9.504			
	Treated	9.555			
	Diff (T-C)	0.051	0.060	0.84	0.401
After	Control	9.411			
	Treated	9.622			
	Diff (T-C)	0.211	0.053	4.00	0.000***
	Diff-in-Diff	0.160	0.077	2.09	0.038**

Notes. This table demonstrates the results of the difference-in-differences estimation. ***, **, and * denote significance at the 1%, 5%, and 10% confidence levels, respectively.

are more influenced by online forums during the quiet period due to the lack of information from IPO firms. Therefore, investors are confused either by IPO firms or by online forums. As the quiet period tends to induce greater dependence on unofficial information sources, such as online forums, we view the CSRC quiet period regulation as a shock to the effect of forum discussions on underpricing.

Table 14 presents the results of our difference-in-differences estimation. In Panel A, the treated group consists of observations with a *ComIssue* value (number of comments within 60 days before the offer price declaration date) greater than its median, and the untreated group consists of observations with a *ComIssue* value less than or equal to its median. In Panel B, the treated and untreated groups are constructed in the same way using *Reading* (number of times articles are read within 60 days before the offer price declaration date).

After the shock from *Quiet*, the treated groups have significantly higher values than the untreated groups, which is consistent with the finding that forum discussions increase the likelihood of underpricing. Table 14 shows that the difference-in-differences values are positive (0.067 and 0.038) and significant (p-value < 0.1 and p-value < 0.05, respectively). We interpret the results to imply that the CSRC's quiet period regulation induces greater dependence on online forums and that forum discussions create noise that increases information asymmetry and exacerbates IPO underpricing.

6. Conclusion

In this study, we use an IPO setting to examine the effect of online forums on information asymmetry. It is difficult to test whether online forums support information transparency under normal circumstances, but the effect of forum postings during IPOs can be easily tested because the level of IPO underpricing can be considered a proxy for information asymmetry. Hence, it is easier to test the influence of online discussions in an IPO setting, especially in China where underpricing was once fairly high.

Using both rational and behavioral frameworks, IPO initial returns are decomposed into their under- and overpricing components to test the influence of online stock forum discussions on IPO pricing. We find a positive relationship between the number of forum comments and underpricing, indicating that online forums produce noise and exacerbate information asymmetry during IPOs. The quiet period regulation causes inves-

tors to rely on forums to gather and exchange information, which amplifies the effect of online forums on information asymmetry. In addition, we examine the influence of online comments with different sentiment levels using split-sample tests. The results indicate a more significant negative impact of online forums under negative sentiment.

The findings of this study have important theoretical and policy implications. First, we extend the literature on the relationship between Internet information and IPO pricing. We provide a clearer picture of this relationship by separating under- and overpricing in a Chinese setting, which is ideal due to the prevalence of relatively high initial returns for Chinese IPOs. Second, the evidence of noise from forums advises investors not to put too much faith in stock forum discussions. According to the evidence, we find that in an IPO setting, online forums negatively affect information asymmetry. Third, the implication for the regulatory authority is that channels for firms to honestly voice against rumors and fake news during IPOs are necessary to alleviate information asymmetry.

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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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CFO narcissism and audit fees: Evidence from listed companies in China

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ABSTRACT

This paper examines the effects of CFO narcissism on audit fees in China. Using the size of CFO signatures in annual audit reports to measure individual narcissism, we find that CFO narcissism is associated with higher audit fees. We find empirical evidence that CFO narcissism significantly increases the audit fees of listed companies, and this effect is stronger in state-owned enterprises. This paper also explores the mediating effects of financial information and the engagement of prestigious Big-4 and Big-10 firms. The results show that companies with narcissistic CFOs have lower quality financial information and prefer more prestigious firms, which leads to higher audit fees. This research highlights the importance of CFO narcissism in corporate performance and provides new evidence that will be useful for listed companies that plan to hire senior executives.

1. Introduction

Financial scandals are common, such as the collapse of Enron in 2001, the WorldCom scandal in 2003, and the Luckin Coffee fraud case in 2020. Fraud is a major concern in all walks of life. On February 20, 2019, China's Ministry of Finance approved the issuance of 18 auditing standards, including "No. 1101 Chinese Auditing Standards for Certified Public Accountants—The Overall Objectives of Certified Public Accountants and the Basic Requirements for Auditing Work," which was drafted with the involvement of the Chinese Institute of Certified Public Accountants. "No. 1141 Auditing Standards for Certified Public Accountants—Responsibilities Related to Fraud in the Audit of Financial Statements"[1] clearly states that

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[1] "No. 1141 Auditing Standards for Certified Public Accountants—Responsibilities Related to Fraud in the Audit of Financial Statements," revised on March 29, 2019.

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if the auditee's personnel can override internal controls then opportunities for fraud will exist; such personnel include directors in important positions with a deep knowledge of the company's internal control deficiencies. The disclosure and prevention of financial fraud are linked to corporate executives. Upper echelons theory holds that due to firms' complex external environment, managers cannot comprehensively grasp all information. Because executives have different levels of cognitive competence, personal experience, and sense of worth, they may make different decisions in the same environment. By influencing executives' behavior and decision-making methods, their cognitive competence, personal experience, and sense of worth influence their corporate behavior. Ham et al. (2017) find that executive narcissism is associated with strategic positioning, strategic selection, and decisions related to personnel structure and staffing. Thus, identifying executive narcissism is important.

The Chief Executive Officer (CEO) and Chief Financial Officer (CFO) are the two most important executives in an enterprise. They are not only responsible for a firm's daily business activities, but also play a decisive role in the quality of its accounting information. Malmendier et al. (2013) find that the quality of accounting information is more related to the CEO's and CFO's characteristics than to the characteristics of the whole management team. However, CFO narcissism affects audit fees through different channels and mechanisms than CEO narcissism. First, CFOs have a more direct influence on the financial reporting process than CEOs; they are directly responsible for the financial statements, and make the key decisions on accounting policies and information disclosure. CFOs have a unique ability to perform accounting manipulation, such as restructuring transactions, using inappropriate accounting policies, and engaging in fraud (Feng et al., 2011). Therefore, CFOs have a direct impact on the quality of financial information. Financial scandals, such as those that engulfed Enron and WorldCom, show that CFOs have a crucial impact on the quality of accounting information. Scholars also believe that CFOs and their personal characteristics have significant impacts on financial reports (Jiang et al., 2010; Ham et al., 2017). To improve the quality of financial information, narcissistic CFOs prefer to pay higher audit fees in exchange for better quality audit services. Second, CFOs are directly involved in the construction and implementation of internal controls. Finally, as the person in charge of communicating with auditors, CFOs are not only involved in the appointment of auditors, but also influence the formulation of auditors' audit plans, which are related to audit fees. Therefore, in this paper we focus on CFOs' personal characteristics, narcissism, and audit fees.

Psychological studies suggest that narcissists usually show the psychological characteristics of authority, superiority, exhibitionism, and attention-seeking (Raskin and Howard, 1988; Bogart et al., 2004), which scholars frequently measure using the Narcissistic Personality Inventory (NPI). However, due to the questionnaire may expose executives' hidden characteristics to others which have potential influence on their career, they are sensitive to their own personality traits, such as narcissism, and may try to conceal them (Cyota et al., 2006). In addition, collecting corporate executives' NPI scores is time-consuming. Therefore, a more convenient and objective measurement method is needed for measuring CFOs' narcissism.

Research on the association between signatures and narcissism has a long history. Since the 1970 s, psychologists have found that individuals with larger signatures tend to be more self-aware and more narcissistic (Snyder and Fromkin,1977). They demonstrate that signature size can be used as an approach to measure the extent of individuals' self-awareness and dominance of others, and individuals with larger signatures have tendency to exhibit control and dominance over others, both of which are associated with narcissism (Zweigenhaft and Marlowe, 1973; Zweigenhaft,1977; Jorgenson,1977). The signature is hard to duplicate, and people even develop unique signatures to distinguish themselves from others. The signature is a powerful symbolic representation of the individual. It may have other cultural associations or express a sense of personal style, but this is its primary purpose. To some extent, people have a strong sense of identity with their own names and associate their names with positive emotions. This strong sense of identity affects their life and career decisions (Pelham et al. 2005). Narcissists focus on themselves and over-value themselves (Zhang and Chen, 2015), which may cause them to pay more attention to their own names. In addition, using the size of

[1] "No. 1141 Auditing Standards for Certified Public Accountants—Responsibilities Related to Fraud in the Audit of Financial Statements," revised on March 29, 2019.

the signature to measure the degree of narcissism can effectively prevent the interviewee from hiding his own personality characteristics (Rudman et al., 2007).

Based on the psychological literature, Hambrick et al. (2018) classify those who exhibit the following four personality characteristics as narcissists. First, they have a strong desire for power, and hope to get the respect they think they deserve. Second, they show leadership and authority, and desire to be the center of attention. Third, they show a sense of superiority and arrogance, and believe they are better than anyone else. Lastly, they are conceited, believing that they have unique and extraordinary ideas. To reflect these four characteristics, Hambrick et al. delete the six questions in NPI-16 that measure self-confidence rather than narcissism, and create two new experiments for examining the association between signature size and narcissism. This paper adopts the methods of Ham et al. (2017, 2018) and Church et al. (2020). A rectangular frame is used to intercept the CFOs' signatures that are included in the annual audit report of China A-share listed companies from 2012 to 2017. Each side of the rectangular frame touches the extreme endpoints of the signature. To reduce the manual measurement error of the rectangular frame, we use the number of pixels of the intercepted rectangle instead of the rectangular area and take its natural logarithm to obtain the signature size, which is used to measure CFOs' narcissistic tendencies.

This research makes the following contributions to the literature. First, based on behavioral economics theory, we empirically analyze the impact of CFOs' narcissistic psychology and personality characteristics on corporate economic activities, avoiding the limitations of traditional corporate governance theories. Second, because CEOs have more opportunities to appear in public and gain more social attention, previous studies on executive narcissism mainly focus on CEOs (Ham et al., 2017), while the literature on CFO narcissism is much smaller. This paper enriches the research on CFO background characteristics. Finally, the literature generally describes CFO characteristics and examines the impact of executives on audit fees using explicit characteristics such as professional background, salary, and educational background (Zhang and Hu, 2013; Wang et al., 2019). This paper starts with the personality trait of CFO narcissism and measures this hard-to-capture personality trait with the effective proxy variable of CFO signature size. This paper enriches the research on the impact of executives' personality characteristics on audit fees. This paper thus provides a reference for other studies of the impact of executive narcissism in Chinese listed companies.

2. Literature review and hypotheses development

The psychological characteristics of narcissists include authority, superiority, exhibitionism, and attention-seeking (Raskin and Howard, 1988; Bogart et al., 2004). Narcissists believe they possess distinctive traits and have a high, non-objective sense of their intelligence, creativity, competence, and leadership (Farwell and Wohlwend-Lloyd, 1998; Rich, 2006). Geiger and North (2006) find that the CFO has independent influence over the company's financial reporting. Narcissists dominate the decision-making process and ignore feedback from others and the results of previous decisions (Wink, 1991; Morf and Rhodewalt, 1993; John and Robins, 1994; Yang et al., 2018). This leads to suboptimal organizational decisions (Nevicka et al., 2011). Therefore, from the auditor's perspective, finance departments led by narcissistic CFOs tend to be less efficient and to have poorer internal controls and financial information than those led by non-narcissistic CFOs. Yang et al. (2018) find that even if narcissists spot their mistake after making a bad decision, their ability to revise their subsequent actions is poorer than that of non-narcissistic people. Narcissists understand external feedback but still have trouble learning from it (Carlson, 2013; Jordan and Audia, 2012). This tendency may lead narcissistic CFOs to adopt more aggressive accounting policies and estimates. Narcissistic CFOs may take a positive view of situations that other executives consider risky. For example, they are less likely to recognize losses in a timely manner, which increases the likelihood of financial misstatements (Ham et al., 2017). Other studies have shown that narcissists are more likely to engage in unethical behavior, such as lying to get their way, engaging in academic dishonesty, and committing crimes (Menon and Sharland, 2011; Hales et al., 2012). Simunic (1980) finds that auditors control litigation risk and make up for the expected loss of high-risk clients by increasing audit fees. Auditors' assessment of fraud risk increases when they are confronted with narcissistic executives. In such cases, auditors will increase their audit fees and are more likely to resign (Johnson et al., 2013; Judd et al., 2017).

There are researchers who believe that CFO narcissism does not lead to negative outcomes for companies. Narcissism can be a motivational mechanism, as it includes a belief in one's own superior abilities and the need for strong and constant affirmation from others. Narcissists are driven to compete, and usually take every possible action to win (Luchner et al., 2011; Xiang and Tian, 2020). Narcissistic CFOs have extreme confidence in the financial information for which they are directly responsible (Chatterjee and Hambrick, 2007). Narcissism drives them to achieve perfect results. Therefore, they may have higher standards for internal controls, require lower financial and operational risk, and reduce unnecessary cash outflow. In this case, CFO narcissism will lead to high-quality financial information. In the short run, high-quality internal controls may require auditors to invest extra time and effort. However, audits may become simpler as the auditor becomes more familiar with the client due to continuous audit demands, thus causing a reduction in audit fees (Xing and Chen, 2013).

Because of their desire for self-expression and attention, narcissistic individuals may make their needs and interests override organizational needs and interests, and engage in extremely egoistic behaviors (Rosenthal and Pittinsky, 2015). They may not only impact audit fees through their effect on the firm's financial information quality, but may also try to show their own distinctiveness and social status by providing high quality corporate financial information. They may gain recognition and appreciation by using company resources to show their uniqueness and superiority (Maccoby, 2007; Higgs, 2009); for example, they may hire prestigious accounting firms and auditors to conduct audits, at the cost of high fees. Independent third-party audit agencies, accounting firms and auditors with good reputations and brand advantage can provide narcissistic CFOs with excellent display opportunities. However, such accounting firms earn their reputations by offering high quality auditing services. Higher audit quality usually requires more complicated and strict audit procedures and the participation of experienced senior auditors. Such audit services come at high cost, including the increase in labor costs caused by a higher level of effort and a potential cost from the loss of customers due to issuing non-standard opinions, which leads to high audit fees. At the same time, related research shows that in the auditing market in China, accounting firms with a high reputation can obtain a premium (Zheng and Zheng, 2017).

Based on the above analysis, we believe that CFO narcissism may have an impact on audit fees through two channels: the quality of accounting information, and the pursuit of self-expression and attention. Our hypotheses are as follows.

H1a: When other factors remain unchanged, CFO narcissism is positively associated with audit fees.

H1b: When other factors remain unchanged, CFO narcissism is negatively associated with audit fees.

3. Research design

3.1. Sample selection and data sources

In this research, we exclude observations that lack details about the specific amount of audit fees, the positions of senior executives, actual controller, internal control indexes, and financial information. It extracts CFO signatures from their annual audit reports. Ultimately, we obtain 6,081 effective observations which are Chinese A-share listed companies from 2012 to 2017. The sample includes state-owned enterprises (2,470 observations) and private enterprise (3,611 observations). To avoid the effects of extreme values, all continuous variables are winsorized at the top and bottom 1% levels. The CFOs' signature information is collected manually. The comprehensive evaluation of accounting firms comes from the "Top 100 Domestic Accounting Firms (Comprehensive Evaluation) List" issued by the Chinese Institute of Certified Public Accountants. The quality of internal control is assessed using the internal control index issued by DIB which is China's first professional institution focusing on risk management, internal control and internal audit, and the other data are collected from the CSMAR database.

3.2. Definitions of variables

3.2.1. Dependent variable

Lnfee is the audit fee, which is the natural log of the fee the listed company pays to the accounting firm for the audit service. The economic transaction between the company and the accounting firm is the audit service,

and the audit fee is the final manifestation of this economic relationship between the company and the accounting firm. Audit fees charged by accounting firms often include three parts: audit costs, normal profits, and risk premiums. This paper proposes that the audit fee is the consideration paid by the client to obtain the audit service of the accounting firm. It includes not only the cost, such as time and human resources, incurred when the audit firm performs the audit service, but also the risk premium required by the audit firm due to potential litigation and other risks involved. Following Li and Wu (2004), Xing and Chen (2013), Chu et al. (2018), this paper measures audit fees as the natural logarithm of the audit fee paid by the listed company in the focal year.

3.2.2. Independent variable

Narcissism is the natural logarithm of the number of pixels in the CFO's signature image, which is a proxy for the CFOs' level of narcissism. Narcissism is the personality trait of overestimating one's own charm and ability, deliberately calling attention to oneself, and having an urgent need for attention, recognition, and approval (Campbell et al., 2011).

3.2.3. Control variables

To minimize the impact of other factors on audit fees and accurately measure the impact of CFO narcissism on audit fees, this paper refers to the research of Zhang and Hu (2013), Cheng et al. (2016), Liu et al. (2018). To account for the effects of audit workload, audit opinions, financial risks, operating risks, internal control risks, and corporate governance, we introduce the control variables *SIZE*, *AO*, *LEV*, *QIUCK*, *REC*, *INV*, *ROA*, *LOSS*, *IC*, *IBD*, *DUAL*, *BMT*. At the same time, to control for the influence of the CEO, we add the CEO's age (*CEO_AGE*) to the model, and finally introduce *YEAR* and *IND*. The variable definitions are shown in Table 1.

3.3. Model specification

We test the relation between CFO narcissism and audit fees via the following model:

$$\begin{aligned} Lnfee_{i,t} = {} & \alpha_0 + \alpha_1 Narcissism_{i,t} + \alpha_2 CEO\_AGE_{i,t} + \alpha_3 AO_{i,t} + \alpha_4 IC_{i,t} + \alpha_5 SIZE_{i,t} + \alpha_6 REC_{i,t} + \alpha_7 INV_{i,t} \\ & + \alpha_8 QUICK_{i,t} + \alpha_9 LEV_{i,t} + \alpha_{10} LOSS_{i,t} + \alpha_{11} ROA_{i,t} + \alpha_{12} IBD_{i,t} + \alpha_{13} DUAL_{i,t} + \alpha_{14} BMT_{i,t} \\ & + \Sigma YEAR_{i,t} + \Sigma IND_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

Table 1
Variable definitions.

Symbol	Definition
Lnfee	Audit fee: the natural logarithm of the audit fee of the listed company in that year.
Narcissism	CFO narcissism: natural logarithm of the number of pixels in CFO signature images.
CEO_AGE	The age of the CEO in the focal year.
AO	Audit opinion: An indicator variable equal to one if the audit opinion is an unmodified opinion in the current year, and zero otherwise.
IC	The quality of internal control: IC = ln(the internal control index issued by DIB + 1)
SIZE	The size of the company: the natural logarithm of total assets at year end.
REC	Trade receivables divided by total assets.
INV	Inventory divided by total assets.
QUICK	Quick ratio = [Current assets – Inventory] / Current Liabilities
LEV	Leverage ratio, the ratio of short-term plus long-term debt to equity.
LOSS	Indicator variable, equal to one if the firm incurred a loss in the prior year, and zero otherwise.
ROA	Change in net income scaled by average total assets in the past year.
IBD	Percentage of independent board directors.
DUAL	Indicator variable equal to one if the manager and chairman are the same person in the current year, and zero otherwise.
BMT	Number of board meetings.
YEAR	Dummy variable for years.
IND	Dummy variable for industries.

4. Results

4.1. Descriptive statistics

Table 2 reports the descriptive statistics for our primary dependent and independent variables for the CFO sample. There are 1,457 listed companies in the sample and 6,081 observations. In the sample, the average *lnfee* is 13.835, around 97% of the listed companies obtain an unmodified opinion, and 8.7% of the firms incurred a loss in the prior year. Regarding CFO narcissism characteristics, there is substantial variation in signature size—the maximum is approximately 1.5 times larger than the minimum. The descriptive statistics of the main variables are shown in Table 2.

4.2. Correlation analysis

Table 3 presents the Pearson correlations for the main variables. CFO signature size is positively correlated with absolute discretionary accruals and negatively correlated with accrual quality, which is consistent with higher accruals-based earnings management for firms with narcissistic CFOs. Similarly, CFO narcissism is positively correlated with audit fees. The Pearson correlation coefficients between CFO narcissism and audit fees is 0.210. Except for *INV* and *IBD*, the other variables are significantly associated with *lnfee*. There are differences between the correlation of some variables and the expected association, which may be because these are the result of a simple correlation analysis without considering other factors. Further multiple regression results are needed to explore which hypothesis of this research can be verified.

4.3. Basic regression analysis

Table 4 reports the correlations between CFO narcissism and audit fees. Column (1) shows the effects of CEO narcissism on audit fees without considering the control variables. As predicted, the coefficient on CFO narcissism is positive for audit fees ($\alpha_1 = 0.125$, $p < 0.01$). As column (2) shows, after adding the control variables to Model (1), the regression coefficients for *Narcissism* are 0.070, at no less than the 1% level, which means CFO narcissism is significantly positively correlated with audit fees; the higher the level of CFO narcissism, the greater the audit fees. Therefore, H1a is supported.

The regression results for the control variables show that *CEO_AGE* is significantly positively correlated with audit fees ($\alpha_2 = 0.125$, $p < 0.01$). *SIZE* is also significantly positively correlated with audit fees ($\alpha_5 = 0.421$, $p < 0.01$), which means the larger the enterprise, the higher the audit fee. This is consistent with the conclusion of Simunic(1980) that the size of the company's assets affects the complexity of the audit and

Table 2
Descriptive analysis of variables.

	N	Mean	Median	Min	Max	Std. Dev.
Lnfee	6081	13.835	13.710	12.612	16.400	0.732
Narcissism	6081	8.950	8.713	7.077	11.243	1.037
CEO_age	6081	49.539	50.000	32.000	65.000	6.301
AO	6081	0.971	1.000	0.000	1.000	0.168
IC	6081	6.479	6.507	5.699	6.722	0.146
SIZE	6081	22.308	22.106	19.599	27.064	1.428
REC	6081	0.114	0.084	0.000	0.458	0.107
INV	6081	0.150	0.113	0.000	0.747	0.147
Quick	6081	1.719	1.116	0.000	12.294	1.906
Lev	6081	0.451	0.441	0.060	0.943	0.213
LOSS	6081	0.087	0.000	0.000	1.000	0.282
ROA	6081	0.044	0.038	−0.154	0.222	0.055
IBD	6081	0.373	0.333	0.333	0.556	0.051
DUAL	6081	0.239	0.000	0.000	1.000	0.426
BMT	6081	9.707	9.000	4.000	24.000	3.856

Table 3
Pearson Correlation Matrices.

	Lnfee	*Narcissism*	*CEO_AGE*	*AO*	*IC*	*SIZE*	*REC*	*INV*	*Quick*	*Lev*	*LOSS*	*ROA*	*IBD*	*DUAL*	*BMT*
Lnfee	1.000														
Narcissism	0.210***	1.000													
	(0.000)														
CEO_AGE	0.143***	0.074***	1.000												
	(0.000)	(0.000)													
AO	0.037***	0.009	0.018	1.000											
	(0.003)	(0.509)	(0.162)												
IC	0.073***	0.015	0.034***	0.303***	1.000										
	(0.000)	(0.138)	(0.008)	(0.000)											
SIZE	0.790***	0.138***	0.127***	0.117***	0.131***	1.000									
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)										
REC	−0.155***	−0.031**	−0.036**	0.048***	0.039***	−0.226***	1.000								
	(0.000)	(0.015)	(0.005)	(0.000)	0.001	(0.000)									
INV	0.030	−0.011	−0.032**	0.059***	0.059***	0.065***	−0.047***	1.000							
	(0.823)	(0.397)	(0.013)	(0.000)	(0.000)	(0.000)	(0.000)								
Quick	−0.289***	−0.025**	−0.049***	0.038***	0.013	−0.364***	0.063***	−0.214***	1.000						
	(0.000)	(0.049)	(0.000)	(0.003)	(0.295)	(0.000)	(0.000)	(0.000)							
Lev	0.373***	0.061***	0.043***	−0.137***	−0.090***	0.503***	−0.043***	0.258***	−0.646***	1.000					
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)						
LOSS	−0.040***	−0.036***	−0.007	−0.238***	−0.330***	−0.090***	−0.056***	−0.005	−0.099***	0.181***	1.000				
	(0.002)	(0.005)	(0.595)	(0.000)	(0.000)	(0.000)	(0.000)	(0.691)	(0.000)	(0.000)					
ROA	−0.069***	0.039***	0.006	0.234***	0.326***	−0.074***	0.070***	−0.111***	0.286***	−0.410***	−0.582***	1.000			
	(0.000)	(0.002)	(0.640)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
IBD	0.009	−0.015	−0.005	0.013	0.019	−0.007	−0.003	0.032**	0.017	−0.002	0.125	−0.019	1.000		
	(0.489)	(0.258)	(0.699)	(0.308)	(0.147)	(0.591)	(0.804)	(0.013)	(0.176)	(0.986)	(0.331)	(0.133)			
DUAL	−0.155***	−0.043***	0.119***	0.004	0.002	−0.193***	0.060***	−0.009	0.111***	−0.134***	−0.017***	0.082***	0.107***	1.000	
	(0.000)	(0.003)	(0.000)	(0.756)	(0.907)	(0.000)	(0.000)	(0.477)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
BMT	0.207***	−0.021*	−0.042***	−0.013	−0.027**	0.235***	−0.036***	0.133***	−0.133***	0.230***	0.009	−0.097***	0.037***	−0.025**	1.000
	(0.000)	(0.095)	(0.001)	(0.296)	(0.035)	(0.000)	(0.005)	(0.000)	(0.000)	(0.000)	(0.481)	(0.000)	(0.004)	(0.048)	

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

Table 4
CFO narcissism and audit fees.

	Lnfee (1)		*Lnfee* (1)	
	Coeff.	t-value	Coeff.	t-value
Constant	13.650	132.484***	3.846	13.501***
Narcissism	0.125	14.381***	0.070	12.991***
CEO_AGE			0.004	4.053***
AO			−0.235	−6.585***
IC			−0.054	−1.273
SIZE			0.421	80.290***
REC			0.160	2.952***
INV			−0.031	−0.643
QUICK			−0.013	−3.334***
LEV			−0.193	−4.634***
LOSS			0.073	2.943***
ROA			−0.087	−0.640
IBD			0.308	2.799***
DUAL			−0.016	−1.212
BMT			0.006	3.731***
YEAR		YES		YES
IND		YES		YES
adj.R^2		0.109		0.658
F-value		67.270		488.386
N		6081		6081

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

thus the audit fee. *REC, LOSS, IBD,* and *BMT* are all significantly positively correlated with audit fees, at less than the 1% level, while *AO* is significantly negatively associated with audit fees ($\alpha_3 = -0.235$, $p < 0.01$). In other words, unmodified opinions are significantly negatively correlated with audit fees.

4.4. Additional robustness tests

4.4.1. Changing the measurement approach

We conduct three additional robustness tests. In the first test, we replace the natural logarithm of the number of pixels in the CFO signature images by *Narcissism_W* and *Narcissism_H,* which are the width and height of the CFO signature image in pixels, respectively. We also use *Narcissism_TS* and *Narcissism_AS,* which are the total area and the average area of each word in the CFO signature image, respectively. We re-run Model (1), and Tables 5 and 6 report the regression results. As Table 5 shows, *Narcissism_H* and *Narcissism_W* are both significantly positively associated with audit fees, and the regression coefficients for *Narcissism_H* and *Narcissism_W* are both 0.001, at no less than a 1% level. Table 6 shows that *Narcissism_TS* and *Narcissism_AS* are positively associated with audit fees ($\alpha_1 = 0.006$, $p < 0.01$; $\alpha_1 = 0.017$, $p < 0.01$). These results indicate that whether measured in terms of width and height or total area and average area, when the other factors remain unchanged, CFO narcissism is positively associated with audit fees. The results further support H1a, and the main research conclusions are robust.

4.4.2. Lagging the dependent variable

In the second test, we use $Lnfee_{i,t+1}$, the listed company's audit fee in year $t + 1$, to address the endogeneity problem of narcissistic CFOs' selection, and we regress Model (2). As Table 7 shows, the regression coefficient is 0.120 at no less than a 1% level, which means that CFO narcissism is significantly positively associated with the audit fees of listed companies even when only the dummy year and industry variables are added to the model. After adding the control variables to Model (2) we find a significantly positive association between

Table 5
Changing the measurement approach – Width and height.

	Lnfee (1)		*Lnfee* (2)	
	Coeff.	t-value	Coeff.	t-value
Constant	4.417	15.667***	4.357	15.439***
Narcissism_H	0.001	13.016***		
Narcissism_W			0.001	12.482***
CEO_AGE	0.004	4.034***	0.004	4.175***
AO	−0.232	−6.499***	−0.234	−6.552***
IC	−0.064	−1.505	−0.054	−1.249
SIZE	0.421	80.254***	0.420	79.843***
REC	0.155	2.861***	0.163	3.002***
INV	−0.023	−0.471	−0.025	−0.520
QUICK	−0.013	−3.349***	−0.012	−3.234***
LEV	−0.188	−4.514***	−0.187	−4.475***
LOSS	0.071	2.833***	0.075	3.030***
ROA	−0.089	−0.655	−0.058	−0.426
IBD	0.334	3.030***	0.290	2.634***
DUAL	−0.015	−1.085	−0.015	−1.143***
BMT	0.006	3.713***	0.006	3.688***
YEAR		YES		YES
IND		YES		YES
adj.R^2		0.658		0.657
F-value		488.463		486.844
N		6081		6081

Table 6
Changing the measurement approach – Total area and average area.

	Lnfee (1)		*Lnfee* (2)	
	Coeff.	t-value	Coeff.	t-value
Constant	4.463	15.817***	4.492	15.903***
Narcissism_TS	0.006	12.703***		
Narcissism_AS			0.017	12.376***
CEO_AGE	0.004	4.093***	0.004	4.039***
AO	−0.231	−6.494***	−0.231	−6.470***
IC	−0.061	−1.423	−0.062	−1.454
SIZE	0.420	79.896***	0.420	79.677***
REC	0.155	2.849***	0.157	2.881***
INV	−0.017	−0.357	−0.019	−0.392
QUICK	−0.013	−3.302***	−0.013	−3.307***
LEV	−0.188	−4.498***	−0.185	−4.443***
LOSS	0.073	2.942***	0.072	2.893***
ROA	−0.073	−0.533	−0.077	−0.565
IBD	0.317	2.882***	0.308	2.791***
DUAL	−0.014	−1.004	−0.013	−0.957
BMT	0.006	3.699***	0.006	3.666***
YEAR		YES		YES
IND		YES		YES
adj.R^2		0.658		0.657
F-value		487.506		486.529
N		6081		6081

Narcissism and $Lnfee_{i,t+1}$ ($\mu_1 = 0.072$, $p < 0.01$), which indicates that even considering the effect of endogeneity, CFO narcissism is positively associated with audit fees, and the main research conclusions are robust.

Table 7
Lagging the dependent variable.

	$Lnfee_{t+1}$ (1)		$Lnfee_{t+1}$ (2)	
	Coeff.	t-value	Coeff.	t-value
Constant	13.646	136.992 ***	3.969	13.462***
Narcissism	0.120	14.328 ***	0.072	12.784***
CEO_AGE			0.003	2.717***
AO			−0.195	−5.279***
IC			−0.021	−0.485
SIZE			0.406	74.701***
REC			0.278	4.950***
INV			−0.007	−0.143
QUICK			−0.01	−2.443**
LEV			−0.182	−4.223***
LOSS			0.081	3.151***
ROA			0.034	0.239
IBD			0.4	3.514***
DUAL			−0.009	−0.611
BMT			0.009	5.771***
YEAR		YES		YES
IND		YES		YES
adj.R^2		0.099		0.625
F-value		64.583		422.881
N		6081		6081

$$\begin{aligned} Lnfee_{i,t+1} = {} & \mu_0 + \mu_1 Narcissism_{i,t} + \mu_2 CEO\_AGE_{i,t} + \mu_3 AO_{i,t} + \mu_4 IC_{i,t} + \mu_5 SIZE_{i,t} + \mu_6 REC_{i,t} \\ & + \mu_7 INV_{i,t} + \mu_8 QUICK_{i,t} + \mu_9 LEV_{i,t} + \mu_{10} LOSS_{i,t} + \mu_{11} ROA_{i,t} + \mu_{12} IBD_{i,t} + \mu_{13} DUAL_{i,t} \\ & + \mu_{14} BMT_{i,t} + \Sigma YEAR_{i,t} + \Sigma IND_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

4.4.3. Heckman two-step model

To alleviate the self-selection problem of CFO signatures being disclosed in the audit reports of listed companies, this paper adopts the Heckman two-step model for a further test to control for the self-selection bias. In the first stage, this paper constructs a model that affects CFO narcissism, where narcissism is measured as a dummy variable, denoted as *Narcissism_D*, and the median of CFO narcissism is used to judge the level of CFO narcissism. CFOs with values higher than the median are recorded as 1, and otherwise 0. According to the requirements of the Heckman two-step model, we also need an exogenous variable that directly affects CFO narcissism but has no direct effect on audit fees. The leadership and decision-making behavior of executives will be affected by their experience, preferences, and personality (Hambrick and Mason, 1984). Educational level can reflect a person's cognitive ability, representing the individual's ability to cope with environmental changes and information processing (Zeng, 2014). Educational level affects people's decision-making process (Fischhoff et al., 1977). The educational background of a CFO affects his personal experience and personality characteristics, and thus guides his behavior. It may affect corporate behavior and information quality through the CFO's management decision-making behavior, such as decisions about audit fees, but the educational background of the CFO is not a direct influence on audit fees.

In China, under the influence of the traditional belief that " the only way for a low-ranking official to rise is to study high ," people with high academic qualifications are generally considered to be more intelligent and capable than others, and at the same time they receive attention and admiration. Narcissists have a high level of self-esteem, which may drive the desire for more education to earn more attention and recognition. CFOs who have more education are likely to be more narcissistic. The educational background of a CFO directly affects the CFO's narcissism, but does not directly affect audit fees, which meets the requirements of the Heckman two-step model for exogenous variables. Therefore, we use the median of a CFO's educational level as the

standard and set *EDU* ass equal to one if the CFO's educational level is higher than the median, and zero otherwise. The CFO education degree variable is introduced to the model of CFO narcissism. The two-step model is as follows:

The first stage: Probit model

$$Narcissism\_D_{i,t} = \beta_0 + \beta_1 EDU_{i,t} + \beta_2 IC_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 LEV_{i,t} + \beta_5 LOSS_{i,t} + \beta_6 BSIZE_{i,t} + \beta_7 IBD_{i,t} + \beta_8 SHARE_{i,t} + \beta_9 GROWTH_{i,t} + \Sigma YEAR_{i,t} + \Sigma IND_{i,t} + \varepsilon_{i,t} \quad (3)$$

The second stage: Regression model

$$Lnfee_{i,t} = \gamma_0 + \gamma_1 Narcissism\_D_{i,t} + \gamma_2 CEO\_AGE_{i,t} + \gamma_3 AO_{i,t} + \gamma_4 IC_{i,t} + \gamma_5 SIZE_{i,t} + \gamma_6 REC_{i,t} + \gamma_7 INV_{i,t} + \gamma_8 QUICK_{i,t} + \gamma_9 LEV_{i,t} + \gamma_{10} LOSS_{i,t} + \gamma_{11} ROA_{i,t} + \gamma_{12} IBD_{i,t} + \gamma_{13} DUAL_{i,t} + \gamma_{14} BMT_{i,t} + \gamma_{15} IMR_{i,t} + \Sigma YEAR_{i,t} + \Sigma IND_{i,t} + \varepsilon_{i,t} \quad (4)$$

where *BSIZE* is the number of directors on the board, *SHARE* refers to ownership concentration, measured by the shareholding ratio of the first majority shareholder, and *GROWTH* is the growth ability of the listed company, which is measured by the ratio of the difference between total sales revenue at year end and at the year's beginning to the total sales revenue at the year's beginning. We regress the Probit model and introduce the inverse Mills ratio (*IMR*) generated in the first stage to the main regression, Model (1), to generate the second stage regression, Model (4). Table 8 reports the regression results, which show that after introducing *IMR*, the coefficient for *Narcissism_D* is 0.069, which means CFO narcissism is significantly positively correlated with audit fees at no less than the 1% level. The coefficient for *IMR* is significantly negative at no less than the 10% level, indicating that other unobserved factors have a significant negative impact on audit fees.

Table 8
Heckman two-step model.

	The first stage *Narcissism_D* (1)			The second stage *Lnfee* (2)	
	Coeff.	z-value		Coeff.	t-value
Constant	−0.612	−0.750	Constant	4.040	13.377***
EDU	0.173	5.000***	*Narcissism_D*	0.069	12.606***
IC	0.045	0.400	*CEO_AGE*	0.003	3.853***
SIZE	0.017	1.070	*AO*	−0.238	−6.665***
LEV	−0.030	−0.320	*IC*	−0.057	−1.322
LOSS	−0.028	−0.440	*SIZE*	0.417	72.640***
BSIZE	0.029	2.590***	*REC*	0.162	2. 984***
IBD	0.038	0.100	*INV*	−0.031	−0.650
SHARE	0.008	7.280***	*QUICK*	−0.013	−3.330***
GROWTH	−0.050	−1.970**	*LEV*	−0.189	−4.541
			LOSS	0.073	2.918***
			ROA	−0.105	−0.772
			IBD	0.333	3.009***
			DUAL	−0.015	−1.111
			BMT	0.006	3.943***
			IMR	−0.113	−1. 937*
YEAR		YES	*YEAR*		YES
IND		YES	*IND*		YES
Pseudo.R^2		0.026	adj.R^2		0.660
Chi^2		219.25	F-value		469.210
N		6081	N		6081

5. Further analysis

5.1. The effect of differences in property rights

Due to the peculiarities of China's institutional background, many listed companies in China's capital market are restructured from state-owned enterprises, and corporate decisions and executive appointments are susceptible to government influence (Liu and Yang, 2013). The ultimate controller of such companies is the State-owned Assets Supervision and Administration Commission (SASAC). Due to the complicated control chain in state-owned enterprises, although the government assigns the executives, it is difficult for the SASAC to effectively supervise these executives. The close connection between the management of state-owned enterprises and government not only means there are fewer legal constraints on state-owned enterprises, but also causes their managers to believe that they have a higher social status (Menglan and Minghui, 2009). This relatively loose environment with minimal supervision encourages narcissistic CFOs to engage in more aggressive behavior, which increases corporate violations. Compared with non-state-owned enterprise CFOs, state-owned enterprise CFOs are more likely to have a political identity, which makes it easy to move between the government and state-owned enterprises and between state-owned enterprises. This flow may aggravate the agency conflict between the CFO and shareholders, and thus increase internal control defects (Cheng and Wang, 2018). Auditors need to be more cautious with state-owned enterprises with narcissistic CFOs, and thus perform more complex audit procedures and take more risks, which increases audit fees. Because narcissistic executives generally favor risky strategies, they may increase internal control deficiencies, reduce organizational performance, and even induce intentional or unintentional errors (Campbell et al., 2011; Rhodewalt et al., 2006; Ham et al., 2017). Studies have shown that different property rights lead to different audit risks and different bargaining powers, which affects audit fees (Zhang and Hu, 2013). Therefore, narcissistic CFOs may have different effects on audit fees under different property rights.

We divide the sample into two groups according to property rights. There are 2,470 observations in the state-owned enterprise group and 3,611 observations in the non-state-owned enterprise group. Table 9 reports

Table 9
Effect of different property rights.

	Lnfee *SOE* (1)		*Lnfee* *NSOE* (2)	
	Coeff.	t-value	Coeff.	t-value
Constant	1.408	3.296***	6.540	17.209***
Narcissism	0.102	11.942***	0.038	5.652***
Test of difference in α_1 *b0-b1*				−0.068***
CEO_AGE	0.008	4.249***	0.001	0.908
AO	−0.211	−3.565***	−0.196	−4.577***
IC	0.069	1.079	−0.172	−3.065***
SIZE	0.468	57.978***	0.356	48.829***
REC	0.307	3.248***	0.042	0.665
INV	0.083	1.091	−0.086	−1.442
QUICK	−0.011	−1.300	−0.012	−2.982***
LEV	−0.326	−4.739***	0.021	0.401
LOSS	−0.001	−0.018	0.130	4.106***
ROA	−0.313	−1.185	0.097	0.640
IBD	0.386	2.100**	0.018	0.133
DUAL	−0.046	−1.445	−0.002	−0.164
BMT	0.005	2.067**	0.007	3.735***
YEAR		YES		YES
IND		YES		YES
adj.R^2		0.707		0.571
F-value		248.743		201.448
N		2470		3611

the group test results. Column (1) is the regression result of the state-owned enterprise group. The regression coefficient for *Narcissism* is 0.103 ($t = 11.972$, $p < 0.01$). Column (2) shows the regression result of the non-state-owned enterprise group. The regression coefficient for *Narcissism* is 0.036 ($t = 5.479$, $p < 0.01$), indicating a significant positive correlation between CFO narcissism and audit fees. We further test the coefficient difference between the state-owned and non-state-owned enterprise groups. The coefficient difference test shows the result of *b0-b1* is −0.068 at no less than a 1% level. In other words, the regression coefficient for CFO narcissism in non-state-owned enterprises is significantly smaller than that for state-owned enterprises, indicating that in state-owned enterprises, CFO narcissism has a stronger positive effect on audit fees.

5.2. The mediating effect of financial information

To further identify how narcissistic CFOs increase audit fees, we explore the relationship between CFO narcissism and the quality of corporate financial information. To some extent, earnings quality is an important indicator of the quality of financial information. The executives of listed companies may manipulate financial information to maintain the expected performance indicators, and even maliciously manipulate earnings (Wei et al., 2009). Therefore, we use the level of corporate earnings quality, *FIQ,* as mediating variable to examine the mechanism by which narcissistic CFOs affect audit fees. According to the estimated absolute value of manipulable accrued profit estimated by the modified Jones model, companies whose earnings are less than the median have a low degree of earnings manipulation, and their information quality is considered to be better; in this case, *FIQ* is equal to one, and otherwise it is zero. First, we separately construct two regression models, Models (5) and (6). Model (5) uses the dummy variable *FIQ* as the dependent variable, *Narcissism* as the explanatory variable, and performs a logistic regression. Model (6) uses *lnfee* as the dependent variable, and *FIQ* and *Narcissism* as explanatory variables. Using these two models, the mediating effect of corporate earnings quality is tested. If the regression coefficient $k_1 * v_1$ in Models (5) and (6) is significantly different from zero, this indicates a mediating effect; otherwise no mediating effect exists.

Table 10 reports the results of the regression. As shown in column (1), there is a significantly negative correlation between CFO narcissism and the financial information quality of listed companies at no less than the

Table 10
Mediating effect of financial information.

	FIQ (1)			*Lnfee* (2)	
	Coeff.	z-value		Coeff.	t-value
Constant	1.558	1.180***	Constant	3.907	13.742***
Narcissism	−0.123	−4.680***	*FIQ*	−0.065	−5.717***
CEO_AGE	−0.003	−0.680	*Narcissism*	0.069	12.677***
AO	0.858	4.890***	*CEO_AGE*	0.004	3.993***
IC	−0.241	−1.210	*AO*	−0.222	−6.235
SIZE	0.001	−0.030	*IC*	−0.057	−1.337***
REC	−2.183	−8.250***	*SIZE*	0.421	80.466***
INV	−0.649	−2.790***	*REC*	0.129	2.365**
LEV	0.473	2.325***	*INV*	−0.043	−0.910
BSIZE	−0.025	−1.310	*QUICK*	−0.015	−3.839***
IBD	−1.648	−2.730***	*LEV*	−0.200	−4.811***
DUAL	−0.055	−0.840	*LOSS*	0.070	2.805***
BMT	−0.033	−4.440***	*ROA*	−0.124	−0.91
SHARE	0.001	0.390	*IBD*	0.289	2.634***
			DUAL	−0.017	−1.244
			BMT	0.005	3.405***
YEAR		YES	*YEAR*		YES
IND		YES	*IND*		YES
Pseudo R^2		0.041	adj.R^2		0.660
Chi^2		343.230	F-value		472.661
N		6081	N		6081

1% level, indicating that CFO narcissism reduces financial information quality. Column (2) examines the relationship between financial information quality and audit fees. The results show a significantly negative correlation between financial information quality and audit fees at no less than the 1% level; that is, the worse the quality of the company's financial information, the higher the audit fee. The regression coefficient k_1*v_1 in Models (5) and (6) is significantly different from zero, indicating that there is a mediating effect. CFO narcissism in listed companies reduces financial information quality and leads to higher audit costs. In other words, financial information quality has a partial mediating effect on how CFO narcissism increases audit fees.

$$\begin{aligned} FIQ_{i,t} = {} & k_0 + k_1 Narcissism_{i,t} + k_2 CEO\_AGE_{i,t} + k_3 AO_{i,t} + k_4 IC_{i,t} + k_5 SIZE_{i,t} + k_6 REC_{i,t} + k_7 INV_{i,t} \\ & + k_8 LEV_{i,t} + k_9 BSIZE_{i,t} + k_{10} IBD_{i,t} + k_{11} DUAL_{i,t} + k_{12} BMT_{i,t} + k_{13} SHARE_{i,t} + \Sigma YEAR_{i,t} \\ & + \Sigma IND_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{5}$$

$$\begin{aligned} Lnfee_{i,t} = {} & v_0 + v_1 FIQ_{i,t} + v_2 Narcissism_{i,t} + v_3 CEO\_AGE_{i,t} + v_4 AO_{i,t} + v_5 IC_{i,t} + v_6 SIZE_{i,t} + v_7 REC_{i,t} \\ & + v_8 INV_{i,t} + v_9 QUICK_{i,t} + v_{10} LEV_{i,t} + v_{11} LOSS_{i,t} + v_{12} ROA_{i,t} + v_{13} IBD_{i,t} + v_{14} DUAL_{i,t} \\ & + v_{15} BMT_{i,t} + \Sigma YEAR_{i,t} + \Sigma IND_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{6}$$

5.3. The mediating effect of accounting firm prestige

The above results demonstrate that CFO narcissism has a stable and significant positive correlation with the audit fees of Chinese listed companies, and that CFOs influence audit fees by affecting the quality of corporate financial information. Financial information quality has a partial mediating effect on how CFO narcissism increases audit fees. This also shows that there may be other variables that modify to influence of CFO narcissism on audit fees. We therefore conduct a test of the mechanism by which CFO narcissism affects audit fees. Narcissistic CFOs hope to obtain the support of a firm with a high reputation to gain external recognition of their business capabilities, so they usually choose a high-reputation accounting firm to provide audit services, such as an international Big 4 accounting firm or one of the top 10 accounting firms in the "List of Top 100 Domestic Accounting Firms (Comprehensive Evaluation)" issued by the Chinese Institute of Certified Public Accountants each year. On the one hand, Cai et al. (2005) point out that large-scale accounting firms tend to have more professional capabilities and independence. To maintain their reputation and independence, large-scale accounting firms are more likely to issue high-quality audit reports (Wang and Zhang, 2014). The high reputation of accounting firms with a brand effect in the audit market mean they can charge a premium (Zheng and Zheng, 2017). On the other hand, a financial department led by a narcissistic CFO is less efficient and the quality of internal control is worse. Compared with non-narcissistic CFOs, the financial risk and operating risk may be higher. As a benchmark in the industry, accounting firms with higher rankings have strict, high-standard audit procedures, which increases audit fees and reduces litigation risks. The higher audit fees compensate for the expected cost of high risks. Therefore, the company with a narcissistic CFO may choose an audit firm with a high comprehensive evaluation, which leads to an increase in audit fees. We use the methods of Sobe (1982) and Yuan et al. (2018) to test the mediating effect of high-reputation accounting firms on CFO narcissism and audit fees. We test the regression coefficient $z_1*\delta_1$ in Models (7) and (8), and find it is significantly different from zero, which means that the mediation effect exists. First, we separately construct two regression models to test the mediation effect of high-reputation firms. Model (7) uses *BIG4* as the dependent variable, and *Narcissism* as the independent variable, and performs logistic regression. Model (8) uses *Lnfee* as the dependent variable, and *BIG4* and *Narcissism* as independent variables. *BIG4* represents whether the annual audit of a listed company is provided by one of the international Big 4 accounting firms. If it is, BIG4 is equal to one; otherwise it is zero. The regression results are shown in Table 11.

Table 11
Mediating effect of prestigious accounting firms – BIG4.

	BIG4 (1)			*Lnfee* (2)	
	Coeff.	z-value		Coeff.	t-value
Constant	−40.000	−12.950***	Constant	5.055	18.202***
Narcissism	0.362	6.550***	*BIG4*	0.537	23.337***
CEO_AGE	0.007	0.630	*Narcissism*	0.057	10.816***
AO	−0.845	−1.790*	*CEO_AGE*	0.003	3.694***
IC	1.786	3.840***	*AO*	−0.185	−5.405**
SIZE	1.071	17.770***	*IC*	−0.104	−2.538***
REC	0.93.	1.740*	*SIZE*	0.378	70.546***
INV	−0.565	−1.040	*REC*	0.129	2.472**
LEV	−2.098	−5.110***	*INV*	0.013	0.281
BSIZE	0.026	0.750	*QUICK*	−0.012	−3.298***
IBD	−0.853	−0.650	*LEV*	−0.129	−3.217***
DUAL	−0.298	−1.620	*LOSS*	0.063	2.626***
BMT	−0.028	−1.840*	*ROA*	−0.153	−1.169
SHARE	0.009	2.280**	*IBD*	0.223	2.113***
			DUAL	−0.012	−0.911
			BMT	0.008	5.271***
YEAR		YES	*YEAR*		YES
IND		YES	*IND*		YES
Pseudo R^2		0.352	adj.R^2		0.686
Chi^2		1129.92	F-value		532.722
N		6081	N		6081

$$BIG4_{i,t} = z_0 + z_1 Narcissism_{i,t} + z_2 CEO\_AGE_{i,t} + z_3 AO_{i,t} + z_4 IC_{i,t} + z_5 SIZE_{i,t} + z_6 REC_{i,t} + z_7 INV_{i,t} + z_8 LEV_{i,t} + z_9 BSIZE_{i,t} + z_{10} IBD_{i,t} + z_{11} DUAL_{i,t} + z_{12} BMT_{i,t} + z_{12} SHARE_{i,t} + \Sigma YEAR_{i,t} + \Sigma IND_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$Lnfee_{i,t} = \delta_0 + \delta_1 BIG4_{i,t} + \delta_2 Narcissism_{i,t} + \delta_3 CEO\_AGE_{i,t} + \delta_4 AO_{i,t} + \delta_5 IC_{i,t} + \delta_6 SIZE_{i,t} + \delta_7 REC_{i,t} + \delta_8 INV_{i,t} + \delta_9 QUICK_{i,t} + \delta_{10} LEV_{i,t} + \delta_{11} LOSS_{i,t} + \delta_{12} ROA_{i,t} + \delta_{13} IBD_{i,t} + \delta_{14} DUAL_{i,t} + \delta_{15} BMT_{i,t} + \Sigma YEAR_{i,t} + \Sigma IND_{i,t} + \varepsilon_{i,t} \quad (8)$$

Column (1) of Table 11 shows the regression results. There is a significantly positive correlation between CFO narcissism and whether listed companies choose a Big 4 accounting firm, indicating that narcissistic CFO choose Big 4 accounting firms.

Column (2) examines the relationship between audit fees and whether companies choose a Big 4 accounting firm. The results show a significantly positive correlation between audit fees and the choice of a Big 4 accounting firm. This means the company's choice of a Big 4 accounting firms increases audit costs. From the above, we know that the regression coefficient $z_1*\delta_1$ in Models (5) and (6) is significantly different from zero, indicating a partial effect; that is, the effect of CFO narcissism in listed companies is mainly due to the choice of prestigious accounting firms to provide audit services, which leads to higher audit fees. Furthermore, to improve the robustness of our identification of the mediating effect of prestigious firms on CFO narcissism and audit fees, we replace *BIG4* in Models (5) and (6) with *BIG10*. *BIG10* is a variable representing the choice of one of the first 10 accounting firms in the "Top 100 Domestic Accounting Firms (Comprehensive Evaluation) List" issued by the Chinese Institute of Certified Public Accountants every year. If the annual audit of a listed company is provided by one of the top 10 accounting firms, *BIG10* is equal to one, and otherwise is zero. Table 12 reports the regression results of the mediating effect of Big 10 accounting firms. The regression coefficient $z_1*\delta_1$ is still significantly different from zero, indicating a partial mediating effect. In other words, CFO narcissism leads a company to choose a high-reputation accounting firm to provide audit services, which leads to higher audit fees. The previous conclusion is robust.

Table 12
Mediating effect of prestigious accounting firms – BIG10.

	BIG10 (1)			*Lnfee* (2)	
	Coeff.	z-value		Coeff.	t-value
Constant	−4.109	−3.050***	Constant	3.895	13.718***
Narcissism	0.104	3.870***	*BIG10*	0.074	6.475***
CEO_AGE	0.005	0.890	*Narcissism*	0.068	12.653***
AO	−0.080	−1.180	*CEO_AGE*	0.004	3.939***
IC	−0.144	−0.470	*AO*	−0.234	−6.602***
SIZE	0.190	6.910***	*IC*	−0.054	−1.256
REC	0.184	0.700	*SIZE*	0.417	79.293***
INV	−0.009	−0.040	*REC*	0.158	2.917***
LEV	−0.467	−2.880***	*INV*	−0.031	−0.659
BSIZE	0.054	2.730***	*QUICK*	−0.013	−3.443***
IBD	0.404	0.660	*LEV*	−0.188	−4.531***
DUAL	0.198	3.020***	*LOSS*	0.067	2.705***
BMT	−0.021	−2.850***	*ROA*	−0.114	−0.837
SHARE	0.007	4.080***	*IBD*	0.314	2.864***
			DUAL	−0.019	−1.434
			BMT	0.006	4.025***
YEAR		YES	*YEAR*		YES
IND		YES	*IND*		YES
Pseudo R^2		0.0261	adj.R^2		0.660
Chi^2		213.750	F-value		473.697
N		6081	N		6081

6. Conclusion

This paper makes use of a sample of 1,457 listed companies in China's A-share market from 2012 to 2017 to explore the relation between CFO narcissism and audit fees. It also examines how property rights modify this effect and examines the mediation effect of corporate financial information quality and accounting firm prestige. The empirical results indicate that CFO narcissism significantly increases the audit fees of listed companies, and this effect is stronger in state-owned enterprises. Further research suggests that CFO narcissism affects audit fees by reducing corporate financial information quality and inducing the company to select a high-reputation accounting firm.

The research in this paper has both theoretical and practical implications. Based on behavioral economics theory, this paper empirically analyzes the effect of CFOs' narcissistic personality characteristics on corporate economic activities. It thus goes beyond the limitations of traditional corporate governance theories, and enriches the research on the impact of background characteristics on audit fees. In terms of practice, this paper uses CFO signature size as a proxy for the difficult-to-measure personality trait of CFO narcissism. The paper's findings will be helpful for those who wish to understand the effects of executive narcissism in listed companies in China. It also provides a reference for the selection of executives and the establishment of corporate governance mechanisms.

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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Board secretary and market information efficiency: Evidence from corporate site visits

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ABSTRACT

Using the setting of corporate site visits, this study examines the information interpretation role of board secretaries on market information efficiency. We find that the presence of the board secretary during corporate site visits can significantly improve the information content of such visits. From the perspective of information interpretation ability, when the board secretary has a dual role, receives high relative compensation, and has a high level of education, his or her participation in site visits has a greater effect on improving the informativeness of such visits. From the perspective of information asymmetry, the information interpretation role of the board secretary is more pronounced when the level of information asymmetry between the firm and its investors is high. Further analysis shows that when the board secretary attends more site visits, the level of analyst forecast error is lower. In summary, we confirm the information interpretation role of board secretaries, which is useful for opening the "black box" of their participation in the information assimilation process and for better understanding of how to improve market information efficiency.

1. Introduction

Board secretaries serve as links between firms and investors (Gao and Wang, 2015; Jiang et al., 2016a). Although board secretaries have various responsibilities, including information disclosure, corporate governance, investor relations management, market value management, and capital operations, their most impor-

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tant responsibility is information disclosure and investor relations management. As an information officer, the board secretary is responsible for the entire information disclosure process. Board secretaries communicate company information to the public, supervise company's compliance with disclosure regulations, help relevant parties to fulfill their obligations, and are responsible for keeping undisclosed material information confidential. As an investor relations officer, the board secretary is responsible for organizing investor relations activities (e.g., shareholder meetings, earnings conferences, road shows, and corporate visits), receiving corporate visits from investors, providing media consultations, and answering questions from investors on online interactive platforms, among others. According to institutional arrangements, board secretaries participate in the entire information disclosure process, including information production, release, dissemination, and assimilation (Shannon, 1948; Jiang et al., 2016a). However, in practice, the question of whether and how board secretaries play a role in every information disclosure process is a common concern for regulators, the market, and firms.

The board secretary is responsible for the company's information disclosure, and thereby participates in the entire information disclosure process, from information release to information assimilation, and seeks to improve investors' assimilation and understanding of company information throughout the process. Indeed, the literature shows that board secretaries can improve information disclosure quality in the information release process (Zhou et al., 2011; Xing et al., 2019; Lin et al., 2016; Gao and Wu, 2008; Bu and Sun, 2018; Gao and Wang, 2015; Peng et al., 2019; Wang and Wang, 2019) and information processing efficiency in the information dissemination process (Mao et al., 2013; Jiang et al., 2016a, 2016b). However, few studies focus on the specific impacts of board secretaries on investors' information assimilation efficiency. Regulators have used earnings conferences, corporate visits, interactive online Q&A platforms (e.g., "Hu Dong Yi" and SSE E-interactive), and road shows to guide firms to improve their interpretation support. In this context, corporate visit is becoming one of the most important methods of interaction between firms and investors. Previous studies confirm the positive effect of corporate site visits on investors' information processing efficiency (Kong et al., 2015b; Cheng et al., 2019; Tan and Cui, 2015; Cao et al., 2015; Li and Pan, 2018).

Therefore, corporate visits provide a good setting for us to observe the specific role and effect of board secretaries in the information assimilation process. First, corporate visit is a typical process of interactive communication. The purpose of corporate visits is to increase transparency and fairness in information disclosure and to help investors better understand firms. Firms can proactively interpret the information that investors are interested in and address their concerns. In the corporate visit process, the board secretary is in charge of the reception and responsible for not only arranging the visit, including the time, location, and participants, but also attending the conference, answering investor questions, and writing a report on the visit. Attending corporate visits is one of the main responsibilities of board secretaries, which can be used to observe their skills. Second, according to the SZSE Information Fair Disclosure Guidelines,[1] firms can only interpret public information, while releasing undisclosed material information is prohibited.[2] This rule separates the process of information interpretation from that of information release, making it possible to test whether the information interpretation role of the board secretary can effectively improve investors' information processing efficiency.

Therefore, we study the influence of board secretaries on investors' information processing efficiency in the information assimilation process, using a sample of firms listed on Shenzhen Stock Exchange (SZSE) with records of corporate visits between 2012 and 2019. We obtain the following results. First, the presence of the board secretary during corporate site visits can significantly improve the informativeness of site visits. Second, from the perspective of the ability of board secretaries to interpret information, when board secretaries

[1] According to the SZSE Information Fair Disclosure Guidelines, "the listed firm and the relevant information disclosure obligatory shall not disclose or divulge to the specific target separately in private and in advance." The Guidelines for the Standardized Operation of Listed Firms published by the SZSE in 2010 also stipulate that "Listed firms and related information disclosure agents shall not disclose or divulge undisclosed material information in any form when they accept the visits, communication and interview activities of specific objects. They can only use publicly disclosed information and undisclosed non-material information as communication content. Otherwise, the company shall immediately publicly disclose the undisclosed material information."

[2] Material information refers to information that has or may have a significant effect on stock prices or affects the decision of investors (SZSE, Information Fair Disclosure Guidelines, 2006). The guidelines prohibits the disclosure of information that is likely to affect stock prices. Therefore, a firm can only discuss information that does not affect its stock price. If there is no new information that could affect the stock price, this can be considered as interpretation rather than disclosure.

have a high level of education, have a dual role, and receive high relative compensation, their participation in site visits has a greater effect on improving the informativeness of corporate site visits. Third, from the perspective of information asymmetry, the information interpretation role of board secretaries is more pronounced for diversified firms, firms not audited by Big 4 auditors, and firms with high operational uncertainty. Fourth, when board secretaries attend more site visits and higher proportion of site visits, the levels of analyst forecast error and analyst forecast dispersion are lower.

Our study contributes to the literature in three ways. First, this study demonstrates the positive influence of board secretaries on market information efficiency from the perspective of information assimilation. The literature has mainly focused on board secretaries' influence on the market through the processes of information release and information dissemination. By focusing on corporate site visits, this study examines the influence of board secretaries on investors' information assimilation efficiency without considering the influence of information quality and the information dissemination process. Our study thus complements the literature by analyzing the role of board secretaries in influencing information assimilation. Second, studying the visualized scene of corporate site visits helps to open the "black box" of the information assimilation process by board secretaries. Most of the board secretary's work related to information disclosure is carried out within the firm and therefore cannot be observed. In contrast, corporate site visit is a public activity in which the board secretary's specific activities in designing the visit, communicating with investors, and writing a report can be observed, providing evidence of the influence of the board secretary on the information assimilation process. Third, the literature shows the impact of analyst characteristics on the outcome of corporate site visits, including analyst distribution, analyst pressure, joint visits from analysts and funds, and relational visits (Cheng et al., 2016a; Han et al., 2018; Tang et al., 2017; Xiao and Ma, 2019), and the effect of institutional investors (Tan et al., 2019b; Li et al., 2018; Tan and Lin, 2016; Xiao and Ma, 2019). However, there is little empirical evidence of the effect of host on corporate site visits. Our study enriches and extends the literature by examining the role of the host in corporate site visits.

The remainder of this paper is organized as follows. Section 2 reviews the related literature and develops the hypothesis. Section 3 describes the research design, including the data source and sample selection, model and variables, and descriptive statistics for the main variables. Section 4 presents the empirical results and relevant robustness tests. Finally, Section 5 concludes the study.

2. Literature review and hypothesis development

Information asymmetry is an important factor affecting information efficiency, and information disclosure is an important way to reduce the information asymmetry between firms and investors. The behavior and quality of firms' information release, dissemination, and assimilation affect investors' information processing costs and thus affect the information efficiency of the capital market. During a corporate site visit, the information interpretation process can be better observed. The board secretary is responsible for organizing the site visit, so his or her professional judgment and skills have a significant influence on the outcome of the site visit.

2.1. Corporate disclosure and market information efficiency

Information efficiency is the foundation of the stock market. The main way to improve information efficiency is to process information in a timely and accurate manner (Tan et al., 2016). According to efficient market theory, in a semi-strong efficient market, prices can fully reflect all public information (Fama, 1970). However, the price drift after earnings announcements (Ball and Brown, 1968) contradicts this assumption, and investors bear the cost of processing public information (Bhushan et al., 1994). Scholars argue that investors' attention is limited, so they cannot pay attention to all information (Simon, 1955) and cannot fully and effectively assimilate information. This limited information processing capacity often forces investors to ignore certain information or to respond insufficiently to information disclosed by a firm (Sims, 2003). Even if investors pay attention to all information, they cannot fully understand it. When investors cannot fully understand firms' information disclosure, and market efficiency decreases (Loughran and McDonald, 2014; Blankespoor et al., 2019). For example, Hirshleifer et al. (2009) find that when more than one firm release earnings

announcement on the same day, the price and trading volume on that day fall, and the price drift phenomenon is more severe.

As mentioned earlier, information asymmetry is an important factor affecting market information efficiency. A large number of studies examine ways to improve market information efficiency. Studies show that information transparency (Wang et al., 2009), institutional ownership (Wang and Wang, 2011; Kong et al., 2015a), and incremental information provided by analysts can improve information efficiency (Zhu et al., 2008; Li and Pan, 2018). Media coverage also improves information efficiency by reducing price synchronization, with various media types having different effects on information efficiency (Huang and Guo, 2014; Yang et al., 2016). Adding information sources can improve investors' assimilation of existing business information. For instance, increased disclosure by peer firms helps investors assimilate information about their stocks (Yu and Wang, 2010). Investors who communicate with firms through "Hu Dong Yi" or SSE E-interactive can obtain more accurate information, also improving information efficiency (Tan et al., 2016; Meng et al., 2019; Ding et al., 2018)

Research on capital market information efficiency focuses mainly on the quantity and quality of information disclosure and the role of institutional investors, analysts, media, and investors in interpreting information, but ignores the role played by information publishers themselves (Mao et al., 2013). Valuable information must go through the process of information release, dissemination, investor response, and management response, from the firm to its investors (Blankespoor, 2018).

First, in the information release process, firms must determine what information to disclose and how, and must ensure that their disclosure complies with the requirements (e.g., truthful expression and relevance) and the information representation mode, as readability and professional terms affect investors' information assimilation efficiency (You and Zhang, 2009; Tan et al. 2019a; Michels, 2017). The board secretary plays a major role in information quality in the information release process. Zhou et al. (2011) find that the overall information disclosure quality of listed firms has improved significantly since the senior executive status of the board secretary was confirmed in the new *Company Law*. Factors such as the gender, dual role (e.g., director and other senior executive titles), working experience, and social capital of the board secretary influence his or her information channels and professional skills, which affect the accuracy of management's earnings forecasts (Xing et al., 2019) and disclosure quality, as evaluated by SZSE (Lin et al., 2016; Gao and Wu, 2008; Bu and Sun, 2018; Gao and Wang, 2015). Excessive compensation of board secretaries also reduces the likelihood of information disclosure violations and improves disclosure quality (Peng et al., 2019).

In the information dissemination process, firms choose an appropriate time and channel for information dissemination based on the content of the information disclosed. The information environment of the firm and the information processing costs of its investors may be affected by these choices, such as whether information is released on Friday and whether multiple issues are disclosed at the same time, or whether information is disseminated via the media or social media (Dellavigna and Pollet, 2009; Blankespoor, 2018; Jung et al., 2018). As the person responsible for publishing information, the board secretary plays a key role in the information transmission process (Mao et al., 2013), and the release time and channel choices should not only meet compliance and timeliness requirements but also coordinate the company's multiple issues to help investors receive and assimilate information. As a result, the board secretary's professional judgment and skills influence investors' information processing in the information dissemination process (Jiang et al., 2016b).

In the information assimilation process, firms interpret existing information to help their investors better understand and absorb that information. Regulators have also actively implemented a series of measures to protect the rights and legitimate interests of investors, especially for medium and small investors with poor ability to interpret information. The Guidelines on Investor Relations in Listed Firms published by the China Securities Regulatory Commission (CSRC) in 2005 aim to guide listed firms continuously improve their information interpretation service through multiple means, such as earnings conferences, corporate visits, interactive online Q&A platforms, and road shows. In this context, listed companies' information disclosure has shifted from declaration to interaction (Zhao and Zhao, 2018). Information demanders and providers jointly participate in the generation of information content through interaction and communication (Miller and Skinner, 2015). With the launch of "Hu Dong Yi" by the SZSE, the level of analyst forecast dispersion is

reduced (Tan et al., 2016), and companies' interactive online Q&A activities on the platform reduce investors' divergence (Ding et al., 2018). However, no study has examined whether the board secretary, as the investor relations officer in China, fully plays his or her role in the interaction and communication between firms and investors, or how this role is fulfilled.

2.2. Interactive communication and corporate visits

The mode of communication between listed firms and investors has changed from declaration to interaction: investors can obtain information about a company by communicating with that company (Miller and Skinner, 2015).

Organizing corporate visits is one of the important modes of interactive communication for listed companies. During a corporate visit, the company arranges for its investors and analysts to visit the company, organizes discussions, and communicates with them, so that visitors can understand the company's business, operations, financial situation, and other matters. For example, BESTORE (SH603719) organized a corporate site visit on August 24, 2020. The company first presented its financial data and operations. Then, during the interactive Q&A session, investors asked about the company's supply chain development model, online and offline business, and the development of subdivided product markets.

Compared with other interactive communication modes (e.g., "Hu Dong Yi", earnings conferences, Weibo), corporate site visits, as a form of face-to-face communication, provide more information than verbal communication. First, investors can obtain information from non-verbal expressions such as tone and body language (Cheng et al., 2016a). Second, by interacting with information spokespersons, investors can better judge the credibility of the disclosed information (Blankespoor, 2018). Indeed, information spokespersons can respond to investors' questions and misconceptions in a timely manner. They also have a significant influence on investors' assimilation of information and their evaluation of information reliability. As a result, during corporate site visits, investors can better observe the characteristics of spokespersons and their communication performance (Brochet et al., 2018). For analysts, compared with online communication, offline site visits can visualize the company's information. Specifically, analysts can obtain information by observing the company's operations. They can investigate manufacturing companies with more intangible assets and more business, which increases the effectiveness of site visits (Cheng et al., 2016a).

Site visits are increasingly becoming the main channel for interactive communication between companies and investors. Although corporate site visits do not provide new information, studies confirm their positive effect on investors' information processing efficiency. Institutional investors can obtain information advantages by visiting listed companies (Kong et al., 2015b), allowing them to make more informed transactions (Solomon and Soltes, 2015) and to increase their shareholdings (Cheng et al., 2019). Analysts can improve their forecast accuracy after corporate site visits (Cheng et al., 2016a; Han et al., 2018; Tan and Cui, 2015), reduce stock price synchronicity (Cao et al., 2015), and improve the market response to their annual reports (Li and Pan, 2018). Corporate visits also help the market better understand listed firms. For instance, stock market reactions are generally positive around corporate visits (Kirk and Markov, 2016; Cheng et al., 2019; Bowen et al., 2018).

However, research on corporate site visits primarily focuses on information intermediaries in the visit process, such as the characteristics of analysts in different places, analyst pressure, joint visits from analysts and funds, and relational visits (Cheng et al., 2016a; Han et al., 2018; Tang et al., 2017), and on the characteristics of institutional investors, such as location and type (Tan et al., 2019b; Li et al., 2018; Tan and Lin, 2016; Xiao and Ma, 2019), little attention is paid to the efforts of the information providers themselves during the site visit process. In fact, organizing corporate site visits is an important investor relations activity. The sample used in this study shows that companies receive on average more than 10 site visits each year. In recent years, corporate site visits have become more frequent, and some listed companies have received hundreds of visits.[3] How should the visit process be properly organized? What information should be explained during the site visit? How can the company communicate information correctly and effectively to investors? All of these questions

[3] For example, Hikvision (SZ002415) revealed in its 2019 annual report that it received 231 investor visits during the year.

affect the effectiveness of corporate information interpretation. During a site visit, whether and how the board secretary, as the person in charge of the visit,[4] performs his or her duties and how the efficiency of information assimilation can be improved remain unclear and require further analysis.

2.3. Corporate visits and information assimilation by the board secretary

As mentioned above, to enhance investors' access to information, regulators have regulated corporate disclosure compliance, enhanced the quality of disclosure, and increased information channels. More importantly, special positions have been created, of which the board secretary is a key example (Gao and Wu, 2008; Zhou et al., 2011). The scope of the board secretary's responsibilities is detailed in the Companies Act amended in 2005: "A listed company shall have a secretary of the board of directors whose responsibilities include the preparation of the general meeting of shareholders and meetings of the board of directors, the preservation of documents, the management of relevant matters concerning information disclosure," thus legally establishing the position of the board secretary as an executive. Subsequently, the CSRC and the stock exchanges issued a number of regulations to specify the role of the board secretary in various aspects, including information disclosure practices, corporate governance and regulatory operations, and investor relations management. The board secretary is involved in the entire process of planning, communicating, and verifying the organization of corporate visits for investors, which are among the most important activities related to investor relations management and information interpretation in a company.

During the planning phase, the board secretary, as the organizer, influences the overall design of the site visit. First, the board secretary must confirm the list of visitors. Research shows that visitors influence the effectiveness of site visits: visits in which only analysts participate provide more incremental information than those attended by both analysts and other participants (Cheng et al., 2016a), and joint site visits with funds and analysts provide more information than visits with funds alone (Tang et al., 2017). The board secretary can arrange the list of visitors by visitor type for a better site visit and good investor relationships. Second, the board secretary must confirm the duration of the visit. The length of communication between investors and companies can affect the effectiveness of their interaction (Kirk and Markov, 2016). The board secretary can choose the required duration of a site visit. For example, a site visit with mutual funds with large shareholdings will involve a longer meeting (Bowen et al., 2017). Third, the board secretary must confirm the location of the site visit. Either the company's meeting room can be used, or a detailed observation of the production site can be arranged for communication with investors. The different scopes of a site visit will affect investors' understanding and may confirm their concerns, for example, about products that are not sufficiently universal. Accordingly, if investors can visit the production site to observe the production process, product characteristics, and quality control process, it will improve their understanding of the company. For example, Shaanxi Coal (SH601225) invited its investors to descend into a well and to visit a coal mining site during a site visit. As a result, investors were able to understand the performance of coal mining equipment and facilities and the coal mining process. Fourth, the board secretary must arrange the participation of company's reception. As a rule, company participants should inform the board secretary[5] of their attendance prior to a site visit. It should be noted that speaking on behalf of the company during a site visit should be avoided unless specifically authorized to do so.[6] Indeed, research shows that participants involved in interactive communica-

[4] As stipulated in the Guidelines on Relations between Listed Companies and Investors (CSRC, 2005), "The Company shall determine that the board secretary is responsible for investor relations." The main responsibilities of investor relations management are as follows. (1) Analysis and research: the board secretary is responsible for analyzing the composition of investors, paying continued attention to investor opinions and media reports, and providing timely feedback to the board and management. (2) Communication and liaison: the board secretary is responsible for integrating and publishing the information required by investors, organizing site visits, and maintaining regular contacts with institutional investors and small and medium investors. (3) Establish and maintain public relations.

[5] Guidelines of the SZSE for the Standardized Operation of Firms Listed on the Main Board 5.2.16: "Any directors, supervisors and senior management of a listed company should inform the board secretary before accepting interviews and site visits with specific targets, and the board secretary is deemed to make proper arrangements for the interview or site visit."

[6] Guidelines of the SZSE for the Standardized Operation of Firms Listed on the Main Board 7.3: "A listed firm should establish an investor relations management mechanism and designate the board secretary as the person responsible for investor relations management, and any other directors, supervisors, senior management and employees of the company should refrain from speaking on behalf of the company in investor relations activities unless they have been specifically authorized and trained."

tion on behalf of their company affect the content of information obtained by investors (Kirk and Markov, 2016). Communication involving marketing officers can help external investors obtain information about the current state of the company's operating income and future growth (Koo and Lee, 2018). In companies with high valuation uncertainty, middle managers may have more information that can help investors make decisions (Kirk and Markov, 2016). Therefore, the board secretary can enhance investors' understanding of the company by inviting the right executives.

In the communication stage, whether the board secretary presents during the site visit also affects its actual effectiveness. During site visits, firms usually take the initiative to inform investors about their strategy, culture, and operations to enhance investors' understanding and identification with the firms (Kirk and Markov, 2016). As the investor relations officer, the board secretary is more aware of the concerns of investors than other executives (Brown et al., 2019), so he or she is better capable to convey information in a targeted manner. Compared with other professional executives, the board secretary can interpret the public information in detail in a simple and easy manner to reduce investor misunderstandings, such as explaining jargon, reading between the lines of an announcement, reminding investors of the company's overall strategy, and refining the information disclosed (Chapman et al., 2019).

Another important feature of a site visit is that the company needs to answer investor questions in detail. When investors visit a company, they are interested in the company's products, future industry developments, investments, and sales, but most of the questions generally revolve around the company's financial and technical prospects (Bowen et al., 2018). As these questions often relate to several areas at the same time, the board secretary's understanding and answers are more comprehensive, as he or she has better access to the firm's overall information than other executives. Moreover, the board secretary participates in preparing board meetings and shareholder meetings, so he or she is more aware of the exact internal operations and all types of information about the firm. Studies show that if board secretaries also have other senior executive titles, they have more information channels within the company (Gao and Wang, 2015; Bu and Sun, 2018) and know more about firm-specific information (Chapman et al., 2019). Xingxi Yu (China Railway Construction, SH601186), who is currently the Secretary-General of the Beijing Listed Companies Association and has won the title of "Gold Board Secretary" for five consecutive terms, said in an interview that "Communicating with investors invariably requires the board secretary to have an in-depth understanding of the industry in which the company operates and of the company itself." The board secretary not only helps investors by providing them with comprehensive information about the firm but can also improve the information interpretation process when he or she has certain expertise. For example, studies show that board secretaries with financial experience ensure professionalism and understandability in interpreting information, as they have a better understanding of the ins and outs of financial data and their implied economic significance, which can better dispel investors' doubts about financial data (Mao et al., 2013; Jiang et al., 2016b). Board secretaries with accounting expertise can better answer questions about the financial prospects of firms (Xing et al., 2019).

At the verification and disclosure stage, the board secretary must prepare and publish a report of the site visit in a timely manner. The sooner the secretary publishes a disclosure report, the sooner investors who did not participate in the site visit can be informed. The time lag between the date of the site visit and the date of the disclosure report significantly affects investors' reaction (Bowen et al., 2018). Moreover, the content of the report affects investors' information assimilation, with the textual tone of the report being positively correlated with market reaction (Bowen et al., 2018). As a result, the ability of the board secretary to present the content of a site visit to the market in a timely and accurate manner affects the information content of the site visit.

In summary, the judgment and professionalism of the board secretary, as the company's investor relations manager and the person responsible for corporate site visit matters, will influence the information assimilation by investors during a corporate site visit. Accordingly, we propose the following hypothesis:

Hypothesis: The board secretary can improve investors' information processing efficiency and increase the information content of corporate site visits.

3. Research design

3.1. Data source and sample selection

We obtain data on corporate site visits conducted by firms listed on SZSE between 2012 and 2019 from the China Stock Market and Accounting Research (CSMAR) database. We exclude (1) firms in the financial sector; (2) firms that have changed their board secretary in a given year; (3) firms with multiple site visits on the same day; (4) special treatment (ST) firms; and (5) observations with missing data. We also winsorize all of the continuous variables at the 1st and 99th percentiles. Our final sample includes 33,885 site visit events to 1,455 unique firms during the 2012–2019 period.

The data on corporate site visits come from investor relations activities in the CSMAR database thematic research series, which are derived from the Investor Relations Activity Record of Listed Companies disclosed after a company completes a site visit.

3.2. Research model and variable definitions

To test the effect of the presence of the board secretary on the informativeness of site visits, we follow previous studies (Bushee et al., 2018; Bowen et al., 2018; Cheng et al., 2019) and construct Model (1):

$$CAR_{i,d} = \alpha + \beta Attend_{i,d} + \gamma' CV_{i,d} + \varepsilon_{i,d} \quad (1)$$

where i represents the company, and d represents the site visit date.

The dependent variable CAR represents the market reaction around a site visit, using the standardized absolute value of the market-adjusted abnormal returns in the [0,1] window (Cheng et al., 2019), as model (2) shows. The higher the value of CAR, the greater the market reaction, indicating the higher information content of a site visit.

$$CAR_{i,d} = \frac{ABSAR_{i,[d,d+1]} - MEAN\_ABSAR_{i,[d-146,d-7]}}{STD\_ABSAR_{i,[d-146,d-7]}} \quad (2)$$

Following previous studies (Cheng et al., 2019), $ABSAR_{i,[d,d+1]}$ is the absolute value of the cumulative market-adjusted abnormal returns over the 2-day window [0,1] around a site visit date for firm i, where the site visit date is day 0. $ABSAR_{i,[d,d+1]} = |AR_{i,d}|+|AR_{i,d+1}|$. $AR_{i,d} = R_{i,d} - R_{m,d}$, where $R_{i,d}$ is the daily return of stock i in period d; $R_{m,d}$ is the daily market return in period d (Basu, 1997; Yi et al., 2016). $MEAN\_ABSAR_{i,[d-146,d-7]}$ is the mean of the absolute value of the 2-day cumulative market-adjusted abnormal returns in the normal period, [−146, −7]; and $STD\_ABSAR_{i,[d-146,d-7]}$ is the standard deviation of the absolute value of the 2-day cumulative market-adjusted abnormal returns in the normal period, [−146, −7].

The independent variable $Attend$ is an indicator equal to 1 if the board secretary attends and communicates with the participants during a site visit, and 0 otherwise. CV is a vector of control variables, and includes company size (*Size*), leverage (*Lev*), revenue growth rate (*Revenue*), return on assets (*ROA*), firm growth (*Tobinq*), institutional shareholdings (*Institution*), analysts following (*Analystfollow*), the interval between the site visit date and the report date (*Lndrdate*), and the SZSE information disclosure rating (*Rank*). In addition, we control for firm and year fixed effects. Table 1 reports the variable definitions.

If our hypothesis is true, β should be significantly positive. Site visits attended by the board secretary have higher information content than those without the board secretary, indicating that the market reaction to site visits is stronger. Therefore, the board secretary helps investors assimilate information.

3.3. Descriptive statistics

Table 2 reports the descriptive statistics of the participation of the board secretary in site visits by industry. As Table 2 shows, the top five industries in which the board secretary attends corporate site visits (in percentage) are Comprehensive, Health and social work, Construction, Hotel and catering, and Information transmission, software, and IT services. Thus, investors can obtain more visual information from corporate site visits in the first four categories of industries. The fifth category, Information transmission, software, and

Table 1
Variable definitions.

Variable	Definition
CAR	The difference between the absolute value of 2-day cumulative market-adjusted abnormal returns in the event period and the mean of the absolute value of 2-day cumulative market-adjusted abnormal returns in the normal period, [−146, −7] before the site visits, divided by the standard deviation of the absolute value of the 2-day cumulative market-adjusted abnormal returns in the normal period.
Attend	An indicator variable that equals 1 if board secretary attend and communicate in the site visits, and 0 otherwise.
Size	The natural logarithm of the total asset.
Lev	Total debt divided by total assets.
Revenue	The percentage change in revenue over the previous year.
ROA	Net income divided by total assets.
Tobinq	Market value divided by book value.
Institution	The ownership of institutional investor.
Analystfollow	The natural logarithm of 1 plus the number of analysts following.
Lndrdate	The natural logarithm of 1 plus days between site visit date and report date.
Rank	SZSE information disclosure rating, 1 is fail, 2 is pass, 3 is good, and 4 is excellent.

Table 2
Industry distribution.

Industry	% of board secretary attending visits	Number of board secretary attending visits	Number of visits
Agriculture, forestry, livestock farming, fishery	56.250%	198	352
Mining	67.647%	138	204
Manufacturing	72.452%	5018	6926
Electricity, heat, gas and water	53.055%	165	311
Construction	83.520%	745	892
Wholesale and retail	66.047%	782	1184
Transportation	53.347%	263	493
Hotel and catering	81.416%	92	113
Information transmission, software and IT services	79.784%	1922	2409
Real estate	49.943%	437	875
Leasing and commerce services	61.475%	150	244
Scientific research and technical services	75.731%	259	342
Water conservancy, environment and public facilities	76.310%	364	477
Health and social work	94.667%	71	75
Culture, sports and entertainment	70.000%	203	290
Comprehensive	100.000%	10	10

IT services, is a high-tech industry that is generally characterized by very technical and more professional information about the company. Therefore, it is more difficult for investors to understand that information, requiring the board secretary to communicate more with investors.

Table 3 presents the descriptive statistics of the main variables. In our sample, about 72.6% of the site visits are attended by board secretaries. The mean (median) of *CAR* on the [0,1] window is 0.118 (−0.190), with a standard deviation of 1.177, indicating that there is a variation in *CAR* around the days of site visits.

4. Empirical results

The empirical method of this study is divided into three parts. First, the main analysis examines the relationship between the presence of the board secretary and the information content of site visits. Second, to account for potential endogeneity problems, we use various methods to conduct robustness tests, including

Table 3
Descriptive statistics of main variables.

Variables	N	Mean	Median	Std.	Min	Max
CAR	3,3885	0.118	−0.190	1.177	−1.421	4.995
Attend	3,3885	0.726	1	0.446	0	1
Size	3,3885	22.26	22.07	1.235	20.15	25.99
Lev	3,3885	0.386	0.377	0.188	0.050	0.799
Revenue	3,3885	0.230	0.168	0.332	−0.358	1.935
ROA	3,3885	0.058	0.051	0.046	−0.076	0.204
Tobinq	3,3885	2.248	1.893	1.235	0.923	7.687
Institution	3,3885	0.399	0.411	0.230	0.007	0.843
Analystfollow	3,3885	2.403	2.485	0.827	0.693	3.892
Lndrdate	3,3885	0.985	0.693	0.706	0	4.007
Rank	3,3885	3.327	3	0.567	1	4

controlling for investor characteristics in the model, deleting site visits around company announcements, deleting site visits on adjacent dates, using the propensity score matching (PSM) method, changing the calculation method of the dependent variable, and testing the influence of omitted variables. To test the influence mechanism, we further examine the moderating effect of information supply and investors' information demand. Finally, in additional analyses, at the firm-year level, we examine the impact of the total number and proportion of site visits attended by the board secretary on the analyst forecast error and analyst forecast dispersion.

4.1. Presence of the board secretary and informativeness of site visits

Table 4 reports the regression results of Model (1). Column (1) reports the results without the control variables. The coefficient on *Attend* is positive and significant (coefficient = 0.040, $t = 2.773$). When we control for firm and year fixed effects in Column (2), the coefficient on *Attend* is still positive and significant (coefficient = 0.051, $t = 2.723$). After adding the firm-level control variables and controlling for firm and year fixed effects in column (3), the coefficient on *Attend* is positive (coefficient = 0.050, $t = 2.696$) and significant at the 1% level. These results show that the presence of the board secretary during site visits helps to improve the information content of site visits, supporting our hypothesis.

4.2. Robustness tests

First, considering that the composition of visitors may affect the outcome of site visits, following previous studies (Cheng et al., 2016a; Tang et al., 2017; Xiao et al., 2017), we add the following control variables related to visitor characteristics in Model (1): whether funds participate in site visits (*Dummy_fund*), whether brokerages *(analyst*) participate in site visits (*Dummy_security*), and whether star brokerages participate in site visits (*Dummy_star*). Star brokerages refer to brokerage research institutions selected as the top local research institutions by *New Fortune* during the 2012–2019 period. Column (1) of Table 5 reports the results with the visitor characteristic variables. The coefficients on *Dummy_fund* and *Dummy_star* are positive and significant at the 1% level. These results show that the participation of funds and star brokerages can improve the information content of site visits. The coefficient on *Attend* is still positive (0.037) and significant at the 5% level, so our main conclusion remains unchanged.

Second, to control for the impact of company event announcements on the market reaction to site visits, we delete all observations with announcements seven days before and after the day of a site visit. Column (2) of Table 5 reports the results of this analysis. The coefficient on *Attend* is 0.054, which is significant at the 1% level, demonstrating the robustness of our main results.

Third, to control for the influence of adjacent site visits on the market reaction, we delete all of the observations of the same firm in which the interval between adjacent site visits is less than two days. Column (3) of

Table 4
Board secretary attendance and informativeness of site visits.

Dependent Variable=	*CAR*		
	(1)	(2)	(3)
Attend	0.040***	0.051***	0.050***
	(2.773)	(2.723)	(2.696)
Size			−0.013
			(−0.421)
Lev			−0.107
			(−0.998)
Revenue			−0.027
			(−1.037)
ROA			−0.592*
			(−1.953)
Tobinq			0.048***
			(4.017)
Institution			0.088
			(1.293)
Analystfollow			−0.062***
			(−4.130)
Lndrdate			0.001
			(0.120)
Rank			0.004
			(0.243)
Constant	0.089***	0.081***	0.454
	(7.291)	(5.452)	(0.647)
Firm Fixed Effects	NO	YES	YES
Year Fixed Effects	NO	YES	YES
Observations	33,885	33,885	33,885
Adj. R-squared	0.0002	0.031	0.032

This table reports results from the OLS regression. All of the regressions include the firm and year fixed effects. Robust t-statistics are in parentheses. The superscripts ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5 reports the results of this analysis. The coefficient on *Attend* is still positive and significant (coefficient = 0.048, $t = 2.290$), so our main conclusion remains valid.

Fourth, column (4) of Table 5 reports the results with our PSM sample. Considering that whether or not the board secretary attends a site visit is not an exogenous event, omitted variable bias may be a problem. To address this concern, we adopt the PSM method. Based on the control variables of Model (1), we use 1:1 nearest neighbor matching without replacement between the sample of board secretaries attending site visits and that of board secretaries not attending site visits. After matching, Model (1) is re-estimated using paired samples. The coefficient on *Attend* is still significant and positive (coefficient = 0.106, $t = 4.282$), so our main conclusion remains robust.

Fifth, in column (5) of Table 5, we change the calculation method of the dependent variable. We use the market model method to calculate expected returns. $R_{i,d} = \alpha + \beta R_{m,d} + \varepsilon_{i,d}$, where $R_{i,d}$ is the daily return of stock in period d; $R_{m,d}$ is the daily market return in period d; and α and β are calculated using a 140-day window $[-146, -7]$ as the estimation period, and the expected returns are calculated over [0,1]. The abnormal return is measured as the actual return minus the expected return. Then, we obtain the dependent variable *CAR_M*, the absolute value of the cumulative abnormal returns. The coefficient on *Attend* with *CAR_M* is positive and significant.

Sixth, in column (6) of Table 5, we change the window of site visit events. We calculate the dependent variable $CAR_{[0,2]}$ as the standardized absolute value of the cumulative market-adjusted abnormal returns over the 3-day window [0,2] around the date of a site visit event. The coefficient on *Attend* is significant and positive

Table 5
Robustness tests.

Dependent Variable=	*CAR*	*CAR*	*CAR*	*CAR*	*CAR_M*	$CAR_{[0,2]}$
	Add visitor characteristics variables	Delete site visits around announcements sample	Delete site visits on adjacent dates sample	PSM sample	Market model method	Change event window
	(1)	(2)	(3)	(4)	(5)	(6)
Attend	0.037**	0.054***	0.048**	0.106***	0.001**	0.064***
	(1.962)	(2.825)	(2.290)	(4.282)	(2.266)	(2.667)
Size	−0.007	−0.002	0.010	−0.058	−0.003***	0.027
	(−0.226)	(−0.066)	(0.282)	(−1.171)	(−4.188)	(0.645)
Lev	−0.126	−0.061	−0.094	−0.225	−0.005*	−0.126
	(−1.172)	(−0.550)	(−0.779)	(−1.378)	(−1.839)	(−0.902)
Revenue	−0.030	−0.025	−0.037	−0.009	0.002***	−0.006
	(−1.138)	(−0.901)	(−1.233)	(−0.242)	(3.657)	(−0.180)
ROA	−0.568*	−0.545*	−0.662*	−0.295	0.005	−0.642
	(−1.875)	(−1.735)	(−1.953)	(−0.672)	(0.724)	(−1.637)
Tobinq	0.046***	0.041***	0.055***	0.038**	0.003***	0.094***
	(3.858)	(3.314)	(4.055)	(2.008)	(10.468)	(6.106)
Institution	0.067	0.099	0.080	0.083	−0.002	0.202**
	(0.987)	(1.411)	(1.048)	(0.776)	(−1.089)	(2.291)
Analystfollow	−0.075***	−0.067***	−0.050***		−0.086***	0.002***
−0.077***						
	(−4.936)	(−4.345)	(−2.974)	(−3.935)	(5.217)	(−3.942)
Lndrdate	−0.003	−0.004	0.008	−0.010	−0.000	0.017
	(−0.241)	(−0.338)	(0.590)	(−0.691)	(−0.562)	(1.120)
Rank	0.007	0.007	0.014	0.004	−0.001***	−0.000
	(0.374)	(0.361)	(0.680)	(0.155)	(−3.043)	(−0.010)
Dummy_fund	0.092***					
	(6.616)					
Dummy_security	−0.018					
	(−0.965)					
Dummy_star	0.106***					
	(6.739)					
Constant	0.280	0.191	−0.162	1.618	0.099***	0.200
	(0.398)	(0.264)	(−0.207)	(1.452)	(6.128)	(0.221)
Firm Fixed Effects	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	33,748	31,554	26,554	18,486	33,885	33,885
Adj. R-squared	0.035	0.032	0.028	0.042	0.136	0.042

This table reports the results from the OLS regression. All of the regressions include the firm and year fixed effects. Robust t-statistics are in parentheses. The superscripts ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

(coefficient = 0.064, $t = 2.667$). Overall, the presence of the board secretary during site visits helps to improve their information content.

Finally, to test the sensitivity of our results to possible omitted variables, we follow previous studies (Frank, 2000; Larcker and Rusticus, 2010) and use the impact threshold for a confounding variable (ITCV) procedure. As shown in Table 6, *Size* has the greatest impact (0.001), and the ITCV value is 0.004, suggesting that a confounding (omitted) variable would have to be four times larger than the most important variable included (*Size*) to reverse the observed relationship between *Attend* and *CAR*. We can conclude that there is no serious omitted variable bias and that our regression results are robust.

Table 6
Impact threshold of confounding variables.

	Impact on coefficient for *Attend* *CAR*
Size	0.0010
Lev	0.0000
Revenue	−0.0060
ROA	−0.0001
Tobinq	−0.0006
Institution	−0.0004
Analystfollow	0.0003
Lndrdate	0.0000
Rank	0.0000
Largest impact	0.0010
Impact threshold of confounding variable	0.0040
Minimum magnitude of confounding variable relative to largest impact included variable required to overturn *Attend*	4

This table reports the results of the impact threshold of a confounding variable (ITCV) analysis.

4.3. Moderating effect analysis

4.3.1. Information supply perspective: Board secretary's information interpretation ability

According to upper echelons theory, the personal characteristics of executives affect their professional performance (Hambrick and Mason, 1984). When the information interpretation ability of the board secretary is higher, his or her influence on the information content of site visits is greater. In this section, we measure the information interpretation ability of the board secretary from three dimensions: dual role, relative compensation, and education level.

First, board secretaries who have a dual role are better able to access more comprehensive information. Prior studies show that the information interpretation ability of board secretaries can be improved when they have other executive titles, as they can participate in more daily operations and important decisions of their company, have more information channels and higher information power, communicate more effectively (Gao and Wu, 2008; Gao and Wang, 2015; Jia and Wen, 2016), and have a better understanding of information disclosure (Bu and Sun, 2018). Therefore, we divide our sample of board secretaries into two groups based on whether they have other executive titles. We expect board secretaries with a dual role to be better able to interpret company information during site visits. Columns (1) and (2) of Table 7 report the results. The coefficient on *Attend* in the dual role group is positive (0.040) and significant at the 10% level. In contrast, the coefficient on *Attend* in the single-role group is not significant. These results show that board secretaries who have other executive titles can help to improve the information content of site visits, resulting in a stronger market reaction.

Second, the higher the compensation of board secretaries, the greater their ability to interpret company information. Compensation is a comprehensive index for measuring individual skills. The relative compensation of executives can reflect their contribution to their company and their influence in the company (Cheng et al., 2016b). If board secretaries receive higher compensation, it indicates that they have more skills (Jia and Wen, 2016). We measure the relative compensation of the board secretary based on the compensation of the three highest paid executives in the company. We expect board secretaries with high relative compensation to have a greater ability to interpret information, thereby increasing the information content of site visits. The sample is divided into two groups according to the median of the annual relative compensation. Columns (3) and (4) of Table 7 report the results. The coefficient on *Attend* for the high compensation group is significant and positive (0.054). However, the coefficient on *Attend* in the low compensation group is not significant. These results show that board secretaries with high relative compensation have a greater ability to interpret company information, and they can better play a role in the information interpretation process and improve the informativeness of site visits by helping investors to assimilate that information.

Table 7
Board secretary attendance and the informativeness of site visits: The degree of board secretaries' information interpretation ability.

Dependent Variable=	*CAR*					
	Dual role (1)	Single role (2)	High compensation (3)	Low compensation (4)	High educated (5)	Low educated (6)
Attend	0.040*	0.040	0.054**	0.028	0.071***	0.043
	(1.923)	(0.885)	(1.966)	(1.056)	(2.612)	(1.476)
Size	−0.034	0.120	−0.052	−0.105**	0.033	−0.083
	(−0.928)	(1.079)	(−0.991)	(−2.024)	(0.669)	(−1.581)
Lev	−0.052	−0.576*	0.038	−0.260	−0.289*	0.082
	(−0.424)	(−1.681)	(0.224)	(−1.474)	(−1.787)	(0.457)
Revenue	−0.028	−0.095	−0.012	−0.055	−0.029	−0.024
	(−0.927)	(−1.242)	(−0.295)	(−1.238)	(−0.698)	(−0.605)
ROA	−0.569*	−0.162	−0.982**	0.210	−0.086	−1.235***
	(−1.664)	(−0.183)	(−1.967)	(0.458)	(−0.177)	(−2.612)
Tobinq	0.049***	0.057	0.042**	0.039**	0.046***	0.032
	(3.685)	(1.513)	(2.338)	(2.082)	(2.603)	(1.639)
Institution	0.108	0.062	0.136	0.109	0.170*	0.114
	(1.434)	(0.283)	(1.229)	(1.041)	(1.654)	(1.004)
Analystfollow	−0.062***	−0.048	−0.052**	−0.047**	−0.058**	−0.036
	(−3.632)	(−1.121)	(−2.206)	(−1.992)	(−2.549)	(−1.551)
Lndrdate	0.006	−0.024	0.010	−0.001	0.006	0.007
	(0.443)	(−0.916)	(0.587)	(−0.036)	(0.356)	(0.392)
Rank	0.006	−0.022	0.045	−0.033	−0.026	0.022
	(0.315)	(−0.428)	(1.515)	(−1.236)	(−0.954)	(0.771)
Constant	0.867	−2.305	1.092	2.634**	−0.501	1.859
	(1.090)	(−0.920)	(0.952)	(2.297)	(−0.457)	(1.638)
Firm Fixed Effects	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	27,613	5,801	16,649	16,765	16,203	15,345
Adj. R-squared	0.033	0.038	0.041	0.031	0.034	0.037

This table reports results of the OLS regression. All of the regressions include the firm and year fixed effects. Robust t-statistics are in parentheses. The superscripts ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Third, the higher the education level of board secretaries, the more likely they are to develop professional skills to interpret information. In other words, board secretaries' level of education reflects the professional knowledge and quality. Research shows that the education level of board secretaries is related to their ability to manage the market value of their company (Jia and Wen, 2016). We expect board secretaries with a higher level of education play a greater role in improving the information content of site visits. To test this conjecture, the sample is divided into two groups based on whether the board secretary has a Master's degree. Columns (5) and (6) of Table 7 report the results. The coefficient on *Attend* in the high education level group is significant and positive (0.071). In contrast, the coefficient on *Attend* in the low education level group is not significant. These results show that board secretaries with a higher level of education have a greater ability to interpret company information.

4.3.2. Investor information demand perspective: The level of information asymmetry

The level of information asymmetry between firms and investors affects investor demand for information interpretation. The higher the level of information asymmetry in the company, the greater the demand for information from investors, the greater the contribution of the board secretary to investors' information assimilation, and the greater the market information efficiency (Chapman et al., 2019). In this section, we use whether a company is diversified, whether it is audited by a Big 4 auditor, and a company's operational uncertainty to measure the level of information asymmetry. We expect companies with a high level of

Table 8
Board secretary attendance and the information content of site visits: The degree of investor information asymmetry.

Dependent Variable=	*CAR*					
	(1) Diversified	(2) Specialized	(3) Non-Big 4	(4) Big 4	(5) High uncertainty	(6) Low uncertainty
Attend	0.056**	0.040	0.048**	0.075	0.066***	0.030
	(2.184)	(1.369)	(2.466)	(1.258)	(2.612)	(1.030)
Size	0.037	−0.096*	−0.028	0.101	−0.037	0.039
	(0.737)	(−1.779)	(−0.846)	(0.507)	(−0.772)	(0.621)
Lev	−0.219	−0.021	−0.114	−0.004	−0.120	−0.083
	(−1.440)	(−0.110)	(−1.031)	(−0.007)	(−0.679)	(−0.476)
Revenue	−0.054	0.001	−0.017	−0.263**	−0.050	0.028
	(−1.493)	(0.020)	(−0.637)	(−2.053)	(−1.368)	(0.435)
ROA	−1.180***	−0.438	−0.655**	1.515	0.092	−1.543***
	(−2.658)	(−0.871)	(−2.090)	(1.045)	(0.204)	(−3.043)
Tobinq	0.048***	0.050***	0.050***	0.035	0.021	0.067***
	(2.623)	(2.645)	(4.003)	(0.500)	(0.997)	(3.712)
Institution	0.105	0.054	0.076	−0.100	0.139	0.044
	(1.010)	(0.506)	(1.087)	(−0.281)	(1.273)	(0.410)
Analystfollow	−0.078***	−0.035	−0.050***	−0.201***	−0.089***	−0.038
	(−3.739)	(−1.335)	(−3.200)	(−2.797)	(−3.807)	(−1.578)
Lndrdate	−0.000	0.008	0.013	−0.069**	−0.014	0.014
	(−0.018)	(0.474)	(1.034)	(−2.157)	(−0.891)	(0.787)
Rank	0.027	0.008	0.014	−0.012	0.015	0.003
	(1.045)	(0.283)	(0.738)	(−0.143)	(0.566)	(0.100)
Constant	−0.629	2.137*	0.707	−1.759	1.069	−0.749
	(−0.569)	(1.829)	(0.983)	(−0.364)	(0.995)	(−0.555)
Firm Fixed Effects	YES	YES	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	18,812	14,250	31,638	2247	16,907	16,978
Adj. R-squared	0.038	0.034	0.032	0.042	0.038	0.032

This table reports the results of the OLS regression. All of the regressions include the firm and year fixed effects. Robust t-statistics are in parentheses. The superscripts ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

information asymmetry to have a more helpful board secretary to help investors assimilate company information, resulting in a stronger market reaction.

First, the business activities and business environment of diversified companies are more complex (Cang et al., 2020), so it is more difficult for investors to assimilate information. Therefore, in diversified companies, investors need more help in interpreting company information. Following Zhang and Zeng (2010), if the number of business or industry divisions of a company is greater than 1, we classify it as a diversified firm, and if the number of business or industry divisions of a company is equal to 0, we classify it as a specialized firm. To test our conjecture, the sample is divided into two groups. Columns (1) and (2) of Table 8 report the results. The coefficient on *Attend* is positive and significant at the 5% level in the diversified firm group; however, the coefficient on *Attend* is not significant in the specialized firm group. These results show that board secretaries of diversified companies improve the informativeness of site visits by helping investors to assimilate that information.

Second, high-quality audit firms play a supervisory role and reduce information asymmetry (Bu and Sun, 2018; Wang and Wang, 2019). Therefore, investors demand more information for non-Big 4 companies. We divide the sample into two groups, and columns (3) and (4) of Table 8 report the results. The coefficient on *Attend* is positive and significant at the 5% level in the non-Big 4 firm group. In contrast, the coefficient on *Attend* is not significant in the Big 4 firm group. These results show that board secretaries of low-quality audit firms is more important in assimilating information.

Third, the higher the operational uncertainty of a company, the higher the information asymmetry for its investors (Lin et al., 2015), and the more likely the board secretary is to play a role in the information assimilation process. To test this conjecture, we use the standard deviation of revenue over the past two years as a

proxy for operational uncertainty. To this end, the sample is divided based on the median of the annual data. Columns (5) and (6) of Table 8 report the results. The coefficient on *Attend* is positive and significant at the 1% level in the high uncertainty group. However, the coefficient on *Attend* is not significant in the low uncertainty group. These results show that in firms with a high level of information asymmetry, investors need more help with information assimilation. The board secretary improves the information content of site visits by attending these visits.

4.4. Additional analysis: Presence of the board secretary and analyst forecast errors

The empirical evidence presented above shows that there is a significant and positive correlation between the presence of the board secretary and the informativeness of site visits, and that this relationship is more significant in firms with a board secretary who has a greater ability to interpret information and in firms for which investors face a higher level of information asymmetry. In this section, we further explore the relationship between the number of site visits attended by the board secretaries and the information asymmetry of firms.

Studies show that corporate site visits can improve analysts' forecast accuracy. This improvement comes from the incremental information obtained through face-to-face communication (Cheng et al., 2016a; Han et al., 2018). The number of site visits attended by institutional investors is significantly and positively correlated with firm disclosure quality (Tan and Lin, 2016), and the number of site visits attended by analysts is significantly and positively correlated with the market reaction to the annual reports of firms (Li and Pan, 2018). Following previous studies (Tan and Lin, 2016; Li and Pan, 2018), we construct Model (3):

$$AnalystForecast_{i,t} = \alpha + \beta AttendTimes_{i,t} + \gamma' CV_{i,t} + \varepsilon_{i,t} \quad (3)$$

Table 9
Board secretaries attending site visits and analyst forecast error and dispersion.

Dependent Variable=	*AnalystForecast_Error*		*AnalystForecast_Dispersion*	
	(1)	(2)	(3)	(4)
AttendNum	−0.002***		−0.002***	
	(−2.668)		(−2.904)	
AttendPercent		−0.004*		−0.002
		(−1.903)		(−1.007)
Size	−0.002	−0.002	−0.001	−0.001
	(−1.185)	(−1.189)	(−0.719)	(−0.663)
Lev	−0.028***	−0.027***	−0.021***	−0.021***
	(−4.375)	(−4.333)	(−4.587)	(−4.539)
Revenue	−0.015***	−0.015***	−0.005***	−0.005***
	(−9.680)	(−9.799)	(−4.179)	(−4.301)
ROA	0.461***	0.459***	−0.001	−0.003
	(26.456)	(26.324)	(−0.092)	(−0.200)
Tobinq	0.005***	0.005***	0.003***	0.003***
	(6.647)	(6.623)	(6.129)	(6.097)
Institution	−0.026***	−0.026***	−0.017***	−0.017***
	(−6.691)	(−6.763)	(−6.064)	(−6.151)
Analystfollow	0.009***	0.009***	0.005***	0.004***
	(10.054)	(9.707)	(6.298)	(5.903)
Rank	−0.003***	−0.003***	−0.001	−0.001
	(−2.754)	(−2.770)	(−0.802)	(−0.899)
Constant	0.100**	0.101**	0.041	0.039
	(2.505)	(2.519)	(1.432)	(1.355)
Firm Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Observations	4,489	4,489	4,085	4,085
Adj. R-squared	0.685	0.685	0.205	0.203

This table reports the results of the OLS regression. All of the regressions include the firm and year fixed effects. Robust t-statistics are in parentheses. The superscripts ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

where *i* represents the company, and *t* represents the year. The dependent variable *AnalystForecast* represents either the level of analyst forecast error or the level of analyst forecast dispersion. Following Wu and Hu (2015), the level of analyst forecast error (*AnalystForecast_Error*) is measured as the absolute value of the difference between the median of analysts' earnings per share forecast and the actual earnings per share divided by total assets. The level of analyst forecast dispersion (*AnalystForecast_Dispersion*) is calculated as the standard deviation of analyst forecasts divided by total assets. The smaller the forecast error and the smaller the forecast dispersion, the better the analyst forecast performance. *AttendTimes* is measured either by the total number (*AttendNum*) or the proportion (*AttendPercent*) of site visits attended by board secretaries throughout the year. *CV* is the vector of control variables, as defined previously.

Table 9 reports the results of Model (3). Column (1) shows the results of the regression of *AnalystForecast_Error* on *AttendNum*. The coefficient on *AttendNum* is significant and negative (coefficient = −0.002, $t = -2.668$). In Column (2), the coefficient on *AttendPercent* is also significant and negative (coefficient = −0.004, $t = -1.903$). Columns (3) and (4) report the results of the regression of *AnalystForecast_Dispersion* on *AttendNum* and *AttendPercent*. These results are consistent with our expectations. When the board secretary participates in site visits and communicates with investors, investors are better able to assimilate company information and have reduced information asymmetry.

5. Conclusion

The board secretary is a key participant in the capital market. Numerous studies have explored how to improve the information role of the board secretary to reduce information asymmetry and improve information efficiency in the capital market (e.g., Mao et al., 2013), which has been a challenging "black box". We focus on firms listed on SZSE that organized corporate site visits between 2012 and 2019 and investigate the information interpretation role of their board secretary in the information assimilation process. Our results show that the presence of the board secretary can significantly improve the informativeness of site visits, thereby improving the information efficiency of the capital market. Specifically, from the perspective of the information interpretation ability of board secretaries, board secretaries who have a dual role, high relative compensation, and a high level of education have a greater effect on improving the informativeness of site visits when attending such visits. From the perspective of information asymmetry, for diversified companies, firms not audited by Big 4 auditors, and firms with high operational uncertainty, the information interpretation role of the board secretary is more pronounced. Further analysis shows that when the board secretary attends more site visits, the levels of analyst forecast error and analyst forecast dispersion are lower. In summary, we provide evidence that by attending site visits, the board secretary play an important role in the information interpretation process, reduce the information processing costs of investors, and ultimately improve market information efficiency.

The findings of this study enrich the literature on information dissemination efficiency and corporate site visits and deepen our knowledge of the role of the board secretary. They also have a number of implications. First, with the implementation of the registration-based IPO system, firms are required to disclose more information. Therefore, policymakers and listed firms should consider how to simultaneously improve the quality of information disclosure and the efficiency of information processing. Second, the assessment of listed firms' disclosure quality by regulatory authorities should include the market information efficiency to more accurately measure the disclosure quality of firms and protect investor interests. Therefore, listed firms should (1) disclose understandable information and (2) provide more opportunities to communicate and interact with investors.

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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Waiting and following: Within-industry herding behavior in annual report disclosure

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ABSTRACT

Using the unique scheduled disclosure system for annual reports in China's stock market, we examine within-industry herding behavior in annual report timing. The results reveal the waiting and following behavior strategies used in the annual reporting process within industry. Firms that originally schedule an early (late) disclosure date within their industry are more likely to reschedule to a later (earlier) date. Informational pressure is the dominant mechanism underlying herding in annual reporting, and capital market reputation incentives mainly induce the herding of bad news. Further analysis shows that delaying disclosure via the waiting strategy reduces the future occurrence of restatements, whereas bringing forward disclosure does not change the propensity of future restatements. Overall, we enrich the limited empirical studies on sequential mandatory disclosure decisions within industry.

1. Introduction

As an enhancing qualitative characteristic of financial information, timeliness is conducive to the use of relevant and faithfully represented information (FASB, 2010). The disclosure of earnings and financial reports leads to stock price fluctuations. Thus, to achieve better market performance, managers with information advantages generally time disclosure by trading off between its costs and benefits (Verrecchia, 1983; Gennotte and Trueman, 1996; Graham et al., 2005).

A growing body of literature has found that a firm's behaviors may be influenced by the behaviors of its industry peers (Lieberman and Asaba, 2006; Bird et al., 2018; Lin et al., 2018; Tuo et al., 2020). In turn,

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we argue that a firm's disclosure behavior may also be influenced by that of its industry peers. Firms sequentially make financial disclosure decisions so that managers can observe and consider peer firms' behaviors when making their own disclosure decisions (Tse and Tucker, 2010). Despite being considered in some theoretical studies (Foster, 1981; Dye and Sridhar, 1995; Heinle and Verrecchia, 2015), this fact has long been ignored in empirical research (Tse and Tucker, 2010; Seo, 2021). In the literature, studies on financial disclosure timing have been infrequent, especially those on the timing of mandatory disclosure (Sengupta, 2004; Son and Crabtree, 2011). Studies on the within-industry timing of financial disclosure have been even less frequent. Only Tse and Tucker (2010) study the within-industry timing of voluntary financial disclosure. They find that managers herd in timing bad earnings warnings by releasing them soon after those of industry peers. This allows managers to ascribe earnings shortfalls to external factors and minimize their apparent responsibility. Voluntary disclosure may be substituted by mandatory disclosure (Noh et al., 2019) and the latter is the main information channel for potential and current investors, particularly in emerging markets (Leventis and Weetman, 2004; Ma et al., 2018). Thus, we aim to investigate whether firms herd in mandatory disclosure timing.

The scheduled disclosure system for annual reports, which only exists in China's stock market, provides a unique opportunity to conduct such research. As the system stipulates, at the end of each fiscal year, listed firms must apply to the Shanghai or Shenzhen Stock Exchange to schedule a disclosure date for annual reporting. The scheduled disclosure dates of all firms are published on the website of the exchanges after all firms complete their schedule. This allows each firm to see the scheduled disclosure dates of its industry peers and to infer the position of its own date within its industry. We deem that firms that originally schedule an early date within their industry have a high propensity to delay their disclosure date, whereas firms that originally schedule a late date have a high propensity to bring their disclosure date forward (i.e., to an earlier date). As each firm is given one chance to reschedule, we expect firms with a high propensity to delay (bring forward) to be more likely to delay (bring forward) their disclosure date. The contingent adjustment of the disclosure date depicts the dynamic process of within-industry herding in disclosure timing.

To conduct our empirical study, we use a sample of annual report disclosure cases of A-share listed firms in China from 2001 to 2018. The findings are consistent with our hypothesis. We reveal two strategies used in the annual within-industry reporting process: waiting and following. Firms that originally schedule an early disclosure date within the industry are more likely to reschedule to a later date (i.e., the waiting strategy), whereas firms that originally schedule a late date are more likely to reschedule to an earlier date (i.e., the following strategy). Both of these strategies are significant at the economic level. Specifically, a one-standard-deviation forward move of the scheduled disclosure date within an industry results in a 4.78% increase in the probability of delaying disclosure. Furthermore, a one-standard-deviation backward move of the scheduled disclosure date within an industry leads to a 4.99% increase in the probability of bringing forward disclosure.

We propose three mechanisms that may cause herding: informational pressure, market reputation incentives, and competitiveness. The empirical results provide evidence that informational pressure is the dominant mechanism that causes herding in annual reporting. Firms tend to interpret the dates scheduled by industry peers as better dates, giving them an incentive to reschedule their date to one closer to those of their peers. The probability of rescheduling is much higher when the scheduled disclosure dates of industry peers are more concentrated. Market reputation incentives underlie the herding of bad news. The tests show that a bad-news annual report that is originally scheduled on an early date within industry is more likely to be rescheduled to a later date to be inconspicuous. This finding aligns with previous findings that bad news is released later than expected (Johnson and So, 2018) and tends to cluster (Tse and Tucker, 2010). However, our results do not support the competitiveness mechanism. Herding in annual reporting is thus not a strategy used to maintain competitive advantage or market status.

Additionally, we examine the impact of disclosure herding on the quality of annual reports. The results show that although delayed annual reports generally have a higher probability of being restated, the restatement probability significantly decreases if the reports are delayed via the waiting strategy. It is reasonable to argue that firms that delay disclosure using the waiting strategy have much more time to carefully prepare their reports and have them audited. Nevertheless, no significant difference in quality is observed if a report is brought forward using the following strategy. That is, bringing forward the disclosure date does not damage

the quality of an annual report. This also implies that A-share listed firms are accustomed to withholding their annual reports even if they have already been prepared.

We contribute to the literature in two ways. First, we are among the first to examine the within-industry herding behavior in mandatory disclosure timing by using the unique scheduled disclosure system for annual reports in China's stock market. We reveal the waiting and following strategies used in the annual report disclosure process within industry and explore the underlying mechanisms. In previous leading work, Tse and Tucker (2010) discover that firms herd in timing voluntary warnings, but they do not depict the dynamic process by which this occurs. By considering this process, we contribute to and enrich the scarce body of empirical work on sequential mandatory disclosure decisions within industry, thereby improving the understanding of why and how firms time their disclosures.

Second, we investigate the economic consequences of herding in annual reporting. Previous studies regard clustered disclosure as a means for firms to use investors' limited attention and are primarily interested in the market reaction toward clustered disclosure. Few studies pay attention to the quality of reports. We show that annual report quality is not damaged by herding disclosure. This finding means that clustered annual reports are almost as credible as others, despite the fact that investors need more time to be well informed.

The remainder of this paper proceeds as follows. Section 2 reviews the studies on financial disclosure timing. Section 3 briefly discusses the scheduled disclosure system and develops the hypothesis. Section 4 introduces our sample, data, and empirical model. Section 5 presents the descriptive statistics and the empirical results. Section 6 concludes the paper.

2. Financial disclosure timing

We categorize the studies on financial disclosure timing into two streams: intraday timing and lag timing.

The intraday timing stream concerns the day and time of day that are considered better for information disclosure. As the market reaction upon disclosure largely depends on investors' attention and capabilities to process the information that a disclosure contains, firms tend to disclose good news on trading days and during trading hours but disclose bad news after trading hours, on weekends, or on a busy day of clustered disclosures (Patell and Wolfson, 1982; Dellavigna and Pollet, 2009; deHaan et al., 2015; Brockbank and Hennes, 2018). Two hypotheses underlie intraday timing. One is the opportunism hypothesis, which holds that firms manage their value by timing bad news to a noteless time to avoid intense market reactions (Hirshleifer et al., 2009; Brown et al., 2012). The other is the altruism hypothesis, arguing that the disclosure of bad news is timed to provide less-informed investors time to interpret and evaluate the information (Patell and Wolfson, 1982; Gennotte and Trueman, 1996; Graham et al., 2005).

The literature on lag timing has focused on how long firms take to disclose an event or report, namely, the timeliness of disclosure. The timeliness of information is essential to the stock market (Bartov and Konchitchki, 2017), especially to emerging markets with weak disclosure systems (Ma et al., 2018). Stock markets generally set mandatory rules to ensure the timeliness of financial disclosure, but managers with better information have discretion over when to disclose. As a result, annual reports and earnings announcements tend to be late (Aubert, 2009). Why do firms delay their financial disclosures? Intuitively, it may be due to the extensive work involved in preparing and auditing the reports. Some evidence has shown that firms with multiple segments and greater accounting complexity generally take much more time to disclose earnings (Sengupta, 2004) and that accounting firms need enough time to maintain auditing quality (Lambert et al., 2017). However, Krishnan and Yang (2009) argue that the accelerated filing requirements for 10-K and 10-Q filings in 2003 do not cause a decrease in reporting quality. Some studies have documented that good news and bad news are timed in different manners based on different market reactions. Good news is generally disclosed early, whereas bad news tends to be disclosed late (Givoly and Palmon, 1982; Kross and Schroeder, 1984; Johnson and So, 2018). Another stream of literature has documented that firms time their disclosures to cater to the information demand of stakeholders and that disclosures are accelerated under high demand (Sengupta, 2004; Son and Crabtree, 2011). When focusing on the factors within industry, proprietary costs may be one of the reasons for delaying disclosure. Proprietary costs refer to the costs of preparing and disseminating information and, most importantly, the costs associated with disclosing information that may be proprietary and therefore potentially damaging (Jovanovic, 1982; Verrecchia, 1983). Empirical studies have

found evidence that firms with high proprietary costs tend to delay their financial reports (Wagenhofer, 1990; Sengupta, 2004). Studying the herding effect among industry peers in disclosing negative earnings warnings, Tse and Tucker (2010) find that firms accelerate their warnings in response to those of peer firms and that warnings cluster as a result. It is the only empirical study to explore within-industry disclosure timing.

3. Institutional background and hypothesis development

3.1. Scheduled disclosure system

In the U.S., the annual report and the 10-K report coexist. However, unlike U.S. firms, Chinese listed firms do not need to file a 10-K report. Thus, in China, the annual report serves as the main channel through which potential investors and current shareholders can remain informed about a firm's performance across various dimensions. Note that the annual report contains plenty of detailed information and must be submitted to the exchange and released on the firm's website before a given deadline. Distinct from the situation in many developed stock markets, the fiscal year of Chinese listed firms must agree with the calendar year and annual reports should be disclosed before the end of April.[1] Consequently, many annual reports used to be released during the last 2 weeks of April. To dilute the risks due to clustered disclosure, the China Securities Regulatory Commission (CSRC) issued a pronouncement on December 16, 1997, providing stock exchanges guidance for solving annual report clustering. Soon afterwards, the Shanghai and Shenzhen Stock Exchanges enacted the scheduled disclosure system. The system requires listed firms to apply to schedule a disclosure date before the deadline specified by the exchange. The exchange designates a day for firms that fail to schedule before the deadline. To even out the annual report distribution over the disclosure period, the exchange sets a maximum number of annual reports to be disclosed per day.[2]

As the scheduled disclosure system stipulates, firms that need to change their scheduled disclosure dates shall apply to the exchange with valid reasons and a new date in advance. Each firm can only reschedule its disclosure date once.[3] From the annual reports of 2001 onwards, all of the scheduled disclosure dates are published on the websites of the exchanges after all of the firms complete scheduling. Although the scheduled disclosure system reduces reporting delays and clustering to some extent (Haw et al., 2006), annual reports continue to be delayed and clustered in China's stock market.

3.2. Hypothesis development

Studies on herding behavior or peer effects in financial disclosure have suggested possible underlying mechanisms, such as informational influence and reputational concern (Brown et al., 2006), reduced uncertainty and reputational concerns (Seo, 2021), informational reasons and rivalry reasons (Cano-Rodríguez et al., 2017), and signaling theory and litigation risk (Tuo et al., 2020). We propose three mechanisms that may underlie herding in annual report timing, namely, informational pressure, market reputation incentives, and competitiveness.

The concept of informational pressure originates from the informational social influence discussed by Deutsch and Gerard (1955). Specifically, individuals in a group tend to rely on the information from and interpretations of other group members over their own and are more likely to make decisions similar to those of their peers when they are more uncertain about the correctness of their own judgments. When decisions are made based on the information obtained by observing others' behaviors, herding behavior occurs (Banerjee, 1992). Although the market reaction to disclosure is difficult to predict, a proper disclosure time is believed to better manage the stock price. Firms not only care about the performance comparison among industry peers (Foster, 1981; Lee et al., 2015), but they also monitor when their peers release annual reports (Sinha and Fried,

[1] For example, firms in the U.S. have discretion over the reporting period and only approximately 60% of them choose a December year-end (Li et al., 2014).

[2] The maximum number of annual reports per day was originally 10, but this has since been increased to 25 for the Shenzhen Stock Exchange and 35 for the Shanghai Stock Exchange.

[3] We find that some firms actually change their scheduled disclosure dates more than once.

2008; Li et al., 2014). Informational pressure suggests that when the scheduled disclosure date of a firm deviates from those of its peers, the firm may reconsider it and interpret the scheduled disclosure dates of its industry peers as better choices that incorporate more information. A firm that is more uncertain about the appropriateness of its own scheduled disclosure date has a higher propensity to change the date to one that is closer to those of its peers. We deem that firms that originally schedule an early disclosure date within their industry have a high propensity to reschedule to a later date, whereas firms that originally schedule a late disclosure date within their industry have a high propensity to reschedule to an earlier date.

Market reputation incentives refer to firms' intention to manage their reputation in the stock market by adjusting their disclosure dates. Many studies have documented that bad news is generally delayed (Givoly and Palmon, 1982; Kross and Schroeder, 1984; Johnson and So, 2018), but rational investors have learned to interpret delayed disclosure as a negative signal (Brown et al., 2012; Guttman et al., 2014). Johnson and So (2018) find that earlier-than-expected announcements usually contain better news than later-than-expected announcements. Thus, we predict that firms that schedule a late disclosure date within their industry but report good news have a strong incentive to bring forward their disclosure date to avoid being mistaken for bad firms. Furthermore, we predict that firms that schedule an early disclosure date within their industry but report bad news have a strong incentive to delay their disclosure and issue it alongside others to be inconspicuous. In short, market reputation incentives suggest that firms that intend to report good (bad) news but originally schedule a late (early) disclosure date within their industry have a high propensity to bring forward (delay) disclosure.

In terms of competitiveness, herding in annual report timing may be a strategy for firms to maintain their competitive advantage and market status. One important reason stems from proprietary costs, which refer mainly to the costs associated with disclosing information that may be proprietary and thus potentially damaging (Jovanovic, 1982; Verrecchia, 1983). Due to proprietary costs, firms tend to withhold proprietary information (Verrecchia, 1983; Wagenhofer, 1990; Sengupta, 2004; Graham et al., 2005) to maintain their competitive advantages. Therefore, we argue that proprietary costs cause firms that originally schedule an early disclosure date within their industry to delay disclosure. In addition, when the industry is highly competitive, not following the actions of rival peers may have significant negative consequences for firms' status quo (Cano-Rodríguez et al., 2017). According to some studies, firms that face strong industry competition may have greater incentives to mimic the prior disclosure behavior of rival peers (Brown et al., 2006; Cano-Rodríguez et al., 2017). As such, we predict that firms that originally schedule a late disclosure date within their industry tend to bring disclosure forward.

The above analysis gives rise to the idea that firms that originally schedule an early (late) disclosure date within their industry have a high propensity to delay (bring forward) disclosure. As each firm is only given one chance to reschedule its disclosure date, we expect firms with a high propensity to delay (bring forward) disclosure to be likely to delay (bring forward) their disclosure dates. This kind of contingent disclosure date adjustment depicts the dynamic process of herding in disclosure timing. We state our hypothesis as follows:

H: Firms that originally schedule an early (late) disclosure date within their industry are more likely to reschedule to a later (earlier) disclosure date.

4. Research design

4.1. Data and sample

The scheduled disclosure system was enacted in 1997, but the exchanges only started publicly announcing scheduled disclosure dates in 2001. Hence, we select the disclosure cases of A-share firms listed on the Shanghai and Shenzhen Stock Exchanges from 2001 to 2018 as our initial sample. The research data are collected from the China Stock Market and Accounting Research database, and some missing data are supplemented from the RESSET database.

In this study, we classify firms based on the Industry Classification Guidelines for Listed Companies compiled by the CSRC in 2012. The guidelines use English letters from A to S to represent each of the 19 industrial

categories and, subsequently, a two-digit number to specify 90 industries. For example, the letter C indicates manufacturing and the code C14 indicates food manufacturing. The literature generally uses the first letter to classify firms (Hung et al., 2015; Wang et al., 2017; Chen et al., 2018). Given the considerable number of manufacturing firms (class C), we use the two-digit number following the letter C to classify the firms into specific industries. As a robustness check, we also use the two-digit numbers of all industry categories as a more specific form of classification and reconduct our analysis.

We exclude disclosure cases in which the actual disclosure date is after April 30, observations from industries with fewer than three firms or in which firms schedule the same disclosure date, and observations with missing data. Our final sample consists of 33,968 firm-year observations. All continuous variables are winsorized at the 1% and 99% levels to control for the potential influence of outliers.

4.2. Key variables

4.2.1. Dependent variables

We construct two dependent variables, $DELAY$ and $ADVAN$. $DELAY$ takes the value of 1 if the actual disclosure date is later than the originally scheduled disclosure date, and 0 otherwise. In contrast, $ADVAN$ equals 1 if the actual disclosure date is earlier than the originally scheduled disclosure date and 0 otherwise.

4.2.2. Independent variables

According to the analysis above, a firm's propensity to delay (bring forward) its disclosure date is a function of the within-industry position of its scheduled disclosure date. A much earlier scheduled disclosure date is associated with a higher propensity to delay and a lower propensity to bring forward disclosure, whereas a much later date is associated with a higher propensity to bring forward and a lower propensity to delay disclosure. Corresponding to the two dependent variables, we design two independent variables, *FIRST* and *LAST*, to reflect the within-industry position of each firm's originally scheduled disclosure date. *FIRST* and *LAST* are calculated as follows:

$$FIRST_{i,t} = \frac{n - m_{i,t}}{n - 1} \tag{1}$$

$$LAST_{i,t} = \frac{m_{i,t} - 1}{n - 1} \tag{2}$$

where n is the distinct count of the scheduled disclosure dates of all of the firms in an industry. If an industry has 10 firms and each firm schedules a different disclosure date, then n equals 10. If two of them schedule the same date, then n equals 9. $m_{i,t}$ is the ordinal of firm i's scheduled disclosure date in the distinct disclosure dates of the industry. $FIRST_{i,t}$ and $LAST_{i,t}$ are both between 0 and 1. A $FIRST_{i,t}$ close to 1 means that a firm's scheduled disclosure date is in a very early position within its industry. In contrast, a $LAST_{i,t}$ close to 1 means that the firm's scheduled disclosure date is in a very late position within its industry. One may notice from $FIRST_{i,t} + LAST_{i,t} = 1$ that $FIRST_{i,t}$ and $LAST_{i,t}$ are mutually substitutable and cannot be included in the regression model simultaneously. However, as shown in the following subsection, setting two independent variables simplifies the interpretation of the empirical results.

4.2.3. Control variables

As shown in Table 1, we control for a set of variables that may affect firms' decisions to change their disclosure date. Among all of the control variables, LAG may be the most indispensable one. One may argue that firms that originally schedule an early (late) disclosure date within their industry are probably firms that have a relatively short (long) time to prepare their annual reports and thus are more likely to delay (bring forward) disclosure. Including LAG into the regression models may allow the coefficients on *FIRST* and *LAST* to more accurately capture individual firms' response to the choices of their industry peers.

4.2.4. Empirical model

To conduct our empirical research, we construct two logit models as follows:

Table 1
Variable definitions.

	Variables	Definitions and measurements
Dependent variables	*DELAY*	equals 1 if the actual disclosure date is later than the originally scheduled disclosure date and 0 otherwise
	ADVAN	equals 1 if the actual disclosure date is earlier than the originally scheduled disclosure date and 0 otherwise
Independent variables	*FIRST*	indicates how early a firm's originally scheduled disclosure date is within its industry, as calculated by formula (1)
	LAST	indicates how late a firm's originally scheduled disclosure date is within its industry, as calculated by formula (2)
Control variables	*LAG*	the logarithm of 1 plus the number of days between the fiscal year-end and the originally scheduled disclosure date
	BEFORE	equals 1 if the originally scheduled disclosure date is before the actual disclosure date of the previous year and 0 otherwise
	SIZE	the logarithm of a firm's total assets
	LEV	financial leverage, the ratio of liabilities to assets
	LOSS	equals 1 if earnings are negative and 0 otherwise
	GROWTH	the growth rate of revenues
	UE	unexpected earnings, measured as the earnings in this year less the previous earnings and divided by the absolute value of the previous earnings
	INDEP	board independence, measured as the percentage of independent directors on the board
	FSR	the percentage of shares held by the largest shareholder
	MHR	the percentage of shares held by the top management team
	ROE	return on equity
	OPINION	equals 1 if a firm obtains an unqualified opinion and 0 otherwise
	BIG4	equals 1 if a firm's auditor is a "big four" public accounting firm and 0 otherwise
	CHANGE	equals 1 if a firm hires a new accounting firm this year and 0 otherwise
	ANALYST	the logarithm of 1 plus the number of analysts following the firm
	INDUSTRY	dummy variables of industry
	YEAR	dummy variables of year

$$\text{Logit}(DELAY_{i,t} = 1) = c + \alpha FIRST_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$\text{Logit}(ADVAN_{i,t} = 1) = c + \alpha LAST_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \quad (4)$$

Model (3) is designed to examine the impact of an early scheduled disclosure date within industry on the probability of delaying disclosure. Model (4) examines the impact of a late scheduled disclosure date within industry on the probability of bringing forward disclosure. $Controls_{i,t}$ represents the control variables shown in Table 1. For the convenience of comparing the impacts of different factors, we standardize the non-dummy variables before adding them to the regression models and report the mean marginal coefficients on all of the independent variables. We predict the coefficient α to be significantly positive, which means that the within-industry position of a firm's originally scheduled disclosure date significantly affects the decision to delay or bring forward its disclosure date. This approach allows us to detect the within-industry herding behavior in annual reporting.

5. Empirical results

5.1. Summary statistics

The summary statistics for the major variables used in this study are shown in Table 2. The sample distribution by year is presented in Panel A. The number of observations increases steadily from 943 to 3,461 during the 18 years covered, which coincides with the growth trend of A-share listed firms.

The descriptive statistics for the major variables are presented in Panel B of Table 2. The mean of *DELAY* and the mean of *ADVAN* show that approximately 12.80% of the sample firms delay their disclosure dates and

Table 2
Summary statistics.

Panel A: Sample distribution by year

Year	Freq.	Percent (%)	Year	Freq.	Percent (%)
2001	943	2.78	2010	1,687	4.97
2002	1,015	2.99	2011	2,049	6.03
2003	1,094	3.22	2012	2,301	6.77
2004	1,161	3.42	2013	2,430	7.15
2005	1,264	3.72	2014	2,478	7.3
2006	1,275	3.75	2015	2,597	7.65
2007	1,336	3.93	2016	2,794	8.23
2008	1,449	4.27	2017	3,095	9.11
2009	1,539	4.53	2018	3,461	10.19
			Total	33,968	100

Panel B: Summary statistics of major variables

Variable	Obs.	Mean	SD	Min.	P25	Median	P75	Max.
DELAY	33,968	0.1280	0.3341	0.0000	0.0000	0.0000	0.0000	1.0000
ADVAN	33,968	0.0917	0.2886	0.0000	0.0000	0.0000	0.0000	1.0000
DIFF	7,464	15.5430	14.7341	1.0000	5.0000	11.0000	22.0000	105.0000
FIRST	33,968	0.4240	0.2874	0.0000	0.1591	0.4211	0.6429	1.0000
LAST	33,968	0.5760	0.2874	0.0000	0.3571	0.5789	0.8409	1.0000
LAG	33,968	4.5088	0.2843	2.3979	4.4067	4.5326	4.7274	4.8040
BEFORE	33,968	0.4726	0.4993	0.0000	0.0000	0.0000	1.0000	1.0000
SIZE	33,968	21.8834	1.3912	19.0327	20.9245	21.6964	22.6100	26.7505
LEV	33,968	0.4703	0.2256	0.0560	0.3008	0.4649	0.6232	1.2113
LOSS	33,968	0.1121	0.3155	0.0000	0.0000	0.0000	0.0000	1.0000
GROWTH	33,968	0.2179	0.5751	−0.6808	−0.0204	0.1229	0.3032	4.0798
UE	33,968	−0.2793	4.4086	−29.0293	−0.3066	0.1057	0.5421	13.8219
INDEP	33,968	0.3554	0.0799	0.0000	0.3333	0.3333	0.4000	0.8000
FSR	33,968	0.3600	0.1559	0.0858	0.2371	0.3361	0.4721	0.7498
MHR	33,968	0.0863	0.1728	0.0000	0.0000	0.0002	0.0487	0.6720
ROE	33,968	0.0513	0.1796	−1.1140	0.0255	0.0656	0.1127	0.5430
OPINION	33,968	0.9415	0.2346	0.0000	1.0000	1.0000	1.0000	1.0000
BIG4	33,968	0.0641	0.2449	0.0000	0.0000	0.0000	0.0000	1.0000
CHANGE	33,968	0.1477	0.3548	0.0000	0.0000	0.0000	0.0000	1.0000
ANALYST	33,968	1.2648	1.1733	0.0000	0.0000	1.0986	2.3026	4.3944

Panel C: Means of *DELAY* and *ADVAN* when *FIRST* is above (below) 0.5

	FIRST ≥ 0.5	*FIRST* < 0.5	Mean-diff.	*t*-statistic	*p*-value
N	14,119	19,849			
DELAY	0.1565	0.1077	0.0488	13.2902	0.0000
ADVAN	0.0586	0.1153	−0.0567	−17.9275	0.0000

Note. The variables are as defined in Table 1.

that 9.17% of them bring forward their disclosure dates. That is, approximately 21.97% of the sample firms reschedule their disclosure dates, suggesting that failing to disclose on the originally scheduled disclosure date is a common phenomenon. *DIFF* measures the number of days by which the firms move their disclosure dates, averaging 15.5430 days. This indicates that for the firms that reschedule, the difference between the originally scheduled date and the actual disclosure date is approximately 15 days. Considering that Johnson and So (2018) set a threshold of only 2 days to screen informative moves of announcement dates, we believe that an average 15-day move of disclosure dates should be economically significant.

The means of *FIRST* and *LAST* are 0.4240 and 0.5760, respectively. Theoretically, if the disclosure dates are randomly scheduled by firms, *FIRST* and *LAST* should average 0.5. The deviation from 0.5 implies that firms tend to schedule late disclosure dates within their industry. *BEFORE* shows that 47.26% of the firms originally schedule a disclosure date that is earlier than their actual disclosure date in the previous year. In

addition, 11.21% of the observations report a loss, 94.15% obtain an unqualified opinion, 6.41% hire a "big four" accounting firm, and 14.77% hire a new accounting firm.

We divide the sample into two groups based on whether the variable *FIRST* is no less than 0.5 and report the means of *DELAY* and *ADVAN* for the two subsamples in Panel C of Table 2. $FIRST \geq 0.5$ means that a firm's originally scheduled disclosure date falls in the first half (including the median point) of all of the dates scheduled by the firms in the same industry. In contrast, $FIRST < 0.5$ means that the firm's scheduled disclosure date is in the latter half of all scheduled dates. As shown in Panel C of Table 2, *DELAY* averages 0.1565 when $FIRST \geq 0.5$ and 0.1077 when $FIRST < 0.5$, with a significant difference of 0.0488 ($t = 13.2902$). *ADVAN* averages 0.0586 when $FIRST \geq 0.5$ and 0.1153 when $FIRST < 0.5$, with a significant difference of −0.0567 ($t = -17.9275$). In summary, the firms that originally schedule an early disclosure date within their industry are more likely to delay their disclosure, whereas the firms that originally schedule a late date within their industry are more likely to move their disclosure up. This interpretation is similar to our main hypothesis.

If firms do herd in annual report timing, the actual disclosure dates should be more concentrated than the originally scheduled disclosure dates. In an untabulated test, we compare the industry-year standard deviation of the actual disclosure dates with that of the originally scheduled disclosure dates. We find that 8.73% of the industry-year observations show no change in the standard deviation, 33.15% of them show an increase in the standard deviation, and 58.12% of them demonstrate a decrease in the standard deviation. In other words, the actual disclosure dates of most of the industry-year groups are more clustered than the originally scheduled disclosure dates. This serves as another piece of primary evidence of firms' herding in annual report timing.

5.2. Correlation analysis

The pairwise correlation coefficients among the variables are tabulated in Table 3. *FIRST* is significantly positively correlated with *DELAY* and *LAST* is significantly positively correlated with *ADVAN*, consistent with our hypothesis.

Unsurprisingly, *LAG* is highly correlated with *FIRST* and *LAST*, because a very late scheduled disclosure date within industry is generally a date far from the fiscal year-end. To ensure that the regression results are robust, all of the following regression results are checked and no evidence of severe multicollinearity is found.

5.3. Baseline regression

We conduct multivariate regression analyses to examine the herding behavior in annual reporting, with *DELAY* and *ADVAN* as the dependent variables and *FIRST* and *LAST* as the main independent variables. The baseline regression results are reported in Table 4. The regression results of using *DELAY* as the dependent variable are reported in column (1). The coefficient on *FIRST* is significantly positive ($\beta = 0.0478$, $z = 10.1599$), suggesting that the firms that originally schedule an early disclosure date within their industry are more likely to delay their disclosure. On average, a one-standard-deviation forward move of the originally scheduled disclosure date within industry results in a 4.78% increase in delaying disclosure probability. The regression results of using *ADVAN* as the dependent variable are reported in column (2). The coefficient on *LAST* is also positive and statistically significant ($\beta = 0.0499$, $z = 9.9925$), suggesting that firms that originally schedule a late disclosure date within their industry are more likely to bring forward their disclosure. On average, a one-standard-deviation backward move of the originally scheduled disclosure date within an industry increases the probability of bringing forward disclosure by 4.99%. As shown in Panel B of Table 2, the standard deviations of *FIRST* and *LAST* are equal. Thus, when the within-industry position of the originally scheduled disclosure date moves, the changes in the firms' propensities to delay and bring forward disclosure are almost equal.

In summary, the impact of the within-industry position of the originally scheduled disclosure date on delaying disclosure is only slightly weaker than audit *OPINION* and *LOSS*. Furthermore, its impact on bringing forward disclosure is the largest among all of our independent variables. That is, a firm's timing of mandatory financial disclosure is largely influenced by industry peers. The empirical results reveal the waiting and following strategies in the annual reporting process within industry, which cause the reports to cluster in the time

sequence. This kind of contingent adjustment of the disclosure date reflects the within-industry herding behavior in mandatory financial disclosure.

5.4. Mechanism tests

5.4.1. Informational pressure

To examine whether informational pressure is one of the mechanisms underlying herding behavior in annual report timing, we must measure the informational pressure faced by firms. Informational pressure implies that an individual who is more uncertain about the correctness of his/her judgment and more certain about the correctness of the judgments of others is more likely to be susceptible to informational pressure and to make decisions with the information obtained via observing the behaviors of group members (Deutsch and Gerard, 1955). Therefore, we consider measuring the consistency, or concentration, of the disclosure dates scheduled by industry peers as a proxy for informational pressure. When the scheduled disclosure dates of industry peers are more consistent or concentrated, an individual firm may be more certain about the correctness of peers' choices and suspicious of its own if it is an outlier. We use a variable DAY to denote the number of days between the fiscal year-end and the scheduled disclosure date. For example, if firm i schedules its annual report for year t on February 1 in year $t+1$, then $DAY_{i,t}$ is 32. Based on DAY, we measure the concentration of the scheduled disclosure dates of firm i's industry peers using the following two methods:

Method 1. Calculate the standard deviation ($STD_{-i,t}$) of DAY of all of the firms in the industry except for firm i:

$$STD_{-i,t} = \sqrt{\frac{1}{n-1}\sum_{j=1}^{n}\left(DAY_{j,t} - AVEDAY_{-i,t}\right)^2} \quad (j \neq i) \tag{5}$$

where n is the number of firms in the industry. $AVEDAY_{-i,t}$ is the average DAY of all of the firms in the industry except for firm i. $STD_{-i,t}$ reflects the dispersion of the scheduled disclosure dates of all of the firms in the industry except for firm i. The smaller $STD_{-i,t}$ is, the higher the informational pressure firm i faces.

Method 2. Calculate the average gap ($DIV_{-i,t}$) between each firm's scheduled disclosure date and the median scheduled disclosure date in the industry except for firm i:

$$DIV_{-i,t} = \frac{\sum_{j=1}^{n}\left|DAY_{j,t} - MEDDAY_{-i,t}\right|}{n-1} \quad (j \neq i) \tag{6}$$

where n is the number of firms in the industry. $MEDDAY_{-i,t}$ is the median of DAY of all of the firms in the industry except for firm i. $DIV_{-i,t}$ also reflects the dispersion of the scheduled disclosure dates of all of the firms in the industry except for firm i. The smaller $DIV_{-i,t}$ is, the higher the informational pressure firm i faces.

We split the firms by the year-industry median of $STD_{-i,t}$ and $DIV_{-i,t}$, and denote those below (above) the median as high (low) informational pressure firms. The cross-sectional regression results are reported in Table 5. In columns (1) to (4), informational pressure is proxied by STD. When informational pressure is high, a one-standard-deviation forward move of the scheduled disclosure date within industry induces a 7.06% increase in the probability of delaying disclosure, which exceeds the probability of 4.78% in the baseline regression. However, when informational pressure is low, a one-standard-deviation forward move of the scheduled disclosure date within industry results in only a 0.65% increase in the probability of delaying disclosure, which is insignificant. In columns (3) and (4), when informational pressure is high, a one-standard-deviation forward move of the scheduled disclosure date within industry causes a 7.71% increase in the probability of bringing forward disclosure, which exceeds the probability of 4.99% in the baseline regression. However, when informational pressure is low, a one-standard-deviation forward move of the scheduled disclosure date results in only a 0.59% increase in the probability of bringing forward disclosure, which is insignificant. In columns (5) to (8), DIV is used as the proxy for the informational pressure faced by firm i. Similar results are obtained. Altogether, the results indicate that a firm is more likely to reschedule its disclosure date by referring to the choices of industry peers when they are more concentrated. Thus, informational pressure is identified as an underlying mechanism that causes herding behavior in annual report timing.

Table 3
Correlation coefficient matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. *DELAY*		−0.1218***	0.1090***	−0.1090***	−0.1064***	0.1070***	−0.0151***	0.0878***	0.1213***	−0.0285***	−0.0470***	0.0072	−0.0319***	−0.0397***	−0.0815***	−0.1557***	−0.0074	0.0518***	−0.0616***
2. *ADVAN*	−0.1218***		−0.1337***	0.1337***	0.1270***	−0.0987***	−0.0085	0.0225***	−0.0072	0.0142***	0.0201***	−0.0372***	0.0069	−0.0169***	0.0210***	0.0035	0.0031	0.0278***	−0.0156***
3. *FIRST*	0.1090***	−0.1284***		−1.0000	−0.9649***	0.3669***	−0.0128**	−0.0365***	−0.1570***	0.0912***	0.1242***	−0.0467***	0.0952***	−0.0672***	0.1665***	0.1399***	0.0565***	−0.0092*	0.0806***
4. *LAST*	−0.1090***	0.1284***	−1.0000		0.9649***	−0.3669***	0.0128**	0.0365***	0.1570***	−0.0912***	−0.1242***	0.0467***	−0.0952***	0.0672***	−0.1665***	−0.1399***	−0.0565***	0.0092*	−0.0806***
5. *LAG*	−0.0979***	0.0952***	−0.8642***	0.8642***		−0.3712***	0.0493***	0.0355***	0.1605***	−0.1069***	−0.1290***	0.0811***	−0.1062***	0.0835***	−0.1718***	−0.1355***	−0.0502***	−0.0029	−0.0544***
6. *BEFORE*	0.1070***	−0.0987***	0.3673***	−0.3673***	−0.3440***		−0.0236***	0.0264***	−0.0270***	0.0131**	0.0950***	0.0043	−0.0053	−0.0446***	0.0168***	−0.0089	0.0134**	−0.0029	−0.0444***
7. *SIZE*	−0.0221***	−0.0006	−0.0094*	0.0094*	0.0803***	−0.0209***		0.3318***	−0.1322***	0.0815***	0.0705***	0.0972***	0.1285***	−0.0622***	0.1829***	0.1761***	0.2878***	−0.0495***	0.4711***
8. *LEV*	0.0934***	0.0242***	−0.0445***	0.0445***	0.0217***	0.0298***	0.3027***		0.1997***	0.0009	−0.0067	−0.0230***	0.0038	−0.2861***	−0.0340***	−0.1989***	0.1048***	0.0457***	−0.0739***
9. *LOSS*	0.1213***	−0.0072	−0.1502***	0.1502***	0.1176***	−0.0270***	−0.1336***	0.2328***		−0.2632***	−0.4559***	0.0021	−0.0901***	−0.0964***	−0.4644***	−0.3381***	−0.0514***	0.0398***	−0.2333***
10. *GROWTH*	0.0086	0.0217***	0.0551***	−0.0551***	−0.0773***	0.0054	0.0392***	0.0302***	−0.1611***		0.4149***	−0.0091*	0.0320***	0.0954***	0.3243***	0.1425***	0.0106**	−0.0128**	0.1930***
11. *UE*	−0.0545***	0.0101*	0.1057***	−0.1057***	−0.0947***	0.0424***	0.0628***	−0.1100***	−0.5845***	0.2519***		0.0155***	0.0018	0.0125**	0.4386***	0.1040***	0.0141***	0.0184***	0.1367***
12. *INDEP*	−0.0073	−0.0908***	−0.0469***	0.0469***	0.0769***	0.0136**	0.1315***	−0.0111**	−0.0100*	0.0050	0.0194***		−0.0518***	0.0831***	0.0104*	0.0286***	0.0157***	−0.0241***	0.1405***
13. *FSR*	−0.0305***	0.0083	0.0911***	−0.0911***	−0.0846***	−0.0049	0.1479***	−0.0109**	−0.0870***	0.0207***	0.0374***	−0.0760***		−0.2114***	0.1172***	0.1000***	0.1002***	−0.0001	0.0408***
14. *MHR*	−0.0411***	−0.0242***	−0.0529***	0.0529***	0.0662***	−0.0334***	−0.1580***	−0.3153***	−0.0854***	0.0267***	0.0344***	0.1509***	−0.1194***		0.0798***	0.1080***	−0.1180***	−0.0629***	0.2106***
15. *ROE*	−0.0833***	0.0146***	0.1326***	−0.1326***	−0.1109***	0.0186***	0.1250***	−0.1279***	−0.5556***	0.1605***	0.4574***	0.0241***	0.0893***	0.0556***		0.1496***	0.1132***	−0.0139**	0.4262***
16. *OPINION*	−0.1557***	0.0035	0.1294***	−0.1294***	−0.0817***	−0.0089	0.1828***	−0.2748***	−0.3381***	0.0600***	0.1760***	0.0484***	0.0945***	0.0818***	0.2523***		0.0411***	−0.0642***	0.2082***
17. *BIG4*	−0.0074	0.0031	0.0496***	−0.0496***	−0.0066	0.0134**	0.3947***	0.1056***	−0.0514***	−0.0106**	0.0187***	0.0280***	0.1065***	−0.1034***	0.0645***	0.0411***		−0.0086	0.1836***
18. *CHANGE*	0.0518***	0.0278***	−0.0084	0.0084	−0.0026	−0.0029	−0.0490***	0.0489***	0.0398***	0.0467***	0.0183***	−0.0431***	0.0013	−0.0456***	−0.0180***	−0.0642***	−0.0086		−0.0389***
19. *ANALYST*	−0.0600***	−0.0135**	0.0742***	−0.0742***	−0.0071	−0.0440***	0.4871***	−0.0842***	−0.2291***	0.0615***	0.1191***	0.1924***	0.0337***	0.1779***	0.2646***	0.1991***	0.1955***	−0.0391***	

Note. This table reports the pairwise correlation coefficients among the main variables. The Pearson correlation coefficients are shown in the lower triangle and the Spearman's correlation coefficients are shown in the upper triangle. The variables are as defined in Table 1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4
Baseline regression results of herding behavior in annual report disclosures.

	(1) *DELAY*	(2) *ADVAN*
FIRST	0.0478***	
	(10.1599)	
LAST		0.0499***
		(9.9925)
LAG	0.0091*	−0.0114***
	(1.8312)	(-3.2120)
BEFORE	0.0411***	−0.0300***
	(12.2307)	(-6.2738)
SIZE	0.0107**	−0.0074**
	(2.4274)	(-1.9950)
LEV	0.0095***	0.0079***
	(3.8934)	(3.0912)
LOSS	0.0709***	−0.0110
	(6.9946)	(-1.3884)
GROWTH	0.0057***	0.0050***
	(2.9352)	(3.4892)
UE	0.0018	0.0023
	(0.9932)	(1.3025)
INDEP	0.0020	0.0038*
	(0.9860)	(1.8764)
FSR	−0.0069***	0.0006
	(-2.8740)	(0.3197)
MHR	−0.0001	−0.0050***
	(-0.0608)	(-3.3244)
ROE	−0.0034***	0.0056**
	(-3.8331)	(2.0400)
OPINION	−0.1165***	0.0387***
	(-11.3284)	(2.9804)
BIG4	−0.0093	0.0097
	(-0.7633)	(0.9398)
CHANGE	0.0348***	0.0083*
	(5.1777)	(1.9525)
ANALYST	−0.0073*	0.0053**
	(-1.7941)	(2.3290)
Industry-fixed effects	yes	yes
Year-fixed effects	yes	yes
N	33,968	33,968
Pseudo-R^2	0.0963	0.0896
Wald chi^2	2,174.05	1,673.76

Note. This table reports the regression results of herding behavior in annual report disclosures. The dependent variable *DELAY* (*ADVAN*) is a dummy that equals 1 if the actual disclosure date is later (earlier) than the scheduled disclosure date and 0 otherwise. The key independent variable *FIRST* (*LAST*) is between 0 and 1 and reaches 1 if a firm's scheduled disclosure date is the first (last) one within its industry. The control variables are as defined in Table 1. All of the non-dummy independent variables are standardized and the reported coefficients are mean marginal coefficients. The reported *z*-statistics (in parentheses) are based on standard errors clustered by industry and year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

5.4.2. Market reputation incentives

If firms have incentives to manage their market reputations by herding in annual reporting, we expect to observe differences in herding behavior. Such differences would stem from different kinds of news contained in the reports, considering that good news and bad news are timed in different ways (Givoly and Palmon, 1982; Patell and Wolfson, 1982; deHaan et al., 2015; Johnson and So, 2018). Following the random-walk earnings assumption (Brooks and Buckmaster, 1976; Foster et al., 1984), we use the earnings in the previous year as the prediction for the current year and measure the firms' unexpected earnings (*UE*) as the earnings of current year less the previous earnings and divided by the absolute value of the previous earnings. Based on *UE*,

the observations are split into good-news firms and bad-news firms. The regression results are reported in Table 6. In columns (1) to (4), we distinguish good news by whether *UE* is above 0. The impact of *FIRST* on *DELAY* is heterogeneous with respect to different kinds of news. As shown in columns (1) and (2), for good news, a one-standard-deviation increase in *FIRST* results in a 3.54% increase in the probability of delaying. For bad news, the probability of delaying increases sharply to 6.96%, exceeding the former by 3.42%. That is, bad news is more likely to be delayed if it is originally scheduled in a very early position within industry. However, in columns (3) and (4), a one-standard-deviation increase in *LAST* causes an increase of approximately 5% in the probability of bringing forward the disclosure regardless of whether it is good or bad news. In other words, a very late scheduled disclosure date within industry has an almost equal impact on bringing forward good news and bad news. In columns (5) to (8), we distinguish good news by whether *UE* is above the year-industry median and obtain results that are very similar to those in columns (1) to (4).

The results indicate that bad news that is originally scheduled on a very early date within an industry has a higher probability of being delayed to be disclosed with others. This implies that market reputation incentives play a role mainly in the herding behavior of bad news timing. Additionally, our results complement the findings by Tse and Tucker (2010). They document that negative earnings warnings tend to occur soon after the warnings of industry peers. We show that good news also has a propensity to cluster, whereas bad news is indeed more likely to wait for its peers.

5.4.3. Competitiveness

Using the ratio of the market value of equity to the book value of equity and industrial concentration as proxies for proprietary costs, Bamber and Cheon (1998) and Sengupta (2004) find weak evidence to support the hypothesis that proprietary costs lengthen the reporting lag. In addition, industrial concentration is not only a proxy for proprietary costs but is also a measure of the intensity of industry competition (Cano-Rodríguez et al., 2017). In this study, we use the ratio of the market value of equity to the book value of equity (*MKBK*) as the proxy for proprietary costs and the Herfindahl-Hirschman Index (*HHI*) of sales, which reflects the industrial concentration, as the proxy for competition intensity (it is actually an alternative measure of proprietary costs). *HHI* is computed as follows:

$$HHI_{k,t} = \sum_{i=1}^{n} \left(\frac{SALE_{i,k,t}}{TOTALSALE_{k,t}} \right)^2 \tag{7}$$

Table 5
Herding in annual reporting: Informational pressure mechanism.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Informational pressure proxied by *STD*				Informational pressure proxied by *DIV*			
	High *DELAY*	Low *DELAY*	High *ADVAN*	Low *ADVAN*	High *DELAY*	Low *DELAY*	High *ADVAN*	Low *ADVAN*
FIRST	0.0706***	0.0065			0.0711***	0.0140		
	(10.4908)	(0.8200)			(10.3271)	(1.4888)		
LAST			0.0771***	0.0059			0.0693***	0.0158**
			(9.4306)	(1.1232)			(8.6968)	(2.3801)
Controls	yes	yes	yes	yes	yes	yes	yes	yes
N	16,920	17,045	16,920	16,999	17,088	16,869	17,085	16,853
Pseudo-R^2	0.1185	0.0911	0.1031	0.0775	0.1095	0.0985	0.1094	0.0734
Wald chi^2	1,368.30	1,096.13	1,019.63	1,112.69	1,336.71	1,227.10	1,060.61	1,118.01

Note. This table reports the regression results of the informational pressure mechanism in the herding of annual reporting. In columns (1) to (4), the sample is split into high (low) informational pressure firms based on whether a firm's *STD* is below (above) the year-industry median. In columns (5) to (8), the sample is split based on whether a firm's *DIV* is below (above) the year-industry median. The dependent variable *DELAY* (*ADVAN*) is a dummy that equals 1 if the actual disclosure date is later (earlier) than the scheduled disclosure date and 0 otherwise. The key independent variable *FIRST* (*LAST*) is between 0 and 1 and reaches 1 if a firm's scheduled disclosure date is the first (last) one within its industry. The control variables are as defined in Table 1. The reported *z*-statistics (in parentheses) are based on standard errors clustered by industry and year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

where $SALE_{i,k,t}$ is the sales of firm i in industry k in year t and $TOTALSALES_{k,t}$ is the total sales of industry k in year t. A higher *HHI* means that the market share is concentrated among a few firms in the industry, suggesting lower industry competition. In contrast, a lower *HHI* indicates that market share is more evenly held by firms in the industry, suggesting higher industry competition.

We denote the firms whose *MKBK* is above (below) the year-industry median as firms with high (low) proprietary costs and denote the firms in an industry with an *HHI* below (above) the year median as firms with high (low) competition intensity. We report the cross-sectional regression results in Table 7. The mean marginal coefficients on *FIRST* and *LAST* show no significant variance among all of the subsamples. This means that the influence of the within-industry position of the originally scheduled disclosure date on the decision to delay or bring forward the disclosure date is not moderated by proprietary costs or industry competition. In other words, competitiveness is not an underlying mechanism that causes herding in annual report timing and herding is not a strategy used to maintain competitive advantage or market status.

5.5. Robustness and sensitivity analyses

5.5.1. Excluding firms that originally schedule in January or April

Given the intuition that if a firm that originally schedules to disclose at a very early (late) date decides to reschedule, most likely the firm can only reschedule to a later (earlier) date, but not to an earlier (later) date. To rule out this alternative explanation for our findings, we construct two new subsamples to test our hypothesis. The first subsample excludes firms that originally schedule in January. The second subsample excludes firms that originally schedule in April. This allows us to remove firms that can reschedule only to later or earlier dates. The regression results are tabulated in columns (1) and (2) of Table 8. After excluding the firms that can only reschedule to later or earlier dates, we still find that firms herd in the annual reporting process.

5.5.2. Focusing on firms that originally schedule a date similar to the previous year

When firms apply to schedule, it is possible for those with knowledge about their peer firms' scheduled dates to consequently schedule a date corresponding to the dates of their peers, whereas firms without such knowledge may naively schedule the same disclosure date as in the previous year. If our basic hypothesis is true, then we should observe these naïve firms herding after seeing other firms' schedules. To test this possibility, we use a subsample of firms that originally schedule within 2 days of their past year's disclosure dates and check whether they reschedule to herd with peer firms in the industry. The new regression results are

Table 6
Herding in annual reporting: Market reputation incentives mechanism.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Whether *UE* is above 0				Whether *UE* is above the year-industry median			
	Good news *DELAY*	Bad news *DELAY*	Good news *ADVAN*	Bad news *ADVAN*	Good news *DELAY*	Bad news *DELAY*	Good news *ADVAN*	Bad news *ADVAN*
FIRST	0.0354***	0.0696***			0.0354***	0.0629***		
	(5.7269)	(11.4183)			(5.7549)	(12.2046)		
LAST			0.0520***	0.0491***			0.0538***	0.0490***
			(10.0615)	(5.8660)			(8.2570)	(7.2896)
Controls	yes	yes	yes	yes	yes	yes	yes	yes
N	20,242	13,702	20,227	13,270	16,994	16,945	16,974	16,403
Pseudo-R^2	0.0823	0.1211	0.0859	0.1027	0.0836	0.1157	0.0925	0.0890
Wald chi^2	1,214.07	1,368.75	960.59	983.23	1,052.60	1,567.72	998.59	943.99

Note. This table reports the regression results of the market reputation incentives mechanism in the herding of annual reporting. In columns (1) to (4), the sample is split into firms with good news ($UE > 0$) and firms with bad news ($UE < 0$). In columns (5) to (8), the sample is split based on whether a firm's *UE* is above (below) the year-industry median of *UE*. The dependent variable *DELAY* (*ADVAN*) is a dummy that equals 1 if the actual disclosure date is later (earlier) than the scheduled disclosure date and 0 otherwise. The key independent variable *FIRST* (*LAST*) is between 0 and 1 and reaches 1 if a firm's scheduled disclosure date is the first (last) one within its industry. The control variables are as defined in Table 1. The reported *z*-statistics (in parentheses) are based on standard errors clustered by industry and year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 7
Herding in annual reporting: Competitiveness mechanism.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Proprietary costs				Industry competition			
	High *DELAY*	Low *DELAY*	High *ADVAN*	Low *ADVAN*	High *DELAY*	Low *DELAY*	High *ADVAN*	Low *ADVAN*
FIRST	0.0491***	0.0469***			0.0529***	0.0454***		
	(9.8435)	(6.8588)			(9.1387)	(6.9887)		
LAST			0.0503***	0.0477***			0.0554***	0.0473***
			(9.6148)	(6.7742)			(8.2371)	(8.1801)
Controls	yes	yes	yes	yes	yes	yes	yes	yes
N	16,950	16,994	16,974	16,970	17,231	16,653	17,231	16,737
Pseudo-R^2	0.0990	0.1039	0.0901	0.1018	0.1046	0.0900	0.0941	0.0907
Wald chi^2	1,419.94	1,120.00	1,159.52	912.82	1,208.41	1,041.69	829.00	830.81

Note. This table reports the regression results of the competitiveness mechanism in the herding of annual reporting. In columns (1) to (4), the sample is split into firms with high (low) proprietary costs based on whether a firm's *MKBK* is above (below) the year-industry median. In columns (5) to (8) the sample is split into firms amid high (low) competition intensity based on whether the *HHI* of the industry is below (above) the year median. The dependent variable *DELAY* (*ADVAN*) is a dummy that equals 1 if the actual disclosure date is later (earlier) than the scheduled disclosure date and 0 otherwise. The key independent variable *FIRST* (*LAST*) is between 0 and 1 and reaches 1 if a firm's scheduled disclosure date is the first (last) one within its industry. The control variables are as defined in Table 1. The reported *z*-statistics (in parentheses) are based on standard errors clustered by industry and year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

reported in columns (3) and (4) of Table 8. We find that the naïve firms do herd in annual report disclosure, which consolidates our main conclusions above.

Additionally, we split the sample of naïve firms into two groups: herding firms and non-herding firms. A herding firm is a firm that originally schedules a disclosure date that falls in the first (last) 25% of all of the scheduled dates in the industry and reschedules to a later (earlier) date. In contrast, a non-herding firm is a firm that originally schedules a disclosure date that falls in the first (last) 25% of all of the scheduled dates in the industry but does not reschedule to a later (earlier) date. Using the two groups, we test the differences in informational pressure, market reputation incentives, and competitiveness between herding firms and non-herding firms. The T-test results reported in Table 9 show that the herding firms have a significantly higher informational pressure than the non-herding firms.[4] Furthermore, competitiveness exhibits no significant difference between the herding firms and the non-herding firms, which is consistent with the findings of the mechanism tests.[5]

5.5.3. Differences between herding firms and bold firms

To develop a better understanding of why firms reschedule, we select and partition the firms into four groups: early bold firms, early herding firms, late bold firms, and late herding firms. Early bold (herding) firms are the firms that originally schedule a disclosure date that falls in the first 25% of all of the scheduled dates in the industry and do not reschedule (but reschedule to a later date), whereas late bold (herding) firms are the firms that originally schedule a disclosure date that falls in the last 25% of all of the scheduled dates in the industry and do not reschedule (but reschedule to an earlier date). By comparing the differences in informational pressure, market reputation incentives, and competitiveness between the early bold firms and the early herding firms, we can determine what makes an early firm reschedule to a later date. Similarly, conducting the same analyses with late bold firms and late herding firms can help us determine what causes a late firm to reschedule to an earlier date. The results are reported in Table 10. In Panel A, we compare the early bold firms

[4] A small *STD* or *DIV* value means that the originally scheduled disclosure dates of industry peers are more concentrated, suggesting high informational pressure.

[5] The T-test results offer weak evidence that herding firms have better unexpected earnings, which does not coincide with the results in Section 5.4.2. Considering that firms with different signs of unexpected earnings probably reschedule their disclosure dates in opposite directions, we expect the results reported in Section 5.5.3 to be more robust for reputation incentives.

Table 8
Robustness test results.

	(1) *DELAY*	(2) *ADVAN*	(3) *DELAY*	(4) *ADVAN*
FIRST	0.0528***		0.0270***	
	(10.3067)		(4.2631)	
LAST		0.0117***		0.0457***
		(3.9156)		(7.1935)
Controls	yes	yes	yes	yes
N	33,468	16,588	9,057	8,973
Pseudo-R^2	0.0946	0.0832	0.0810	0.0925
Wald chi^2	2,120.80	939.11	576.02	495.03

Note. This table reports the results of the robustness tests using different subsamples. In column (1), firms that originally schedule in January are excluded. In column (2), firms that originally schedule in April are excluded. In columns (3) and (4), the sample consists of firms that originally schedule within 2 days of their previous year's disclosure date. The dependent variable *DELAY* (*ADVAN*) is a dummy that equals 1 if the actual disclosure date is later (earlier) than the scheduled disclosure date and 0 otherwise. The key independent variable *FIRST* (*LAST*) is between 0 and 1 and reaches 1 if a firm's scheduled disclosure date is the first (last) one within its industry. The control variables are as defined in Table 1. The reported *z*-statistics (in parentheses) are based on standard errors clustered by industry and year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

with the early herding firms. The early herding firms have a significantly greater informational pressure than do the early bold firms, and the early firms with unfavorable earnings tend to reschedule to a later date. Again, early bold firms and early herding firms have no significantly divergent competitiveness. In Panel B, we compare the late bold firms with the late herding firms. Informational pressure continues to play an important role in the herding of late firms. The results also suggest that the late firms with relatively unfavorable earnings are less likely to bring disclosure forward to an earlier date, which is a new finding adding to those in Section 5.4.2. However, we find no evidence supporting the mechanism of competitiveness. *MKBK* and *HHI* show no consistent and significant differences between the herding firms and the bold firms. Altogether, informational pressure is the dominant mechanism that underlies herding in annual report timing and market reputation incentives also play a role in shaping the herding of bad news. No robust evidence is found to support the role of competitiveness.

5.5.4. Other robustness checks

Other robustness checks we conduct include using the first letter and the two-digit numbers specified in the Industry Classification Guidelines for Listed Companies by the CSRC in 2012 to denote the firms' industries, excluding industries with fewer than 5 or 10 firms. Inspired by Johnson and So (2018), we also expect the cases in which the gap between the scheduled and actual disclosure dates is no less than 2 days to be more informative. Hence, we let *DELAY* and *ADVAN* equal 1 only when the actual disclosure date differs from the scheduled disclosure date by at least 2 days. The new regression results are very similar to those tabulated above.

5.6. Further analysis

We find that individual firms tend to wait or follow the disclosures of their industry peers when timing their own disclosure. In this section, we investigate whether the contingent adjustment of disclosure dates induced by waiting or following strategy influences the annual report quality. Intuitively, the firms that delay their annual report using the waiting strategy have more time than expected to prepare the report and have it audited. As a result, the report should be of good quality and less likely to be restated in the future. In contrast, the firms that bring forward their annual report using the following strategy have less time than expected to prepare it. Thus, the report is predicted to be of low quality and more likely to be restated. To examine this hypothesis, we build the following logit models:

$$\text{Logit}(RES_{i,t}=1) = c + \alpha_1 DELAY_{i,t} + \alpha_2 WAIT_{i,t} + \alpha_3 DELAY_{i,t} * WAIT_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \quad (8)$$

$$\text{Logit}(RES_{i,t}=1) = c + \alpha_1 ADVAN_{i,t} + \alpha_2 FOLLOW_{i,t} + \alpha_3 ADVAN_{i,t} * FOLLOW_{i,t} + \beta Controls_{i,t} + \varepsilon_{i,t} \quad (9)$$

Table 9
Examining potential mechanisms using naïve firms.

	Non-herding firms	Herding firms	Mean-diff.
N	4,019	488	
STD	−0.1481	−0.3307	0.1826***
DIV	−0.1948	−0.4365	0.2417***
UE	−0.7412	−0.3052	−0.4360*
UE_Ind_Adj	−0.0953	−0.0284	−0.0669
MKBK	0.0071	0.0796	−0.0725
HHI	0.0179	0.0717	−0.0538

Note. This table reports the results of the T-test between the non-herding firms and the herding firms selected from the naïve firms. *STD* and *DIV* are defined as in formulas (5) and (6), respectively, measuring the informational pressure faced by individual firms. *UE* is unexpected earnings and *UE_Ind_Adj* is *UE* standardized by industry and year. *MKBK* is the ratio of the market value of equity to the book value of equity, a proxy for proprietary costs. *HHI* is defined as in formula (7), a proxy for competition intensity. For the convenience of comparison across industry and year, *STD*, *DIV*, and *MABK* are standardized by industry and year and *HHI* is standardized by year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

where $RES_{i,t}$ indicates whether the annual report of firm i in year t is restated in the subsequent periods; it equals 1 if it is. $WAIT_{i,t}$ is designed to reflect the waiting strategy of firm i in year t; it equals 1 if $FIRST_{i,t} > 0.75$. The interaction term $DELAY_{i,t}*WAIT_{i,t} = 1$ means that the annual report is delayed via the waiting strategy. Similarly, $FOLLOW_{i,t}$ reflects the following strategy of firm i in year t; it equals 1 if $LAST_{i,t} > 0.75$. The interaction term $ADVAN_{i,t}*FOLLOW_{i,t} = 1$ means the annual report is brought forward via the following strategy.[6] The control variables are the same as those in model (1). The financial restatement cases cover the period of 2004 to 2017, with 27,455 observations in total.

The regression results are reported in Table 11. In column (2), the coefficient on $DELAY$ is 0.0402. This means that the probability of a delayed annual report being restated is 4.02% higher than that of the non-delayed reports. However, the coefficient on $DELAY*WAIT$ suggests that if the report is delayed with the waiting strategy, the probability of it being restated is 3.38% lower than that of ordinary delayed reports. It is rational to argue that the better quality of the reports delayed via the waiting strategy is the result of the extra time received to prepare them well and have them audited. In column (4), the coefficients on $ADVAN$ and $ADVAN*FOLLOW$ are both statistically insignificant, suggesting that annual report quality is not damaged by bringing forward the disclosure, regardless of whether the annual reports are brought forward using the following strategy. This is inconsistent with our prediction. This finding may imply that firms actually do not need that much time to prepare their annual report, as a shortened period is not necessarily related to a low-quality report. It also implies that A-share listed firms are accustomed to withholding annual reports even if they are already prepared.

6. Conclusion

China's stock market has a unique scheduled disclosure system for annual reports, wherein each firm is required to schedule a disclosure date for its annual report before it is disclosed. Using this unique scheduled disclosure system, we examine the within-industry herding behavior in annual report timing. The results show that firms that originally schedule an early disclosure date within their industry are more likely to delay disclosure, whereas firms that schedule a late date are more likely to bring forward disclosure. The results reveal the waiting and following strategies in the annual reporting process within industry. This kind of contingent adjustment of the disclosure date reflects herding in disclosure timing among industry peers.

[6] $FIRST_{i,t}$ ($LAST_{i,t}$) > 0.75 means that the originally scheduled disclosure date of firm i is very early (late) in the industry and that such a firm should have a very high propensity to delay (bring forward) disclosure. Thus, a change in its disclosure date is more likely to be driven by the waiting (following) strategy. As a robustness check, we adjust the threshold from 0.75 to 0.5 and obtain similar results.

Table 10
Examining potential mechanisms using bold firms and herding firms.

Panel A: Early bold firms vs. early herding firms

	Early bold firms	Early herding firms	Mean-diff.
N	4,096	1,061	
STD	−1.4269	−1.6124	0.1855***
DIV	−1.4347	−1.5790	0.1443***
UE	0.3901	−0.1660	0.5561***
UE_Ind_Adj	0.1531	0.0367	0.1164***
MKBK	0.1741	0.1468	0.0273
HHI	0.1024	0.1367	−0.0343

Panel B: Late bold firms vs. late herding firms

	Late bold firms	Late herding firms	Mean-diff.
N	9,031	1,630	
STD	−0.0409	−0.1366	0.0957***
DIV	−0.0933	−0.2460	0.1527***
UE	−0.7835	−0.4658	−0.3177**
UE_Ind_Adj	−0.1142	−0.0447	−0.0695**
MKBK	−0.0174	0.1286	−0.1460***
HHI	−0.0493	−0.0171	−0.0322

Note. This table reports the results of the T-test between the bold firms and the herding firms selected from the early firms and the late firms, respectively. *STD* and *DIV* are defined as in formulas (5) and (6), respectively, measuring the informational pressure faced by individual firms. *UE* is unexpected earnings and *UE_Ind_Adj* is *UE* standardized by industry and year. *MKBK* is the ratio of the market value of equity to the book value of equity, a proxy for proprietary costs. *HHI* is defined as in formula (7), a proxy for competition intensity. For the convenience of comparison across industry and year, *STD*, *DIV*, and *MABK* are standardized by industry and year and *HHI* is standardized by year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

The mechanism tests indicate that informational pressure is the dominant reason for the observed timing herding. Individual firms are inclined to interpret the disclosure dates scheduled by their peers as better dates, giving them an incentive to adjust their own dates to be closer to those of their peers. The probability of rescheduling the disclosure date is much higher when the scheduled disclosure dates of industry peers are more concentrated. Market reputation incentives mainly underlie the herding of bad news. Bad news that is scheduled on a very early date within industry has a higher probability of being delayed. This aligns with findings that bad news is released later than expected (Johnson and So, 2018) and tends to cluster (Tse and Tucker, 2010).

We further find that although the delayed annual reports generally have a higher probability of being restated, the restatement probability decreases significantly if the reports are delayed via the waiting strategy. We attribute this improvement to the extra time that results for the reports to be prepared well and audited. However, the reports that are brought forward via the following strategy do not demonstrate lower quality than other reports. This suggests that bringing forward the disclosure date does not damage annual report quality, implying that firms do not actually need that much time to prepare their annual reports.

We document herding behavior among industry peers in annual reporting, enrich the scarce empirical studies on sequential mandatory disclosure decisions within industry, and offer a better understanding of why and how listed firms time their disclosures. Although our study is based on the scheduled disclosure system for annual reports in China's stock market, it could be expanded to other markets and voluntary disclosures. In markets without this system, the unobservability of each firm's original disclosure plan makes it hard to depict the dynamic process of herding disclosure. Nonetheless, it is also reasonable to expect that firms are, in the same manner as Chinese listed firms, delaying and bringing forward their disclosures to wait or follow their industry peers. As for voluntary disclosures, the non-mandatory characteristics may imply a more evident herding effect in disclosure timing.

Table 11
Testing the impact of herding in annual reporting on report quality.

	(1) *RES*	(2) *RES*	(3) *RES*	(4) *RES*
DELAY	0.0322***	0.0402***		
	(5.6058)	(6.9132)		
WAIT		0.0138*		
		(1.7434)		
*DELAY*WAIT*		−0.0338***		
		(-2.6037)		
ADVAN			0.0089	0.0085
			(1.0413)	(1.1165)
FOLLOW				0.0072
				(1.3779)
*ADVAN*FOLLOW*				−0.0008
				(-0.0512)
Controls	yes	yes	yes	yes
N	27,455	27,455	27,455	27,455
Pseudo-R^2	0.0392	0.0396	0.0378	0.0379
Wald chi^2	851.59	869.93	843.76	847.80

Note. This table reports the regression results of the impact of herding in annual reporting on report quality. The dependent variable *RES* is a dummy that equals 1 if the report is restated in the future and 0 otherwise. The independent variable *DELAY* (*ADVAN*) is a dummy that equals 1 if the actual disclosure date is later (earlier) than the scheduled disclosure date and 0 otherwise. *WAIT* is designed to reflect the waiting strategy and equals 1 if $FIRST > 0.75$. The interaction term $DELAY*WAIT = 1$ means that the annual report is delayed via the waiting strategy. *FOLLOW* reflects the following strategy and equals 1 if $LAST > 0.75$. The interaction term $ADVAN*FOLLOW = 1$ means that the annual report is brought forward via the following strategy. The control variables are as defined in Table 1. The reported *z*-statistics (in parentheses) are based on standard errors clustered by industry and year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

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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Do common owners influence corporate social responsibility? Firm-level evidence from China

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ABSTRACT

Using a sample of Chinese A-share listed companies from 2007 to 2018, this article explores the influence of common owners on corporate social responsibility (CSR). The results show that common owners significantly promote CSR investment, indicating that increased CSR represents a bright side to common owners, in contrast to their anticompetitive effect. Further analysis shows that the nature of state ownership significantly weakens the positive relationship between common owners and CSR investment. Prospector firms strengthen the positive influence of common owners on CSR investment, whereas defender firms weaken the effect. Moreover, common owners benefit from increasing CSR investment, and co-owned firms benefit by easing their financial constraints when they invest or increase their investment in social responsibility. The findings enhance the outstanding of how common owners affect corporate behavior and enrich the literature on common ownership and CSR investment.

1. Introduction

As stakeholders' claims have attracted attention, investment in corporate social responsibility (CSR) has become an important aspect of corporate strategic management. The view that CSR investments are beneficial for obtaining and maintaining a sustainable competitive advantage (Jones et al., 2018) is also now widely acknowledged. The literature provides extensive evidence of factors determining the level of CSR investment at the institutional, organizational, and personal levels (Aguinis and Glavas, 2012). Shareholders, as important stakeholders, particularly institutional investors, have a powerful effect on CSR investment (Graves and Waddock, 1994; Johnson and Greening, 1999; Neubaum and Zahra, 2006; David et al., 2007;

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Schaefer, 2008; Glac, 2014; Hart and Zingales, 2017; Buchanan et al., 2018; F. Cao et al., 2019; Erhemjamts and Huang, 2019; Dyck et al., 2019). How do common owners that hold stocks in several companies within an industry influence CSR investment? This article investigates the association between common owners and CSR investment. According to the preliminary statistics of Chinese A-share listed companies from 2007 to 2018,[1] 64% of listed companies have common owners, among which the top 10 shareholders include at least one common owner, and this percentage reached 75.59% in 2015. Common owners are noticeably prevalent in Chinese A-share listed companies, motivating the author to explore how common owners influence firms' behavior in the context of emerging economies.

The U.S. antitrust agencies define common owners as investors simultaneously holding stocks in competing corporations. Azar et al. (2018) refer to common owners as overlapping investors holding many natural competitors' shares in the U.S. airline industry and verify that common ownership can impair product market competition. There is growing interest in common owners. However, theoretical and empirical studies primarily focus on the fierce debate regarding whether the anticompetitive effects of common owners are serious enough to violate relevant anti-monopoly laws and regulations and whether authorities must take action to limit the anticompetitive effects of common owners (He and Huang, 2017; Kennedy et al., 2017; O'Brien and Waehrer, 2017; Posner et al., 2017; Azar et al., 2018; Elhauge, 2018). Scholars also explore the effects of common owners on corporate governance (Antón et al., 2018a; Kang et al., 2018; Gilje et al., 2019), corporate information disclosure (Jung, 2013; Pawliczek and Skinner, 2018; Park et al., 2019) and corporate innovation (López and Vives, 2017; Antón et al., 2018b; Borochin et al., 2018; Kostovetsky and Manconi, 2018). However, the literature on common owners does not consider the effects of common owners on CSR. The only relevant study, that of Condon (2019), constructs a framework to theoretically explore how institutional investor activism influences environmental issues using common owners' economic incentives; however, it does not address the effect of common owners on other aspects of CSR and does not provide empirical evidence of a correlation between common owners and CSR.

Considering common owners as those that hold the shares of several competitors in an industry as an entry point, this study advances two rival hypotheses concerning the association between common owners and CSR. First, considering firms' motivation for CSR, which can provide better access to financing to increase the likelihood of success under fierce product market competition, the anticompetitive effects of common owners may decrease firms' investment in CSR. Second and in contrast, considering the objective of common owners to maximize their portfolio value, common owners may be more concerned about firms' commitments to CSR, which can promote the industry's sustainable development; therefore, firms' managers may invest more in CSR to cultivate a reputable corporate image among common owners and to align with their preferences concerning CSR. The findings show that common owners significantly boost firms' investment in CSR.

Considering the different ownership types, the different types of corporate strategy, and the different characteristics of firms' decisions and behaviors, this study further explores whether the cross-sectional characteristics of the nature of the ultimate controller and the type of corporate strategy moderate the positive influence of common owners on CSR. The empirical results show that the nature of state ownership significantly weakens the positive relation between common owners and CSR. Prospector firms, which use a certain corporate strategy, strengthen the positive influence of common owners on CSR, whereas defender firms, which use another type of corporate strategy, weaken the positive influence of common owners on CSR. Moreover, common owners receive rewards from the stock market by improving firms' CSR, and firms can benefit from easing their financial constraints when they invest or increase their investment in social responsibility. Notably, although investing in CSR creates costs, firms consider shareholders' preference for social responsibility in their business process, which includes corporate citizenship (Jones, 2010; Lin et al., 2010).

To alleviate endogeneity concerns, this study uses various empirical strategies, such as adding corporate governance variables, lagging the independent variables in the regression models, using propensity score matching, and using the Heckman two-stage regression. In addition, this study re-estimates all of the models

[1] The data are from the China Stock Market and Accounting Research (CSMAR) database, which is used frequently in studies on China.

by clustering standard errors at the firm level and changing the scope of common owners to recalculate the proxy variables. The regression results suggest that the conclusions are robust.

This study makes several contributions to the literature. First, it enhances the understanding of how common owners affect corporate behavior. Existing research focuses on anticompetitive effects, corporate governance, information disclosure, and corporate innovation. However, despite the importance of common owners, there remains a paucity of evidence regarding the relationship between common owners and CSR. Regarding the anticompetitive effects of common owners, Azar et al. (2018) document that common owners have anticompetitive effects, and He and Huang (2017) imply that common owners reduce product market competition. Scholars disagree whether authorities should formulate and enforce an antitrust policy to limit common owners' competitive harm (Elhauge, 2016, 2017, 2018; Posner et al., 2017; O'Brien and Waehrer, 2017; Patel, 2018; Bebchuk and Hirst, 2018; Klovers and Ginsburg, 2018). Nevertheless, Park et al. (2019) find that common owners have positive impacts on corporate information disclosure; Antón et al. (2018b) argue that common owners improve R&D when technological spillovers are large relative to product market spillovers; and Kostovetsky and Manconi (2018) indicate that greater common institutional ownership is related to more patent citations. In brief, common owners have negative effects on product market competition but positive effects on promoting information disclosure and corporate innovation. This study complements the literature concerning how common owners affect corporate behavior and provides evidence of the bright side of common owners in terms of promoting firms' investment in CSR.

Second, this study enriches the literature on the determinants and economic consequences of CSR investments. Regarding the association between shareholders and CSR, the literature is more interested in the effects of institutional shareholders. Graves and Waddock (1994) show that institutional investors are inclined to hold shares of companies that exhibit better CSR performance. Johnson and Greening (1999) find that pension fund managers who keep an eye on a company for a long time can improve both the people and product quality of corporate social performance. Neubaum and Zahra (2006) show that the relationship between institutional ownership and corporate social performance varies with investment horizon, activism, and coordination. Buchanan et al. (2018) find that during the 2008 global financial crisis, CSR firms with high institutional ownership had significantly higher firm values than firms with low institutional ownership. Erhemjamts and Huang (2019) argue that institutions with longer investment horizons can upgrade CSR at the firm level, that is, there is a positive correlation between institutional ownership horizon and CSR. Dyck et al. (2019) show that institutional ownership increases firms' environmental and social performance across 41 countries. This study suggests that common owners are an important factor influencing CSR. It explores and recognizes the moderating role of the nature of state ownership and corporate strategies in the positive association between common owners and CSR. The findings expand research on shareholders' influence on CSR investments.

Finally, this study deepens the understanding of firms' commitment to CSR. Parmar et al. (2010) claim that CSR is an expansion of corporate obligations through business ethics based on maximizing shareholder value. Closely related to that, Hart and Zingales (2017) highlight that the maximization of shareholders' welfare is not equivalent to the maximization of market value, and they suggest that firms and asset managers should consider the preferences of their investors when developing corporate policies and that shareholders can express their preferences through the right to vote. The findings of this study suggest that although investment in CSR generates considerable costs, firms consider shareholders' preferences regarding social responsibility, which corroborates the viewpoints of Hart and Zingales (2017).

The remainder of this paper proceeds as follows. Section 2 puts forward the hypotheses based on a review of the literature and theoretical analysis. Section 3 outlines the proxy variables and empirical models used in this study. Section 4 reports the sample selection process, describes the statistics of the main variables, and conducts the correlation analysis. Section 5 reports the baseline multivariate regression results and those of a series of cross-sectional tests and supplemental analyses. Section 6 discusses potential endogeneity and conducts various robustness checks, and Section 7 presents the conclusions.

2. Related literature and hypothesis development

The literature indicates that CSR investments can contribute to obtaining and maintaining a sustainable competitive advantage. Freeman (1984, 1994) documents that firms associate stakeholders' claims with corpo-

rate operational philosophy, consider stakeholders' preferences, and balance the competing demands of various stakeholder groups, which can contribute to better strategic decisions by managers and a better operational environment for firms. Pratima Bansal and Roth (2000) claim that obtaining a competitive advantage is one of the motivations for CSR investments. Sen and Bhattacharya (2001) argue that CSR is a crucial strategic factor for firms to succeed in product market competition. McWilliams et al. (2002) also claim that social responsibility norms can result in a sustained competitive advantage. Porter and Kramer (2002) propose that corporate philanthropy, an aspect of CSR, can improve a firm's competitive advantage. The establishment of mutually beneficial relationships with stakeholders can engender sustainable competitive advantages (Harrison et al., 2010; Jones et al., 2018). Gregory et al. (2016) show that corporate social performance is value relevant, and this valuation mainly stems from improved earnings persistence, which is consistent with better corporate social performance conferring a competitive advantage. Accordingly, the more intense the product market competition is, the greater the volatility of operational profits and the greater the operational risk. Nevertheless, firms engaging in CSR can contribute to social capital and reduce firms' heterogeneous risk (Bansal and Clelland, 2004). In other words, the more intense the product market competition is, the more prone firms are to invest in CSR as a competitive strategy in response to the liquidation threats created by fierce product market competition (Schmidt, 1997).

Furthermore, research shows that CSR can improve access to external capital. Cheng et al. (2014) find that superior CSR performance results in better access to finance, which can be ascribed to reduced agency costs and information asymmetry that then lower financial constraints. Benlemlih (2015) shows that firms with high CSR significantly shorten their debt maturity, and they use more short-term debt and shareholders' equity and less long-term debt to finance investments. These findings indicate that firms with better CSR performance are more likely to obtain loans in the debt market. Therefore, as fierce product market competition intensifies the uncertainty of operating profits and future cash flows and increases the financial constraints firms face, firms have a strong incentive to invest in CSR to reduce the financial constraints caused by intense product market competition.

However, investors holding shares in natural competitors can discourage firms from competing and even push the product market toward monopolistic competition (Azar et al., 2018). That is, common owners can adversely affect the extent of product market competition (He and Huang, 2017; Azar et al., 2018). Azar et al. (2018) examine whether common ownership hinders product market competition in the U.S. airline industry, and their empirical results show that common ownership concentration increases ticket prices by approximately 3% to 7%, suggesting that common ownership has anticompetitive effects. He and Huang (2017) argue that common owners can offer product market benefits by fostering collaboration and facilitating significantly greater market share growth for cross-held firms in the same industry. Moreover, Posner et al. (2017) propose limiting common owners' holdings to below a particular threshold to restrain anticompetitive forces. Elhauge (2016, 2017, 2018) introduces new legal theories to address the problem of common owners' anticompetitive effects, which harm economic growth. However, some scholars argue that the anticompetitive effects of common owners are substantially overstated (Klovers and Ginsburg, 2018; Bebchuk and Hirst, 2018). Taking a step back, regardless of whether common owners' holdings should be limited, scholars basically agree that common owners are highly likely to reduce product market competition.

Given that common owners reduce firms' incentives to compete and thus adversely affect product market competition, firms' motivation for social responsibility, which is a competitive strategy to obtain sustainable competitive advantages and to improve access to finance, is weakened as product market competition decreases. That is, common owners alleviate competition in the product market, directly reducing firms' motivation for CSR investments to obtain competitive superiority. Reduced product market competition reduces liquidation threats and the fluctuation and uncertainty of operating profits and future cash flows, which can be directly attributed to the anticompetitive effects of common owners. In this regard, co-owned firms have significantly lower financing needs, and their motivations for social responsibility decline further. In brief, from the perspective of firms' incentives to invest in CSR, common owners should reduce co-owned firms' incentives to invest in CSR through their anticompetitive effects. According to the above discussion, this study formulates Hypothesis 1:

Hypothesis 1. Ceteris paribus, common owners are negatively associated with co-owned firms' CSR investments.

However, the maximization of common owners' portfolio value converges with the interests of the industry as a whole, even with the overall economy to some extent. The extent of convergence may be greater as more firms within an industry are held by common owners. According to the definition of common ownership, the basic characteristic of common owners is holding multiple firms in the same industry. This basic characteristic indicates that common owners should seek to maximize their portfolios' value regardless of the value of individual firms (Azar et al., 2018; Schmalz, 2018). In this regard, compared with individual firms, the objective of maximizing portfolio value suggests that common owners should pay greater attention to the industry and even more to macroeconomic growth. Therefore, common owners are concerned about firms' CSR investments, which are closely related to industry and even macroeconomic growth (Akerlof, 2002; Campbell, 2007). Condon (2019) documents that considering the benefit of portfolio returns, diversified investors may reasonably motivate firms within their portfolios to internalize negative externalities and engage in or increase climate change-related activism, such as exerting pressure to reduce carbon emissions, which is conducive to the industry's long-term development and that of the overall economy. In other words, when co-owned firms' investments in CSR enhance portfolio value, common owners should push co-owned firms to pursue CSR investments.

Furthermore, individual firms may weigh the costs and benefits of CSR investments. Individual firms should be unwilling to invest in CSR when the costs outweigh the benefits. However, common owners connect several firms within an industry through their portfolio, which is similar to a mini ecosystem. Firms within the mini ecosystem actively invest in CSR and pay attention to the claims of stockholders, creditors, customers, and suppliers, attracting excellent managers and skilled employees, maintaining a friendly relationship with local communities and the general public, and developing their reputation (Brammer and Pavelin, 2006). They have a positive role in the sustainable development of these mini ecosystems. Corporate donations,[2] as a visible component of CSR performance, are conducive to forming a good corporate reputation and improving stakeholders' understanding of corporate image (Brammer and Millington, 2005, 2006). Saiia (2002) states that strategic philanthropy is an important embodiment of good corporate citizenship. Wang and Qian (2011) find that corporate philanthropy has a positive impact on corporate financial performance, and firms that are not government owned or politically well–connected benefit more from corporate philanthropy. In addition, CSR investments can broker greater trust between firms and their stakeholders and investors. Social capital derived from trust helps increase profitability and growth for firms with high CSR intensity; even during the 2008–2009 financial crisis, firms with high CSR intensity had higher stock returns than firms with low CSR intensity (Lins et al., 2017), which meant less speculative risk for common owners. Specifically, CSR can decrease systematic risk (Albuquerque et al., 2018), which is an important issue with respect to the value of common owners' portfolios. Therefore, common owners have strong incentives to maximize their portfolio value by pushing co-owned firms to invest in CSR and by promoting the mini ecosystem and the entire industry to enter and maintain a virtuous development circle.

Finally, given that co-owned firms connect through common owners' portfolios, Jung (2013) finds that common ownership can be a transmission channel, and firms that take the lead in increasing market risk disclosure inspire investors to pursue analogous increases from other firms in their portfolios, which implies that common owners facilitate the diffusion of disclosure practices. Similarly, an overlapping investor may lead firms with common owners to have similar CSR practices. There are at least two reasons that co-owned firms may satisfy common owners' demands for CSR investments. First, co-owned firms may adopt similar CSR practices after a first-mover firm's investment in CSR because of peer pressure from other firms owned by common owners (Cao et al., 2017; Lin et al., 2018). Second, common owners can decide which stocks to retain or sell (Edmans et al., 2019), and the behaviors of holding and selling can strongly signal that the firm being sold is bad, which may cause the firm's stock price to suffer a large slump. To avoid being sold first when inves-

[2] As Lys et al. (2015) highlight, corporate donations are one type of CSR investment. Although the distinction between corporate donations and CSR investment decisions is conducive to understanding the determinants of different CSR investments, this study does not discuss it in detail, which is a shortcoming and requires further research.

tors suffer a liquidity shock, co-owned firms may develop their image and reputation and build trust by investing or increasing their investment in CSR to satisfy common owners' preferences for social responsibility (Glac, 2014; Hart and Zingales, 2017). In addition to exit, common owners can govern and influence co-owned firms' CSR strategies through voice (Edmans et al., 2019).

Overall, common owners have strong incentives and abilities to push co-owned firms to make CSR investments, and co-owned firms may invest or increase their investment in CSR in response to common owners' preference for social responsibility. Based on the foregoing analysis, this study formulates Hypothesis 2:

Hypothesis 2. Ceteris paribus, common owners are positively associated with co-owned firms' CSR investments.

3. Variables and empirical models

3.1. Variable measurements

3.1.1. Common owners variables

As some top 10 shareholders hold too few shares to influence a firm, this study's definition of common owners is limited to shareholders holding at least 1% of a firm's outstanding shares. Following He and Huang (2017) and Park et al. (2019), this study constructs four variables to gauge firms' common owner status in a given fiscal year: *DumCross*, which is an indicator variable that equals 1 if shareholders holding at least 1% of the firm's outstanding shares simultaneously hold the shares of at least one other firm in the same industry; *NumCross*, which is the number of common owners that hold the focal firm; *NumConnect*, which is the number of same-industry peers that share any common owners with the focal firm; and *AvgNum*, which is the average number of same-industry peers held by common owners. According to conventional practices, this study uses the natural logarithm of *NumCross*, *NumConnect*, and *AvgNum* to reduce skewness.

3.1.2. CSR variables

Parmar et al. (2010) state that CSR expands corporate obligations based on business ethics beyond the objective of maximizing shareholders' wealth. CSR concerns the interests of multiple stakeholders, such as shareholders, creditors, employees, suppliers, customers, governments, and the community. Therefore, CSR is corporate behavior involving resource allocation (Carroll, 1979; Waddock and Graves, 1997). Among the various aspects of CSR, corporate donations are a highly externally visible and discretionary aspect of CSR (Brammer and Millington, 2005, 2006, 2008), and they demonstrate social responsiveness to multiple stakeholders, for instance, employees, governments, and the community (Berman et al., 1999; Wood and Jones, 1995). Hence, it is reasonable to consider corporate donations as largely reflecting firms' concerns about and fulfillment of CSR.

Therefore, referring to Griffin and Mahon (1997) and Brammer and Millington (2008), this study measures CSR based on firms' donation data, which is consistent with Marquis and Qian (2014), who advise that CSR activities should be directly examined. This study constructs three variables to proxy CSR investments at the firm-year level: *DumDonation*, which is an indicator variable that equals 1 for firm-years in which the firm makes any donations and 0 otherwise; *Donation*, which is the amount of all donations made scaled by total assets; and *DM_Donation*, which is *Donation* adjusted by the average donation ratio of the industry to which the firm belongs, i.e., *DM_Donation* equals *Donation* minus the industry's average donation ratio.

3.1.3. Control variables

Following previous studies (W. Li and Zhang, 2010; Jo and Harjoto, 2011, 2012; Choi et al., 2018; Yuan et al., 2019), this study includes several control variables that may affect a firm's CSR investments. The firm-level control variables include the following: firm size (*Lnasset*) is measured as the natural logarithm of the firm's total assets; leverage (*Lev*) is the ratio of total liabilities divided by total assets; return on assets (*Roa*) is net profits divided by total assets; sales growth (*Growth*) is the change between the current year's sales and last year's sales divided by last year's sales; operating cash flow (*Cflow*) is net cash flow from operating activities divided by total assets; the nature of state ownership (*SOE*) equals 1 if the state ownership of the

listed firm is a central or local government agency or government-controlled state-owned enterprise and 0 otherwise (Du, 2014b); firm age (*Lnage*) is the natural logarithm of the number of years since the firm was founded. In addition, this study controls both year and industry fixed effects to mitigate concerns that time-invariant firm or industry characteristics affect the association between common owners and CSR investments. See Appendix A for a detailed description of all of the variables.

3.2. Empirical models

To test the hypotheses, this study estimates Eq. (1) to link common owners and CSR investments along with firm-specific control variables and year and industry fixed effects:

$$CSR_{it} = \beta_0 + \beta_1 CO_{it} + \beta Controls + Year + Industry + \delta_{it} \quad (1)$$

where i and t index firms and years, respectively. The dependent variable is *CSR investments*, proxied by *DumDonation*, *Donation*, and *DM_Donation*; and the independent variable is *CO*, i.e., common owners, proxied by *DumCross*, *NumCross*, *NumConnect*, and *AvgNum*. *Controls* is a vector of control variables as mentioned above, and *Year* and *Industry* are year and industry fixed effects, respectively. As discussed, how common owners affect CSR investments remains an open question. Therefore, a negative and significant β_1 will be consistent with Hypothesis 1, whereas a positive and significant β_1 will be consistent with Hypothesis 2. Notably, when the dependent variable is *DumDonation*, this study uses a logit regression model to examine Eq. (1).

4. Sample and descriptive statistics

4.1. Sample selection

The sample includes Chinese A-share listed firms during the 2007–2018 period. Then, firms in banking, insurance, and other financial industries are deleted because of their unique financial characteristics. Next, the firm-year observations with transaction statuses of ST (special treatment), *ST (suspension from trading), or PT (particular transfer) are deleted. Finally, firm-year observations missing common owners, CSR investments, or firm-specific control variables are deleted. This sample selection process results in a final sample of 23,091 firm-year observations.

To alleviate the potential influence of extreme observations, the continuous variables are winsorized at the 1% and 99% levels. Furthermore, the *t*-statistics based on the standard errors of the regression results are adjusted following White (1980). Common owner data, CSR investment data, and other data are from the CSMAR database, which is frequently used in studies on China.

4.2. Descriptive statistics

Fig. 1 presents a time series of the percentage of Chinese A-share listed firms with at least one common owner from 2007 to 2018. During this period, the percentage of listed firms having common owners increasingly fluctuated. The lowest percentage was about 34% in 2008, and the highest percentage was 55% in 2018; that is, 55% of listed firms had shareholders holding at least 1% of the firm's outstanding shares and simultaneously holding shares from at least one other firm in the same industry.

Table 1 provides the descriptive statistics for the variables used in the main tests. Approximately 68.0% of the firm-year observations include donations[3] (*DumDonation*). However, the mean value of *Donation* as a percentage of total assets is approximately 0.017%, and the maximum value of *Donation* is approximately 0.241%. The mean (maximum) value of *DM_Donation* is −0.009% (0.202%), which suggests that firms' donation percentages of total assets differ greatly within an industry. The statistics of *NumCross*, *NumConnect*, and *AvgNum* are described before taking their natural logs. The mean value of *Dumcross* is 0.428, which means that

[3] Corporate donation data are from specific items in the nonoperating expenditures of firms' financial statements. When there is no value for corporate donations, 0 is used.

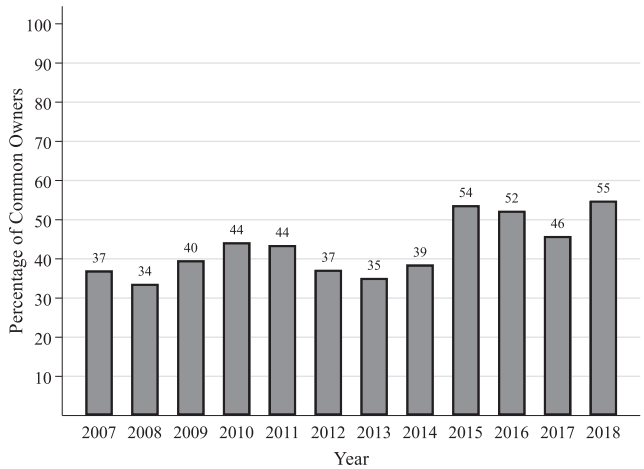

Fig. 1. Time series of the percentage of Chinese A-share listed firms with common owners.

Table 1
Descriptive Statistics.

Variable	*N*	Min	P25	*M*	P50	P75	Max	*SD*
DumDonation	23,091	0	0	0.680	1	1	1	0.466
Donation	23,091	0	0	0.017	0.002	0.014	0.241	0.038
DM_Donation	23,091	−0.062	−0.016	−0.002	−0.009	−0.001	0.202	0.036
DumCross	23,091	0	0	0.428	0	1	1	0.495
NumCross	23,091	0	0	0.746	0	1	5	1.101
NumConnect	23,091	0	0	3.477	0	2	50	8.419
AvgNum	23,091	0	0	2.047	0	1.500	32	5.052
Lnasset	23,091	19.07	21.08	22.01	21.86	22.78	27.00	1.344
Lev	23,091	0.049	0.294	0.465	0.462	0.626	1.088	0.223
Roa	23,091	−0.289	0.012	0.035	0.033	0.062	0.213	0.063
Growth	23,091	−0.653	−0.028	0.225	0.116	0.294	4.429	0.627
Cflow	23,091	−0.216	0.001	0.041	0.041	0.085	0.262	0.078
SOE	23,091	0	0	0.472	0	1	1	0.499
Lnage	23,091	1.099	2.485	2.666	2.708	2.944	3.401	0.413

This table presents the descriptive statistics for the variables used in the main tests. All of the variables are defined in Appendix A.

42.8% of the observations include at least one shareholder holding more than 1% of the firm's outstanding shares and the shares of more than one other firm in the same industry. The maximum value of *NumCross* is 5, indicating that a firm has five common owners, and the mean value of *NumConnect* is 3.477, indicating that the average co-owned firm is connected to approximately eight firms (3.477/42.8%) in the same industry through common owners. The maximum value of *AvgNum* is 32, meaning that the average commonly owned firm is connected to 32 firms in the same industry through one common owner.

Table 2 shows the Pearson correlation analysis between the dependent variable, independent variable, and firm-specific control variables. As shown in Table 2, *DumDonation* is significantly positively correlated with *DumCross*, *NumCross*, *NumConnect*, and *AvgNum* at the 1% level. *DM_Donation* is identical to *DumDonation*. *Donation* is significantly positively correlated with *DumCross* and *NumCross* at the 1% level, but not with *NumConnect* and *AvgNum*. The correlation analysis mostly and preliminarily supports Hypothesis 2. Moreover, the coefficients of the pairwise correlations between the control variables are no higher than 0.4, suggesting that multicollinearity is not a serious problem when these variables are simultaneously included in the regressions.

Table 2
Pearson correlation analysis.

Pearson	*DumDonation*	*Donation*	*DM_Donation*	*DumCross*	*NumCross*	*NumConnect*	*AvgNum*	*Lnasset*	*Lev*	*Roa*	*Growth*	*Cflow*	*SOE*	*Lnage*
DumDonation	1													
Donation	0.305***	1												
DM_Donation	0.266***	0.911***	1											
DumCross	0.062***	0.025***	0.032***	1										
NumCross	0.078***	0.068***	0.057***	0.782***	1									
NumConnect	0.032***	0.002	0.033***	0.477***	0.562***	1								
AvgNum	0.019***	−0.020***	0.019***	0.468***	0.343***	0.874***	1							
Lnasset	0.191***	−0.049***	0.023***	0.246***	0.233***	0.247***	0.207***	1						
Lev	0.013*	−0.111***	−0.088***	0.013*	0.011*	−0.012*	−0.020***	0.324***	1					
Roa	0.108***	0.156***	0.125***	0.123***	0.153***	0.062***	0.034***	0.070***	−0.363***	1				
Growth	0.012*	0.008	0.01	−0.014**	−0.009	−0.034***	−0.034***	0.043***	0.034***	0.175***	1			
Cflow	0.051***	0.102***	0.071***	0.078***	0.100***	0.056***	0.039***	0.060***	−0.149***	0.324***	0.005	1		
SOE	−0.045***	−0.107***	−0.106***	0.163***	0.137***	0.079***	0.059***	0.303***	0.259***	−0.089***	−0.057***	0.048***	1	
Lnage	−0.046***	−0.090***	−0.035***	0.019***	0.024***	0.112***	0.097***	0.147***	0.178***	−0.095***	−0.006	−0.030***	0.138***	1

This table presents the Pearson correlation analysis between the dependent variable, independent variable, and firm-specific control variables.
All of the variables are defined in Appendix A. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

5. Empirical results

5.1. Baseline multivariate regression results

Table 3 reports the results from estimating Eq. (1) with the CSR investment proxy[4] variables *DumDonation*, *Donation*, and *DM_Donation*, and the rcorresponding regression results are shown in Columns (1)–(4), (5)–(8), and (9)–(12), respectively. As shown in all columns of Table 3, except for the coefficient of *DumDonation* on *AvgNum* being positive but not significant in Column (4), the coefficients of *DumDonation* on *DumCross*, *NumCross*, and *NumConnect*, the coefficients of *Donation* on *DumCross*, *NumCross*, *NumConnect*, and *AvgNum*, and the coefficients of *DM_Donation* on *DumCross*, *NumCross*, *NumConnect*, and *AvgNum* are all positive and significant at the 1% level, providing strong and consistent support for Hypothesis 2. These results reveal that common owners promote CSR investments, echoing the conjecture that common owners are concerned about firms' CSR investments as they are closely related to industry and even macroeconomic growth and that common owners promote mini ecosystems and sustainable industry development. Regarding co-owned firms, their managers consider common owners' preference for social responsibility when they develop CSR strategies.

Considering that the incentives for corporate donations are seeking legitimacy from the Chinese government (Zhang et al., 2016; Zheng et al., 2017), do nongovernment-affiliated common owners encourage firms to donate for the same purpose? To answer this question, this study categorizes common owners into government-affiliated and nongovernment-affiliated groups and constructs two variables based on the common owner variables *DumCross* and *NumCross*: *Gov_DumCross* is an indicator variable that equals 1 if any of a firm's common owners are affiliated with the government, and *NonGov_DumCross* is an indicator variable that equals 1 if any of a firm's common owners are not affiliated with the government; *Gov_NumCross* is the number of common owners affiliated with the government, and *NonGov_NumCross* is the number of common owners not affiliated with the government.

The regression results are shown in Table 4. The results show that the positive effect of nongoverment-affiliated common owners on CSR investment is more prominent (Columns 1, 3, and 5). Moreover, as the number of common owners not affiliated with the government increases, CSR investment significantly increases, and as the number of common owners affiliated with the government increases, CSR investment significantly decreases (Columns 2, 4, and 6). That is, the incentive of nongovernment-affiliated common owners to promote corporate donations to seek legitimacy is stronger than that of government-affiliated common owners. It also means that common owners encourage firms to invest in CSR based on not only their concerns about CSR and sustainable industry development but also the motivation of seeking legitimacy, which complements the conclusions of previous studies (Zhang et al., 2016; Zheng et al., 2017).

Additional empirical tests confirm and supplement this conclusion. First, in the empirical model (Eq. (1)), adding the political connection variable to the control variables, which follows the definition in Chen et al. (2011), the results are consistent with those in Table 3 and supplement the findings on the influence of institutional antecedents on corporate donation decisions in the Chinese context by Zhang et al. (2016) and Zheng et al. (2017). In other words, in addition to gaining legitimacy, catering to the concerns of common owners is an important factor influencing corporate donation decisions. Second, conducting the empirical test using only the non-SOE sample, the results show that the positive effect of common owners on CSR investments remains significant in non-state-owned enterprises. Last, this study estimates Eq. (1) again controlling for *Year*Industry* fixed effects, and the results, as shown in Table 3, are robust.[5]

[4] Additionally, this study adopts RKS rating scores (Marquis and Qian, 2014; Li et al., 2020), which are provided by third-party agencies that assess listed companies' CSR reporting, as a CSR investment proxy, and the regression results are essentially consistent with the baseline multivariate regression results in Table 3. The results are not included in the text but will be provided upon request.

[5] The results are not included in the text but will be provided upon request. Thanks to an anonymous reviewer for their valuable comments.

Table 3
Common Owners and CSR Investments.

Variable	Dum_Donation (Logit Model)				Donation (OLS Model)				DM_Donation (OLS Model)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DumCross	0.105***				0.003***				0.002***			
	(3.179)				(5.117)				(4.787)			
NumCross		0.137***				0.004***				0.004***		
		(4.194)				(7.451)				(6.980)		
NumConnect			0.034**				0.002***				0.002***	
			(2.024)				(6.479)				(6.469)	
AvgNum				0.022				0.001***				0.001***
				(1.075)				(4.380)				(4.585)
Lnasset	0.511***	0.506***	0.513***	0.516***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(29.362)	(29.029)	(29.365)	(29.656)	(5.101)	(4.238)	(4.609)	(5.301)	(4.904)	(4.091)	(4.344)	(4.992)
Lev	−0.110	−0.109	−0.110	−0.112	−0.009***	−0.009***	−0.009***	−0.009***	−0.009***	−0.009***	−0.009***	−0.009***
	(−1.273)	(−1.266)	(−1.277)	(−1.300)	(−7.367)	(−7.354)	(−7.280)	(−7.327)	(−7.283)	(−7.270)	(−7.190)	(−7.232)
Roa	2.118***	2.077***	2.146***	2.168***	0.054***	0.053***	0.054***	0.055***	0.051***	0.050***	0.051***	0.052***
	(7.368)	(7.224)	(7.465)	(7.544)	(10.957)	(10.635)	(10.961)	(11.152)	(10.380)	(10.074)	(10.358)	(10.543)
Growth	−0.049**	−0.048*	−0.049**	−0.050**	−0.001**	−0.001*	−0.001*	−0.001**	−0.001**	−0.001*	−0.001*	−0.001*
	(−1.970)	(−1.930)	(−1.969)	(−2.020)	(−2.041)	(−1.888)	(−1.826)	(−1.989)	(−2.000)	(−1.851)	(−1.763)	(−1.918)
Cflow	0.592***	0.577***	0.593***	0.603***	0.023***	0.023***	0.023***	0.023***	0.020***	0.020***	0.020***	0.020***
	(2.806)	(2.732)	(2.809)	(2.857)	(6.680)	(6.527)	(6.574)	(6.686)	(5.799)	(5.653)	(5.683)	(5.791)
SOE	−0.499***	−0.502***	−0.494***	−0.490***	−0.008***	−0.009***	−0.008***	−0.008***	−0.008***	−0.009***	−0.009***	−0.008***
	(−14.121)	(−14.209)	(−13.980)	(−13.881)	(−15.733)	(−16.004)	(−15.834)	(−15.604)	(−15.911)	(−16.171)	(−16.060)	(−15.850)
Lnage	−0.228***	−0.228***	−0.230***	−0.232***	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**	−0.002**
	(−5.080)	(−5.084)	(−5.118)	(−5.151)	(−2.290)	(−2.285)	(−2.224)	(−2.281)	(−2.383)	(−2.379)	(−2.305)	(−2.353)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	−8.555***	−8.468***	−8.586***	−8.643***	0.006	0.009*	0.008	0.005	−0.013**	−0.010*	−0.011**	−0.013**
	(−20.431)	(−20.161)	(−20.463)	(−20.651)	(1.160)	(1.785)	(1.444)	(0.997)	(−2.411)	(−1.817)	(−2.082)	(−2.513)
R2_A	0.091	0.091	0.091	0.091	0.118	0.119	0.118	0.117	0.041	0.042	0.041	0.040
N	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091

This table presents the estimation results for the effects of common owners on CSR investments. The models in Columns (1)–(4) are estimated by logit regression, and Columns (5)–(12) are estimated by ordinary least squares (OLS). All of the continuous variables are winsorized at the 1% and 99% levels. All specifications include all of the control variables and year and industry fixed effects. The sample period is 2007–2018. The *t*-statistics (z-statistics in the logit model) based on robust standard errors adjusted for White (1980) are shown in brackets. All variables are defined in Appendix A. ***, **, and * denote significance at 1%, 5%, and 10% levels (two-tailed), respectively.

Table 4
Common Owners According to Government Affiliation.

Variable	Dum_Donation (Logit Model)		Donation (OLS Model)		DM_Donation (OLS Model)	
	(1)	(2)	(3)	(4)	(5)	(6)
Gov_DumCross	−0.124		−0.001		−0.001	
	(−1.582)		(−0.613)		(−0.540)	
NonGov_DumCross	0.129***		0.003***		0.003***	
	(3.806)		(5.544)		(5.181)	
Gov_NumCross		−0.253**		−0.003*		−0.002*
		(−2.277)		(−1.814)		(−1.659)
NonGov_NumCross		0.155***		0.004***		0.004***
		(4.699)		(7.908)		(7.386)
Lnasset	0.512***	0.508***	0.001***	0.001***	0.001***	0.001***
	(29.430)	(29.111)	(5.195)	(4.329)	(4.989)	(4.180)
Lev	−0.110	−0.109	−0.009***	−0.009***	−0.009***	−0.009***
	(−1.272)	(−1.268)	(−7.381)	(−7.373)	(−7.296)	(−7.288)
Roa	2.096***	2.054***	0.054***	0.052***	0.051***	0.049***
	(7.289)	(7.142)	(10.891)	(10.544)	(10.319)	(9.991)
Growth	−0.046*	−0.045*	−0.001*	−0.001*	−0.001*	−0.001*
	(−1.855)	(−1.803)	(−1.915)	(−1.710)	(−1.880)	(−1.682)
Cflow	0.583***	0.567***	0.023***	0.023***	0.020***	0.019***
	(2.759)	(2.686)	(6.643)	(6.482)	(5.763)	(5.610)
SOE	−0.493***	−0.494***	−0.008***	−0.008***	−0.008***	−0.008***
	(−13.892)	(−13.933)	(−15.591)	(−15.818)	(−15.783)	(−16.000)
Lnage	−0.227***	−0.228***	−0.002**	−0.002**	−0.002**	−0.002**
	(−5.062)	(−5.071)	(−2.275)	(−2.267)	(−2.369)	(−2.363)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	−8.605***		0.006	0.009*	−0.013**	−0.010*
	(−20.520)		(1.049)	(1.679)	(−2.511)	(−1.919)
R2_A	0.091	0.091	0.118	0.120	0.041	0.042
N	23,091	23,091	23,091	23,091	23,091	23,091

This table presents the estimation results with common owners sorted into government- and nongovernment-affiliated categories. All of the continuous variables are winsorized at the 1% and 99% levels. All specifications include all of the control variables and year and industry fixed effects. The sample period is 2007–2018. The *t*-statistics (z-statistics in the logit model) based on robust standard errors adjusted for White (1980) are shown in brackets. All of the variables are defined in Appendix A. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

5.2. Cross-sectional tests

5.2.1. Cross-sectional tests: state-owned enterprises

According to the literature (Li and Zhang, 2010; Du, 2014b), compared with non-state-owned firms, corporate governance and corporate strategies, such as CSR, differ in state-owned firms. Li and Zhang (2010) find that the positive correlation between corporate ownership dispersion and CSR for state-owned firms is reversed. Du (2014b) provides evidence that the negative association between Confucianism and minority shareholder expropriation differs between state-owned and non-state-owned enterprises. Therefore, these studies prompt further examination of whether and how common owners' positive influence on CSR investments differs between state-owned and non-state-owned enterprises. This study introduces an interaction between common owners and the nature of state ownership (i.e., CO_{it}*SOE_{it}) into Eq. (1) to examine the interactive effects on CSR investments.

$$CSR_{it} = \beta_0 + \beta_1 CO_{it} + \beta_2 SOE_{it} + \beta_3 CO_{it} * SOE_{it} + \beta Controls + Year + Industry + \delta_{i,t} \quad (2)$$

In Eq. (2), SOE_{it} is the nature of state ownership, and it equals 1 if the ultimate controller of the listed firm is a central or local government agency or government-controlled state-owned enterprise and 0 otherwise (Du, 2014b). All of the other variables are the same as in Eq. (1).

Table 5
Common owners, SOE, and CSR investments.

Variable	DumDonation (Logit Model)				Donation (OLS Model)				DM_Donation (OLS Model)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DumCross	0.204***				0.004***				0.004***			
	(4.480)				(5.224)				(5.090)			
*DumCross*SOE*	−0.192***				−0.003***				−0.003***			
	(−3.085)				(−3.082)				(−3.196)			
NumCross		0.238***				0.006***				0.006***		
		(5.165)				(7.136)				(6.996)		
*NumCross*SOE*		−0.187***				−0.004***				−0.004***		
		(−3.060)				(−3.912)				(−4.134)		
NumConnect			0.083***				0.002***				0.002***	
			(3.513)				(6.208)				(6.248)	
*NumConnect*SOE*			−0.090***				−0.002***				−0.002***	
			(−2.915)				(−3.198)				(−3.273)	
AvgNum				0.077***				0.002***				0.002***
				(2.731)				(4.345)				(4.443)
*AvgNum*SOE*				−0.106***				−0.001**				−0.001**
				(−2.822)				(−2.339)				(−2.283)
SOE	−0.423***	−0.434***	−0.436***	−0.434***	−0.007***	−0.007***	−0.007***	−0.008***	−0.007***	−0.007***	−0.007***	−0.008***
	(−9.733)	(−10.309)	(−10.719)	(−10.708)	(−11.290)	(−11.241)	(−12.394)	(−12.680)	(−11.419)	(−11.262)	(−12.584)	(−12.965)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	−8.614***	−8.527***	−8.646***	−8.698***	0.005	0.008	0.007	0.005	−0.014***	−0.011**	−0.012**	−0.014***
	(−20.558)	(−20.287)	(−20.574)	(−20.754)	(0.974)	(1.534)	(1.281)	(0.891)	(−2.593)	(−2.072)	(−2.238)	(−2.607)
R2_A	0.091	0.091	0.091	0.091	0.118	0.120	0.119	0.117	0.041	0.043	0.042	0.040
N	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091

This table presents the estimation results for the moderating effects of the nature of state ownership, i.e., *SOE*, on the association between common owners and CSR investments. The models in Columns (1)–(4) are estimated by logit regression, and Columns (5)–(12) are estimated by OLS. All of the continuous variables are winsorized at the 1% and 99% levels. All specifications include all of the control variables and year and industry fixed effects. The sample period is 2007–2018. The *t*-statistics (z-statistics in the logit model) based on robust standard errors adjusted for White (1980) are shown in brackets. All of the variables are defined in Appendix A. ***, **, and * denote significance at 1%, 5%, and 10% levels (two-tailed), respectively.

Table 5 presents the results from estimating Eq. (2) with the CSR investment proxy variables *DumDonation*, *Donation*, and *DM_Donation*, and the corresponding regression results are shown in Columns (1)–(4), (5)–(8), and (9)–(12), respectively. As shown, the coefficients of SOE_{it} (β_2) are negative and significant at the 1% level in all cases.

Moreover, when the dependent variable is *DumDonation*, the interaction items between *CO* and *SOE*, i.e., *DumCross*SOE*, *NumCross*SOE*, *NumConnect*SOE*, and *AvgNum*SOE*, are negative and significant at the 1% level across Columns (1)–(4) of Table 5. When the dependent variable is *Donation*, the interaction items between common owners and the nature of state ownership are negative and significant at the 1%, 1%, 1%, and 5% levels in Columns (5)–(8) of Table 5, respectively. When the dependent variable is *DM_Donation*, adjusted by the average donation ratio of the industry to which the firm belongs, the interaction items of *DumCross*SOE*, *NumCross*SOE*, *NumConnect*SOE*, and *AvgNum*SOE*, are negative and significant at the 1%, 1%, 1%, and 5% levels in Columns (9)–(12), respectively. In other words, the coefficients of the interaction between common owners and the nature of state ownership, that is, *CO*SOE* (β_3), are negative and significant.

These results ($\beta_3 < 0$) indicate that because state-owned firms intensely interact with the government, common owners may have less influence on state-owned firms' CSR investments even if they are co-owned. In this regard, the financial objectives of state-owned firms are distinct from those of non-state-owned firms, i.e., maximizing firm value. Therefore, state-owned firm managers may consider common owners' preferences for social responsibility to a lesser extent. In sum, the nature of state ownership weakens the positive effects of common owners on CSR investments, suggesting that common owners' positive influence on CSR investments is less pronounced for state-owned firms. These findings support the arguments in the literature.

In addition, the results ($\beta_2 + \beta_3 < 0$) suggest that state-owned firms are already burdened with many government policy tasks (Shleifer and Vishny, 1994), such as infrastructure development and the resolution of unemployment challenges, so they may be less involved in CSR investments. In other words, state-owned firms are politically committed to CSR, thus they invest in CSR differently from how non-state-owned firms invest in CSR, such as making donations as nonoperating expenses.

5.2.2. Cross-Sectional Tests: Prospectors and Defenders

Firms with different business strategies have different characteristics (Miles and Snow, 1978; Miles and Snow, 2003; Bentley et al., 2013). Prospectors focus on innovation, which produces greater outcome uncertainty and a greater need for financing, whereas defenders focus on efficiency, which produces less outcome uncertainty and more operating cash flow (Bentley et al., 2013). Therefore, prospectors may have stronger incentives to invest in CSR to better access finance, whereas defenders may make fewer CSR investments as they have less need for financing. Therefore, this study conjectures that the association between common owners and CSR investments may vary between firms with different business strategies.

Following Bentley et al. (2013), this study classifies business strategy into three types according to the strategy score: defenders (strategy score from 6 to 12), analyzers (strategy score from 13 to 23), and prospectors (strategy score from 24 to 30). This study introduces an interaction between common owners and business strategies (i.e., CO_{it} * $Prospectors_{it}$ and CO_{it} * $Defenders_{it}$) into Eq. (1) to examine their interactive effects on CSR investments.

$$CSR_{it} = \beta_0 + \beta_1\ CO_{it} + \beta_2\ Prospectors_{it} + \beta_2\ Defenders_{it} + \beta_3\ CO_{it} * Prospectors_{it} + \beta_3 CO_{it} * Defenders_{it} + \beta Controls + Year + Industry + \delta_{it} \quad (3)$$

where $Prospectors_{it}$ and $Defenders_{it}$ are indicator variables for the types of business strategy. Specifically, $Prospectors_{it}$ equals 1 for the observations with a strategy score from 24 to 30 and 0 otherwise; $Defenders_{it}$ equals 1 for the observations with a strategy score from 6 to 12 and 0 otherwise. All of the other variables are the same as in Eq. (1).

Table 6 reports the results from estimating Eq. (3). With *DumDonation* as the dependent variable, the coefficients of *DumCross*Prospectors*, *NumCross*Prospectors*, *NumConnect*Prospectors*, and *AvgNum*Prospectors* are positive and significant at the 1%, 1%, 5%, and 5% levels in Columns (1)–(4), respectively. The coefficients of *DumCross*Defenders*, *NumCross*Defenders*, *NumConnect*Defenders*, and *AvgNum*Defenders* are negative but not significant in Columns (1)–(4).

Table 6
Common owners, business strategy, and CSR investments.

Variable	DumDonation (Logit Model)				Donation (OLS Model)				DM_Donation (OLS Model)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DumCross	0.073				0.003***				0.002***			
	(1.482)				(3.832)				(3.792)			
*DumCross*Prospectors*	0.415***				0.003				0.003			
	(3.099)				(1.498)				(1.379)			
*DumCross*Defenders*	−0.114				−0.002				−0.002			
	(−0.906)				(−1.337)				(−1.502)			
NumCross		0.108**				0.004***				0.003***		
		(2.224)				(5.063)				(4.957)		
*NumCross*Prospectors*		0.418***				0.003				0.003		
		(3.005)				(1.320)				(1.260)		
*NumCross*Defenders*		−0.177				−0.001				−0.002		
		(−1.401)				(−0.816)				(−1.021)		
NumConnect			0.019				0.001***				0.001***	
			(0.843)				(4.572)				(4.657)	
*NumConnect*Prospectors*			0.163**				0.000				0.000	
			(2.486)				(0.448)				(0.393)	
*NumConnect*Defenders*			−0.036				−0.001				−0.001*	
			(−0.688)				(−1.576)				(−1.729)	
AvgNum				0.009				0.001***				0.001***
				(0.317)				(3.535)				(3.688)
*AvgNum*Prospectors*				0.176**				0.000				0.000
				(2.259)				(0.243)				(0.169)
*AvgNum*Defenders*				−0.016				−0.001*				−0.001*
				(−0.256)				(−1.752)				(−1.875)
Prospectors	0.067	0.083	0.120	0.130*	−0.000	−0.000	0.001	0.001	−0.000	−0.000	0.001	0.001
	(0.805)	(1.027)	(1.556)	(1.682)	(−0.192)	(−0.090)	(0.784)	(0.931)	(−0.294)	(−0.221)	(0.616)	(0.771)
Defenders	−0.186**	−0.163**	−0.207***	−0.227***	−0.001	−0.002*	−0.001*	−0.002*	−0.001	−0.001	−0.001	−0.001*
	(−2.256)	(−2.044)	(−2.739)	(−3.016)	(−1.608)	(−1.805)	(−1.786)	(−1.879)	(−1.402)	(−1.556)	(−1.577)	(−1.701)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	−9.753***	−9.670***	−9.783***	−9.831***	0.012*	0.015**	0.014**	0.012*	−0.009	−0.006	−0.007	−0.009
	(−16.669)	(−16.481)	(−16.671)	(−16.789)	(1.823)	(2.246)	(2.087)	(1.768)	(−1.351)	(−0.935)	(−1.060)	(−1.376)
R2_A	0.100	0.100	0.099	0.099	0.093	0.095	0.093	0.093	0.051	0.053	0.052	0.051
N	12,913	12,913	12,913	12,913	12,928	12,928	12,928	12,928	12,928	12,928	12,928	12,928

This table presents the estimation results for the moderating effects of business strategy type, i.e., prospectors and defenders, on the association between common owners and CSR investments. The models in Columns (1)–(4) are estimated by logit regression, and those in Columns (5)–(12) are estimated by OLS. All of the continuous variables are winsorized at the 1% and 99% levels. All specifications include all of the control variables and year and industry fixed effects. The sample period is 2007–2018. The *t*-statistics (z-statistics in the logit model) based on robust standard errors adjusted for White (1980) are shown in brackets. All of the variables are defined in Appendix A. ***, **, and * denote significance at 1%, 5%, and 10% levels (two-tailed), respectively.

With *Donation* as the dependent variable, the interaction items between common owners and prospectors, i.e., *DumCross*Prospectors*, *NumCross*Prospectors*, *NumConnect*Prospectors*, and *AvgNum*Prospectors*, are positive but not significant, as shown in Columns (5)–(8), respectively. The interaction item *AvgNum*Defenders* is negative and significant at the 10% level in Column (5), and the interaction items *DumCross*Defenders*, *NumCross*Defenders*, and *NumConnect*Defenders* are negative but not significant in Columns (6)–(8), respectively. With *DM_Donation* as the dependent variable, the interaction items between common owners and prospectors are positive but not significant in Columns (9)–(12). The interaction items *NumCross*Defenders* and *AvgNum*Defenders* are negative and significant at the 10% level in Columns (11) and (12), and the interaction items *DumCross*Defenders* and *NumCross*Defenders* are negative but not significant in Columns (9) and (10).

These results indicate that prospectors strengthen the positive association between common owners and CSR investments, whereas defenders weaken the positive association, even though the weakening effect of defenders is not particularly significant. Further analysis shows that compared with defenders, prospectors have strong incentives to invest in CSR because of their need for financing to support their continually seeking and marketing new products and that common owners can facilitate research and development cooperation for prospectors (He and Huang, 2017). For these reasons, common owners' support is more important for prospectors. Thus, common owners have a stronger influence on prospectors, which can encourage prospector firms to invest more in CSR, and the managers of prospector firms are more prone to satisfying common owners' preferences for social responsibility. In contrast, the motivation to invest in CSR to improve access to financing and to seek collaboration is lower for defenders as they have less outcome uncertainty and less need for financing. Hence, common owners have a weaker influence on defenders, and the positive impacts of common owners on CSR investments are weakened by defenders.

5.3. Supplemental analyses

5.3.1. Supplemental analysis: higher stock returns

Studies indicate that firms that invest more in CSR have higher stock returns (Lins et al., 2017). Therefore, this study introduces the interaction term of common owners and CSR investments and constructs the following regression model to examine the effect of common owners on the positive relationship between CSR investments and stock returns:

$$StockReturn_{it} = \beta_0 + \beta_1 CSR_{it} + \beta_2 CO_{it} + \beta_3 CO_{it} * CSR_{it} + \beta Controls + Year + Industry + \delta_{it} \quad (4)$$

In Eq. (4), the dependent variable is $StockReturn_{it}$, measured by firms' annual stock returns. All of the other variables are the same as in Eq. (1).

Table 7 presents the results from estimating Eq. (4) with *DumDonation*, *Donation*, and *DM_Donation* as the CSR investment proxy variables, and the corresponding regression results are shown in Columns (1)–(4), (5)–(8), and (9)–(12), respectively. As shown in Columns (1)–(4), the interaction terms *DumCross*DumDonation*, *NumCross*DumDonation*, *NumConnect*DumDonation*, and *AvgNum*DumDonation* are not significant. However, the interaction terms *DumCross*Donation*, *NumCross*Donation*, *NumConnect*Donation*, and *AvgNum*Donation* are positive and significant at the 1% level in Columns (5)–(8). When the dependent variable is *DM_Donation*, the coefficients of *DumCross*DM_Donation*, *NumCross*DM_Donation*, and *NumConnect*DM_Donation* are positive and significant at the 1%, 1%, and 5% levels in Columns (9) and (10), respectively. This result is consistent with the conclusion of Lys et al. (2015)[6] that CSR is significantly positively correlated with stock returns.

These results reveal that whether co-owned firms invest in CSR does not significantly affect their stock returns compared with non-co-owned firms, as shown in Table 7 Columns (1)–(4), but co-owned firms that invest more in CSR have higher stock returns than non-co-owned firms, as shown in Columns (5)–(12). That is, the stock market cannot recognize whether firms invest in CSR, but it can identify firms that invest heavily in CSR and reward them with higher stock returns. From the perspective of common owners, these results

[6] Corporate donations in this study represent one type of CSR investment, which is consistent with Lys et al. (2015), but it differs from "charity" in the charity hypothesis that posits that CSR expenditures are negatively correlated with future financial performance.

Table 7
Common Owners, CSR Investments, and Stock Returns.

Variable	Stock Return (DumDonation)				Stock Return (Donation)				Stock Return (DM_Donation)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DumCross	0.029**				0.031***				0.043***			
	(2.323)				(4.039)				(6.016)			
*DumCross*CSR*	0.018				0.637***				0.498***			
	(1.268)				(3.828)				(2.825)			
NumCross		0.052***				0.053***				0.062***		
		(3.893)				(6.788)				(8.667)		
*NumCross*CSR*		0.015				0.448***				0.401***		
		(1.006)				(3.157)				(2.621)		
NumConnect			0.010*				0.007*				0.011***	
			(1.814)				(1.953)				(3.201)	
*NumConnect*CSR*			0.001				0.225***				0.158**	
			(0.099)				(3.116)				(2.076)	
AvgNum				0.002				−0.003				0.001
				(0.305)				(−0.743)				(0.161)
*AvgNum*CSR*				−0.002				0.247***				0.156
				(−0.289)				(2.670)				(1.632)
CSR Vars	−0.017*	−0.016*	−0.009	−0.007	−0.224*	−0.175	−0.103	−0.055	−0.211*	−0.201*	−0.100	−0.054
	(−1.790)	(−1.737)	(−1.048)	(−0.831)	(−1.906)	(−1.557)	(−0.931)	(−0.501)	(−1.757)	(−1.747)	(−0.899)	(−0.488)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	2.618***	2.664***	2.599***	2.561***	2.626***	2.672***	2.609***	2.572***	2.622***	2.669***	2.607***	2.571***
	(34.955)	(35.400)	(34.492)	(34.156)	(35.170)	(35.587)	(34.725)	(34.408)	(35.109)	(35.542)	(34.686)	(34.375)
R2_A	0.642	0.643	0.641	0.641	0.642	0.643	0.642	0.641	0.642	0.643	0.641	0.641
N	22,767	22,767	22,767	22,767	22,767	22,767	22,767	22,767	22,767	22,767	22,767	22,767

This table presents the estimation results for the moderating effects of common owners on the association between CSR investments and stock returns. All of the models are estimated by OLS. All of the continuous variables are winsorized at the 1% and 99% levels. All specifications include all of the control variables and year and industry fixed effects. The sample period is 2007–2018. The *t*-statistics based on robust standard errors adjusted for White (1980) are shown in brackets. All of the variables are defined in Appendix A. ***, **, and * denote significance at 1%, 5%, and 10% levels (two-tailed), respectively.

suggest that common owners encouraging firms to invest more in CSR benefit from higher stock returns. In other words, common owners earn rewards through the stock market for improving CSR.

5.3.2. Supplemental analysis: alleviate financial constraints

Additionally, following the literature documenting that CSR can lower financial constraints (Cheng et al. (2014), this study introduces the interaction term of common owners and CSR investments and constructs the following regression model to examine the effect of common owners on the association between CSR investments and financial constraints:

$$FinancialConstraint_{it} = \beta_0 + \beta_1\ CSR_{it} + \beta_2\ CO_{it} + \beta_3\ CO_{it} * CSR_{it} + \beta Controls + Year + Industry + \delta_{it} \quad (5)$$

In Eq. (5), *FinancialConstraint* is the extent of listed firms' financial constraints, measured using the SA index in Hadlock and Pierce (2010). All of the other variables are the same as in Eq. (1).

Table 8 reports the regression results using Eq. (5) and *DumDonation*, *Donation*, and *DM_Donation* as the CSR investment proxy variables, and the corresponding regression results are shown in Columns (1)–(4), (5)–(8), and (9)–(12), respectively. The results in Columns (1)–(4) show that the coefficients of *DumCross*DumDonation*, *NumCross*DumDonation*, *NumConnect*DumDonation*, and *AvgNum*DumDonation* are negative and significant at the 1% level across all columns. Moreover, except the interaction item *DumCross*DM_Donation* that is negative and significant at the 1% level in Column (9), the interaction items *NumCross*DM_Donation* and *AvgNum*DM_Donation* are negative and significant at the 5% level in Columns (10)–(12). These results indicate that co-owned firms that invest or invest more in CSR experience significantly

Table 8
Common owners, CSR investments, and financial constraints.

Variable	Financial Constraint (DumDonation)				Financial Constraint (Donation)				Financial Constraint (DM_Donation)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
DumCross	0.012***				−0.010***				−0.009***			
	(3.051)				(−4.659)				(−4.665)			
*DumCross*CSR*	−0.031***				0.081				−0.140***			
	(−6.669)				(1.641)				(−2.675)			
NumCross		0.008*				−0.013***				−0.011***		
		(1.866)				(−5.883)				(−5.529)		
*NumCross*CSR*		−0.027***				0.106***				−0.100**		
		(−5.676)				(2.736)				(−2.372)		
NumConnect			−0.002				−0.012***				−0.011***	
			(−1.200)				(−10.537)				(−10.674)	
*NumConnect*CSR*			−0.012***				0.061***				−0.052**	
			(−5.246)				(2.837)				(−2.247)	
AvgNum				−0.002				−0.014***				−0.013***
				(−0.804)				(−10.268)				(−10.726)
*AvgNum*CSR*				−0.016***				0.056*				−0.080**
				(−5.664)				(1.934)				(−2.537)
CSR Vars	0.056***	0.054***	0.052***	0.052***	0.084**	0.073**	0.080**	0.091***	0.176***	0.163***	0.161***	0.162***
	(19.459)	(19.238)	(19.745)	(19.975)	(2.192)	(2.038)	(2.300)	(2.645)	(4.370)	(4.313)	(4.430)	(4.498)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	2.433***	2.428***	2.416***	2.423***	2.391***	2.384***	2.370***	2.378***	2.394***	2.387***	2.372***	2.380***
	(55.510)	(55.077)	(54.562)	(54.979)	(54.077)	(53.564)	(53.035)	(53.450)	(54.158)	(53.645)	(53.106)	(53.522)
R2_A	0.691	0.691	0.692	0.692	0.685	0.685	0.686	0.686	0.685	0.685	0.686	0.686
N	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091	23,091

This table presents the estimation results for the moderating effects of common owners on the association between CSR investments and financial constraints. All of the models are estimated by OLS. All of the continuous variables are winsorized at the 1% and 99% levels. All specifications include all of the control variables and year and industry fixed effects. The sample period is 2007–2018. The *t*-statistics based on robust standard errors adjusted for White (1980) are shown in brackets. All of the variables are defined in Appendix A. ***, **, and * denote significance at 1%, 5%, and 10% levels (two-tailed), respectively.

lower financial constraints. From the perspectives of co-owned firms, CSR investments can therefore lower financial constraints to some extent.

However, the interaction items *NumCross*Donation*, *NumConnect*Donation*, and *AvgNum*Donation* are positive and significant at the 1%, 1%, and 5% levels in Columns (6)–(9), respectively, and the coefficient of *DumCross*Donation* is positive but not significant in Column (5), suggesting that co-owned firms with more CSR investments have greater financial constraints. These results seem to conflict with the results with *DumDonation* and *DM_Donation* as the CSR investment proxies. However, these results may be attributable to *Donation* being regarded as a cash outflow and nonoperating expenses that directly lower available cash flow, but *DumDonation* and *DM_Donation* are somewhat removed from directly influencing firms' cash flows.

In addition, as the results in Table 8 show, the total effects of CSR investments on financial constraints ($\beta_1 + \beta_3$) are positive and significant. In this regard, donations, as they affect cash outflow, would exacerbate the degree of financial constraints faced by firms, which is consistent with the viewpoint expressed in Friedman (1970), namely, as an expenditure, corporate donations directly reduce corporate operating profits. Even so, listed firms make donations to commit to CSR. This practice indicates that firms consider shareholders' preferences for social responsibility, including common owners' preferences (Hart and Zingales, 2017), which is consistent with views on corporate citizenship in the literature (D. A. Jones, 2010; C. Lin et al., 2010).

6. Potential endogeneity and robustness checks

6.1. Potential endogeneity

6.1.1. Mitigating potential endogeneity driven by omitted variables

To mitigate potential endogeneity driven by omitted variables, this study includes additional corporate governance variables,[7] such as the percentage of shares owned by a firm's top shareholder, *Shar1*, the percentage of shares owned by a firm's managers, *Manageshare*, the natural logarithm of the number of directors on the board, *Board*, the ratio of independent directors to the total directors on the board, *Indenpendr*, and whether the CEO and chairman of the board are the same person, *Dual*, and re-estimates Eqs. (1)–(5). All of the variables are defined in Appendix A. These results are not tabulated; however, they are qualitatively similar to those reported in Tables 3–8.

6.1.2. Mitigating potential endogeneity driven by reverse causality

The above results confirm that common owners can promote co-owned firms' CSR investments. However, the conclusion can be interpreted with an alternative explanation, namely, that common owners are inclined to select firms that invest or invest more in CSR when constructing their portfolio. To mitigate this potential endogeneity driven by reverse causality, this study lags the independent and control variables one year in Eqs. (1)–(5) and then re-estimates Eqs. (1)–(5). The findings remain strong and robust.

6.1.3. Mitigating potential endogeneity driven by sample selection bias

Propensity Score Matching

When choosing listed firms in a certain industry to build their portfolios, common owners may consider certain characteristics of listed firms. For example, they are more likely to hold shares of firms with good financial performance. Moreover, considering their effect on firms, they may tend to hold shares of firms in which the firms' largest shareholders own a lower percentage of shares. Therefore, this study uses the propensity score matching procedure to alleviate potential endogeneity from sample selection bias.

[7] Institutional investors' shareholdings are excluded for two reasons. First, common owners may have some institutional investors. Including institutional investors' shareholdings requires considering common owners' effects on CSR investments by creating common ownership and institutional investor shareholdings proxies, which may not clearly reveal common owners' incremental effects on CSR investments. Second, the correlation coefficient between common owners' proxies (i.e., *NumConnect*) and institutional investors shareholdings is 0.481, close to 0.5, which may result in a serious multicollinearity problem and invalidate the regression results. Nevertheless, the untabulated tests also include institutional investors' shareholdings in the additional control variables, measured as the percentage of shares owned by a firm's institutional investors. The results are qualitatively similar to those reported in Tables 3–8.

Based on the firm characteristics of size (*Lnasset*), leverage (*Lev*), return on assets (*Roa*), sales growth (*Growth*), operating cash flow (*Cflow*), the nature of state ownership (*SOE*), firm age (*Lnage*), the percentage of shares owned by firms' largest shareholders (*Shar1*), the percentage of shares owned by firms' managers (*Manageshare*), the natural logarithm of the number of directors on the board (*Board)*, the ratio of independent directors to total directors (*Indenpendr*), and whether the CEO and chairman of the board are the same person (*Dual*), this study uses the one-to-one nearest neighbor matching method to construct regression samples in which the firms' characteristics are as similar as possible, except for having common owners. Using the matched sample, this study re-estimates Eqs. (1)–(5), and the regression results are not tabulated but are qualitatively similar to those reported in Tables 3–8.

Heckman Two-Stage Regression

Additionally, this study adopts the Heckman two-stage regression approach to further control potential endogeneity driven by sample selection bias. In the first stage, this study uses a probit regression model to estimate the following model, Eq. (6), and acquires the inverse Mills ratio, i.e., lambda. In the second stage, this study includes the lambda obtained in the first stage in the control variables and re-estimates Eqs. (1)–(5). The regression results are not tabulated but are qualitatively similar to those reported in Tables 3–8.

$$P\ (Dumcross_{it}) = \alpha_0 + \alpha_1 Lnasset_{it} + \alpha_2 Lev_{\ it} + \alpha_3 Roa_{it} + \alpha_4 Growth_{it} + \alpha_5 Cflow_{it} + \alpha_6 SOE_{it} + \alpha_7 Lnage_{it} + \alpha_8 Shar1_{it} + \alpha_9 Manageshare_{it} + \alpha_{10} Boadr_{it} + \alpha_{11} Independr_{it} + \alpha_{12} Dual_{it} + u_{it} \quad (6)$$

6.2. Robustness checks

Although this study controls the sensitivities of the regression results using many proxy variables to measure the dependent and independent variables, it conducts a series of additional tests to confirm the robustness of the baseline results. First, the study re-estimates all of the models by clustering standard errors at the firm level, and the results suggest that this study's conclusions are robust.

Second, this study recalculates the proxy variables for common owners by changing it from shareholders holding more than 1% of a firm's shares to firms' top 5 shareholders and re-estimates Eqs. (1)–(5). Except for the coefficients of *DumDonation* on *DumCross*, *NumCross*, *NumConnect*, and *AvgNum* are negative and significant at the 10%, 5%, and 5% levels, respectively, and the remaining results are robust to the alternative common owner measure of the top 5 shareholders.

In brief, the results in Tables 3–8 are valid after controlling for potential endogeneity between common owners and CSR investments, and the findings are robust to a variety of sensitivity tests.

7. Conclusions

Corporate shareholders are an important factor influencing CSR (Aguinis and Glavas, 2012). Extending this line of research, this study provides strong evidence that common owners have significantly positive effects on co-owned firms' CSR investments. Moreover, this study analyzes whether the positive association between common owners and CSR investments varies with cross-sectional characteristics, that is, the nature of state ownership and business strategy type. This study finds that the nature of state ownership significantly weakens the positive association between common owners and CSR investments, and that the prospector corporate strategy strengthens the positive influence of common owners on CSR, whereas the defender corporate strategy weakens the positive effect of common owners on CSR investments.

In addition, this study examines the economic consequences of co-owned firms improving CSR investments from the perspectives of common owners and co-owned firms. The regression results indicate that common owners can obtain rewards from the stock market by promoting more CSR investments, and co-owned firms can benefit by alleviating their financial constraints when they invest or invest more in social responsibility. Notably, although investing in CSR imposes costs, firms still consider satisfying shareholders' preferences for social responsibility, including common owners' preferences, which is consistent with the viewpoints regarding corporate citizenship.

This study extends a growing stream of the literature examining the influence of common owners on corporate behavior. The findings also enrich research on the determinants and economic consequences of CSR investments. Moreover, the findings provide evidence of the effects of common owners on corporate behavior and show that CSR investments represent a bright side of common owners. By doing so, the study also provides practical implications for firm managers devising CSR strategies and for authorities assessing the positive effects of common owners on corporate behavior.

Compliance with Ethical Standards

This article does not contain any studies with human participants or animals.

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Appendix A. Variable definitions

Variable	Label	Definition and Calculation
Common Owners	*DumCross*	An indicator variable that equals 1 if the shareholders holding at least 1% of a firm's outstanding shares simultaneously hold the shares of at least one other firm in the same industry and 0 otherwise
	NumCross	The number of common owners that hold the focal firm
	NumConnect	The number of same-industry peers that share any common owners with the focal firm
	AvgNum	The average number of same-industry peers held by the common owners
CSR Investments	*DumDonation*	An indicator variable that equals 1 for firm-years in which the firm makes any donations and 0 otherwise
	Donation	The amount of donations scaled by total assets
	DM_Donation	*Donation* adjusted by the average donation ratio in the industry to which the firm belongs, i.e., *DM_Donation* equals *Donation* minus the average donation ratio of the industry to which the firm belongs
Business Strategy	*Prospectors*	An indicator variable that equals 1 for observations with a strategy score from 24 to 30 and 0 otherwise (Bentley et al., 2013)
	Defenders	An indicator variable that equals 1 for observations with a strategy score from 6 to 12 and 0 otherwise (Bentley et al., 2013)
The Nature of State Ownership	*SOE*	An indicator variable that equals 1 if the ultimate controller of the listed firm is a central or local government agency or government-controlled state-owned enterprise and 0 otherwise (Du, 2014a)
Stock Returns	*StockReturns*	Firms' annual stock returns
Financial Constraint	*Financial Constraints*	Hadlock and Pierce (2010) financial constraints, i.e., SA index $= -0.737 * \text{Size} + 0.043 * \text{Size}^2 - 0.04 * \text{Age}$
Firm Size	*Size*	The natural logarithm of the firm's total assets

(Continued on next page)

Appendix A. (*continued*)

Leverage	*Lev*	The ratio of total liabilities divided by total assets
Return on Assets	*Roa*	Net profits divided by total assets
Sales Growth	*Growth*	The change between current year sales and last year's sales divided by last year's sales
Operating Cash Flow	*Cflow*	Net cash flow from operating activities divided by total assets
Firm Age	*Lnage*	The natural logarithm of the number of years since the firm was founded
Largest Shareholder	*Shar1*	The percentage of shares owned by a firm's largest shareholder
Managerial Ownership	*Manageshare*	The percentage of shares owned by a firm's managers
Board Size	*Board*	The natural logarithm of the number of directors on the board
Independent Directors	*Indenpendr*	The ratio of independent directors to total directors on the board
Whether the CEO and Chairman are the same person	*Dual*	An indicator variable that equals 1 if the CEO and chairman of the board are the same person and 0 otherwise
Year fixed effects	*Year*	Year Dummy variables are set according to the fiscal year
Industry fixed effects	*Ind*	Industry Dummy variables are set according to the industry classification code, issued by the China Securities Regulatory Commission in 2001; for manufacturing, industry dummy variables are set according to the industry category code plus the first two digits of the industry segmentation code, whereas other industry dummy variables are set according to the industry category code

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Where to donate: The geographical distribution of corporate philanthropy in China

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ABSTRACT

An emerging body of literature has demonstrated that corporate philanthropy can be an important part of a company's business strategy. However, we know relatively little about how companies allocate philanthropic resources to achieve their strategic targets. Using geographical distribution data on corporate philanthropy in China from 2009 to 2016, we provide robust evidence of companies' revenue-driven regional favoritism. Specifically, companies donate more to regions where they obtain revenue than to other regions. Further evidence suggests that this revenue-driven regional favoritism may have both reputational and political motivations. Further analysis suggests that China's targeted poverty alleviation policy has compromised revenue-driven regional favoritism while increasing the amount of money donated to poor regions. Overall, we enrich understanding of decision-making on corporate philanthropy. We also demonstrate that companies can use the geographical distribution of corporate philanthropy strategically to obtain consumer and government favor in regions where they operate. The results also provide evidence at the micro company level of the effect of China's implementation of a targeted poverty alleviation policy.

1. Introduction

Corporate philanthropy in China has developed significantly since the 2008 Wenchuan earthquake. Companies account for more than 60% of total donations in China, according to the China Charity Donation report issued by the China Charity Federation from 2009 to 2016. Although corporate philanthropy has been viewed as an altruistic behavior unrelated to a company's ability to make a profit, an increasing number of

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studies have suggested that corporate philanthropy is not purely motivated by altruism. Extensive research has demonstrated the wide range of business benefits that a company can reap from engaging in philanthropy (Brammer and Millington, 2005; Faccio et al., 2006; Zhang et al., 2013; Flammer, 2015; Li et al., 2016; Xia et al., 2019). These benefits can be explained through the enlightened self-interest conceptualization of corporate social responsibility (CSR) in which CSR is believed to benefit shareholders as well as to operate to the benefit of stakeholders and society as a whole (Keim, 1978). Despite the valuable insights obtained from such studies, research highlighting how companies allocate philanthropic resources across regions to achieve strategic targets are still scarce. Given this limitation, the process that companies use to allocate philanthropic resources requires further investigation.

Corporate philanthropy has been found to help companies overcome the liabilities of foreignness, gain consumer recognition, obtain the social license to operate, and secure government support (Zaheer, 1995; Su and He, 2010; Long and Yang, 2016; Hornstein and Zhao, 2018). Based on the above benefits, corporate philanthropy can be used as part of a company's business strategy to enhance its competitiveness, attract and retain customers, and increase revenue in regions to which it donates. If so, we expect companies to donate more to regions where they obtain revenue (vs. regions where they do not obtain revenue), in line with companies' profit-maximizing objective.

To investigate the geographical distribution of decision-making on corporate philanthropy and the motivations underlying it, we manually collect geographical distribution data on corporate philanthropy in China from 2009 to 2016. The empirical results reveal that companies allocate philanthropic resources very unevenly and exhibit strong revenue-driven regional favoritism. These results are in line with the enlightened self-interest perspective.

We also find that the revenue-driven regional favoritism of Chinese companies is driven by reputational and political motivations. Motivated by reputational concerns, companies with high media coverage and companies that sell products directly to consumers demonstrate more pronounced revenue-driven regional favoritism. Motivated by political concerns, the greater the government fiscal pressure in regions where companies obtain revenue, the more philanthropic resources the companies allocate to these regions. Additionally, enterprises that are not state-owned donate more to regions where they obtain (vs. those where they do not obtain) revenue.

We further investigate whether and, if so, how the geographical distribution of corporate philanthropy changes within a particular institutional setting, focusing on China's 2014 implementation of a targeted poverty alleviation policy. Our empirical results show that since the implementation of the targeted poverty alleviation policy, the amount of money donated to regions where companies obtain revenue has decreased, whereas the amount of money donated to poor regions has increased. Therefore, our results suggest that targeted poverty alleviation objectively enhances the altruism effect of corporate philanthropy.

We expand and enrich the literature in several ways. First, our study offers a novel perspective on the geographical distribution of corporate philanthropy. The literature on corporate philanthropy has documented that altruism cannot fully explain corporate philanthropy behavior (Brammer and Millington, 2005; Wang and Qian, 2011; Flammer, 2015; Long and Yang, 2016; Xia et al., 2019). We extend this line of research by examining the important, yet previously ignored, topic of the geographical distribution of corporate philanthropy, providing evidence that companies donate more to regions where they obtain revenue.

Second, we contribute to the emerging literature on the relationship between geography and business strategy. Studies have acknowledged that geographical factors explain much of the cross-sectional variation in companies' financial characteristics, such as corporate payout policy (John et al., 2011), financing (Gao et al., 2011), compensation (Kedia and Rajgopal, 2009), and mergers and acquisitions (Chakrabarti and Mitchell 2013). However, research highlighting the relationship between geography and corporate philanthropy remains scarce. We uncover the importance of geographical factors to decision-making on corporate philanthropy and enrich relevant theoretical and empirical research.

Finally, this study has practical significance. Our findings offer timely insights for the Chinese government and other parties concerned about corporate philanthropy. We provide company-level evidence of the effect of implementing China's targeted poverty alleviation policy.

The remainder of this paper is organized as follows. Section 2 provides an overview of the corporate philanthropy motivation literature. Section 3 develops the hypothesis. Section 4 describes the sample, variable

definitions, and empirical model specifications. Section 5 reviews the summary statistics and reports the main empirical results. Section 6 presents the motivation test. Finally, Section 7 offers a brief conclusion.

2. Literature review

Discerning the motivation of corporate philanthropy is the primary task in evaluating companies' donation behaviors (Long and Yang, 2016). Overall, research has documented two types of corporate philanthropy, namely altruism motivated corporate philanthropy and self-interest motivated corporate philanthropy.

According to altruistic motivation theory, corporate philanthropy is an act inspired by social conscience and altruism (Edmondson and Carroll, 1999; Sánchez, 2000; Xu and Li, 2016). This theory suggests that companies engage in philanthropy to enhance the welfare of society, even if it has little or no effect on company profits (Cowton, 1987; Campbell et al., 1999; Sánchez, 2000). However, an emerging body of literature has demonstrated that corporate philanthropy is not motivated purely by altruism. Companies can hope to reap several benefits from engaging in philanthropy. The first benefit is reputation. Corporate philanthropy can serve as advertising through which companies can enhance their reputation and establish brand recognition (Zhang et al., 2010; Pan et al., 2017). Shan et al. (2008) studied corporate philanthropy after the Wenchuan earthquake on May 12, 2008 in China. They found that companies used corporate philanthropy for self-advertising. Zhang et al. (2010) suggested that corporate philanthropy can be used as an alternative to traditional advertising. The second benefit is political connections. Companies can use corporate philanthropy to cultivate a relationship with the government, in turn promoting their acquisition of government favors. Local governments exert strong control over the allocation of key economic resources, such as land, credit, subsidies, and tax breaks, in China (Buchholtz et al., 1999; Su and He, 2010). This motivates companies to establish political connections with the government. Dai et al. (2014) documented that corporate philanthropy can serve as a special political contribution made by a company to establish political connections. The third benefit is insurance-like protection. Corporate philanthropy can be considered an ex-ante risk management behavior used to cope with future adverse situations. Godfrey (2005) documented that moral capital promoted by corporate philanthropy provides insurance against difficult times. Fu and Ji (2017) found that the amount of money donated by a company increases with litigation risk, indicating that the company may practice philanthropy to prevent further loss of reputation. The fourth benefit is agency costs. Corporate philanthropy may be a form of agency cost for CEOs to enhance their social standing and improve their prestige at their companies' expense (Brown et al., 2006; Long and Yang, 2016).

With the increase in global market competition, corporate philanthropy has become more strategic (Zhang et al., 2010). The benefits that a company can reap from its engagement in philanthropy have led companies to perceive corporate philanthropy as a business strategy. Despite valuable insights from studies demonstrating the positive implications of corporate philanthropy activities for companies, it is unclear how companies allocate corporate philanthropic resources across regions to achieve their strategic targets. We investigate companies' decision-making process surrounding corporate philanthropy and its underlying motivation from the perspective of geographical distribution.

3. Theory and hypothesis development

Studies have documented that corporate philanthropy helps companies overcome liabilities of foreignness (Zaheer, 1995), establish brand recognition and consumer loyalty (Zhang et al., 2010), and cultivate connections with the government (Su and He, 2010; Long and Yang, 2016). These benefits drive companies to view corporate philanthropy as a business strategy for obtaining the favor of consumers and the government. However, the strategic effect of corporate philanthropy may decrease with distance. Compared with other stakeholders, stakeholders that directly benefit from a company's philanthropy have a higher evaluation of the company. Therefore, it is thus reasonable to expect that if corporate philanthropy is used as a form of strategic investment to obtain consumer and government favor, more philanthropic resources are allocated to regions where companies obtain revenue.

Reputational concerns motivate companies to allocate more philanthropic resources to regions where they obtain revenue. Consumers take corporate philanthropy into account when evaluating products and making

purchasing decisions (Sen and Bhattacharya, 2001; Wongpitch et al., 2016). In various respects, corporate philanthropy has been found to improve consumers' evaluations of companies and their products (Sen and Bhattacharya, 2001), to project a more positive image and enhance reputation (Hess et al., 2002), to enhance consumers' trust and brand loyalty (Pivato et al., 2008), and to increase consumers' willingness to purchase (Wongpitch et al., 2016). Therefore, corporate philanthropy can serve as advertising through which companies can enhance their reputation, establish brand recognition and consumer loyalty, and ultimately increase their revenue. Maintaining and further increasing revenue in the region where a company operates are crucial to its development. To obtain the favor of consumers, companies tend to donate more to regions where they obtain revenue.

Political concerns also motivate companies to donate more to regions where they obtain revenue. China has established an institutional separation between businesses and the government, but local governments continue to exert strong control over the allocation of key economic resources. Governments not only shape perceptions of legitimacy but can also exert strong control over a company through rewards or punishments and through the allocation of critical resources that companies need, such as land, credit, subsidies, and tax breaks (Dai et al., 2014; S. Li et al., 2015). Studies have documented that companies that establish political connections with the government enjoy the resources controlled by the government (Faccio et al., 2006; Zhang et al., 2013). Corporate philanthropy is a means through which companies build political connections with the government (Su and He, 2010; W. Li et al., 2015; Long and Yang, 2016). Companies thus have a strong incentive to build political connections with the government via corporate philanthropy. Meanwhile, the Chinese government shoulders the responsibility of closing the poor–rich gap and reducing poverty. Corporate philanthropy is an important form of charity through which companies assist their local governments in implementing certain policy objectives related to social relief and welfare programs (Wang and Qian, 2011). Hence, the shortage of public funds motivates local governments to solicit donations from local companies. Corporate philanthropy is a feasible way to relieve fiscal pressure on the government and to nurture political connections (Su and He, 2010). Therefore, by allocating more philanthropic resources to the regions in which they operate, companies can secure favorable treatment from their local governments (Li and Zhang, 2010; W. Li et al., 2015).

Based on the previous discussion, we propose the following hypothesis:

– Hypothesis: Companies donate more to regions where they obtain revenue (vs. regions where they do not obtain revenue).

4. Research design

4.1. Sample selection and data source

Chinese A-share companies listed on the Shanghai and Shenzhen stock exchanges from 2009 to 2016 are selected as the study sample. We manually collect geographic information on corporate philanthropy from annual reports and CSR reports. Geographical distribution data on revenue are derived from the China Stock Market and Accounting Research (CSMAR) database. Other financial data are derived from the CSMAR database or the China Research Data Service database. We then select our sample as follows: (1) we exclude financial, insurance, and securities listed companies that have special operational characteristics and accounting systems; (2) we exclude special treatment companies, coded as ST (the company has suffered losses for 2 consecutive years) and *ST (the company has suffered losses for 3 consecutive years); (3) we exclude observations that do not disclose geographic information on donations and revenues; and (4) we exclude samples with missing data. Our final sample consists of 45,536 company-year-province observations, including 28,224 company-year-province observations on donations to regions where the company obtains revenue and 17,312 observations on donations to other regions. To reduce the influence of outliers, all of the continuous variables are winsorized at the 1% and 99% levels.

Table 1
Variable definitions.

Dependent variables	
Donation	The amount of money donated by company *i* to province *j* in year *t*
Donation_as	The amount of money donated by company *i* to province *j* in year *t* divided by the total assets of company *i* in year *t*
Independent variable	
Divincom	The amount of revenue obtained by company *i* from province *j* in year *t*
Control variables	
Size	The natural logarithm of total assets at the end of the year
Lev	The ratio of total liabilities to total assets at the end of the year
Sellsexp	The natural logarithm of 1 plus the amount of sales expenses at the end of the year
Cash	Cash holdings, which equal the cash and cash equivalents divided by current liabilities
Growth	The annual percentage revenue growth of a company
Roa	The ratio of annual net profit to total assets at the end of the year
Age	The number of years since a company's establishment
Dual	A dummy variable that equals 1 if the chairman and the CEO are the same person and 0 otherwise
Z	The sum of the shares held by the second to fifth largest shareholders divided by the shares held by the largest shareholder of the company
Politic	A dummy variable that equals 1 if the CEO or chairperson of the board previously worked or currently works in any government bureau and 0 otherwise
GDP	The gross regional product of province *j* in year *t*

4.2. Measures

The dependent variable is province-level corporate philanthropy (*Donat*). *Donat* is measured in two ways: *Donation* and *Donation_as*. *Donation* represents the amount of money donated by company *i* to province *j* in year *t*. *Donation_as* represents the amount of money donated by company *i* to province *j* in year *t* divided by the total assets of company *i* in year *t*.[1]

The independent variable is the province-level revenue of company *i* (*Divincom*), namely the amount of revenue obtained by company *i* from province *j* in year *t*.

Following Shan et al. (2008), Du et al. (2014), and Pan et al. (2017), we also control for a series of variables that affect corporate philanthropy. These variables include corporate characteristics, corporate governance, political connections, and the macroeconomic environment. In addition, we control for company, year, and province fixed effects. Table 1 presents definitions of all of the variables.

4.3. Empirical model specification

We construct the following ordinary least squares regression model to test our hypothesis:

$$Donat_{i,t,j} = \beta_0 + \beta_1 Divincom_{i,t,j} + \sum Controls + \sum Industry + \sum Year + \sum Province + \varepsilon \quad (1)$$

where *Donat* (proxied by $Donation_{i,t,j}$ and $Donation\_as_{i,t,j}$) is our dependent variable, and *Divincom* is the independent variable. If our hypothesis is true, β_1 should be significantly positive.

5. Results

5.1. Descriptive statistics

Table 2 reports the geographical distribution of corporate philanthropy in China. It shows that philanthropic resources are distributed very unevenly. Companies seem to donate mainly to developed provinces

[1] The value of a company's corporate philanthropy is small relative to its total assets. Therefore, the unit of corporate philanthropy is 10,000 yuan, whereas the unit of total assets is 100 million yuan.

Table 2
Geographical distribution of corporate philanthropy.

Province	2009	2010	2011	2012	2013	2014	2015	2016	Total	%
Guangdong	6	11	15	10	11	8	9	13	83	9.62
Sichuan	4	7	7	3	39	8	4	5	77	8.92
Qinghai	1	32	2	2	2	7	8	8	62	7.18
Beijing	0	6	7	12	8	10	10	7	60	6.95
Fujian	4	6	7	9	7	8	10	9	60	6.95
Shanghai	2	5	9	10	9	4	4	4	47	5.45
Yunnan	1	5	7	4	3	12	4	7	43	4.98
Jiangsu	1	4	7	7	7	1	5	11	43	4.98
Zhejiang	2	4	5	7	12	6	4	3	43	4.98
Anhui	4	3	2	5	4	3	6	11	38	4.40
Shandong	2	3	7	2	5	2	3	3	27	3.13
Hunan	1	3	3	4	3	3	4	6	27	3.13
Xinjiang	1	1	4	3	4	3	5	5	26	3.01
Gansu	1	8	1	2	3	3	3	3	24	2.78
Guizhou	1	5	5	3	1	1	1	5	22	2.55
Shanxi	1	2	1	1	3	3	3	7	21	2.43
Henan	1	1	4	2	1	1	1	7	18	2.09
Hebei	0	1	2	2	3	2	2	3	15	1.74
Tianjin	1	2	1	1	2	0	4	2	13	1.51
Jiangxi	1	1	0	2	4	2	1	2	13	1.51
Shaanxi	0	2	1	4	1	2	1	2	13	1.51
Liaoning	0	0	2	2	2	1	2	2	11	1.27
Inner Mongolia	0	0	0	2	3	2	2	1	10	1.16
Guangxi	0	4	0	0	1	3	1	1	10	1.16
Tibet	0	0	1	2	0	0	2	5	10	1.16
Hubei	1	2	2	2	0	0	0	2	9	1.04
Hainan	0	2	1	0	0	3	1	1	8	0.93
Hong Kong, Macao, and Taiwan	6	0	0	0	0	0	1	1	8	0.93
Chongqing	1	3	1	1	0	0	1	1	8	0.93
Jilin	1	3	0	1	1	1	0	0	7	0.81
Ningxia	0	0	1	0	2	1	1	1	6	0.70
Heilongjiang	0	0	1	0	0	0	0	0	1	0.12
Total	44	154	105	105	138	91	98	128	863	
%	5.10	14.60	12.28	12.17	16.34	11.59	11.94	15.99		100

Note: This table presents data on the number of listed companies that donate money to province j in year t.

in China. The top five regions to which companies donate are Guangdong, Sichuan, Qinghai, Beijing, and Fujian. All of these provinces (autonomous regions and municipalities) are developed, with the exception of Qinghai. Qinghai has received many company donations in response to natural disasters. After the 2010 Yushu earthquake ($M = 7.1$) in Qinghai, many companies donated to the province in the name of earthquake relief (Hurtado and Agudelo, 2013). Therefore, we exclude observations of company donations in response to natural disasters, such as earthquakes and typhoons, in one of the robustness tests.

Table 3 reports the descriptive statistics of the main variables. Panel A shows that the mean value of province-level corporate philanthropy is 2,700 yuan, with a standard deviation of 2.58, and the mean value of province-level revenue is 48.8 million yuan, with a standard deviation of 3.195. These values highlight the tremendous geographical differences between corporate philanthropy and revenue. Panel B groups the variables into subsamples of companies that donate to regions where they obtain revenue (28,224 company-year-province observations) and to other regions (17,312 company-year-province observations). The means are calculated for each subsample. The results show that the means of province-level donations and province-level revenue are significantly higher for companies that donate to regions where they obtain revenue. This indicates that companies donate more generously to regions where they obtain revenue.

Table 3
Descriptive statistics.

Panel A. Descriptive statistics of the variables

Variables	Obs.	Mean	SD	Minimum	Median	Maximum
Donation	45,536	0.270	2.580	0.000	0.000	46.000
Donation_as	45,536	0.046	0.486	0.000	0.000	9.925
Divincom	45,536	0.488	3.195	0.000	0.000	36.030
Size	45,536	22.920	1.342	17.630	22.880	27.350
Lev	45,536	0.535	0.191	0.041	0.544	0.983
Sellsexp	45,536	17.040	5.075	0.000	18.290	22.800
Cash	45,536	0.089	0.241	0.000	0.000	2.608
Growth	45,536	16.400	33.720	−79.690	11.380	304.300
Roa	45,536	7.031	5.706	−14.910	5.932	42.920
Age	45,536	12.290	6.090	0.000	0.000	24.000
Dual	45,536	0.155	0.362	0.000	0.000	1.000
Z	45,536	0.643	0.625	0.008	0.415	3.455
politic	45,536	0.439	0.496	0.000	0.000	1.000
GDP	45,536	9.491	0.988	6.092	9.660	11.300

Panel B. Mean difference tests of the variables

Variables	Donated to regions where they obtain revenue (N=28,224)		Donated to other regions (N=17,312)		Mean difference test
	Mean	SD	Mean	SD	
Donation	0.303	2.702	0.216	2.366	0.087***
Donation_as	0.0530	0.520	0.0355	0.426	0.017***
Divincom	0.614	3.547	0.283	2.504	0.330***

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

Table 4 presents the correlation coefficients of the main variables. It shows that province-level donation is significantly and positively correlated with province-level revenue. These results provide preliminary support for our hypothesis, indicating that companies donate more to regions where they obtain revenue.

Table 5 reports the main regression results. Our hypothesis predicts that regions where companies obtain revenue receive larger donations. Columns 1 and 3 of Table 5 include no other control variables than year, industry, and province fixed effects, whereas columns 2 and 4 include all of the control variables. The coefficient of *Divincom* is significantly positive. This result suggests that the more revenue a company obtains from a region, the more philanthropic resources are allocated to this region, which is consistent with our hypothesis.

5.2. Robustness checks

5.2.1. Alternate measurement and Tobit regression method

Following Xu and Li (2016) and Pan et al. (2017), we examine whether our main findings are robust to the use of alternative corporate philanthropy measures: *Donation_rev* and *Logdonation*. *Donation_rev* is the amount of money donated by company *i* to province *j* in year *t* divided by the revenue of company *i* in year *t*. *Logdonation* is calculated as the natural logarithm of 1 plus the amount of money donated by company *i* to province *j* in year *t*. Columns 1 and 2 of Table 6 show the regression results. *Divincom* remains significantly positive, thus supporting the main findings. Considering the characteristics of the data with left truncation (0 at truncation) for the dependent variable, the Tobit regression method is used for the robustness test. Columns 3 and 4 of Table 6 show the results, which are consistent with the previous findings.

5.2.2. Self-selection problem: The Heckman two-stage method

As province-level revenue is disclosed voluntarily, companies that disclose their province-level revenue may be more likely to donate to regions where they obtain revenue (vs. regions where they do not obtain revenue). This may result in biased samples, in turn affecting the accuracy and validity of the results. Following Deng

Table 4
Correlation matrix of main variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Donation	1.00	0.98***	0.18***	0.04***	0.01**	0.03***	0.00	0.02***	0.00	−0.01***	0.00	0.02***	0.01**	0.05***
(2) Donation_as	0.83***	1.00	0.18***	0.03***	0.00	0.04***	0.01	0.02***	0.01**	−0.01**	0.00	0.01***	0.02***	0.05***
(3) Divincom	0.14***	0.11***	1.00	0.06***	0.05***	0.00	−0.01**	0.00	−0.03***	−0.02***	0.00	−0.01**	0.02***	0.11***
(4) Size	0.05***	0.00	0.12***	1.00	0.51***	0.32***	0.15***	0.02***	−0.18***	0.20***	−0.21***	−0.06***	0.08***	0.08***
(5) Lev	0.01*	−0.01**	0.07***	0.53***	1.00	0.08***	0.04***	0.06***	−0.38***	0.13***	−0.17***	−0.06***	0.00	0.00
(6) Sellsexp	0.01***	0.01**	0.03***	0.08***	−0.01***	1.00	0.18***	0.12***	0.03***	0.07***	−0.01**	−0.01	−0.02***	0.05***
(7) Cash	0.01**	0.01*	−0.01	0.05***	−0.07***	0.11***	1.00	−0.02***	−0.05***	0.07***	0.03***	0.05***	−0.04***	0.00
(8) Growth	0.02***	0.02***	0.00	0.03***	0.06***	0.02***	−0.01*	1.00	0.24***	−0.16***	0.02***	0.10***	0.04***	−0.05***
(9) Roa	0.00	0.01**	−0.01***	−0.17***	−0.33***	0.05***	0.03***	0.23***	1.00	−0.17***	0.08***	0.07***	0.09***	−0.05***
(10) Age	−0.02***	−0.02***	0.00	0.19***	0.17***	0.06***	0.02***	−0.10***	−0.16***	1.00	−0.13***	−0.20***	−0.17***	0.09***
(11) Dual	0.00	0.01*	−0.04***	−0.20***	−0.17***	0.05***	0.04***	0.02***	0.08***	−0.15***	1.00	0.11***	−0.03***	0.02***
(12) Z	0.01*	0.01*	−0.03***	−0.09***	−0.10***	−0.10***	0.08***	0.08***	0.07***	−0.20***	0.12***	1.00	0.00	0.01***
(13) Politic	0.02***	0.02***	0.03***	0.07***	0.01*	−0.02***	−0.04***	0.03***	0.09***	−0.16***	−0.03***	−0.03***	1.00	−0.03***
(14) GDP	0.01**	−0.01	0.09***	0.07***	0.00	0.02***	−0.01	−0.02***	−0.05***	0.07***	0.02***	0.01	−0.03***	1.00

Note: The lower-triangular cells report the Pearson correlation coefficients and the upper-triangular cells report the Spearman rank correlations. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5
Companies' preference for regions where they obtain revenue.

Variables	*Donation*		*Donation_as*	
	(1)	(2)	(3)	(4)
Divincom	0.115***	0.113***	0.019***	0.019***
	(5.89)	(5.72)	(6.00)	(6.13)
Size		0.078**		−0.001
		(3.01)		(-0.31)
Lev		−0.190		−0.038*
		(-1.61)		(-2.01)
Sellsexp		−0.000		0.001
		(-0.02)		(1.15)
Cash		0.097		0.013
		(1.36)		(1.02)
Growth		0.000		0.000
		(1.26)		(1.39)
Roa		−0.000		−0.000
		(-0.14)		(-0.79)
Age		−0.007		−0.000
		(-1.81)		(-0.69)
Dual		0.055		0.012
		(1.24)		(1.47)
Z		0.020		0.004
		(0.74)		(0.97)
Politic		0.023		0.008
		(0.67)		(1.21)
GDP		0.000		0.000
		(1.09)		(0.67)
Constant	0.206	−1.521**	0.008	0.030
	(1.24)	(-2.96)	(0.38)	(0.48)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Observations	45,536	45,536	45,536	45,536
Adjusted R^2	0.037	0.039	0.036	0.037

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

Table 6
Robustness tests: Alternate measurement and Tobit regression method.

Variables	Alternate measurement		Tobit regression method	
	Donation_rev	*Logdonation*	*Donation*	*Donation_as*
	(1)	(2)	(3)	(4)
Divincom	0.011***	0.019***	1.918***	0.37***
	(5.128)	(6.001)	(12.051)	(10.47)
Control	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Observations	45,536	45,536	45,536	45,536
Adjusted R^2	0.014	0.047	/	/
Pseudo R^2	/	/	0.049	0.058

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

et al. (2020), we adopt the Heckman two-step method to address this potential issue. We design a model to examine the possibility of a company disclosing its province-level revenue. The first step of the model is expressed as follows:

$$\begin{aligned} Income_{i,t} = {} & \beta_0 + \beta_1 Size_{i,t} + \beta_2 Lev_{i,t} + \beta_3 Roa_{i,t} + \beta_4 State_{i,t} + \beta_5 Payrate_{i,t} + \beta_6 Seo_{i,t} + \beta_7 Share_{i,t} \\ & + \beta_8 Outdirector_{i,t} + \beta_9 Dual_{i,t} + \beta_{10} Big4_{i,t} + \beta_{11} HHI_{i,t} + \beta_{12} Loss_{i,t} + \sum Industry \\ & + \sum Year + \varepsilon \end{aligned} \tag{2}$$

where the dependent variable *Income* is a dummy variable that equals 1 if the company discloses its province-level revenue information and 0 otherwise. We estimate a logit model for *Income* on a bunch of variables that are likely to influence a company's decision to disclose the geographic information on its revenue. Following Luo and Zhu (2010) and Zhang and Liao (2010), we include the following variables: *Size*, the natural logarithm of total assets at the end of the year; *Lev*, the ratio of total liabilities to the total assets at end of the year; *Roa*, the ratio of annual net profit to the total assets at the end of the year; *State*, a dummy variable that equals 1 if the company is a state-owned enterprise (SOE) and 0 otherwise; *Payrate*, other cash paid related to operating activities divided by revenue; *SEO*, a dummy variable that equals 1 if the company conducts a seasoned equity offering in year $t + 1$ and 0 otherwise; *Share*, the quadratic sum of the top 10 stockholders' share ratio; *Outdirector*, the percentage of independent directors, which equals the number of independent directors divided by the total number of board members; *Dual*, a dummy variable that equals 1 if the chairman and the CEO are the same person and 0 otherwise; *Big4*, a dummy variable that equals 1 if a company's external auditor is a Big 4 auditor and 0 otherwise; *HHI*, the industry's Herfindahl–Hirschman Index; and *Loss*, a dummy variable that equals 1 when a company has a negative net income and 0 otherwise. We calculate the inverse Mills ratio (*IMR*) from the model. Next, the IMR is added to regression model (1) as a control in the second stage.

Table 7 reports the final results. After controlling for *IMR*, *Divincom* remains significantly positive at the 1% level. Thus, our findings are robust.

5.2.3. Missing variables: Placebo test

To verify that the results are not caused by missing variables, we conduct a placebo test. Following Pan et al. (2017), we randomize province-level revenue for each company and define *Divincom_placebo* as the amount of revenue obtained from a randomly designated province. After replacing *Divincom* in the baseline model with *Divincom_placebo*, we re-run the regression. We repeat this process 500 and 800 times. If companies donate more to regions where they obtain revenue, then province-level donation should not demonstrate any significant positive associations with randomly chosen province-level revenues.

Table 7
Robustness tests: The Heckman two-stage method.

Variables	*Donation*	*Donation_as*
Divincom	0.115***	0.019***
	(5.78)	(6.18)
IMR	−0.059***	−0.008**
	(-3.94)	(-3.11)
Control	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Observations	45,536	45,536
Adjusted R^2	0.039	0.037

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

Fig. 1 displays the results of the random placebo test. The ratio of the significant positive coefficient is small, suggesting that the random distribution of the province-level revenue of a company does not have a significant impact on its province-level donations. Therefore, our results are not caused by unobservable factors.

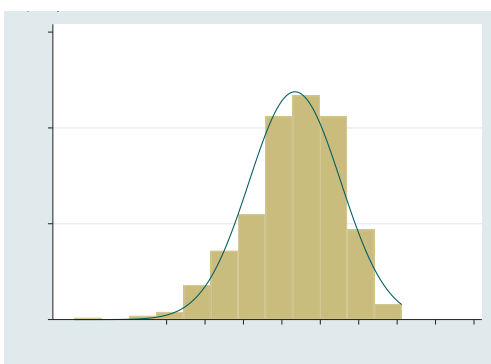
5.2.4. Reverse causality: Donations measured at year t + 1

Our baseline estimates may also suffer from reverse causality, namely the more philanthropic resources that are allocated to a region, the more revenue a company obtains from this region. To eliminate this concern, we use *Donation* and *Donation_as* at year $t + 1$ as the dependent variable, regress it on *Divincom* at year t, and re-run the regression. The time interval between the variables avoids reverse causality. Table 8 shows the results, which are consistent with the previous findings.

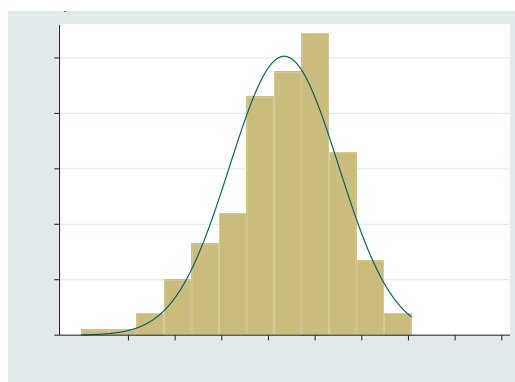
5.2.5. Other robustness checks

To enhance the reliability of our conclusions, we conduct further robustness tests, as described below.

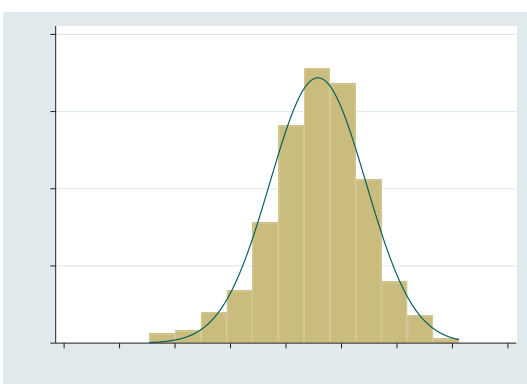
(1) Exclude observations involving companies' donations to natural disasters. Many natural disasters, such as the Yushu earthquake (M = 7.1), the Lushan earthquake (M = 7.0), and the super typhoon Rammasun, occurred in China during the sample period. Many companies donate to regions where natural dis-



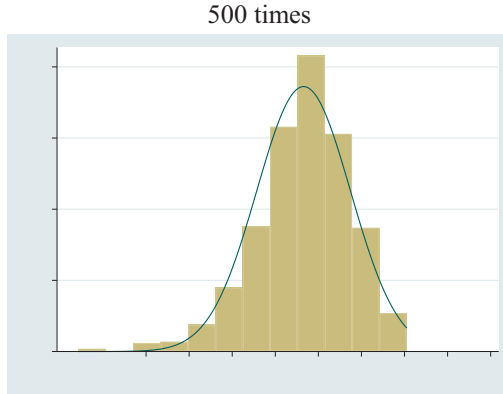
Donation as the dependent variable, repeat 500 times



Donation_as as the dependent variable, repeat 500 times



Donation as the dependent variable, repeat 800 times



Donation_as as the dependent variable, repeat 800 times

Fig. 1. Placebo test: *t*-value distribution of the regression coefficient of *Divincom*.

Table 8
Robustness tests: Donations measured at year $t+1$.

Variables	$Donation_{t+1}$	$Donation\_as_{t+1}$
$Divincom_t$	0.107***	0.016***
	(5.78)	(6.00)
Control	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Observations	40,352	40,352
Adjusted R^2	0.032	0.030

Note: As the variable is used in year $t+1$, we lose 1 year of observations. The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

Table 9
Regression results excluding donations to natural disasters.

Variables	*Donation*	*Donation_as*
Divincom	0.111***	0.018***
	(5.68)	(6.02)
Control	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Observations	45,194	45,194
Adjusted R^2	0.042	0.039

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

asters occur, leading to the geographic aggregation of corporate philanthropy. To rule out the impact of natural disasters, we exclude the observations of corporate philanthropy related to disaster relief. Table 9 shows the results, which are consistent with the previous tests.

(2) Exclude observations involving companies' donations to poor regions where they obtain revenue. We find that companies donate more to regions where they obtain revenue rather than to other regions in need of support. From this perspective, we hold that corporate philanthropy is not purely motivated by altruism. However, it is difficult to clarify the motivation of corporate philanthropy if the regions where companies obtain revenue are also poor regions.[2] To rule out this effect, we exclude the observations involving poor regions where companies obtain revenue. Table 10 shows the regression results, which are consistent with the previous findings.

(3) Exclude observations involving companies' donations to their headquarters. To rule out the influence of the headquarters-based pattern of CSR, we exclude observations involving corporate philanthropic spending being invested in the headquarters province. Table 11 shows the regression results, which are consistent with the previous findings.

6. Motivation tests

In the previous section, we provide empirical evidence that companies donate more to regions where they obtain revenue. In this section, we further examine the motivations for revenue-driven regional favoritism. As

[2] Poor regions are defined in the next section.

Table 10
Regression results excluding donations to poor regions.

Variables	*Donation*	*Donation_as*
Divincom	0.109***	0.018***
	(5.54)	(5.87)
Control	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Observations	36,998	36,998
Adjusted R^2	0.044	0.041

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

Table 11
Regression results excluding donations to companies' headquarters.

Variables	*Donation*	*Donation_as*
Divincom	0.043*	0.006**
	(1.70)	(2.02)
Control	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Observations	44,270	44,270
Adjusted R^2	0.018	0.018

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

mentioned earlier, reputational motivations and political motivations are two potential motivations for revenue-driven regional favoritism. If those motivations are indeed valid, any cross-sectional differences in reputation and political status should be related to the allocation of philanthropic resources across regions.

6.1. Reputational motivations

6.1.1. Media coverage

Companies donate more to regions where they obtain revenue to enhance their profile, project a more positive image, and improve their reputation. However, for companies to realize their reputational purpose, their stakeholders must be informed of their corporate philanthropy. The more widely information regarding a company's corporate philanthropy spreads, the more the company's reputation is promoted. As an information intermediary, the media play a key role in information transmission. Media reports are an important way for stakeholders to stay informed about companies (Fang and Peress, 2009). Media coverage broadens the scope of philanthropic information delivery, enhances the speed of philanthropic information transmission, and enhances the reputation promotion effect of corporate philanthropy (Pan et al., 2017). It is reasonable to expect revenue-driven regional favoritism to be stronger for companies with higher local media coverage. To test the reputational motivation of corporate philanthropy, we construct model (3), which is based on model (1) and introduces the interaction term between province-level revenue (*Divincom*) and media coverage (*Media*). Of greatest concern are the sign and statistical significance of β_2. We expect the coefficient of the interaction term β_2 to be positive.

$$Donat_{i,t,j} = \beta_0 + \beta_1 Divincom_{i,t,j} + \beta_2 Divincom_{i,t,j} \times Media_{i,t,j} + \beta_3 Media_{i,t,j} + \sum Controls + \sum Industry + \sum Year + \sum Province + \varepsilon \quad (3)$$

Following Dai et al. (2011), we use the number of newspaper reports on a company to measure media coverage. Giving province-level donation data, *Media* is defined as the amount of news covering the firm in each province's newspapers. Province-level newspaper reports are manually collected from the China Academic Literature Online Publication Database Full-Text Database of Important Newspapers in China.

Columns 1 and 2 of Table 12 present the results. The coefficient of *Divincom* remains significantly positive. The coefficient of the interaction between *Divincom* and *Media* is positive and significant at 5% or better. These results indicate that companies characterized by higher local media coverage donate more to regions where they obtain revenue.

Table 12
Media coverage, product properties, and revenue-driven regional favoritism.

Variables	Media exposure		Product properties	
	(1)	(2)	(3)	(4)
	Donation	*Donation_as*	*Donation*	*Donation_as*
Divincom	0.112***	0.019***	0.093***	0.015***
	(5.64)	(6.03)	(4.661)	(4.903)
Divincom × *Media*	0.009**	0.003***		
	(2.52)	(3.58)		
Media	0.004	0.001**		
	(1.26)	(2.38)		
Divincom × *Consumer*			0.073**	0.013**
			(2.002)	(2.312)
Consumer			0.176**	0.016*
			(2.371)	(1.77)
Size	0.079***	−0.001	0.112***	0.003
	(3.01)	(-0.31)	(4.106)	(1.07)
Lev	−0.195	−0.038**	−0.281**	−0.047**
	(-1.61)	(-1.98)	(-2.187)	(-2.205)
Sellsexp	0.000	0.001	0.001	0.000
	(0.01)	(1.16)	(0.137)	(0.653)
Cash	0.104	0.014	0.066	0.013
	(1.41)	(1.06)	(0.873)	(0.711)
Growth	0.000	0.000	0.000	0.000
	(1.26)	(1.38)	(0.726)	(1.091)
Roa	−0.000	−0.000	−0.002	−0.001
	(-0.11)	(-0.70)	(-0.554)	(-0.944)
Age	−0.007*	−0.001	−0.006	−0.001
	(-1.79)	(-0.76)	(-1.399)	(-0.648)
Dual	0.058	0.013	0.069	0.015
	(1.28)	(1.54)	(1.411)	(1.51)
Z	0.022	0.005	0.031	0.005
	(0.77)	(1.00)	(1.065)	(0.982)
Politic	0.022	0.007	0.023	0.007
	(0.62)	(1.12)	(0.597)	(0.908)
GDP	0.000	0.000	−0.433**	−0.126***
	(0.98)	(0.79)	(-2.12)	(-3.388)
Constant	−1.547***	0.028	1.818	1.131***
	(-2.94)	(0.43)	(0.949)	(3.271)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Observations	44,112	44,112	45,536	45,536
Adjusted R^2	0.040	0.039	0.037	0.034

Note: The China Academic Literature Online Publication Database Full Text Database of Important Newspapers in China does not include newspapers from Hong Kong, Macao, or Taiwan. Therefore, the sample size is reduced in columns 1 and 2. The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

6.1.2. Product properties

Corporate philanthropy can be used as a means of non-price competition similar to advertising, which promotes corporate image. However, the value of corporate philanthropy probably varies across the industry. Individual consumers are more responsive to corporate philanthropy than industry buyers are. Thus, the advertising effect of corporate philanthropy is more valuable for companies that sell products directly to consumers (Brammer and Millington, 2005; Shan et al., 2008; Flammer, 2015). Consequently, it is reasonable to expect revenue-driven regional favoritism to be stronger for companies that sell products directly to consumers. To test the reputational motivation of corporate philanthropy, we construct model (4), which is based on model (1) and introduces the interaction term between province-level revenue (*Divincom*) and a dummy variable indicating whether a company sells products directly to consumers (*Consumer*). We expect the coefficient of the interaction term β_2 to be positive.

$$Donat_{i,t,j} = \beta_0 + \beta_1 Divincom_{i,t,j} + \beta_2 Divincom_{i,t,j} \times Consumer_{i,t,j} + \beta_3 Consumer_{i,t,j} + \sum Controls + \sum Industry + \sum Year + \sum Province + \varepsilon \quad (4)$$

where the classification of whether a company sells products directly to consumers (*Consumer*) is obtained from Shan et al. (2008). Columns 3 and 4 of Table 12 present the results. As shown, the coefficient of *Divincom* remains significantly positive. The coefficient of the interaction between *Divincom* and *Consumer* is positive and significant at 5%. These results indicate that companies that sell products directly to consumers donate more to regions where they obtain revenue.

6.2. Political motivations

6.2.1. Fiscal pressure of the local government

Political motivations also incentivize companies to donate more to regions where they obtain revenue. Corporate philanthropy is an important means through which companies assist their local governments in implementing certain policy factors in social relief and welfare programs (Wang and Qian, 2011). When a government fails to fund adequate public services, it reaches out to companies for additional funding. Hence, corporate philanthropy is a feasible way to relieve the pressure faced by the government and nurture political connections (Su and He, 2010). Consequently, if corporate philanthropy is used as a means of local political networking, we should observe that companies donate more to regions where the local government is in greater need. To measure the need for support, we use the fiscal pressure of local governments (*Press*). Following Pan et al. (2017), we measure the fiscal pressure of local governments (*Press*) by the per capita financial income of each province (excluding Hong Kong, Macao, and Taiwan). We construct model (5), which is based on model (1) and introduces the interaction term between province-level revenue (*Divincom*) and the fiscal pressure on the government (*Press*). The lower the value of *Press* is, the greater the fiscal pressure on the local government is. We expect the coefficient of the interaction term β_2 to be negative.

$$Donat_{i,t,j} = \beta_0 + \beta_1 Divincom_{i,t,j} + \beta_2 Divincom_{i,t,j} \times Press_{i,t,j} + \beta_3 Press_{i,t,j} + \sum Controls + \sum Industry + \sum Year + \sum Province + \varepsilon \quad (5)$$

Columns 1 and 2 of Table 13 present the results. The coefficient of *Divincom* remains significantly positive. The coefficient of the interaction between *Divincom* and *Press* is negative and significant at 5% or better. These results indicate that companies can use corporate philanthropy to meet political ends to cultivate their relationship with their local governments.

6.2.2. Ownership type

There are obvious differences in the resource endowments of SOEs and non-SOEs in China, leading to differences in their donation behaviors. Non-SOEs in China have been discriminated against in the financial market, whereas SOEs are more likely to benefit from preferential policies, such as better property rights protection, lighter tax burdens, and more government subsidies (Li and Zhang, 2010; Li and Xie, 2014). Thus, the motivation to cultivate a relationship with the local government is stronger for non-SOEs. Consequently, it

Table 13
Fiscal pressure of the local government, ownership type, and revenue-driven regional favoritism.

Variables	Fiscal pressure of the local government		Ownership type	
	Donation (1)	*Donation_as* (2)	*Donation* (3)	*Donation_as* (4)
Divincom	0.155***	0.027***	0.163***	0.028***
	(4.88)	(5.18)	(5.514)	(5.614)
Divincom × *Press*	−0.458**	−0.084***		
	(-2.50)	(-2.88)		
Press	−1.831	−0.062		
	(-1.42)	(-0.32)		
Divincom × *SOE*			−0.075**	−0.015**
			(-2.068)	(-2.485)
SOE			−0.012	0.006
			(-0.319)	(1.011)
Size	0.079***	−0.001	0.116***	0.003
	(3.00)	(-0.34)	(3.885)	(1.105)
Lev	−0.208*	−0.041**	−0.303**	−0.05**
	(-1.71)	(-2.10)	(-2.295)	(-2.302)
Sellsexp	0.000	0.001	0.001	0.000
	(0.02)	(1.16)	(0.1)	(0.699)
Cash	0.104	0.013	0.052	0.012
	(1.42)	(1.06)	(0.676)	(0.666)
Growth	0.000	0.000	0.000	0.000
	(1.28)	(1.38)	(0.774)	(1.212)
Roa	−0.001	−0.000	−0.002	−0.001
	(-0.22)	(-0.86)	(-0.654)	(-1.01)
Age	−0.007*	−0.000	−0.005	0.000
	(-1.75)	(-0.62)	(-1.174)	(-0.547)
Dual	0.060	0.013	0.074	0.017*
	(1.34)	(1.56)	(1.568)	(1.793)
Z	0.021	0.005	0.023	0.005
	(0.75)	(1.00)	(0.782)	(0.938)
Politic	0.022	0.008	0.007	0.006
	(0.62)	(1.15)	(0.181)	(0.704)
GDP	0.000	0.000	−0.426**	−0.125***
	(1.31)	(0.94)	(-2.077)	(-3.326)
Constant	−1.221**	0.049	1.79	1.124***
	(-2.21)	(0.64)	(0.922)	(3.204)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Observations	44,113	44,113	45,536	45,536
Adjusted R^2	0.042	0.040	0.036	0.034

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

is reasonable to expect revenue-driven regional favoritism to be stronger for non-SOEs. We construct model (6), which is based on model (1) and introduces the interaction term between province-level revenue (*Divincom*) and a dummy variable indicating a company's ownership type (*SOE*). *SOE* equals 1 if the company is ultimately controlled by the government and 0 otherwise. Given that the motivation to cultivate a relationship with the local government is stronger for non-SOEs, we expect the coefficient of the interaction term β_2 to be negative.

$$Donat_{i,t,j} = \beta_0 + \beta_1 Divincom_{i,t,j} + \beta_2 Divincom_{i,t,j} \times SOE_{i,t,j} + \beta_3 SOE_{i,t,j} + \sum Controls + \sum Industry + \sum Year + \sum Province + \varepsilon \quad (6)$$

Columns 3 and 4 of Table 13 present the results. The coefficient of *Divincom* remains significantly positive. The coefficient of the interaction between *Divincom* and *SOE* is negative and significant at 5%. These results indicate that non-SOEs donate more to regions where they obtain revenue.

6.3. Impact of targeted poverty alleviation

Since 2014, Chinese companies have been expected to engage in targeted poverty alleviation.[3] Studies have indicated that companies adjust their donation behavior to meet changing social expectations (Campbell, 2007; Huang et al., 2008). Indeed, urged by the government and other stakeholders, companies have become increasingly involved in targeted poverty alleviation (Deng et al., 2020a, 2020b). Therefore, it is necessary to examine whether and, if so, how targeted poverty alleviation affects the allocation of philanthropic resources.

Since the implementation of targeted poverty alleviation, stakeholders have increasingly expected companies to engage in poverty alleviation. In such a situation, donating to poor regions is in line with social expectations, which helps companies gain and maintain legitimacy. The central government has formulated a series of policies to promote targeted poverty alleviation, including the incorporation of poverty alleviation performance into the system used to appraise and promote officials. This incentivizes local government officials to get involved in targeted poverty alleviation. Corporate philanthropy is an important way for companies to assist the government in accelerating the progress of poverty alleviation and in easing the fiscal pressure on the government. Therefore, the government has preferred companies to donate to poor regions since 2014. Local governments may provide secure access to scarce resources in return for companies' assistance in targeted poverty alleviation.

Based on the above analysis, the implementation of the targeted poverty alleviation policy has made donating to poor regions an important means through which companies can meet the expectations of society and government. However, it is difficult for companies to rapidly increase their philanthropic resources in the short term. As a result, donating more to poor regions decreases the amount of money that can be donated to other regions. Consequently, it is reasonable to expect the amount of money donated to the regions where companies obtain revenue to have decreased but the amount of money donated to poor regions to have increased since the implementation of the targeted poverty alleviation policy.

First, we test the impact of targeted poverty alleviation on the amount of money donated to the regions where companies obtain revenue. Based on model (1), we construct model (7). *Post* is a dummy variable that equals 1 for years after 2013 and 0 otherwise. *Post* captures the effect of the implementation of the targeted poverty alleviation policy on the allocation of philanthropic resources across regions. We introduce the interaction term between *Divincom* and *Post* and expect the coefficient of the interaction term β_2 to be significantly negative.

$$Donat_{i,t,j} = \beta_0 + \beta_1 Divincom_{i,t,j} + \beta_2 Divincom_{i,t,j} \times Post_{i,t,j} + \beta_3 Post_{i,t,j} + \sum Controls + \sum Industry + \sum Year + \sum Province + \varepsilon \quad (7)$$

Table 14 presents the results. The coefficient of *Divincom* remains significantly positive. The coefficient of the interaction between *Divincom* and *Post* is negative and significant at 5% or better. These results indicate that the implementation of targeted poverty alleviation is associated with the reduction in philanthropic resource allocation to the regions where companies obtain revenue.

We also test the impact of targeted poverty alleviation on the amount of money donated to poor regions. We construct model (8) for regression analysis.

$$Donapoor_{i,t} = \beta_0 + \beta_1 Post_{i,t} + \sum Controls + \sum Industry + \sum Year + \varepsilon \quad (8)$$

where the dependent variable is the amount of money donated to poor regions (*Donapoor*). *Donapoor* is measured in two ways: *Donapoor_20* and *Poorprop*. Following the classification method of the National Bureau of Statistics, the provinces with the bottom 20% of the annual per capita disposable income are defined as poor

[3] The targeted poverty alleviation policy was first proposed in November 2013. Since then, it has gradually developed. We treat 2014 as the first year of the implementation of targeted poverty alleviation in China.

Table 14
The targeted poverty alleviation policy and revenue-driven regional favoritism.

Variables	*Donation*	*Donation_as*
Divincom	0.131***	0.022***
	(5.655)	(5.796)
Divincom × *Post*	−0.062**	−0.013***
	(-2.313)	(-3.422)
Post	0.325**	0.097***
	(2.407)	(3.892)
Size	0.113***	0.003
	(3.781)	(1.051)
Lev	−0.308**	−0.05**
	(-2.316)	(-2.312)
Sellsexp	0.001	0.000
	(0.161)	(0.689)
Cash	0.062	0.013
	(0.806)	(0.677)
Growth	0.000	0.000
	(0.887)	(1.145)
Roa	−0.002	−0.001
	(-0.603)	(-0.965)
Age	−0.005	0.000
	(-1.186)	(-0.562)
Dual	0.082*	0.017*
	(1.813)	(1.733)
Z	0.031	0.006
	(1.101)	(1.115)
Politic	0.016	0.007
	(0.404)	(0.844)
GDP	−0.419**	−0.123***
	(-2.054)	(-3.306)
Constant	1.779	1.114***
	(0.925)	(3.218)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Observations	45,536	45,536
Adjusted R^2	0.036	0.034

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

regions. $Donapoor\_20_{i\_t}$ is calculated as the amount of money donated by a company to poor regions. $Poorprop_{i,t}$ is the amount of money donated by a company to poor regions divided by the total amount of money donated by the company in the same year.

Table 15 presents the results. The coefficient of the targeted poverty alleviation period (*Post*) is positive and significant at 5%. This indicates that companies have donated more to poor regions since the implementation of the targeted poverty alleviation policy.

In general, our results suggest that companies donate more to poor regions after the implementation of targeted poverty alleviation. This enhances the altruism effect of corporate philanthropy, even if companies are driven by reputational and political motivations.

7. Conclusions

In response to increasing awareness of the positive implications of corporate philanthropy for firm revenue, many companies voluntarily engage in corporate philanthropy. The increasing importance of corporate philanthropy is reflected in the proliferation of research in this area. Many studies have suggested that corporate

Table 15
The targeted poverty alleviation policy and donations to poor regions.

Variables	*Donapoor_20*	*Poorprop*
Post	0.34**	0.024**
	(2.139)	(2.356)
Size	0.13	0.000
	(1.554)	(0.089)
Lev	−0.597	−0.005
	(-1.372)	(-0.301)
Sellsexp	0.03**	0.001**
	(2.533)	(2.283)
Cash	0.13	−0.001
	(0.28)	(-0.11)
Growth	0.004	0.000
	(1.473)	(0.729)
Roa	−0.006	0.000
	(-0.397)	(-0.234)
Age	0.016	0.000
	(0.821)	(-0.01)
Dual	−0.094	0.000
	(-0.476)	(0.055)
Z	0.482	0.004
	(1.61)	(0.588)
Politic	0.307*	0.011**
	(1.716)	(1.976)
GDP	−0.555***	−0.019***
	(-3.443)	(-3.687)
Constant	0.956	0.133**
	(0.51)	(2.055)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Observations	1,423	1,423
Adjusted R^2	0.047	0.034

Note: The *t*-statistics reported in parentheses are calculated based on robust standard errors clustered by company. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively.

philanthropy is not motivated purely by altruism and have demonstrated the wide range of benefits that a company can reap from engaging in philanthropy. Despite the valuable insights provided by these studies, insufficient attention has been paid to the process of philanthropic resource allocation across regions. We enrich the literature by examining how companies in China allocate philanthropic resources across regions to achieve their strategic targets.

Using data on Chinese listed companies from 2009 to 2016, we find that philanthropic resources are distributed very unevenly and that companies exhibit strong revenue-driven regional favoritism. We also find the revenue-driven regional favoritism of Chinese companies to be driven by reputational and political motivations. Motivated by reputational concerns, companies with high media coverage and companies that sell products directly to consumers demonstrate more pronounced revenue-driven regional favoritism. Motivated by political concerns, the greater the government fiscal pressure in regions where companies obtain revenue, the more philanthropic resources companies allocate to these regions. Additionally, non-SOEs donate more to regions where they obtain revenue than to regions where they do not obtain revenue. Finally, the implementation of China's targeted poverty alleviation policy has enhanced the altruism effect of corporate philanthropy.

This study has several important implications. First, corporate philanthropy does not necessarily come at the expense of efficiency. The allocation of philanthropic resources across regions can be used as part of a company's business strategy to obtain consumer and government favor in regions where it operates. Strategical corporate philanthropy may concurrently promote social welfare and company revenue. Second, as social

expectations change, corporate philanthropy should be adjusted dynamically. Third, the government should adopt policies to encourage instead of compel companies to engage in philanthropy. Firms in China are often urged by the government to contribute to social programs, such as disaster relief and poverty reduction, when the government fails to adequately fund public services. However, charity is not companies' main goal. Compelling companies to participate in social programs not only distorts the rules of the market but may also impede the sustainable development of corporate philanthropy.

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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