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Stakeholder demands and corporate social responsibility: Evidence from the Olympic Games

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ABSTRACT

We propose that stakeholder demand can explain firms' corporate social responsibility (CSR) activities and empirically test our proposition using 2002–2016 panel data from multiple countries. We select the Olympic Games as our experimental context and use a difference-in-differences design. We find that firms domiciled in countries that host the Olympic Games subsequently experience a significantly smaller increase in CSR commitment than firms in countries that unsuccessfully bid to host the Olympics. We also find that firms domiciled in cities that host the Olympic Games exhibit a significantly smaller increase in CSR than those domiciled in other cities in the same country. Additional tests indicate that firms in host countries with greater increases in the levels of happiness tend to experience an even smaller increase in CSR. Our findings are consistent with the stakeholder demand explanation, as stakeholders are less likely to require local firms to invest in CSR if utilities, such as those from environmental improvement, increase.

Running head: Olympic Games and CSR.

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1. Introduction

The substantial increase in the number of firms investing in corporate social responsibility (CSR) activities has motivated researchers to examine why firms commit to CSR. The stakeholder theory suggests that CSR can reduce the negative externalities from many economic activities and ultimately benefit firms because society values and rewards such activities (Heal, 2005; Godfrey et al., 2009). However, the agency theory suggests that agency problems can prompt CSR because managers can personally benefit from investing in CSR at the expense of shareholders (Bénabou and Tirole, 2010; Cheng et al., 2013; Krüger, 2015; Ferrell et al., 2016). Investment in CSR has generally been examined from the perspectives of firms or managers, in terms of whether such activities benefit firms in general or individual managers (Radhakrishnan et al., 2018). However, stakeholders also play an important role in firms' CSR investments. Investors in a firm, local communities, employees, and customers are all considered stakeholders in the literature (Statman, 2006; Renneboog et al. 2008; Shan et al., 2017). Firms are likely to be willing to meet stakeholders' CSR demands as such investments can enhance trust and reciprocity and thereby increasing the stakeholders' willingness to support the firms (Lins et al., 2017). Thus, the lack of research on whether and how stakeholders' demands for CSR affect firms' decisions to invest in it is surprising, given the importance of stakeholders in such decisions.

Research on CSR and sports events tends to focus on marketing issues (Ibrahim and Almarshed, 2014; Uhrich et al., 2014; Habitzreuter and Koenigstorfer, 2021) in terms of how such events can be incorporated into CSR strategies to engage customers and enhance corporate or brand images. Some recent studies examine how the behavior of both investors and firms are influenced by sporting events (e.g., Edmans et al., 2007; Drake et al., 2016) and indicate that the emotions and attention of investors are significantly affected as they may deviate from the classic model that assumes full rationality (Lee et al., 1991). However, the effect of sports events on CSR-related decision-making has not been fully examined. As sports or related investment can affect the perceptions and well-being of stakeholders, we propose that hosting a major sports event can significantly affect the CSR investment demand from stakeholders of local firms.

Using panel data from multiple countries from 2002 to 2016 and the Olympic Games as our experimental setting, we empirically examine whether and how local stakeholders' demand for CSR affects firms' CSR investments. We apply a difference-in-differences (DID) research design and denote firms in Olympics host countries as the treatment group and those in countries that unsuccessfully bid to host the Olympics (bidder countries) as the control group. Bidder and host countries are comparable in terms of their ability to meet the requirements (such as financial resources and level of economic development) for hosting the Olympic Games, and thus bidder countries are an ideal control group.

We find that firms domiciled in both groups of countries experience significant increases in CSR commitment over time, which is consistent with the growing awareness of the importance of CSR activities at both the corporate and national levels. However, we find that after the Olympic Games, firms in host countries experience a significantly smaller increase in CSR commitment than do firms in bidder countries. This finding, which suggests that stakeholders in Olympic host countries require less CSR investment from local firms relative to stakeholders in countries that do not host the Games may seem surprising. However, it is consistent with the psychology literature indicating that a positive state of mind or good mood (for example, when stakeholders experience a utility increase) leads to greater satisfaction with one's current surroundings or situation, and thus such individuals are less likely to demand change (Isen et al., 1978; Westbrook, 1980; Schwarz and Clore, 1983). This finding also supports our conjecture that the substantial local government investment in communities and the environment when hosting the Olympics Games can increase the utility of local stakeholders, and therefore they have less need for local firms to invest in CSR following the Olympic Games.

Although our sample of firms domiciled in bidder countries serves as a valid benchmark for examining the changes in CSR activities after the Olympic Games, our finding of a smaller increase in CSR commitment for firms domiciled in Olympic host countries may be due to institutional differences across countries. To address this concern, we conduct a within-country analysis and use other cities (i.e., non-host cities) in Olympic host countries as the control sample. Consistent with our results from using firms in bidder countries as the control sample, we find that the increase in CSR for firms in cities that host the Olympic Games

(i.e., host cities) is significantly smaller than for those domiciled in other cities in the same country (i.e., non-host cities).

We propose that our findings can be explained by stakeholder demand. The countries and cities that successfully host the Olympic Games generally enjoy substantial social and environmental improvements in terms of infrastructure, services, etc. (Dolan et al., 2019; Wills, 2019). Local stakeholders are therefore likely to enjoy a utility increase in terms of their well-being. Their need for local firms to commit to further CSR activities is thus likely to decrease. This is supported by our finding that firms from countries that are ranked higher in the Happiness Index tend to exhibit a lower level of CSR commitment than those from countries ranked lower in the index. Our results are also robust to various measures of CSR, sample periods, and alternative explanations. In addition, our examination of the scores for specific dimensions of CSR reveals that our findings are driven mainly by the difference in firms' commitment to the environmental dimensions of CSR.

Our study makes the following contributions to the literature. First, we suggest that stakeholders demand less CSR investment by firms if environmental and social improvements occur in their local areas, increasing their well-being. This phenomenon is likely to occur in countries that host the Olympic Games, as they typically enjoy improvements in social and environmental developments in preparation for the event. Consistent with our stakeholder demand explanation, we find that firms in host countries and cities exhibit a significantly smaller increase in CSR commitment after the Games than those in bidder countries/cities.[1] Our novel proposal that stakeholder demand can explain CSR investment thus contributes to the literature on why firms invest in CSR (Bénabou and Tirole, 2010; Cheng et al., 2013; Huang and Watson, 2015; Krüger, 2015; Ferrell et al., 2016; Radhakrishnan et al., 2018).

Second, we contribute to the literature on sports and finance (Ibrahim and Almarshed, 2014; Uhrich et al., 2014; Habitzreuter and Koenigstorfer, 2021). Sporting events can affect the emotions and attention of investors and consequently their behavior (Edmans et al., 2007; Drake et al., 2016). Most studies on sports and finance focus on the effects sporting events can have on stock returns and price reactions to earnings news. We therefore extend this literature by empirically examining whether and how the Olympic Games, possibly the most influential global sporting event, can affect corporate policies and decision-making.

Finally, although CSR research provides evidence for the relationships between CSR and variables such as firm performance, evidence for causality or the identification of causal mechanisms is rare (Orlitzky, 2008). We use the Olympic Games as our experimental setting along with the DID method to examine the difference in CSR performance between the treatment and control groups. [2]In addition, increasingly, the literature indicates that exogenous shocks can affect corporate policies and firms adjust their corporate policies in response to unanticipated shocks. [3]We therefore contribute to the literature on corporate policies and external shocks by empirically examining whether and how investment in CSR activities is influenced by a country's hosting of the Olympic Games. Therefore, we identify a new determinant of CSR commitment, as our results suggest that the demand for CSR from local stakeholders influences firms' decisions.

The remainder of this paper is organized as follows. In Section 2 we review the literature and develop our hypotheses. In Section 3 we introduce the data, samples, and methods used. We examine the relationship between the Olympic Games and CSR in Section 4. Section 5 provides robustness tests, and Section 6 concludes this paper.

[1] We find the effects of hosting the Olympics on firm value to be statistically insignificant (in terms of Tobin's Q or stock returns, for example). This is not surprising as firm performance or value can be affected by many factors not just CSR. In line with this view, the literature provides mixed evidence for the relation between CSR investment and firm value or performance (Tsang et al. 2021). In this study, our focus is to examine the effect of the Olympics on firms' CSR investments in response to stakeholders' demands. We thank an anonymous reviewer for this suggestion about how to extend the scope of our study.

[2] The Olympic Games can be considered exogenous to specific firms, so our DID research design is less affected by endogeneity (Ashenfelter and Card, 1985), and therefore our method contributes to the CSR literature in terms of identification.

[3] For example, Do et al. (2020) find that firms located close to the sites of terrorist attacks significantly increase their investment in CSR, and Dai et al. (2020 a) find that CEOs of such firms receive pay increases after such attacks.

2. Literature review and hypothesis development

A key question in CSR research is why firms invest in CSR (Huang and Watson, 2015; Radhakrishnan et al., 2018). One view is that firms that exhibit an awareness of social responsibility may be valued and rewarded. For example, Shan et al. (2017) find that corporate policies that are more inclusive and tolerant in terms of sexual orientation can attract talented employees and thus improve productivity. Surroca et al. (2010) argue that CSR can accelerate the development of intangible assets, such as those related to innovation, human capital, reputation, and culture. Heal (2005) suggests that firms may invest in CSR to reduce the negative externalities that can result from various economic activities, because of the differences between private and social costs. This can ultimately benefit shareholders by avoiding litigation and reducing the risk of regulatory action. Godfrey et al. (2009) find that CSR improves public relations and reduces potential conflicts between firms and the community, which provides an "insurance-like" benefit when firms are faced with negative legal or regulatory action. Firms with better CSR performance are also found to have lower costs of capital, greater levels of institutional ownership, more favorable recommendations from financial analysts, and more positive media coverage (Dhaliwal et al., 2011; 2012; Cheng et al., 2014; Cahan et al., 2015; Ioannou and Serafeim, 2015; Tan et al., 2020).

However, another strand of the literature suggests that CSR investment can decrease shareholder value. The agency view of CSR suggests that managers have incentives to invest in CSR for their own benefit (Bénabou and Tirole, 2010; Cheng et al., 2013; Krüger, 2015; Ferrell et al., 2016). For example, Cheng et al. (2013) find that measures of agency problems are significantly related to CSR, and Manchiraju and Rajgopal (2017) find that stock prices dropped in 2013 when India passed a new law requiring firms to fulfill a mandatory CSR spending threshold. Krüger (2015) finds that investors respond negatively to positive CSR news, indicating that agency problems may drive CSR and affect shareholders. Thus, the evidence for why firms invest in CSR is mixed or ambiguous.[4]

Yet another strand of the literature focuses on how sports events can factor in corporate CSR strategies in terms of marketing and consumer reach. Ibrahim and Almarshed (2014) conduct field surveys with consumers at an international sporting event and find that a firm's CSR level can significantly affect consumers' purchase intentions. They conclude that the unique features of such events make them ideal settings for promoting CSR initiatives. Uhrich et al. (2014) examine the CSR activities of soccer World Cup and Olympic Games sponsors and find that consumer attitudes toward the sponsoring brands influence the link between CSR and sponsorship. Habitzreuter and Koenigstorfer (2021) investigate how environmental CSR affects the attitudes of individuals with differing objectives toward sporting event sponsors. Thus, most studies of the link between firms' CSR strategies and sporting events focus on marketing aspects.

In this study, we propose that CSR investment can also be explained from the perspective of stakeholder demand. Investors, local communities, employees, and sometimes even customers are regarded as stakeholders (Statman, 2006; Renneboog et al., 2008; Shan et al., 2017). An extensive evidence shows that responding to stakeholders' demands for CSR investment can benefit firms (Edmans, 2011, 2012; Ertugrul, 2013; Flammer, 2013; Shan et al., 2017; Wisse et al., 2018, Chava, 2014; Dai et al., 2020b).

CSR commitment usually involves a broad set of ethical, social, and environmental criteria and can include contributing to environmental protection, promoting labor diversity, producing safe and high-quality products, and helping local communities and society (Statman, 2006; Renneboog et al., 2008). Stakeholders generally appreciate and reward firms who demonstrate a commitment to environmental CSR (Flammer, 2013; Chava, 2014; Fernando et al., 2019). The importance of the environment to stakeholders can be illustrated by the effect of the April 2010 British Petroleum (BP) incident in the Gulf of Mexico. U.S. stakeholders reacted angrily to this major environmental disaster, publicly criticizing and boycotting the company. BP's stock price was cut in half in two months. Thus, both the literature and anecdotal evidence indicate that stakeholders care about environmental issues and can thus derive utilities from environmental CSR.

[4] In their review of 127 studies published between 1972 and 2002, Margolis and Walsh (2003) find that the relationship between CSR and financial performance can be positive (109 studies), negative (7 studies), or nonsignificant (28 studies).

As discussed, we propose that stakeholder demand on local firms to invest in CSR may be relatively lower after a country hosts the Olympic Games because of the government investment in environmental development and the subsequent related increase in well-being.[5] However, testing this explanation, and in particular, identifying the causes of CSR and stakeholder demand, can be challenging due to endogeneity issues.

A growing strand of literature examines the effects of exogenous shocks on corporate policies. Do et al. (2020) find that firms located close to terrorist attack sites significantly increase their investment in CSR activities in response to the attacks to gain community visibility, which eventually helps increase firm value. Dai et al. (2020 a) also find that the CEOs of firms located near the sites of terrorist attacks receive pay increases after such attacks. Thus, terrorist attacks are identified in these studies as the causes leading firms to adjust their corporate policies. We draw on this research and consider the hosting of the Olympic Games to empirically test whether and how stakeholders' demands for social and environmental improvement affect firms' investment in CSR activities.

The Olympic Games are also exogenous to the decisions made by individual firms. The scale and significance of this major sporting event means that host countries and cities typically allocate extensive resources to improving the local environment, and infrastructure. These are often related to the expected outcomes of CSR activities (Dolan et al., 2019; Wills, 2019). Thus, local stakeholders in host countries are likely to experience an improvement in their general well-being after the Olympics take place, particularly in terms of the environment (Dolan et al., 2019). Countries that fail in their bids to host the Olympics (bidder countries) plan for the Games like the successful countries but do not experience the same improvements, and thus serve as an effective control group. We therefore propose that local stakeholders in host countries should derive a greater utility increase from environmental development following the Olympics than those in bidder countries.

The "cognitive loop" hypothesis (Isen et al., 1978) in psychology predicts that when individuals are in a good state of mind or mood (e.g., when they experience a utility increase), they tend to be more satisfied with their surroundings or situations and are therefore less likely to demand change (Schwarz and Clore, 1983). As local stakeholders in Olympics host cities or countries are likely to experience a substantial increase in their well-being after the Games (Dolan et al., 2019), we draw on this hypothesis and predict that they will also have a lower demand for CSR than the stakeholders of firms in other areas (Isen et al., 1978; Westbrook, 1980; Schwarz and Clore, 1983). However, hosting the Olympics can be relatively costly for host nations (Dolan et al., 2019; Wills, 2019) and may lead to a financial deficit, which may consequently decrease the utility of local stakeholders.[6] Taken together, whether hosting the Olympics can, as we predict, increase local stakeholders' utility or decrease it, as this alternative explanation suggests, is ultimately an empirical question.

We thus propose the following hypothesis:

H1. *Firms in Olympics host countries experience less demand for CSR investment from their stakeholders than firms in countries that do not host the Olympics.*

We argue that stakeholders are less likely to pressure firms to implement CSR after the successful hosting of the Olympics in their cities or countries of origin because they will experience an increase in utility or happiness from an external source. This suggests that their level of well-being or happiness can determine how they perceive their firms' activities. We propose the following hypothesis based on our stakeholder demand explanation to directly investigate this:

H2. *Firms in Olympics host countries with a higher level of stakeholder satisfaction experience less demand for CSR investment from their stakeholders than firms in Olympics host countries with a lower level of stakeholder satisfaction.*

[5] One concern is how close stakeholders are to firms. Among the types of stakeholders, employees and local communities are typically close to firm headquarters, and because of the local bias effect (e.g., Coval and Moskowitz, 1999, 2001), a large proportion of investors are also likely to be close to the firm. Customers can be more dispersed. However, firms are likely to have more influence on markets closer to them, and thus to have more local customers than customers further away. In addition, this concern about the location of stakeholders actually biases the results against our predictions (i.e., if many stakeholders are located far away from the firms, we should expect to find insignificant results from the city-level analysis). We thank an anonymous reviewer for pointing out this caveat.

[6] We thank an anonymous reviewer for this alternative explanation.

3. Data, Sample, and research design

3.1. Data and sample selection

Our data on the Olympic Games are from the International Olympic Committee (https://www.olympic.org/). Our sample period is from 2002 to 2016, and thus includes the following countries: the U.S., 2002 (Winter); Greece, 2004 (Summer); Italy, 2006 (Winter); China, 2008 (Summer); Canada, 2010 (Winter); the U.K., 2012 (Summer); Russia, 2014 (Winter); and Brazil, 2016 (Summer). However, our research design requires that all of the firms in the sample have at least two years of data before and after the Olympic Games, which results in a final sample that includes two Summer Olympics hosts (i.e., China, 2008, and the U.K., 2012) and two Winter Olympics hosts (i.e., Italy, 2006, and Canada, 2010). For each event, we obtain information on the host city, the year, the total number of medals received by all participating countries, and all countries that put in bids to host those Games (See Appendix A).

Data on CSR are from Thomson Reuters ASSET4, which is a comprehensive database for CSR performance that covers firms from many countries worldwide. It contains measures of (1) environmental performance, (2) social performance, (3) corporate governance, and (4) economic performance. A firm receives an annual score for each of these aspects based on its performance relative to its peer firms.[7] Following other studies (Ioannou and Serafeim, 2012; Luo et al., 2015; El Ghoul et al., 2017), we use environmental and social performance scores to construct a CSR score for each firm-year.[8]

We obtain firm-level financial data from WorldScope, auditor information from Capital IQ, analyst coverage data from I/B/E/S, and institutional ownership from FactSet/LionShares. The country-level controls are hand-collected from various sources, including Gallup World Poll surveys, the World Value Survey Database, the World Bank, and the Heritage Index of Economic Freedom. Many countries may not be eligible to host the Olympic Games or have no intention to bid, and as we aim to identify the impact of the Games on CSR investment, our sample only includes countries that have applied to be hosts (i.e., host countries and bidder countries). Therefore, the firms in our sample are limited to those domiciled in the four host countries (Canada, China, Italy, and the U.K.) and eight bidder countries (Austria, France, Japan, Russia, South Korea, Spain, Switzerland, and the U.S.). Our final sample consists of 23,937 firm-year observations for 2,000 unique firms from 2002 to 2016.

Table 1 reports the descriptive statistics of our sample. Panels A and B present the statistics by year and by country, respectively. Firms in the U.S. represent the highest percentage of our sample (43.10%), followed by Japan (19.63%), and the U.K. (14.51%). Of the four host countries, U.K. firms are the highest percentage of our sample (14.51%), followed by Canada (8.61%), Italy (1.81%), and China (0.32%). The average CSR scores of firms in our sample increase from 46.97 in 2002 to 54.65 in 2016, which is consistent with the increasing attention given to CSR by stakeholders and society in general (Dhaliwal et al., 2012; Ioannou and Serafeim, 2012; Liao et al., 2021). South Korean firms have the highest average CSR score in our sample (58.89), followed by those in France (58.56) and Spain (57.50). Firms in China have the lowest average CSR score (45.38), followed by those in Canada (46.68) and the U.S. (47.55).[9]

[7] Details of this database are given in Appendix B. The measures of CSR it provides are generally consistent with measures previously used (e.g., Flammer, 2013; Chava, 2014). We thank an anonymous reviewer for this point.

[8] Environmental performance measures a firm's impact on living and nonliving natural systems, such as air, land, water, and the ecosystem as a whole. Social performance measures a firm's capacity to generate trust and loyalty in its workforce, customers, and society through the use of best management practices.

[9] Unreported t-tests for mean differences indicate that most of the CSR values are statistically different across countries and across time.

Table 1
Sample distributions. This table presents the distributions of our sample. Panel A presents the distribution of the number of firms and average CSR scores by year. Panel B presents the number of firm-year observations and average CSR scores by country. * indicates Olympic host countries. Data sources are given in Appendix C.

Panel A - By year

	Year	Obs.	Percentage	CSR score
1	2002	568	2.37%	46.97
2	2003	577	2.41%	47.25
3	2004	1,114	4.65%	47.06
4	2005	1,396	5.83%	47.19
5	2006	1,425	5.95%	47.52
6	2007	1,544	6.45%	48.01
7	2008	1,812	7.57%	48.50
8	2009	1,938	8.10%	49.03
9	2010	1,999	8.35%	49.64
10	2011	1,982	8.28%	50.15
11	2012	1,974	8.25%	50.34
12	2013	1,966	8.21%	50.53
13	2014	1,955	8.17%	50.99
14	2015	1,893	7.91%	53.10
15	2016	1,794	7.49%	54.65
	Overall	***23,937***	***100%***	***49.82***

Panel B - By country

	Country	Obs.	Percentage	CSR score
1	Austria	209	0.87%	52.29
2	Canada*	2,061	8.61%	46.68
3	China*	77	0.32%	45.38
4	France	999	4.17%	58.56
5	Italy*	433	1.81%	52.84
6	Japan	4,699	19.63%	50.05
7	Russia	248	1.04%	49.56
8	South Korea	241	1.01%	58.89
9	Spain	519	2.17%	57.50
10	Switzerland	659	2.75%	53.54
11	United Kingdom*	3,474	14.51%	52.73
12	United States	10,318	43.10%	47.55
	Overall	***23,937***	***100%***	***49.82***

3.2. Research design

In our main tests, we use the following DID model to test H1.[10]

$$CSR_{i,j,t} = \beta_0 + \beta_1 Olympics_{j,t} \times Post_t + Controls_{i,j,t} + YearIndicators + IndustryIndicators + CountryIndicators + \varepsilon_{i,t} \quad (1)$$

where *i*, *j*, and *t* indicate the firm, country, and year, respectively. The dependent variable, *CSR*, is the total CSR score from ASSET4 (i.e., our proxy for a firm's CSR commitment/investment). In our robustness tests, we also use environmental and social performance scores separately as the dependent variables. *Olympics* is an indicator variable set to one for all firms domiciled in Olympic host countries and zero for firms in bidder

[10] A regression discontinuity design (RDD) is not suitable for our study as it requires the majority threshold and relies on proposals that pass or fail by a narrow margin of votes. The voting procedure in the IOC may not satisfy this requirement as the selection process of Olympic host cities usually involves several rounds of elimination.

countries. *Post* is an indicator variable set to one for the years of and after the Olympics and zero otherwise.[11] We define the location of a firm as that of its headquarters (Coval and Moskowitz, 1999, 2001; Ivković and Weisbenner, 2004; Hong et al., 2004, 2005; Pirinsky and Wang, 2006), and the headquarter information is obtained from Capital IQ. In this DID model, the firms in the bidder countries comprise the control group, and those in the host countries the treated group, as denoted by the indicator variable *Olympics*. The interaction variable, *Olympics* × *Post*, identifies differences in the changes in CSR scores after the Olympics Games for the treated group relative to the control group.

Controls is a vector of control variables. Following the literature (Ioannou and Serafeim, 2012; El Ghoul et al., 2017; Liang and Renneboog, 2017), we control for the following firm-specific characteristics: firm size (*Size*), firm age (*Firm age*), profitability (*ROA*), sales growth (*Gsales*), leverage (*Leverage*), capital expenditures (*Capex*), R&D expenses (*R&D*), an indicator variable to indicate whether a firm reports R&D expenses for that year (*R&D dummy*), an indicator variable to indicate whether a firm employs a "Big Four" auditor (*Auditor*), the number of analysts that follow a firm (*Analyst*), and domestic and foreign investor ownership separately (*DIO* and *FIO*). In addition, we control for country-specific characteristics that may affect firms' CSR activities, such as GDP growth (*GGDP*), stock market capitalization (*MktCap*), and the economic freedom index (*EconFree*). Finally, country, industry, and year indicators are included to control for unobserved characteristics across countries, industries, and time. All of the continuous variables are winsorized at the 1st and 99th percentiles. To adjust for possible cross-sectional and serial correlations, standard errors are clustered at the firm level.

Table 2 provides the summary statistics for the key variables.[12] Panel A presents the CSR scores. The mean of the total CSR scores for the full sample is 49.821. The average social and environmental scores are 50.54

Table 2
Summary Statistics. This table provides summary statistics for key variables. Sample size, mean, standard deviations, 25th percentile, median, and 75th percentile are reported. Panel A presents summary statistics of CSR. Panel B presents summary statistics of firm characteristics variables. Panel C presents summary statistics of country-level variables. All variables are defined in Appendix C.

Variable	N	Mean	Std Dev	Q1	Median	Q3
Panel A: CSR						
CSR	23,937	49.821	9.815	41.605	49.022	57.793
Social	23,937	50.543	8.775	43.576	50.228	57.395
Environment	23,937	48.146	14.109	37.164	46.433	59.603
Panel B: Firm Characteristics						
Size	23,937	9.029	1.577	7.930	8.852	9.992
Firm age	23,937	3.420	1.588	2.996	3.932	4.554
ROA	23,937	5.216	4.849	2.051	4.333	7.432
GSales	23,937	0.070	0.221	−0.042	0.048	0.152
Leverage	23,937	0.607	0.232	0.452	0.605	0.764
Capex	23,937	0.044	0.045	0.060	0.032	0.012
R&D	23,937	0.011	0.028	0.000	0.000	0.000
R&D dummy	23,937	0.770	0.421	1.000	1.000	1.000
Auditor	23,937	0.885	0.318	1.000	1.000	1.000
Analyst	23,937	2.194	1.167	1.792	2.565	3.045
DIO	23,937	0.345	0.336	0.037	0.195	0.693
FIO	23,937	0.103	0.094	0.043	0.080	0.132
Panel C: Country Controls						
GGDP	23,937	0.015	0.019	0.011	0.018	0.026
MktCap	23,937	1.042	0.357	0.723	1.043	1.337
EconFree	23,937	75.189	5.542	73.000	76.200	79.100

[11] The standard approach in the literature is to use the Game year as the event year (Edmans et al., 2007; Kavetsos and Szymanski, 2010; Drake et al., 2016; Dolan et al., 2019). We also replace the Game year with the announcement year and repeat the analyses and find that the results are insignificant. This is consistent with our stakeholder demand explanation, as the improvement in CSR in the year of the announcement should not be as great as that in the year of and after the Olympics. Consequently, local stakeholders do not obtain as great a utility increase in the announcement year as in the actual Olympics year. We thank an anonymous reviewer for pointing this out.

[12] Data definitions and sources are documented in Appendix C.

and 48.15, respectively. Panel B presents the statistics for the firm characteristics. On average, the ROA ratio is 5.2%, the debt ratio is 0.607, the R&D ratio is 0.011, and the levels of domestic and foreign institutional ownership are about 34.5% and 10.3%, respectively. Panel C presents country-level macro-variables such as GDP growth, stock market capitalization, and the economic freedom index. Our statistics are generally comparable to those previously reported (Ioannou and Serafeim, 2012; El Ghoul et al., 2017; Liang and Renneboog, 2017; Liao et al., 2021).

4. Empirical results

4.1. Univariate tests

We begin our empirical analysis with univariate tests. First, we compare CSR scores for the host and bidder countries from 3 years before the Olympic Games year to 3 years afterward. Panel A of Table 3 summarizes the results, which show that the CSR scores for host countries (treated group) and bidder countries (control group) increase from 3 years before the Olympics (t-3) to 3 years after (t + 3). The average CSR scores for host and bidder countries in year t-3 are 49.84 and 47.01, respectively, and increase to 52.48 and 51.95, respectively, in year t + 3. This indicates the increase in the awareness of the importance of CSR commitment and in the stakeholder demand for firms to invest in CSR.

However, the increase in CSR scores across the periods before and after the Olympic Games is significantly smaller for host (3.62%) than for bidder countries (6.36%). A t-test for the difference in the mean between the two groups of countries (-2.74%) indicates that it is significant at the 1% level. To ensure robustness, we also examine changes in the CSR scores of the groups from 1 year before (t-1) to 1 year after (t + 1) and 2 years before (t-2) to 2 years after (t + 2) the Olympics. Overall, the results are consistent with the use of a 3-year window surrounding the Olympics. Both host and bidder countries experience increases in CSR scores over time when we use various event windows, but during the same period, the increase is significantly smaller for host than for bidder countries at the 1% level in all cases.

To address the concern that differences in country-level institutions may contribute to the significant difference in CSR score changes between the pre- and post-Olympics periods, we further limit our analysis to host countries only. Specifically, we examine the changes in CSR scores between firms located in cities that host the Olympics (i.e., host cities) and those in other cities in the host countries (i.e., non-host cities). We repeat the univariate tests and present the results in Panel B of Table 3.

Table 3
Univariate Analysis. This table reports the univariate tests. Panel A presents mean values of CSR scores for firms in host countries and in bidder countries separately. Panel B presents mean values of CSR scores for firms in host cities and in non-host cities in host countries. The Olympic Game year is t, and event windows are year t-3 to t + 3, t-2 to t + 2, t-1 to t + 1, respectively. A two-tailed t-test for mean differences is conducted between CSR score changes surrounding the Olympics between firms in host countries (host cities) and firms in bidder countries (non-host cities). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Olympic Host versus Bidder Countries (Cross-country comparison)

	Pre-OG			**Post-OG**			
	t-3	*t-2*	*t-1*	*t*	*t + 1*	*t + 2*	*t + 3*
Host country	49.84	49.35	49.64	50.34	50.59	51.15	52.48
N =	432	503	503	503	503	503	492
Bidder country	47.01	47.69	48.25	49.20	49.84	50.25	51.95
N =	1,403	1,497	1,497	1,497	1,497	1,497	1,435
Host country		Pre-OG	Post-OG	N	**(Post - Pre)/Pre**		
Pre-OG 3 years vs. Post-OG 3 years		49.61	51.41	506	Change (%)	***3.62%***	(a1)
Pre-OG 2 years vs. Post-OG 2 years		49.50	50.87	506	Change (%)	***2.77%***	(a2)
Pre-OG 1 year vs. Post-OG 1 year		49.64	50.59	504	Change (%)	***1.91%***	(a3)
Bidder country		Pre-OG	Post-OG	N	**(Post - Pre)/Pre**		
Pre-OG 3 years vs. Post-OG 3 years		47.65	50.68	1,500	Change (%)	***6.36%***	(b1)

(*continued on next page*)

Table 3 (*continued*)

Panel A: Olympic Host versus Bidder Countries (Cross-country comparison)

	Pre-OG				**Post-OG**		
	t-3	*t-2*	*t-1*	*t*	*t + 1*	*t + 2*	*t + 3*
Pre-OG 2 years vs. Post-OG 2 years		47.97	50.05	1,498	Change (%)	***4.33%***	(b2)
Pre-OG 1 year vs. Post-OG 1 year		48.25	49.84	1,497	Change (%)	***3.30%***	(b3)
Host – Bidder							*t*-value
(a1) - (b1) =						***−2.74%***	−3.70***
(a2) - (b2) =						***−1.56%***	−2.99***
(a3) - (b3) =						***−1.39%***	−3.36***

Panel B: Host Cities versus Non-Host Cities (Within-OG country comparison)

	Pre-OG				**Post-OG**		
	t-3	*t-2*	*t-1*	*t*	*t+1*	*t+2*	*t+3*
Host cities	51.77	51.86	52.03	52.45	52.61	53.08	54.98
N =	143	153	153	153	153	153	149
Non-host cities	48.88	48.27	48.61	49.42	49.73	50.32	51.41
N =	289	350	350	350	350	350	343

Host Cities	Pre-OG	Post-OG	N	**(Post - Pre)/Pre**		
Pre-OG 3 years vs. Post-OG 3 years	51.89	53.56	153	Change (%)	***3.22%***	(a1)
Pre-OG 2 years vs. Post-OG 2 years	51.95	52.85	153	Change (%)	***1.74%***	(a2)
Pre-OG 1 year vs. Post-OG 1 year	52.03	52.61	153	Change (%)	***1.12%***	(a3)
Non-host Cities	Pre-OG	Post-OG	N	**(Post - Pre)/Pre**		
Pre-OG 3 years vs. Post-OG 3 years	48.59	50.48	350	Change (%)	***3.91%***	(b1)
Pre-OG 2 years vs. Post-OG 2 years	48.44	50.02	350	Change (%)	***3.27%***	(b2)
Pre-OG 1 year vs. Post-OG 1 year	48.61	49.73	350	Change (%)	***2.30%***	(b3)
Host – Non-host						*t*-value
(a1) - (b1) =					***−0.68%***	−1.66*
(a2) - (b2) =					***−1.53%***	−1.99**
(a3) - (b3) =					***−1.18%***	−1.78*

These results show the same pattern as those in Panel A. The CSR scores increase for firms in both host and non-host cities for all event windows, but the firms in the host cities experience a significantly smaller increase in CSR scores. For example, the changes in scores from year *t*-1 to year *t* + 1 are 1.12% for firms in host cities and 2.30% for those in non-host cities, and the difference (-1.18%) between the two groups (host cities minus non-host cities) is significant at the 10% level. This result is consistent with our previous cross-country univariate analysis shown in Panel A. Our univariate tests therefore indicate the growing importance of CSR investment across all cities in our sample and that the increase in CSR scores is significantly smaller for firms in host cities than for firms in other cities within the host countries.

4.2. Baseline DID regressions

We estimate the baseline DID model as in Equation (1) and present the results in Table 4. Fixed effects for year, country, and industry are included, and standard errors are clustered at the firm level. Model (1) reports the regression results for the full sample. Consistent with H1, the coefficient of *Olympics* × *Post* (-0.487) is significant at the 5% level. The effect is also economically significant. On average, firms in host countries expe-

Table 4
Olympic Games and CSR – Country Level. The table presents multivariate OLS results of Equation (1). The dependent variables are CSR scores. Column (1) reports the regression results for the full sample, and Columns (2)-(4) report regression results for sample periods from year *t*-3 to *t* + 3, *t*-2 to *t* + 2, and *t*-1 to *t* + 1, respectively, where year t is the Olympics Game year. *Olympics* is an indicator set to one for firms domiciled in Olympic host countries and zero for firms domiciled in bidder countries. *Post* is an indicator set to one for years after the Olympics and zero otherwise. Country, industry, and year fixed effects are included but not reported in all regressions. Constants are not reported. Variable definitions are in Appendix C. *t*-statistics are in parentheses calculated using standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dep. Var. = CSR			
	Full sample	*t-3 to t + 3*	*t-2 to t + 2*	*t-1 to t + 1*
	(1)	(2)	(3)	(4)
Olympics* × *Post	**−0.487****	**−0.488****	**−0.618*****	**−0.075**
	(-1.98)	**(-2.13)**	**(-2.59)**	**(-0.23)**
Size	3.615***	3.771***	3.800***	3.899***
	(29.89)	(27.00)	(25.95)	(24.90)
Firm age	0.471***	0.497***	0.479***	0.468***
	(5.17)	(4.96)	(4.63)	(4.28)
ROA	0.173***	0.174***	0.178***	0.173***
	(7.30)	(6.15)	(5.79)	(4.98)
GSales	−2.470***	−2.506***	−2.899***	−2.959***
	(-9.49)	(-7.65)	(-7.53)	(-5.62)
Leverage	0.828	1.009	1.139	1.001
	(1.42)	(1.46)	(1.52)	(1.20)
Capex	−5.856**	−2.733	−1.130	−0.724
	(-2.11)	(-0.84)	(-0.33)	(-0.19)
R&D	29.10***	26.25***	27.70***	29.03***
	(3.88)	(2.99)	(3.03)	(2.94)
R&D dummy	−0.706	−0.657	−0.478	−0.427
	(-1.59)	(-1.31)	(-0.89)	(-0.71)
Auditor	0.411	0.433	0.356	0.364
	(0.85)	(0.81)	(0.65)	(0.62)
Analyst	0.486***	0.378**	0.331**	0.300*
	(3.60)	(2.48)	(2.09)	(1.76)
DIO	0.060	0.412	0.424	0.447
	(0.08)	(0.44)	(0.44)	(0.44)
FIO	4.628***	5.050***	5.249***	5.534***
	(2.84)	(2.81)	(2.80)	(2.80)
GGDP	−18.49***	−15.29***	−14.46***	−25.65**
	(-5.11)	(-4.26)	(-2.73)	(-2.13)
MktCap	−1.415***	−0.680	−0.065	0.801
	(-3.59)	(-1.54)	(-0.14)	(0.80)
EconFree	0.119***	0.029	0.408***	0.217
	(3.22)	(0.63)	(3.74)	(1.38)
Country, year, industry fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.622	0.623	0.620	0.615
N	23,937	13,762	10,000	6,000

rience an increase in CSR scores that is 38.5% smaller than those of bidder countries after the Olympic Games.[13]

To address concerns about confounding events, we restrict our sample period to shorter event windows and re-estimate Equation (1) using *t*-3 to *t* + 3, *t*-2 to *t* + 2, and *t*-1 to *t* + 1. The regression results are presented in Models (2) to (4) in Table 4. The coefficients of *Olympics* × *Post* are all negative and significant at the 5% level or better except for the event window *t*-1 to *t* + 1, which has a negative but insignificant coefficient at conventional levels. CSR scores do not typically fluctuate to any extent over a short period, which leads to insufficient variations, and thus no statistically significant results are obtained.

[13] As the coefficient for *Olympics* is −0.487 and the estimated constant is 5.262, we obtain $e^{(-0.487+5.262)}/e^{5.262}-1 = 38.5\%$.

The coefficients of the other variables are generally consistent with those reported in the literature. Firms that are larger, older, and more profitable have higher CSR scores, as do those with more R&D investment. Firms that are followed by more analysts have higher CSR scores, probably because they are more concerned about their public image. Thus, the results in Tables 3 and 4 provide evidence consistent with H1 as firms in host countries exhibit a relatively lower level of CSR commitment than those in bidder countries, following the Olympic Games.

4.3. City-level DID regressions

To address the concern that our results may be affected by country-specific factors, we re-estimate Equation (1) using city-level locations. Thus, in this analysis, we restrict our sample to Olympics host countries. Following our argument, we propose that as stakeholders in host cities likely experience a greater level of improvement in social and environmental development than stakeholders in non-host cities, the firms in the host cities may expect less demand for CSR improvement from their stakeholders. As a result, firms located in host cities are the treated group in this test, and those located in non-host cities in host countries are the control group. The indicator variable, *Olympics_city*, is set to one for the treated group and to zero for the control group. Thus, the interaction term *Olympics_city* × *Post* measures the change in the CSR scores from the pre-hosting to the post-hosting period for firms located in host cities, relative to the change in the CSR scores for firms located in non-host cities during the same period. As we restrict our analysis to host countries and compare firms domiciled in their host cities and non-host cities, this result is not likely to be caused by differences in country-level factors such as institutions, regulatory regimes, or accounting standards across host and non-host countries.

The results of these regressions are summarized in Table 5. Model (1) presents the results for the full sample. As predicted, the coefficient of *Olympics_city* × *Post* is negative and significant at the 5% level. As in Table 4, we present the results separately using event windows from year t-3 to $t + 3$, from t-2 to $t + 2$, and from t-1 to $t + 1$ in Models (2) to (4), respectively. Consistent with the results in Table 4, the coefficients of *Olympics_city* × *Post* are all negative and significant except for Model (4), in which the coefficient is negative but insignificant. Thus, the results in Table 5 show that even within host countries, firms in host cities exhibit less of an increase in CSR investment than those in non-host cities during the same period. These results, together with the results in Tables 3 and 4, provide strong support for the prediction in H1.[14]

4.4. Mechanisms

H2 predicts that stakeholders in firms domiciled in countries with a greater increase in utility will have a lower demand for CSR investment. To test H2, we estimate the following model:

$$\begin{aligned} CSR_{i,j,t} = {} & \beta_0 + \beta_1 Olympics_{j,t} + \beta_2 Post_t + \beta_3 \Delta WellBeing_{j,t} + \beta_4 Olympics_{j,t} \times Post_t + \beta_5 Olympics_{j,t} \\ & \times \Delta WellBeing_{j,t} + \beta_6 Post_t \times \Delta WellBeing_{j,t} + \beta_7 Olympics_{j,t} \times Post_t \times \Delta WellBeing_{j,t} \\ & + Controls_{i,j,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

The triple interaction term (*Olympics* × *Post* × Δ*WellBeing*) measures the change in the CSR scores for firms in host countries that experience a greater improvement in the level of well-being/satisfaction relative to the CSR score change for firms in host countries with a lower level of such improvement across the two periods. H2 predicts a significantly negative coefficient (i.e., β7) of the triple interaction term. Here, we use two measures of changes in the well-being of a country's stakeholders: the one-year change in the Happiness Index from the World Value Survey Database and the percentage change in gold medals received in the last Olympics. Higher values for these two variables indicate a higher level of well-being/satisfaction for the stakeholders in that country, so changes in these two measures indicate changes in stakeholders' utility in the focal

[14] We conduct a parallel trend test by interacting each year with *Olympics*. We find no significant difference in CSR investment between the treated and control groups before the Olympics, but the difference between the two groups become statistically significant following the Olympics. Overall, our data satisfy the parallel trend hypothesis.

Table 5
Olympic Games and CSR – City Level. The table presents the multivariate OLS results of Equation (1). The dependent variables are CSR scores. Column (1) reports the regression results for the full sample, and Columns (2)-(4) report regression results for sample periods from year *t*-3 to *t* + 3, *t*-2 to *t* + 2, and *t*-1 to *t* + 1, respectively, where year t is the Olympics Game year. *Olympics*_city is an indicator set to one for firms domiciled in Olympic host cities and zero for firms domiciled in non-host cities in host countries. *Post* is an indicator set to one for years after the Olympics and zero otherwise. Country, industry, and year fixed effects are included but not reported in all regressions. Constants are not reported. Variable definitions are in Appendix C. *t*-statistics are in parentheses calculated using standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dep. Var. = CSR			
	Full sample (1)	*t-3 to t + 3* (2)	*t-2 to t + 2* (3)	*t-1 to t + 1* (4)
Olympics_city* × *Post	**−0.673****	**−0.895****	**−0.878***	**−0.747**
	(-2.31)	**(-2.44)**	**(-1.91)**	**(-1.12)**
Size	2.430***	2.544***	2.547***	2.592***
	(30.37)	(22.63)	(19.08)	(14.51)
Firm age	0.416***	0.462***	0.448***	0.399***
	(7.06)	(5.73)	(4.67)	(3.15)
ROA	0.149***	0.161***	0.198***	0.219***
	(8.86)	(7.02)	(7.27)	(5.62)
GSales	−1.780***	−1.487***	−2.018***	−1.588***
	(-6.55)	(-4.16)	(-4.73)	(-2.67)
Leverage	−0.335	−0.657	−0.402	−0.139
	(-0.75)	(-1.02)	(-0.50)	(-0.12)
Capex	1.630	1.251	5.704*	8.078*
	(0.85)	(0.48)	(1.91)	(1.93)
R&D	20.22*	8.879	6.527	−2.655
	(1.88)	(0.64)	(0.40)	(-0.12)
R&D dummy	−0.661	−0.681	−0.453	−0.297
	(-1.23)	(-0.95)	(-0.53)	(-0.25)
Auditor	1.143***	1.265**	0.951	0.803
	(2.72)	(2.38)	(1.60)	(1.06)
Analyst	0.276***	0.135	0.108	0.061
	(3.61)	(1.33)	(0.90)	(0.37)
DIO	3.256***	3.200***	3.118***	2.542
	(4.44)	(3.23)	(2.62)	(1.57)
FIO	6.702***	7.085***	7.859***	8.553***
	(8.52)	(6.74)	(6.26)	(5.04)
GGDP	–22.13*	−29.430	−12.860	
	(-1.75)	(-1.04)	(-0.39)	
MktCap	0.094	−0.822	2.909	
	(0.14)	(-0.47)	(1.18)	
EconFree	−0.175***	−0.038	0.503	
	(-3.03)	(-0.28)	(1.28)	
Country, year, industry fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.675	0.705	0.704	0.686
N	6,045	3,439	2,515	1,509

country. Both measures are at the country level and no data are available at the city level, so we estimate Equation (2) at the country level only.

We present the results of this test in Table 6. Models (1) and (2) show the regression results using the two measures of changes in well-being. Consistent with H2, the coefficients of the triple interaction (*Olympics* × *Post* × Δ*WellBeing*) are negative and statistically significant. Thus, is suggests that stakeholders in host countries that have a greater increase in utility tend to exhibit less of a demand for local firms to invest in CSR than stakeholders in host countries who experience less of an increase in such utility.[15]

[15] The results in Table 6 also rule out the alternative explanation that bidder countries increase CSR investment to improve their chances of hosting the next Olympics Games. As this test compares differences within firms in host countries, the results are not affected by bidder countries. Therefore, this alternative explanation cannot predict the results in Table 6, whereas our stakeholder explanation can. The overall results are thus more consistent with our stakeholder demand explanation than with this alternative explanation.

Table 6
Olympic Games, CSR, and Happiness. The table presents multivariate OLS results of Equation (2). The dependent variables are CSR scores. *Olympics* is an indicator set to one for firms in Olympic host countries and zero for firms in bidder countries. *Post* is an indicator set to one for years after the Olympics and zero otherwise. Δ*WellBeing* is a measure of the two: Column (1) it is defined as the 1-year change of Happiness Index scaled by the previous year value from World Value Survey Database; Column (2) it is defined as the change in the number of Gold Medals received in the current Olympic Game minus the number of Gold Medals received by the same country from the previous Olympic Game, scaled by the latter. Constants are not reported. Variable definitions are in Appendix C. *t*-statistics are in parentheses calculated using standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dep. Var. = CSR	
ΔWellBeing =	*ΔHappiness*	*ΔGold Medals*
	(1)	(2)
***Olympics* × *Post* × ΔWellBeing**	**−0.321*****	**−1.093*****
	(-2.63)	**(-3.26)**
Olympics	2.894***	2.497
	(4.42)	−1.620
Post	0.253*	0.463***
	(1.65)	(3.10)
Δ*WellBeing*	−0.067**	−0.087
	(-2.20)	(-0.64)
Olympics × *Post*	−0.801***	−0.283
	(-2.72)	(-0.93)
Olympics × Δ*WellBeing*	(0.02)	0.212
	(-0.24)	(1.41)
Post × Δ*WellBeing*	0.140***	0.346*
	(2.96)	(1.72)
Size	3.890***	3.609***
	(29.94)	(29.81)
Firm age	0.449***	0.469***
	(4.49)	(5.16)
ROA	0.167***	0.174***
	(6.54)	(7.33)
GSales	−2.371***	−2.482***
	(-7.71)	(-9.40)
Leverage	1.436**	0.804
	(2.28)	(1.38)
Capex	−6.850**	−5.843**
	(-2.23)	(-2.10)
R&D	29.51***	29.02***
	(3.84)	(3.87)
R&D dummy	−0.680	−0.708
	(-1.49)	(-1.59)
Auditor	0.534	0.401
	(1.07)	(0.83)
Analyst	0.490***	0.485***
	(3.32)	(3.60)
DIO	−0.295	0.059
	(-0.38)	(0.07)
FIO	4.375**	4.691***
	(2.40)	(2.87)
GGDP	−20.48***	−20.10***
	(-5.42)	(-5.94)
MktCap	−0.164	−1.560***
	(-0.42)	(-3.95)
EconFree	0.169***	0.102***
	(3.87)	(2.99)
Adj. R^2	0.628	0.622
N	19,246	23,937

CSR typically involves social, environmental, and other dimensions. But as many host countries tend to focus more on improving environmental aspects of CSR, local stakeholders are likely to derive a greater increase in utility from these aspects after a country's hosting decision. Thus, according to the stakeholder demand explanation, stakeholders in host countries should have less of a demand for local firms to invest in the environmental aspects of CSR than in other aspects.

We test this by replacing the dependent variable, the CSR score, in Equation (1) with the social and the environmental CSR scores, and rerun the regressions when considering these separately.

Table 7

Olympics Games and CSR Components. The table presents multivariate OLS results of Equation (1). The dependent variables are Social CSR scores for Model (1) and Environmental CSR scores for Model (2), respectively. Detailed information on CSR is given in Appendix B. *Olympics* is an indicator set to one for firms in Olympic host countries and zero for firms in bidder countries. *Olympics_city* is an indicator set to one for firms domiciled in Olympic host cities, and zero for firms domiciled in non-host cities but in host countries. *Post* is an indicator set to one for years after the Olympics and zero otherwise. Country, industry, and year fixed effects are included but not reported in all regressions. Constants are not reported. Variable definitions are in Appendix C. *t*-statistics are in parentheses calculated using standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Panel A: Host *Countries*		Panel B: Host *Cities*	
Dep. Var. =	**Social**	**Environment**	**Social**	**Environment**
	(1)	(2)	(1)	(2)
Olympics* × *Post	**−0.117**	**−1.351*** **		
	(-0.49)	**(-3.46)**		
Olympics_city* × *Post			**−0.404**	**−1.196*** **
			(-1.46)	**(-2.84)**
Size	3.061***	4.954***	2.060***	3.332***
	(27.13)	(28.88)	(28.22)	(28.20)
Firm age	0.367***	0.719***	0.364***	0.545***
	(4.32)	(5.82)	(6.89)	(6.03)
ROA	0.167***	0.194***	0.153***	0.147***
	(7.50)	(5.83)	(9.54)	(6.11)
GSales	−2.313***	−2.893***	−1.831***	−1.676***
	(-9.31)	(-8.18)	(-7.08)	(-4.18)
Leverage	0.917*	0.620	0.213	−1.665**
	(1.69)	(0.76)	(0.51)	(-2.51)
Capex	−3.769	−11.11***	2.851	−1.669
	(-1.46)	(-2.90)	(1.58)	(-0.61)
R&D	28.35***	31.41***	5.409	53.60***
	(3.96)	(3.10)	(0.54)	(3.65)
R&D dummy	−0.319	−1.660***	−0.890*	−0.226
	(-0.77)	(-2.72)	(-1.79)	(-0.29)
Auditor	0.562	0.119	2.025***	−0.627
	(1.24)	(0.18)	(5.05)	(-0.96)
Analyst	0.480***	0.535***	0.329***	0.185*
	(3.85)	(2.84)	(4.44)	(1.66)
DIO	0.852	−1.701	3.045***	3.888***
	(1.17)	(-1.52)	(4.45)	(3.65)
FIO	3.748**	6.666***	5.453***	9.666***
	(2.51)	(2.88)	(7.38)	(8.49)
GGDP	−20.86***	−12.88**	−18.760	–32.23*
	(-5.90)	(-2.34)	(-1.63)	(-1.68)
MktCap	−1.285***	−1.737***	0.749	−1.252
	(-3.50)	(-2.88)	(1.16)	(-1.22)
EconFree	0.0961***	0.170***	−0.218***	−0.092
	(2.78)	(3.08)	(-4.02)	(-1.09)
Country, year, industry fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.587	0.610	0.661	0.617
N	23,937	23,937	6,045	6,045

Our stakeholder demand explanation predicts a significantly negative coefficient of *Olympics* × *Post* with the environmental social score as the dependent variable. The regression results are summarized in Table 7. Panel A replicates Table 4 and estimates Equation (1) at the country level, and Panel B replicates Table 5 and estimates Equation (1) at the city level. In Panels A and B, the coefficients of *Olympics* × *Post* are significant and negative when the dependent variables are the environmental CSR scores and insignificant when they are the social CSR scores. These findings suggest that firms in host countries experience a significantly lower demand for CSR investment related to environmental dimensions after the Olympics than firms in bidder countries. The results in Panel B of Table 7 are generally similar to those in Panel A.[16] When combining the results from Tables 6 and 7, we find strong evidence supporting the stakeholder demand explanation, as the increased level of well-being for the local stakeholders in host countries or cities leads them to reduce their demands that firms invest in CSR.

5. Robustness tests

5.1. Country-specific analysis

Although our findings support the proposition that hosting the Olympic Games influences stakeholders' demand for CSR, we conduct an additional robustness test and create four indicator variables, *Olympics_ITA*, *Olympics_CHN*, *Olympics_CAN*, and *Olympics_GBR*, to indicate the four host countries of Italy, China, Canada, and the U.K., respectively. We then replace the indicator variable, *Olympics*, in Equation (1) with these four host country indicator variables. The coefficients of the interactions between these variables and *Post* show the differences in the changes in the CSR scores between the firms in each of the four host countries and those in the bidder countries after the Olympics.

We rerun Equation (1) and present the regression results in Table 8. Model (1) presents the results using the full sample. Model (2) presents the results using the t-3 to t + 3 event window. The coefficients of three of the four interactions are negative and significant. The coefficient of the interaction for Italy is generally positive and insignificant. We repeat the regression with the t-2 to t + 2 and t-1 to t + 1 event windows and summarize the results in Models (3) and (4), respectively. China and Canada have negative and significant coefficients for the interactions in all of the regressions. In general, our findings are consistent with the stakeholder demand explanation, as the stakeholders in most of the host countries, and particularly in those that are capital-market-oriented, typically express less demand for local firms to invest in CSR after the Olympic Games.

5.2. Alternative explanations

Firms may have fewer financial resources to devote to CSR after the Olympics, because the Games may present negative net value projects and generate huge deficits, thus creating a financial burden for the host countries (Wills, 2019). This may present an alternative explanation for our findings, as firms in host countries may experience deteriorating financial conditions and have fewer resources to invest in CSR.[17] To rule this out, we create two variables to measure the changes in the financial conditions of these firms before and after the Olympics: *Change in Economy* and *Change in ROA*. *Economy* is the first component in a principal component analysis (PCA) based on GDP per capita, trade to GDP, exports, imports, investment incentives, corporate debt, and credit rating. *ROA* is defined as net income before extraordinary items scaled by total assets for each firm.

We include *Change in Economy* and *Change in ROA* and the interactions between them and *Olympics* × *Post* in Equation (1) and present the regression results in Table 9. The triple interactions capture the effects on CSR scores caused by changes in firms' financial conditions between the host and bidder countries around the Olympics. A negative coefficient for this interaction indicates that deteriorating financial conditions cause less of an increase in CSR scores for firms in the host countries after the Olympics. Our stakeholder demand expla-

[16] In untabulated results, we also find that firms in host countries experience a significantly smaller increase in the main subcategories of environmental CSR scores (such as emission reduction and resource reduction) after the Olympics than firms in bidder countries.

[17] We thank an anonymous reviewer for suggesting this alternative explanation.

Table 8
Olympic Games and CSR – by Host Country. This table reports the multivariate OLS results of Equation (1) with additional country-specific interaction terms. We create four dummy variables, *Olympics_ITA, Olympics_CHN, Olympics_CAN,* and *Olympics_GBR,* to indicate four Olympics host countries (i.e., Italy, China, Canada, and U.K., respectively). *Post* is an indicator set to one for years after the Olympics and zero otherwise. Column (1) reports the regression results for the full sample, and Columns (2)-(4) report regression results for sample periods from year *t*-3 to *t* + 3, *t*-2 to *t* + 2. and *t*-1 to *t* + 1, respectively, where year t is the Olympics Game year. Country, industry, and year fixed effects are included but not reported in all regressions. Constants are not reported. Variable definitions are in Appendix C. *t*-statistics are in parentheses calculated using standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dep. Var. = CSR			
	Full sample (1)	*t-3 to t + 3* (2)	*t-2 to t + 2* (3)	*t-1 to t + 1* (4)
Olympics_ITA* × *Post	**2.245****	**0.584**	**0.471**	**0.657**
	(2.00)	**(0.49)**	**(0.42)**	**(0.64)**
Olympics_CHN* × *Post	**−3.934***	**−4.566****	**−4.446*****	**−2.624****
	(-1.68)	**(-2.43)**	**(-3.57)**	**(-2.04)**
Olympics_CAN* × *Post	**−1.078*****	**−0.745****	**−0.825*****	**−1.445****
	(-2.86)	**(-2.39)**	**(-2.74)**	**(-2.39)**
Olympics_GBR* × *Post	**−0.347***	**−0.346**	**−0.487***	**0.279**
	(-1.75)	**(-1.62)**	**(-1.90)**	**(0.85)**
Size	3.614***	3.773***	3.802***	3.902***
	(29.90)	(27.00)	(25.96)	(24.89)
Firm age	0.470***	0.497***	0.479***	0.468***
	(5.17)	(4.96)	(4.63)	(4.28)
ROA	0.172***	0.174***	0.179***	0.174***
	(7.26)	(6.16)	(5.80)	(4.99)
GSales	−2.472***	−2.516***	−2.899***	−2.980***
	(-9.47)	(-7.65)	(-7.43)	(-5.64)
Leverage	0.842	1.014	1.140	0.999
	(1.44)	(1.47)	(1.52)	(1.20)
Capex	−5.844**	−2.754	−1.118	−0.736
	(-2.11)	(-0.85)	(-0.32)	(-0.19)
R&D	29.10***	26.29***	27.72***	29.07***
	(3.88)	(2.99)	(3.03)	(2.94)
R&D dummy	−0.705	−0.658	−0.479	−0.421
	(-1.58)	(-1.31)	(-0.89)	(-0.70)
Auditor	0.394	0.420	0.344	0.363
	(0.81)	(0.78)	(0.62)	(0.62)
Analyst	0.488***	0.378**	0.332**	0.294*
	(3.63)	(2.49)	(2.09)	(1.72)
DIO	0.068	0.414	0.427	0.451
	(0.09)	(0.44)	(0.44)	(0.44)
FIO	4.628***	5.051***	5.251***	5.542***
	(2.83)	(2.80)	(2.80)	(2.80)
GGDP	−18.42***	−13.79***	−13.55**	−18.510
	(-5.34)	(-4.27)	(-2.49)	(-1.48)
MktCap	−1.326***	−0.468	0.045	1.005
	(-3.76)	(-1.12)	(0.10)	(0.99)
EconFree	0.145***	0.052	0.409***	0.141
	(3.90)	(1.24)	(3.85)	(0.90)
Country, year, industry fixed effects	Yes	Yes	Yes	Yes
Adj. R^2	0.623	0.623	0.620	0.615
N	23,937	13,762	10,000	6,000

nation predicts insignificant coefficients for the triple interactions, whereas the alternative explanation predicts significantly negative coefficients.

As shown in Table 9, the coefficients of the triple interactions are insignificant, and thus the alternative explanation is not supported. In addition, the coefficients of *Change in Economy* and *Change in ROA* are not significant and the coefficients of *Olympics* × *Post* remain negative and significant, so the results in Table 9

Table 9
Olympic Games and CSR: Alternative explanations. The table presents multivariate OLS results of testing an alternative explanation. The dependent variables are CSR scores. *Olympics* is an indicator set to one for firms in Olympic host countries and zero for firms in bidder countries. *Post* is an indicator set to one for years after the Olympics and zero otherwise. *CE* is the change in economic conditions of the firms, measured using the two methods: Column (1) CE is defined as *Change in Economy,* calculated as the one-year change in Economy. Economy is the first component from a principal component analysis (PCA) based on GDP per capita, Trade to GDP, Exports, Imports, Investment incentives, Corporate debt and Credit rating; Column (2) CS is defined as *Change in ROA,* calculated as 1-year change in ROA, where ROA is earnings before extraordinary items over total assets. Constants are not reported. Variable definitions are in Appendix C. *t*-statistics are in parentheses calculated using standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dep. Var. = CSR	
Cross-Sectional Var. (CE) =	*Change in Economy*	*Change in ROA*
	(1)	(2)
Olympics	3.584**	3.143*
	(2.20)	(1.88)
Post	0.247*	0.236*
	(1.85)	(1.68)
CE	0.370	0.003
	(1.48)	(0.31)
Olympics × *Post*	−0.585**	−0.573**
	(-2.08)	(-2.20)
Olympics × *CE*	0.558	−0.011
	(0.95)	(-1.02)
Post × *CE*	−0.525*	−0.002
	(-1.92)	(-0.25)
Olympics* × *Post* × *CE	**0.814**	**0.011**
	(0.65)	**(0.88)**
Size	3.770***	3.626***
	(29.28)	(28.12)
Firm age	0.465***	0.505***
	(4.80)	(5.23)
ROA	0.177***	
	(7.10)	
GSales	−2.396***	−2.026***
	(-8.63)	(-8.02)
Leverage	1.012	0.576
	(1.63)	(0.93)
Capex	−4.592	−7.526**
	(-1.57)	(-2.50)
R&D	30.17***	29.29***
	(3.79)	(3.66)
R&D dummy	−0.544	−0.598
	(-1.17)	(-1.27)
Auditor	0.408	0.383
	(0.79)	(0.72)
Analyst	0.520***	0.575***
	(3.71)	(4.04)
DIO	0.136	0.189
	(0.16)	(0.23)
FIO	4.648***	4.984***
	(2.74)	(2.95)
GGDP	–22.66***	−19.13***
	(-6.76)	(-5.63)
MktCap	−1.555***	−1.528***
	(-4.37)	(-3.83)
EconFree	0.0921**	0.119***
	(2.41)	(3.03)
Constant	8.282**	9.161***
	(2.50)	(2.65)
Adj. R^2	0.628	0.622
N	19,884	21,779

indicate that the smaller increase in CSR scores for the firms in host countries after the Olympics is not related to changes to their financial conditions. Thus, the overall results are more consistent with our proposed stakeholder demand explanation than with the alternative explanation.

5.3. Other robustness tests

We also conduct a series of additional robustness tests, but for the sake of brevity we do not report the results. For example, we address concerns that there might be different firms are included across two different periods (i.e., before to after the Olympics). Therefore, we restrict our sample to the same group of firms with the same number of firm-year observations before and after the Olympics. We repeat our analyses with this subsample and find that the results are consistent.

We also consider two other plausible reasons why location decisions could affect our study.[18] First, firms may choose to establish their headquarters in Olympics host or non-host cities at the time of incorporation. To address this, we examine the ages of the firms in our sample and find that the median (mean) age of firms is 54 (67.5). We further find that over 98% of our sample are over 5 years old, which indicates that our results are not likely to be driven by newly established firms that choose to locate their headquarters in Olympics host cities after they are announced.

Firms may also relocate from non-host cities to Olympics host cities after Olympics host cities are announced, or vice versa. Ideally, we would address this by examining firm relocations in our sample, but Capital IQ does not provide historical records of firm headquarters, which is common in cross-country studies. We therefore examine anecdotal evidence, which provides several explanations of why this concern should not drive our results. First, firms do not typically relocate from one country to another. Second, if firms relocating within a country affect our city-level analyses, our DID research design can alleviate this concern as long as they do not relocate within our event window (i.e., t-3 to t + 3) systematically, as this may affect our findings. The likelihood that firms will follow particular relocation patterns and relocate within three years before to three years after the Olympics Games is low. We acknowledge this caveat, but it is reasonable to conclude that our results are not driven by firm location decisions.

In addition, if the Olympics were held in countries that exhibit a reduction in CSR, the increase in CSR would be smaller even if they did not host the Olympics. Therefore, our findings are likely to hold with or without considering the Olympics. To address this concern, we conduct a pseudo-test with placebo Olympic years. We randomly assign non-Olympic years as Olympic years and rerun the tests. The untabulated results show that the coefficients of *Olympics* × *Post* have mixed signs and are no longer statistically significant. Therefore, our findings are not caused by specific CSR trends in the host countries.

Finally, we also examine whether a similar effect can be observed with the announcement of Olympics host countries.[19] Unlike the actual hosting event, local stakeholders are unlikely to obtain as great a utility increase in the announcement year as they do in the actual Olympic year. We replace the Olympic year with the announcement year and repeat the previous analyses. Consistent with our prediction, we find that CSR score changes do not show a statistically significant difference between firms in the host countries and those in the bidder countries after the announcement of the Games.

6. Conclusions

The debate about why firms invest in CSR remains open. We contribute to the growing body of literature on external shocks and CSR by proposing that stakeholder demand can prompt firms to invest in CSR, and we empirically test this explanation. We argue that firms' CSR investments are influenced by the demand for CSR from local stakeholders. These stakeholders derive utilities from social and environmental development. If local stakeholders experience an increase in these utilities, they are less likely to require CSR investment

[18] We thank the editor for pointing out this caveat.
[19] The announcements are usually made at least five years before the Olympic year.

from local firms. We use the Olympic Games as our experimental setting because they are exogenous to individual firms' corporate policies, such as CSR.

We observe a relatively smaller increase in CSR investment by firms in countries that have recently hosted the Olympic Games than by firms in bidder countries. Our further analysis also shows that firms in host countries experience a significantly smaller increase in the environmental aspects of CSR but not in its social aspects. In addition, our results indicate that firms in host countries with a higher utility increase experience a significantly smaller increase in the CSR scores than those in host countries with a lower utility increase. Overall, we identify a new determinant of firms' CSR investment/commitment. Our findings lend support to the stakeholder demand explanation for the heterogeneity in firms' CSR investments. Our results suggest that corporate decisions may be influenced by stakeholder demand. Specifically, stakeholders' demand for firms' CSR investment varies according to the utility they obtain, and firms adjust their CSR policies accordingly.

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.

Appendix A. Olympic Games

OG Year	*Host Country*	*Host_ISO*	*Host City*	*# of Gold Medals*	*Bidder Countries*
2006	Italy	ITA	Turin	5	Switzerland
2008	China	CHN	Beijing	48	Japan; France
2010	Canada	CAN	Vancouver	14	South Korea; Austria
2012	United Kingdom	GBR	London	29	Spain; United States; Russia; France

Appendix B. Overview of ASSET4 data

Pillars	Categories
Environmental performance	Resource reduction Emission reduction Product innovation
Social performance	Employment quality Health and safety Training and development Diversity Human rights Community Customer/Product responsibility

(*continued*)

Pillars	Categories
Corporate governance	Board structure Compensation policy Board functions Shareholder rights Vision and strategy
Economic performance	Revenue/Client loyalty Margins/Performance Profitability/Shareholder loyalty

Appendix C. Variable definitions

Variable	Definition	Source
CSR	Total CSR score, defined as the average of environmental CSR and social CSR scores.	ASSET4
Olympics	An indicator set to one for firms in Olympic host countries and zero for firms in bidder countries.	International Olympic Committee (IOC)
Olympics_city	An indicator set to one for firms located in Olympic host cities and zero for firms in non-host cities in host countries.	
Post	An indicator set to one for years after the Olympics and zero otherwise.	IOC
Happiness	The percentage change in the Happiness Index over the previous year. The Happiness Index is obtained from the World Value Survey, calculated as the percentage of "very happy" or "rather happy" responses to the total number of responses to the question: "Taking all things together, would you say you are (i) Very happy, (ii) Rather happy, (iii) Not very happy, (iv) Not at all happy, (v) Don't know."	World Value Survey Database
Gold Medals	The total number of gold medals received by a country in the Summer (Winter) Olympics minus the total number of gold medals it received in the previous Summer (Winter) Olympics, divided by the total number of gold medals received by the country in the previous Summer (Winter) Olympics.	IOC
Size	Natural logarithm of the book value of total assets in U.S. dollars.	Worldscope
Firm Age	Natural logarithm of the number of years since the establishment of the firm.	Worldscope
ROA	Net income before extraordinary items scaled by total assets.	Worldscope
Gsales	Sales growth measured as the percentage change in sales from the prior year.	Worldscope

(*continued on next page*)

(*continued*)

Variable	Definition	Source
Leverage	Total liabilities divided by the book value of total assets.	Worldscope
Capex	Ratio of capital expenditures to total assets.	Worldscope
R&D	Research and development expenses scaled by total assets.	Worldscope
R&D dummy	A dummy set to one if R&D expenses are not reported and zero otherwise.	Worldscope
Auditor	A dummy set to one if the auditors are Big 4 and zero otherwise.	Capital IQ
Analyst	Natural logarithm of the number of analysts that follow a firm.	I/B/E/S
DIO	Domestic institutional ownership, defined as the percentage of shareholdings (end-of-year) by institutions located in the country in which the stock is listed.	FactSet/LionShares
FIO	Foreign institutional ownership, defined as the percentage of shareholdings (end-of-year) by institutions in a country different from the stock listing location.	FactSet/LionShares
GGDP	Annual GDP growth.	World Bank
MktCap	Stock market capitalization as a percentage of GDP.	World Bank
EconFree (Economics Freedom Index)	The Heritage Index of Economic Freedom ranges from 0 to 100, with a higher score indicating a higher degree of economic freedom in a country. It includes four key aspects of the economic environment over which governments typically exercise policy control: rule of law (such as property rights and freedom from corruption); government size (including fiscal freedom and government spending); regulatory efficiency (including business freedom, or the efficiency of the government's regulation of business, labor, and monetary freedom); and market openness (such as trade, investment, and financial freedom).	Heritage Index of Economic Freedom

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Improving internal control quality as a corporate response to the *Forbes Rich List*

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ABSTRACT

This study takes advantage of the *Forbes Rich List* as an external shock to examine its effect on internal control quality in mainland China. Using the difference-in-differences (DiD) method for a large sample of 17,910 firm-year observations from 2000 to 2014, we find that firms controlled by entrepreneurs included in the *Forbes Rich List* tend to have higher internal control quality than firms not controlled by entrepreneurs in the list. The listed entrepreneurs improve their firms' internal control quality by means of reducing the information asymmetry between the firms and outsiders. Further tests show that the event effect is more pronounced when firms have higher misreporting costs and when listed entrepreneurs hold chairman positions than in other situations. Our results remain robust after applying the propensity score matching method, stacked DiD estimation, and an alternative measure of internal control quality. These findings enrich the literature on the effect of the *Rich List* and the determinants of internal control quality in emerging markets.

1. Introduction

In the US, internal control over financial reporting is of increased interest due to the occurrence of numerous accounting scandals (e.g., Enron, WorldCom, Qwest) and the subsequent enaction of the Sarbanes–Oxley Act (SOX) in 2002. Sections 302 and 404 of SOX require firms to disclose their internal control over financial reporting. In China, the *Internal Control Norms of Listed Firms* (*Norms*), implemented in 2009, require listed firms to report their internal control effectiveness. In contrast to Sections 302 and 404 of SOX, which only

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require the disclosure of internal control over financial reporting, the *Norms* require the disclosure of internal control in terms of five aspects: the legality of a firm's operations, the safety of property, the authenticity and integrity of financial information, the efficiency of operations, and the achievement of strategies. We thus take advantage of the internal control index in China to assess the overall quality of the internal control system in terms of these five aspects as a corporate response to entrepreneurs' inclusion in the *Forbes Rich List*.

Good internal control can protect firms and entrepreneurs from substantial damage to their reputations caused by a restatement or fraud (Johnstone et al., 2011). Research on internal control mainly focuses on the consequences of internal control quality; the few studies on the determinants of internal control quality focus primarily on the influence of firm characteristics and general corporate governance characteristics (e.g., Krishnan, 2005; Wilford, 2016). Few studies investigate whether and how inclusion on the *Rich List* impacts firms' internal control effectiveness. Therefore, we use entrepreneurs' inclusion on the *Forbes Rich List* as an external event that increases the potential political and reputation costs of entrepreneurs, and we examine its effect on internal control quality.

As an authoritative, well-known list that recognizes the world's richest individuals, the *Forbes Rich List* may alleviate endogeneity problems because it is the relative performance of entrepreneurs that determines whether they are included in the list. Therefore, an entrepreneur cannot predict how the *Rich List* will evaluate their wealth or how other entrepreneurs will react to the list. The entrepreneurs on the *Forbes Rich List* have higher media coverage, more analysts following their firms, and greater reputation and political costs than those not on the list. Inclusion on the *Rich List* can serve as a positive motivator, as greater public attention imposes higher reputation and political costs on the listed entrepreneur, encouraging them to hold their companies to higher standards. Reporting internal control weaknesses (ICWs) can directly harm the reputations of both the entrepreneurs on the *Rich List* and their firms, which may result in lower firm value and less entrepreneur wealth. Therefore, entrepreneurs on the *Rich List* may have a stronger incentive to monitor their firms' management than their counterparts. Such entrepreneurs may play a monitoring role by ensuring board committee effectiveness and preventing CEO entrenchment, leading to higher internal control quality. In addition, better monitoring by stricter external auditors after client firms' inclusion on the *Rich List* may help to improve their internal control quality. However, the listees' companies are subjected to greater scrutiny than other companies. Increased public attention can lead to exposure of illegal practices and expropriation (Wu and Ye, 2020), which can result in more reported ICWs.

Using a sample of 17,910 firm-year observations from 2000 to 2014, we find that firms controlled by entrepreneurs on the *Forbes Rich List* indeed have significantly higher internal control quality than other firms. The listed entrepreneurs improve their firms' internal control quality by means of reducing the information asymmetry between the firms and outsiders. Further tests show that the event effect is more pronounced when firms have higher misreporting costs (i.e., for firms with a longer history, with more analysts following them, and with more research reports on them) and when listed entrepreneurs hold chairman positions than in other situations. Our results remain robust after applying the propensity score matching (PSM) method, stacked difference-in-differences (DiD) method, and an alternative measure of internal control quality. These findings suggest that inclusion on the *Rich List* can motivate entrepreneurs to adopt higher operational and financial standards and to maintain high-quality internal control systems.

This study contributes to the literature in three aspects. First, it takes advantage of the external shock of the *Forbes Rich List* to examine its effect on internal control effectiveness. Firth et al. (2014) use the *Hurun Rich List* to explore the relationship between publicity and stock market performance in China. Wu and Ye (2020) find that auditor conservatism increases with client publicity using the *Hurun Rich List* in China. While these studies focus on the *Rich List*'s influence on the external market, our paper adds to this body of literature by examining the influence of the *Forbes Rich List* on the effectiveness of firms' internal control.

Second, studies examining the effect of the *Rich List* in China mainly focus on the perceptions of external investors and auditors (Firth et al., 2014; Wu and Ye, 2020). Negative consequences for the stock market and increased auditor conservatism may arise from external parties' views on disparities in wealth and firm members' expropriation. Reporting ICWs can provide a direct indicator of problematic financial reporting, and it harms entrepreneurs' reputations in the market and limits their future opportunities. Despite the possible negative perceptions of external parties, it is also important to explore whether inclusion on the *Rich List* drives

entrepreneurs to play a positive monitoring role internally. Our study fills this gap by examining the effect of the *Rich List* on firms' internal control.

Third, this study adds to the literature on the determinants of internal control effectiveness. In China, the internal control index assesses the overall quality of the internal control system by examining not only firms' internal control over financial reporting but also the legality of operating management, the safety of firms' property, firms' operating efficiency and effectiveness, and the achievement of their development strategies (Shu et al., 2018). Moreover, instead of examining general board characteristics, this study focuses on the entrepreneurs on the *Rich List*. Inclusion on the *Rich List* increases public attention and thus creates higher potential reputation and political costs for entrepreneurs. Therefore, it is important to enrich the internal control literature by verifying the effect of listed entrepreneurs on internal control effectiveness.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents our research design. Section 4 describes our data and sample. Section 5 reports the empirical results. Section 6 concludes the paper.

2. Literature review

2.1. Literature on internal control quality

The literature indicates that the effectiveness of internal control affects accrual quality (Ashbaugh-Skaife et al., 2008; Doyle et al., 2007), the cost of equity capital (Ashbaugh-Skaife et al., 2008; Beneish et al., 2008; Hammersley et al., 2008), the cost of debt financing (Costello and Wittenberg-Moerman, 2011; Dhaliwal et al., 2011; Kim et al., 2011), management forecasting (Feng et al., 2009), audit fees (Hoitash et al., 2009), investment efficiency (Cheng et al., 2013), innovation (Li et al., 2017), and insider trading (Skaife et al., 2013).

Regarding the determinants of internal control quality, studies identify certain firm characteristics (e.g., Ashbaugh-Skaife et al., 2007; Doyle et al., 2007; Rice and Weber, 2012) and corporate governance characteristics (e.g., Bedard et al., 2014; Hoitash et al., 2009; Ji et al., 2015; Krishnan, 2005; Li et al., 2010; Zhang et al., 2007) that are related to internal control effectiveness. Doyle et al. (2007) and Ashbaugh-Skaife et al. (2007) find that firms with ICWs are relatively small, young, financially weak, and complex; that they have greater accounting risks and more auditor resignations than other firms; and that the occurrence of ICWs corresponds to the firms' rapid growth and/or restructuring. Rice and Weber (2012) further investigate the factors driving the disclosure of ICWs under Section 404 of SOX and find that not all ICWs are identified and reported. Their study shows that only a minority of restating firms acknowledge existing control weaknesses during their misstatement periods.

In terms of corporate governance factors, Hoitash et al. (2009) examine the association between corporate governance and the disclosure of ICWs under Sections 302 and 404 of SOX. They find that the likelihood of disclosing material problems in internal control is lower for firms with higher audit committee quality and stronger boards of directors (e.g., boards that are smaller, more independent, and more reputable; have directors with longer tenure; and hold more frequent board meetings). Li et al. (2010) show that firms with CFOs who have weaker accounting knowledge and experience tend to have lower internal control quality. Bedard et al. (2014) find that companies with CFOs sitting on their boards are less likely to report ICWs. In addition, Defond and Lennox (2017) identify that Public Company Accounting Oversight Board inspections can effectively improve internal control quality. Liu et al. (2017) verify that internal control employee quality has a significant and positive influence on internal control quality. More studies on the effects of internal and external corporate governance mechanisms on internal control effectiveness are needed.

2.2. The Rich List and internal control quality

As an authoritative list recognizing great financial success, the *Rich List* is a double-edged sword. Inclusion on the *Rich List* can generate positive outcomes. It increases public attention toward the listed entrepreneur and their firm, building the entrepreneur's reputation capital and reducing their financing costs (Siegel, 2005). Some entrepreneurs exploit these market opportunities by creating their own wealth and social welfare (Wu

and Ye, 2020). Moreover, firms controlled by entrepreneurs on the *Rich List* experience stricter scrutiny from public media and the government; this imposes higher reputation and political costs on the listed entrepreneurs. Damage to their reputations may affect their wealth and firm value. Fama (1980) and Holmstrom (1999) argue that reputation concerns motivate managers to prove themselves by taking actions to signal their talent over time, and these concerns create incentives for managers to avoid risky actions that may have negative consequences for their firms.[1] Such incentives may motivate entrepreneurs on the *Rich List* to fulfill their duties and oversee their firms' internal control systems. Moreover, Wu and Ye (2020) show that auditors become stricter in auditing client firms after their controlling owners are included in the *Rich List*. One important task of the auditor is to monitor the internal control of its client firms. Better monitoring by stricter auditors will thus improve firms' internal control quality.

However, because China is transitioning from a centrally planned system to a market economy, entrepreneurs may build their fortunes through expropriation and rent-seeking behaviors, leading to poor internal control (Firth et al., 2014; Wu and Ye, 2020). We present the following hypothesis on the positive aspects of the *Rich List*.

H1*:* Firms controlled by entrepreneurs on the *Rich List* tend to have higher internal control quality than other firms.

3. Research design

We evaluate the effect of an entrepreneur's inclusion on the *Forbes Rich List* on their firm's internal control quality. To increase the power of the tests, we follow Wu and Ye (2020) and focus on the year in which the entrepreneur is first included in the *Rich List*. Following Wu and Ye's (2020) DiD research setting, our control group includes companies that are publicly listed on the A-share market during the same period but are not controlled by *Rich List* entrepreneurs. Pooling the treatment and control firms together, we obtain the following model (see the appendix for the definitions of the variables):

$$\begin{aligned} LGIC_{it} = {} & \beta_0 + \beta_1 List[T, T+2]_{it} + \beta_2 BoardSize_{it} + \beta_3 Rindep_{it} + \beta_4 Lgcomp_{it} + \beta_5 Ncommittee_{it} \\ & + \beta_6 Lgemployee_{it} + \beta_7 Big4_{it} + \beta_8 Lgasset_{it} + \beta_9 Leverage_{it} + \beta_{10} CR_{it} + \beta_{11} Inventory_{it} + \beta_{12} Loss_{it} \\ & + \beta_{13} Salesgrowth_{it} + \beta_{14} Return_{it} + firm\ fixed\ effects + year\ fixed\ effects + \varepsilon_{it} \end{aligned} \tag{1}$$

To eliminate the possibility of correlated but omitted variables confounding the association between listed entrepreneurs and internal control quality, we use linear regressions with firm and year fixed effects. Our dependent variable, *LGIC*, is the natural logarithm of the internal control index computed using the DIB database, based on the aforementioned five measures (i.e., the legality of operating management, the safety of the firm's property, the authenticity and integrity of financial reports and related information, operating efficiency and effectiveness, and the achievement of development strategies).[2] $List[T, T+2]$ is an indicator variable for treatment firms in the post-listing event years from T to $T+2$. β_1 represents the effect of inclusion on the *Rich List* for the treatment group. We include a large set of control variables in the model: board size (*BoardSize*), percentage of independent directors on the board (*Rindep*), natural logarithm of CEO compensation (*Lgcomp*), number of board committees (*Ncommittee*), natural logarithm of the number of employees (*Lgemployee*), Big Four auditor (*Big4*), natural logarithm of total assets (*Lgasset*), leverage ratio (*Leverage*), current ratio (*CR*), inventory ratio (*Inventory*), consecutive loss (*Loss*), and annual stock returns (*Return*).

[1] Empirical studies also suggest that reputation concerns reduce moral hazard (Drymiotes, 2007; Ertimur et al., 2012; Fich and Shivdasani, 2007; Lin et al., 2016; Masulis and Mobbs, 2011; Srinivasan, 2005).

[2] We use the dummy variable of internal control deficiency, as disclosed in a company's internal control report, as an alternative measure of internal control quality; see Section 5.5.2.

4. Data and sample

From the *Forbes Rich List*, we obtain the names of rich individuals and the companies controlled by them as listed from 2000 to 2014.[3] The internal control index data are obtained from the DIB database. Our sample starts in 2000, as this is the first year for which the internal control index data are available in the DIB database. The financial and firm characteristic data are obtained from the China Stock Market and Accounting Research (CSMAR) database. After eliminating observations with missing data, our final sample consists of 17,910 firm-year observations from 2000 to 2014. Table 1 presents the incidence of listed entrepreneurs by year, industry, and province. As shown in Panel A, the number and percentage of listed entrepreneurs increase from 6 (1.13%) in 2000 to 169 (9.28%) in 2014. This increase emphasizes their important role in the firm's monitoring and advisory process. Panels B and C further show that listed entrepreneurs are most commonly found in the manufacturing industry (775 observations, 61.75%) and real estate industry (164 observations, 13.07%); geographically, they are most prevalent in Zhejiang, Guangdong, Jiangsu, Shanghai, and Beijing than in other cities.

Table 2 summarizes the descriptive statistics of all of the variables used in the main test. From 2000 to 2014, the average internal control index (*ICindex*) is 637.950. Regarding the variables associated with inclusion on the list, 7% of our observations relate to controlling entrepreneurs on the *Rich List* (*Onlist*). Among them, 17.1% (0.012/0.07) relate to controlling entrepreneurs listed on the *Rich List* for the first time (*List1st*), 78.6% (0.055/0.07) relate to controlling entrepreneurs listed on the *Rich List* in both year *t* and year/t (*Remainlist*), and 5.7% (0.004/0.07) relate to controlling entrepreneurs who are removed from the *Rich List* before year *t* and appear on the list again in year *t* (*Againlist*). Panel B shows the differences in firm and director characteristics between firms with and without listed entrepreneurs. Compared with firms without listed entrepreneurs, firms with listed entrepreneurs tend to have higher internal control index (*ICindex*) values, smaller boards (*BoardSize*), more independent directors (*Rindep*), higher CEO compensation (*Compensation*), more board committees (*Ncommittee*), larger firms (*Assets*), and lower probabilities of loss (*Loss*), as well as higher liquidity (*CR*), leverage (*Leverage*), inventory (*Inventory*), sales growth rates (*Salesgrowth*), and stock returns (*Return*). Untabulated results regarding the Pearson correlation coefficients among the main variables reveal that the correlations between most of the variables are weak; thus, the likelihood of multicollinearity in the models is low and therefore unlikely to affect the empirical findings.

5. Empirical results

5.1. Main Results: Testing H1

Table 3 reports the regression results for the effect of inclusion on the *Rich List* on a firm's internal control quality, based on Eq. (1). We control for firm and year fixed effects in all three columns of Table 3. The dependent variable in all models is *LGIC*.

As shown in Column (1), the coefficient on *List[T, T + 2]* is positive and significant at the 5% level. This is consistent with *H1*, indicating that internal control quality increases significantly with inclusion on the *Rich List* during the period from year T to year $T + 2$.[4] In Column (2), we further include the pre-listing periods of our treatment sample, *List[T-1]* and *List[T-2]*, in our regression. We find little change in internal control quality before inclusion on the *Rich List*, as evidenced by the non-significant coefficients on *List[T-1]* and *List[T-2]*. More importantly, the coefficient on *List[T, T + 2]* is still positive and significant at the 5% level. The non-significant results in the pre-listing periods and the consistently significant results in the post-listing periods reinforce our prediction that inclusion on the *Rich List* leads to changes in internal control quality. The use of multiple treatment events that occur at different times provides a relatively strong design for causal inference (Wu and Ye, 2020).

[3] Forbes has various rich lists in different countries around the world, while the Hurun Report mainly focuses on the rich in China. We adopt the *Forbes Rich List* to ensure better comparability with research in other countries.

[4] An untabulated regression using only the top 200 entrepreneurs on the *Rich List* produces similar results.

Table 1
Firm-years with listed entrepreneurs by year, industry, and province.

Panel A: Firms with listed entrepreneurs by year

Year	Obs. with listed entrepreneurs	%Obs. with listed entrepreneurs	Obs. with no listed entrepreneurs	%Obs. with no listed entrepreneurs	Total
2000	6	1.13%	524	98.87%	530
align="right">2001	24	2.85%	818	97.15%	842
2002	27	2.88%	910	97.12%	937
2003	20	2.08%	943	97.92%	963
2004	38	3.78%	967	96.22%	1,005
2005	68	8.31%	750	91.69%	818
2006	66	7.79%	781	92.21%	847
2007	87	7.60%	1,058	92.40%	1,145
2008	88	7.01%	1,167	92.99%	1,255
2009	110	8.25%	1,224	91.75%	1,334
2010	114	8.32%	1,256	91.68%	1,370
2011	133	8.89%	1,363	91.11%	1,496
2012	148	8.59%	1,575	91.41%	1,723
2013	157	8.61%	1,666	91.39%	1,823
2014	169	9.28%	1,653	90.72%	1,822
Total	1,255	7.01%	16,655	92.99%	17,910

Panel B: Firm-years with listed entrepreneurs by industry

IND	Industry	Obs. with listed entrepreneurs	Percentage
A	Agriculture, forestry, animal husbandry, and fishery	18	1.43%
B	Mining	34	2.71%
C	Manufacturing	775	61.75%
E	Construction	29	2.31%
F	Wholesale and retail	60	4.78%
G	Transportation, warehousing, and postal	6	0.48%
H	Accommodation and catering	1	0.08%
I	Information transmission, software, and IT services	74	5.90%
K	Real estate	164	13.07%
L	Leasing and business services	26	2.07%
M	Research and technical services	0	0.00%
N	Ecological preservation, environmental treatment, and public utility management	16	1.27%
P	Education	0	0.00%
Q	Healthcare	12	0.96%
R	Culture, sports, and entertainment	16	1.27%
S	Conglomerates	24	1.91%
Total		1,255	100.00%

Panel C: Firm-years with listed entrepreneurs by province

Province	Obs. with listed entrepreneurs	Percentage
Shanghai	74	5.90%
Yunnan	2	0.16%
Inner Mongolia	9	0.72%
Beijing	70	5.58%
Jilin	12	0.96%
Sichuan	73	5.82%
Tianjin	2	0.16%
Ningxia	17	1.35%
Anhui	15	1.20%
Shandong	54	4.30%
Shanxi	20	1.59%
Guangdong	186	14.82%
Guangxi	9	0.72%

Table 1 (*continued*)

Panel C: Firm-years with listed entrepreneurs by province		
Province	**Obs. with listed entrepreneurs**	**Percentage**
Xinjiang	17	1.35%
Jiangsu	141	11.24%
Jiangxi	21	1.67%
Hebei	32	2.55%
Henan	35	2.79%
Zhejiang	210	16.73%
Hainan	15	1.20%
Hubei	41	3.27%
Hunan	24	1.91%
Gansu	20	1.59%
Fujian	65	5.18%
Tibet	8	0.64%
Guizhou	6	0.48%
Liaoning	13	1.04%
Chongqing	28	2.23%
Shanxi	12	0.96%
Qinghai	3	0.24%
Heilongjiang	21	1.67%
Total	1,255	100.00%

This table presents the number and percentage of firm-year observations with listed entrepreneurs by year, industry, and province. Panel A presents the number and percentage of firms with listed entrepreneurs by year; Panel B presents the number and percentage of firm-years with listed entrepreneurs by industry; Panel C presents the number and percentage of firm-years with listed entrepreneurs by province.

In Column (3), we further examine the heterogeneous effects of various *Rich List* situations on firms' internal control quality. The variables *List1st*, *Remainlist*, and *Againlist* equal one if the controlling entrepreneur is listed for the first time, listed in 2 subsequent years, and listed after being removed from the *Rich List*, respectively. The coefficients on *List1st*, *Remainlist*, and *Againlist* are positive and significant at the 10%, 1%, and 5% levels, respectively. These results further suggest that it takes time for the controlling entrepreneur to improve the firm's internal control quality. Our DiD research setting for the post-listing periods from year T to year $T + 2$ is thus appropriate to analyze this situation regarding *Rich List* inclusion.

5.2. Channels through which listed entrepreneurs affect internal control Quality: Moderation effect of information asymmetry

In this section, we further explore the channels through which listed entrepreneurs may affect their firms' internal control quality. Conventional agency theory suggests that managers are motivated to pursue their own interests, which may harm the value of their firms and exacerbate the information asymmetry between the firms and outsiders. High information asymmetry creates opportunities for managers to engage in entrenchment strategies, which may harm internal control quality. As listed controlling entrepreneurs attract more public attention and may incur higher reputation and political costs than their non-listed counterparts, they should be more motivated to reduce information asymmetry, improve the effectiveness of the board's monitoring of management, and ensure effective internal control. Therefore, we predict that listed entrepreneurs improve internal control quality by reducing the information asymmetry between their firms and outsiders.

We measure information asymmetry using the volume-synchronized probability of informed trading (*VPIN*) (Easley et al., 2012) extracted from the CSMAR database. The cross-sectional results are reported in Table 4. As shown in Table 4, the effect of inclusion on the *Rich List* on internal control quality is more pronounced in firms with higher *VPIN*, indicating that listed entrepreneurs play an important role in improving internal control quality by reducing the information asymmetry between their firms and outsiders.

Table 2
Descriptive statistics.

Panel A: Full-sample descriptive statistics

Variable	N	Mean	Std. Dev.	P25	Median	P75	Min	Max
ICindex	17,910	673.950	103.136	627.970	683.985	721.130	8.970	999.750
Onlist	17,910	0.070	0.255	0.000	0.000	0.000	0.000	1.000
List1st	17,910	0.012	0.108	0.000	0.000	0.000	0.000	1.000
Remainlist	17,910	0.055	0.227	0.000	0.000	0.000	0.000	1.000
Againlist	17,910	0.004	0.060	0.000	0.000	0.000	0.000	1.000
BoardSize	17,910	9.225	1.973	8.000	9.000	10.000	3.000	19.000
Rindep	17,910	0.331	0.105	0.333	0.333	0.375	0.000	0.800
Compensation ($ thousands)	17,910	3,239.498	4,194.141	1,018.600	2,121.200	3,920.000	23.100	120,000.000
Ncommittee	17,910	3.173	1.569	3.000	4.000	4.000	0.000	9.000
Employee	17,910	5,328.938	19,100.000	917.000	2,008.000	4,451.000	7.000	553,000.000
Big4	17,910	0.063	0.243	0.000	0.000	0.000	0.000	1.000
Assets ($ million)	17,910	6,273.765	13,700.000	1,111.639	2,240.262	4,902.886	142.027	96,100.000
Leverage	17,910	0.067	0.090	0.000	0.026	0.104	0.000	0.462
CR	17,910	1.769	1.528	0.966	1.343	1.974	0.174	14.579
Inventory	17,910	0.175	0.153	0.076	0.137	0.220	0.000	0.943
Loss	17,910	0.026	0.160	0.000	0.000	0.000	0.000	1.000
Salesgrowth	17,910	0.185	0.409	−0.016	0.127	0.301	−0.735	3.868
Return	17,910	0.279	0.858	−0.254	0.021	0.545	−0.909	11.947

Panel B: Comparison of director and firm characteristics in firms with and without listed entrepreneurs

Variable	**Firms without listed entrepreneurs**		**Firms with listed entrepreneurs**		**MeanDiff**
	Obs.	**Mean**	**Obs.**	**Mean**	
ICindex	16,655	672.143	1,255	697.938	−25.795***
BoardSize	16,655	9.252	1,255	8.865	0.388***
Rindep	16,655	0.329	1,255	0.361	−0.032***
Compensation ($ thousands)	16,655	3,116.650	1,255	4,869.803	−1,753.153***
Ncommittee	16,655	3.145	1,255	3.548	−0.404***
Employee	16,655	5,319.878	1,255	5,449.173	−129.295
Big4	16,655	0.063	1,255	0.061	0.002
Assets ($ million)	16,655	6,155.591	1,255	7,842.047	−1,686.456***
Leverage	16,655	0.067	1,255	0.072	−0.006**
CR	16,655	1.748	1,255	2.052	−0.304***
Inventory	16,655	0.173	1,255	0.206	−0.034***
Loss	16,655	0.027	1,255	0.017	0.010**
Salesgrowth	16,655	0.180	1,255	0.243	−0.063***
Return	16,655	0.271	1,255	0.385	−0.114***

Panel A presents the descriptive statistics for the main variables of the full sample of 17,910 firm-years. Panel B shows the differences in director and firm characteristics in firms with listed entrepreneurs and firms without listed entrepreneurs. The definitions of the variables are specified in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.3. Effect of the cost of misreporting

The discovery of poor internal control can result in more unfavorable consequences for some firms than for others. Hoitash et al. (2012) show a more pronounced negative association between ICWs and changes in CFO compensation in firms with higher financial misreporting costs. Entrepreneurs on the *Rich List* attract more public attention. A higher cost of misreporting increases the potential for a stronger negative market reaction to internal control deficiencies, which harms the reputation of a listed entrepreneur and threatens their position on the *Rich List*. Therefore, listed entrepreneurs in firms with higher misreporting costs are more motivated to improve their internal control quality than listed entrepreneurs in firms with lower misreporting costs.

We use three proxies for the cost of misreporting: firm age (*FirmAge*), the number of analysts following the company (*AnalystAttention*), and the number of research reports on the company (*ReportAttention*). We con-

Table 3
Regression results for the effect of inclusion on the *Rich List* on internal control.

	(1)	(2)	(3)
	LGIC	*LGIC*	*LGIC*
List[T, T + 2]	0.016**	0.019**	
	(1.97)	(2.15)	
List[T-1]		0.018	
		(1.58)	
List[T-2]		0.003	
		(0.22)	
List1st			0.020*
			(1.71)
Remainlist			0.035***
			(2.89)
Againlist			0.032**
			(2.52)
BoardSize	0.002**	0.002**	0.002**
	(2.02)	(2.01)	(2.00)
Rindep	0.064**	0.064**	0.063**
	(2.09)	(2.09)	(2.06)
Lgcomp	0.033***	0.033***	0.033***
	(9.20)	(9.21)	(9.23)
Ncommittee	0.002	0.002	0.002
	(1.49)	(1.49)	(1.48)
Lgemployee	−0.004	−0.005	−0.004
	(−1.60)	(−1.60)	(−1.52)
Big4	0.003	0.003	0.003
	(0.30)	(0.32)	(0.28)
Lgasset	0.038***	0.038***	0.037***
	(8.32)	(8.35)	(8.15)
Leverage	−0.057***	−0.056***	−0.056***
	(−82.63)	(−2.61)	(−82.62)
CR	0.008***	0.008***	0.008***
	(6.94)	(6.94)	(6.92)
Inventory	0.071***	0.071***	0.069***
	(3.75)	(3.76)	(3.71)
Loss	−0.270***	−0.270***	−0.270***
	(−816.99)	(−816.99)	(−816.99)
Salesgrowth	0.044***	0.044***	0.044***
	(14.12)	(14.11)	(14.14)
Return	0.023***	0.023***	0.023***
	(11.93)	(11.89)	(11.93)
Intercept	5.283***	5.281***	5.303***
	(59.58)	(59.64)	(60.47)
Firm fixed effects	Included	Included	Included
Year fixed effects	Included	Included	Included
N	17,910	17,910	17,910
Adjusted R^2	0.175	0.175	0.175

This table shows the regression results for the effect of listed entrepreneurs on internal control quality. *List[T, T + 2]* is an indicator variable for treatment firms in the post-listing event years, from year T to year $T + 2$, where T denotes the year in which the controlling owner is first included in the *Rich List*. *List[T-1]* is an indicator variable for treatment firms 1 year before the event year, and *List[T-2]* is an indicator variable for treatment firms 2 years before the event year. *List1st* equals one if the controlling entrepreneur appears on the *Forbes Rich List* for the first time. *Remainlist* equals one if the controlling entrepreneur appears on the *Forbes Rich List* in both year *t* and year/t. *Againlist* equals one if the controlling entrepreneur is removed from the *Forbes Rich List* before year *t* and appears on the *List* again in year *t*. The standard errors are corrected for heteroscedasticity and firm-level clustering. The variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

sider firms that have a longer history, are followed by more analysts, or are the subject of more research reports to have higher misreporting costs. Table 5 shows the regression results regarding the effect of the cost of misreporting on the relationship between listed entrepreneurs and their firms' internal control quality. The firm-years are divided into two subsamples based on the median of the three partitioning variables (*FirmAge*, *AnalystAttention*, and *ReportAttention*). Our cross-sectional results, provided in Table 5 and obtained using *List[T, T + 2]* as the test variable, show that the effect of listed entrepreneurs on their firms' internal control effectiveness is more pronounced for firms with a higher cost of misreporting (older firms, firms followed by more analysts, and firms that are the subject of more reports).

5.4. Effect of listed Entrepreneurs' positions

Panel A of Table 6 presents the positions of listed entrepreneurs in their respective firms. In 240 firm-years (19.12%), the listed entrepreneurs hold the positions of both chairman and CEO, CFO, or COO; 482 firm-years (38.41%) involve listed entrepreneurs holding only the chairman position; and 821 firm-years (65.42%) involve listed entrepreneurs who sit on the board of directors. Panel B further shows the regression results for the effects of various positions held by listed entrepreneurs on their firms' internal control quality. *Chairman_c* equals one if the listed entrepreneur is the chairman of the board and holds the position of CEO, CFO, or COO; *Chairman_nonC* equals one if the listed entrepreneur is the chairman of the board and does not hold the position of CEO, CFO, or COO; and *Director_nonchair* equals one if the listed entrepreneur is a non-chairman director. As shown in Panel B of Table 6, the coefficients on *Chairman_c* and *Chairman_nonC* are both positive and significant at the 1% level, indicating that listed entrepreneurs who hold the position of chairman play a crucial role in monitoring their firms' management and improving their internal control quality.

5.5. Robustness tests

5.5.1. Endogeneity issues

To eliminate the possibility of correlated but omitted variables confounding the association between listed entrepreneurs and internal control quality, we use linear regressions with firm and year fixed effects in Section 5.1. To eliminate the possibility of differences in the observable firm and director characteristics affecting the main results, when testing *H1*, we use PSM to construct a matched sample with no listees but otherwise

Table 4
Effect of information asymmetry on the relationship between listed entrepreneurs and internal control quality.

	VPIN	
	High	**Low**
	(1)	(2)
	LGIC	*LGIC*
List[T, T + 2]	0.018*	−0.009
	(1.84)	(−0.67)
Control variables	Included	Included
Intercept	5.327***	5.324***
	(53.36)	(32.36)
Firm fixed effects	Included	Included
Year fixed effects	Included	Included
N	9,990	7,920
Adjusted R^2	0.141	0.175

This table reports the regression results for the effect of information asymmetry on the relationship between listed entrepreneurs and internal control quality. Firms with higher *VPIN* are considered to have higher information asymmetry. The variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

similar observable firm and director characteristics. Following the literature (Armstrong et al., 2010; Cheng et al., 2013; Lawrence et al., 2011), we match firms with listees (treatment sample) with those without listees (control sample), based on observable firm and director characteristics, using the following steps. First, we obtain a probit model using *Onlist* as the dependent variable (Panel A). We then calculate the predicted probability of a firm having a *Rich List* listee, based on the firm characteristics included in our probit model. Second, we match each treatment firm with the 10 control observations with the closest propensity scores within a distance of 0.03 from the treatment firm's propensity score (Bharath et al., 2011). Third, we examine the covariate balance between the treatment and control groups. Panel A of Table 7 shows that covariate balance is achieved, as the treatment and control groups appear to be similar in their observable dimensions (the *t*-statistics when testing the differences between the treatment and control groups are not significant). Consistent with *H1*, the results of the univariate test show that the treatment firms tend to have higher internal control quality than the control firms ($t = 1.97$).

We then use the propensity score matched sample to re-estimate Eq. (1) in Panel C. Consistent with the hypothesis, Panel C shows that firms controlled by entrepreneurs on the *Forbes Rich List* during the period from year T to year $T+2$ tend to have higher internal control quality ($t = 2.08$) than other firms. Taken together, the tests using the PSM sample further validate our inferences by eliminating the possibility that differences in observable firm and director characteristics affect the main results.

5.5.2. Stacked DiD method

Following Baker et al. (2022), to address the possible biases in staggered DiD models, we use stacked regression to run our DiD estimation. For each observation in the treatment group, we generate a 5-year subsample covering the period from 2 years before the first time that the controlling entrepreneur is listed to 2 years after the event. For each cohort of treatment observations, as the control group, the subsample includes observations that are included in the same cohort and are not treated throughout the sample period. Then, we stack all subsamples together, and the overall sample size is increased from 17,910 to 239,191. Table 8 reports the results. *List[T-2]*, *List[T-1]*, *List[T]*, *List[T + 1]*, and *List[T + 2]* are corresponding dummy variables for the treatment firms that refer to 2 years before, 1 year before, the year of, 1 year after, and 2 years after inclusion on the *Rich List*. As shown in Column (1), the coefficient on our main test variable *List[T, T + 2]* is still positive and significant at the 5% level using the stacked DiD approach, which confirms the positive effect of inclusion on the *Rich List* on internal control quality, as in our main test. In Column (2), we further decompose *List[T, T + 2]* into *List[T]*, *List[T + 1]*, and *List[T + 2]* to determine the effects of different periods during or after the event year. The coefficient on *List[T + 1]* is positive and significant at the

Table 5
Effect of the cost of misreporting on the relationship between listed entrepreneurs and internal control quality.

	FirmAge		***AnalystAttention***		***ReportAttention***	
	Old	**Young**	**High**	**Low**	**High**	**Low**
	(1)	(2)	(3)	(4)	(5)	(6)
	LGIC	*LGIC*	*LGIC*	*LGIC*	*LGIC*	*LGIC*
List[T, T + 2]	0.025**	0.007	0.018*	0.021	0.018*	0.024
	(1.99)	(0.60)	(1.87)	(1.32)	(1.80)	(1.59)
Control variables	Included	Included	Included	Included	Included	Included
Intercept	5.374***	4.535***	5.339***	5.194***	5.370***	5.143***
	(36.29)	(28.98)	(51.52)	(33.32)	(51.33)	(32.98)
Firm fixed effects	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included
N	9,732	8,178	13,044	4,866	12,519	5,391
Adjusted R^2	0.127	0.214	0.190	0.124	0.192	0.124

This table reports the regression results for the effect of the cost of misreporting on the relationship between listed entrepreneurs and internal control quality. Firms with a longer history (*FirmAge*), more analysts following them (*AnalystAttention*), and greater report attention (*ReportAttention*) are considered to have higher costs of misreporting. The variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6
Effect of listed entrepreneurs' positions.

Panel A: Descriptions of the positions of listed entrepreneurs			
Type of listed entrepreneur position		**Obs.**	**Percentage**
Director	Chairman with CEO/CFO/COO position	240	19.12%
	Chairman without CEO/CFO/COO position	482	38.41%
	Non-chairman	99	7.89%
Non-director		434	34.58%
Total		1,255	100.00%

Panel B: Regression results for the effect of listed entrepreneurs' positions on internal control quality	
	LGIC
Chairman_C	0.051***
	(3.56)
Chairman_nonC	0.043***
	(4.09)
Director_nonchair	0.015
	(0.85)
Nondirector	0.004
	(0.32)
Control variables	Included
Intercept	5.305***
	(60.57)
Firm fixed effects	Included
Year fixed effects	Included
N	17,910
Adjusted R^2	0.176

This table examines the roles/positions of listed entrepreneurs. Panel A describes the roles/positions of listed entrepreneurs. Panel B reports the regression results for the effect of listed entrepreneurs' roles/positions on internal control quality. *Chairman_C* equals one if the listed entrepreneur is the chairman of the board and holds the position of CEO/CFO/COO; *Chairman_nonC* equals one if the listed entrepreneur is the chairman of the board and does not hold the position of CEO/CFO/COO; *Director_nonchair* equals one if the listed entrepreneur is a non-chairman director. *Nondirector* equals one if the listed entrepreneur is not a director on the board and zero otherwise. The other variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

10% level, while the coefficient on *List[T + 2]* is significant at the 5% level, which confirms the significant post-listing effects of inclusion on the *Rich List*. Moreover, there is no significant difference between the control group and the treatment group in the 2-year interval before the event. The results further prove the positive effect of *Rich List* inclusion on internal control quality using the stacked DiD method.

5.5.3. Alternative measure of internal control Quality: ICdeficiency

In Table 9, we use an alternative measure of internal control quality, *ICdeficiency*, to estimate Eq. (1). *ICdeficiency* equals one if an internal control deficiency is disclosed in a company's internal control report and zero otherwise. As internal control deficiency data are only available from 2007 onward in the CSMAR database, our sample includes 8,421 observations from 2007 to 2014, as shown in Table 9. Panel A of Table 9 presents the incidence of internal control deficiencies by year. As shown, the number and percentage of firm-years with internal control deficiencies increase from 4 (3.57%) in 2007 to 433 (23.98%) in 2014. Panel B further shows the regression results for the effect of listed entrepreneurs on internal control quality when using *ICdeficiency* as the dependent variable. We use probit regression and control for industry and year fixed effects with standard errors clustered by firm. The coefficient on *List[T, T + 2]* is negative and significant at the 5% level, which is consistent with our main prediction that listed entrepreneurs are incentivized to reduce internal control deficiencies.

Table 7
PSM analysis.

Panel A: Differences in internal control quality and control variables between the treatment and control groups

Variable	Treatment	Control	*t*	*p*-value
LGIC	6.536	6.523	1.97	0.049
BoardSize	8.864	8.842	0.32	0.746
Rindep	0.361	0.360	0.15	0.884
Lgcomp	14.890	14.868	0.54	0.590
Ncommittee	3.548	3.526	0.46	0.647
Lgemployee	7.796	7.790	0.11	0.912
Big4	0.061	0.065	−0.33	0.741
Lgasset	22.084	22.101	−0.34	0.735
Leverage	0.072	0.072	−0.02	0.986
CR	2.052	2.062	−0.14	0.890
Inventory	0.206	0.206	0.07	0.947
Loss	0.017	0.018	−0.33	0.739
Salesgrowth	0.243	0.237	0.30	0.762
Return	0.385	0.388	−0.09	0.930

Panel B: First-stage regression results for the probability of having a listed entrepreneur

First-stage regression	
	Onlist
BoardSize	−0.057***
	(−6.62)
Rindep	0.709***
	(3.48)
Lgcomp	0.099***
	(4.92)
Ncommittee	0.006
	(0.43)
Lgemployee	0.013
	(0.84)
Big4	−0.284***
	(−84.28)
Lgasset	0.126***
	(6.18)
Leverage	−0.316*
	(−81.74)
CR	0.062***
	(6.89)
Inventory	0.336***
	(3.57)
loss	0.100
	(0.94)
Salesgrowth	0.147***
	(4.32)
Return	0.061***
	(3.81)
Intercept	−5.712***
	(−16.52)
N	17,910
Pseudo-R^2	0.049

Panel C: Second-stage regression results for the effect of listed entrepreneurs on internal control quality using the propensity score matched sample

	LGIC
List[T, T+2]	0.018**
	(2.08)
Control variables	Included

(*continued on next page*)

Table 7 (*continued*)

Panel C: Second-stage regression results for the effect of listed entrepreneurs on internal control quality using the propensity score matched sample	
	LGIC
Intercept	5.385***
	(44.75)
Firm fixed effects	Included
Year fixed effects	Included
N	8,941
Adjusted R^2	0.148

This table shows the results for the effect of listed entrepreneurs on internal control quality using the PSM method. Panel A shows the differences in internal control index and control variables used to estimate the probit propensity score model between the treatment and control groups. Panel B shows the first-stage regression results estimating the probability of a firm having a listed entrepreneur. Panel C reports the second-stage regression results for the effect of listed entrepreneurs on internal control quality using the propensity score matched sample. The variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.5.4. Effects of listed entrepreneurs on internal control quality in the following years

Francis et al. (2008) show a strong positive correlation between single- and multi-year reputation measures. Inclusion on the *Rich List* may affect internal control quality in the years following listing. Table 10 shows the regression results for the effects of listed entrepreneurs on their firms' internal control in year $t + 1$ and year $t + 2$. *LGF1IC* is the natural logarithm of the internal control index value in year $t + 1$, and *LGF2IC* is the nat-

Table 8
Stacked DiD estimation.

	(1)	(2)
	LGIC	*LGIC*
List[T, T + 2]	0.018**	
	(2.05)	
List[T-1]	−0.002	0.017
	(−0.17)	(1.50)
List[T-2]	0.017	−0.002
	(1.51)	(−80.18)
List[T]		0.012
		(1.07)
List[T + 1]		0.019*
		(1.66)
List[T + 2]		0.023**
		(2.15)
Control variables	Included	Included
Intercept	5.148***	5.148***
	(197.49)	(197.50)
Firm fixed effects	Included	Included
Year fixed effects	Included	Included
N	239,191	239,191
Adjusted R^2	0.426	0.426

This table shows the regression results for the effect of listed entrepreneurs on internal control quality using stacked DiD estimation. *List[T, T + 2]* is an indicator variable for treatment firms in the post-listing event years, from year T to year $T + 2$, where T denotes the year in which the controlling owner is first included in the *Rich List*. *List[T-2]*, *List[T-1]*, *List[T]*, *List[T + 1]*, and *List[T + 2]* are corresponding dummy variables for the treatment firms that refer to 2 years before, 1 year before, the year of, 1 year after, and 2 years after the event of inclusion on the *Rich List*. The standard errors are corrected for heteroscedasticity and firm-level clustering. The variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9
Alternative measure of internal control quality—*ICdeficiency*.

Panel A: Incidence of internal control deficiencies by year					
Year	**Obs. with IC deficiency**	**%Obs. with IC deficiency**	**Obs. With no IC deficiency**	**%Obs. With no IC deficiency**	**Total**
2007	4	3.57%	108	96.43%	112
2008	14	2.62%	521	97.38%	535
2009	13	2.09%	610	97.91%	623
2010	45	4.76%	900	95.24%	945
2011	133	11.41%	1,033	88.59%	1,166
2012	486	31.46%	1,059	68.54%	1,545
2013	405	23.98%	1,284	76.02%	1,689
2014	433	23.98%	1,373	76.02%	1,806
Total	1,533	18.20%	6,888	81.80%	8,421

Panel B: Regression results for the effect of listed entrepreneurs on internal control deficiency	
	ICdeficiency
List[T, T+2]	Probit
	−0.214**
	(−82.15)
Control variables	Included
Intercept	−410.140***
	(−18.12)
Industry fixed effects	Included
Year fixed effects	Included
N	8,361
Pseudo-R^2	0.100

Panel A shows the number and percentage of internal control deficiencies by year. Panel B shows the regression results for the effect of listed entrepreneurs on internal control quality using *ICdeficiency* as an alternative measure. *ICdeficiency* equals one if an internal control deficiency is disclosed in the company's internal control report and zero otherwise. The variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

ural logarithm of the internal control index value in year $t + 2$. The coefficients on *List[T, T + 2]* in Columns (1) and (2) are both positive and significant at the 5% level, which confirms our prediction that inclusion on the *Rich List* has positive effects on firms' internal control quality in the years following inclusion on the list.

Table 10
Effects of listed entrepreneurs on internal control quality in the following years.

	(1)	(2)
	LGF1IC	*LGF2IC*
List[T, T + 2]	0.020**	0.025**
	(2.05)	(2.39)
Control variables	Included	Included
Intercept	6.354***	7.055***
	(63.85)	(68.67)
Firm fixed effects	Included	Included
Year fixed effects	Included	Included
N	17,532	15,609
Adjusted R^2	0.073	0.054

This table reports the effects of listed entrepreneurs on internal control quality in year $t + 1$ and year $t + 2$. The variable *LGF1IC* is the natural logarithm of the internal control index in year $t + 1$, and *LGF2IC* is the natural logarithm of the internal control index in year $t + 2$. The other variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 11
Effect of the *Norms* regulation in 2008.

	(1)	(2)
	On or before 2008	After 2008
	LGIC	*LGIC*
List[T, T + 2]	−0.011	0.024**
	(-0.87)	(2.04)
Control variables	Included	Included
Intercept	4.295***	5.352***
	(27.61)	(29.30)
Firm fixed effects	Included	Included
Year fixed effects	Included	Included
N	8,342	9,568
Adjusted R^2	0.265	0.091

This table reports the effect of the *Norms* regulation in 2008 on the relationship between listed entrepreneurs and internal control quality. Column (1) shows the regression results for the effect of listed entrepreneurs on internal control quality during or before 2008, while Column (2) shows the regression results for the effect of listed entrepreneurs on internal control quality after 2008. The variables are defined in the appendix. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.5.5. Effect of the Norms regulation in 2008

The *Norms* were released in 2008 and implemented in 2009, and they require public firms to report their internal control effectiveness. As stated in the Introduction, according to the *Norms*, the goal of internal control is to ensure the legality of a firm's operating management, the safety of its property, the authenticity and integrity of its financial reports and related information, its operating efficiency and effectiveness, and the achievement of its development strategies. The demand for more intensive monitoring of internal control is therefore expected to be higher after the release of the *Norms*. We accordingly predict that the demand for listed entrepreneurs to monitor and improve their firms' internal control quality is more pronounced after 2008. As shown in Table 11, the coefficient on *List[T, T + 2]* is significant at the 5% level after 2008 (see Column (2)) and not significant before 2008 (see Column (1)). This confirms our prediction that the demand for listed entrepreneurs to more intensively monitor internal control is higher after the release of the *Norms* in 2008.

6. Conclusion

In this study, we investigate whether entrepreneurs' inclusion on the *Forbes Rich List* in China affects the internal control quality of the firms they control. Under a high level of public attention, entrepreneurs appearing on the list attach great importance to their firms' disclosed information. While in the US Sections 302 and 404 of SOX only require the disclosure of internal control over financial reporting, the internal control index taken from the DIB database provides more complete information on Chinese listed firms, because it requires the disclosure of internal control over five aspects of a firm (its financial reporting, the legality of its operating management, the safety of its property, the efficiency and effectiveness of its operations, and the achievement of its development strategies). Therefore, we use this complete assessment index of the internal control systems of Chinese companies to examine whether controlling entrepreneurs who appear on the *Forbes Rich List* have a stronger incentive to monitor their firms' management and maintain high-quality internal control systems than non-listed controlling entrepreneurs.

Using a sample of 17,910 firm-year observations from 2000 to 2014, we find that firms controlled by entrepreneurs on the *Rich List* have significantly higher internal control quality. This is consistent with the positive effect of inclusion on the *Rich List.* The listed entrepreneurs improve their firms' internal control quality by means of reducing the information asymmetry between the firms and outsiders. We also find that the effect of listed entrepreneurs on their firms' internal control quality is more pronounced when firms have a higher

cost of misreporting (i.e., for firms with a longer history, with more analysts following them, and with more research reports on them) and when listed entrepreneurs hold chairman positions than in other situations. Our results remain robust after applying the PSM method, the stacked DiD method, and an alternative measure of internal control quality.

While most studies investigate the consequences of internal control effectiveness, our study takes advantage of the external shock of the *Forbes Rich List* and contributes to the literature on the determinants of internal control effectiveness by focusing on the effect of entrepreneurs' inclusion on the *Rich List*. This study improves understanding of the role of public attention in a firm's internal control outcomes.

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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Appendix. Variable definitions

Dependent variables	
ICindex	The internal control index computed based on five measures (i.e., the legality of operating management, the safety of the firm's property, the authenticity and integrity of financial reports and related information, operating efficiency and effectiveness, and the achievement of development strategies) using the DIB database.
LGIC	The natural logarithm of the internal control index.
ICdeficiency	Equals one if there is an internal control deficiency disclosed in the company's internal control report and zero otherwise.
LGF1IC	The natural logarithm of the internal control index in year $t + 1$.
LGF2IC	The natural logarithm of the internal control index in year $t + 2$.
Test variables	
List[T, T + 2]	An indicator variable for treatment firms in the post-listing event years, from year T to year $T + 2$, where T denotes the year that the controlling owner is first included in the *Forbes Rich List*.
List[T-1]	An indicator variable for treatment firms 1 year before the event year.
List[T-2]	An indicator variable for treatment firms 2 years before the event year.
List[T]	An indicator variable for treatment firms in the event year.
List[T + 1]	An indicator variable for treatment firms 1 year after the event year.
List[T + 2]	An indicator variable for treatment firms 2 years after the event year.
List1st	Equals one if the controlling entrepreneur appears on the *Forbes Rich List* for the first time and zero otherwise.
Remainlist	Equals one if the controlling entrepreneur appears on the *Forbes Rich List* in both year t and year t-1 and zero otherwise.
Againlist	Equals one if the controlling entrepreneur is removed from the *Forbes Rich List* before year t and appears on the *List* again in year t and zero otherwise.
Onlist	Equals one if the controlling entrepreneur is on the *Forbes Rich List* and zero otherwise.
Chairman_c	Equals one if the listed entrepreneur is the chairman of the board and holds the position of CEO/CFO/COO and zero otherwise.

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(*continued*)

Dependent variables	
Chairman_nonC	Equals one if the listed entrepreneur is the chairman of the board and does not hold the position of CEO/CFO/COO and zero otherwise.
Director_nonchair	Equals one if the listed entrepreneur is a non-chairman director and zero otherwise.
Nondirector	Equals one if the listed entrepreneur is not a director on the board and zero otherwise.
Other variables	
BoardSize	The number of directors on the board.
Rindep	The percentage of independent directors on the board.
Lgcomp	The natural logarithm of the CEO's total compensation.
Ncommittee	The number of board committees.
Lgemployee	The natural logarithm of the number of employees.
Big4	Equals one if a company is audited by a Big Four audit firm and zero otherwise.
Lgasset	The natural logarithm of total assets.
Leverage	Long-term debt divided by total assets.
CR	Current assets divided by current liabilities.
Inventory	Inventory divided by year-end total assets.
Loss	Equals one if the firm has negative aggregate earnings before extraordinary items in the last and current fiscal years and zero otherwise.
SalesGrowth	The sales growth rate.
Return	Annual stock returns.
VPIN	The volume-synchronized probability of informed trading from the CSMAR database.
FirmAge	The number of years since the firm was established.
AnalystAttention	The number of analysts following the firm.
ReportAttention	The number of research reports on the firm.

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Free cash flow productivity among Chinese listed companies: A comparative study of SOEs and non-SOEs

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ABSTRACT

This paper investigates the free cash flow productivity of SOEs compared with non-SOEs and examines its possible determinants. We find that SOEs have slightly weak free cash flow productivity but significantly stronger than non-SOEs. Similar performance exists among commercial class I and II SOEs and public-benefit SOEs. Further analyses suggest that firm size, age, sales growth, ownership concentration, government subsidies, and industry monopoly factors cannot explain this phenomenon. The common driver for all types of SOEs to generate stronger free cash flows than non-SOEs is their stronger expense control capability.

1. Introduction

The State-owned Assets Supervision and Administration Commission (SASAC) of China issued the *Guidance on Accelerating the Construction of a World-Class Financial Management System for Central Enterprises* in February 2022, proposing to establish financial boundaries with key indicators such as financial leverage, return on equity, free cash flow and economic value added as the core indicators, making free cash flow a key financial indicator for the first time. In January 2023, a meeting of the persons in charge of SOEs affiliated to

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central government (central SOEs) was held to start the step-by-step implementation of the free cash flow assessment.[1] From the perspective of corporate operating sustainability, "free cash flow" refers to the cash flow in excess of that needed to fund all investments with positive net present values (NPV) (Jensen, 1986). Specifically, it is the net cash flow arising from a firm's operating activities (net operating cash flow) that can be freely distributed to capital providers (shareholders and creditors of financing liabilities) after meeting the cash needs of its investments (Rappaport, 1986). In the long run, a firm may have the ability to continuously create value only when it has a large surplus of net operating cash inflows after satisfying its capital investments and interest repayments and may use the surplus to disgorege cash to shareholders (i.e., dividend payout, share repurchase) (Xie, 2013, 2021; Xie et al., 2020). This implies that free cash flow productivity is an important indicator of a firm's viability, which is a key element in building a world-class firm. However, to ensure the functionality of the free cash flow indicator during the transition of SOEs' financial management systems, it is necessary to provide a database for its scientific and rational use, and therefore, it is necessary to conduct a comprehensive and systematic assessment of SOEs' free cash flow productivity in conjunction with the performance of non-SOEs.

However, no study in the literature systematically compares SOEs with non-SOEs from the perspective of free cash flow productivity. Most of the relevant literature compares SOEs and non-SOEs in terms of accrual-based accounting performance (Sun and Tong, 2003; Chen et al., 2009; Wang and Hu, 2016), production efficiency (Yao, 1998; Liu, 2000) and corporate innovation (Wu, 2012; Tang and Zuo, 2014), largely ignoring free cash flow productivity. Theoretically, SOEs not only bear significant policy and social burdens (Lin et al., 1998) but also have major flaws in their corporate governance because of multi-level principal–agent relationships (Yang, 1997) and insider control problems (Wei and Liu, 2007), which easily induces their managers to act myopically and in deviation from their shareholders' interests. As a result, SOEs' free cash flow productivity may be weaker than that of non-SOEs. However, relative to non-SOEs, SOEs have a stronger market position and receive stronger social supervision (Jiang et al., 2014), and their block shareholders have weaker incentives to capture private gains (Jiang et al., 2010), resulting in stronger free cash flow productivity than non-SOEs. Thus, how the free cash flow productivity of SOEs performs compared to that of non-SOEs remains an empirical question requiring examination.

This paper measures the long-term free cash flow productivity of firms by using the free cash flow on equity (FCFOE) proposed by Xie (2021) and assesses and compares the free cash flow productivity of state-owned listed companies and non-state-owned listed companies, using A-share non-financial listed companies that were listed for at least 10 years between 2007 and 2020 as the sample. The functional positioning of state-owned listed companies is investigated in this paper according to the SASAC classification criteria. We find that the level of free cash flow productivity of SOEs is slightly weak overall but significantly stronger than that of non-SOEs. In particular, in terms of SOEs, free cash flow productivity is strongest for commercial class I SOEs, followed by commercial class II SOEs, and is weakest for public-benefit SOEs, but all three types of SOEs have significantly stronger free cash flow productivity than non-SOEs in the same industries. Stronger expense control ability is the common driver of SOEs having better free cash flow productivity than non-SOEs, and the three types of SOEs also display their own strengths in working capital management, product and service profitability and tax planning. This paper further shows that the aforementioned relationship between the free cash flow productivity of SOEs with different functional positioning and non-SOEs in the same industries is somewhat general across firms of different sizes, ages, levels of sales growth and ownership concentrations, except for commercial class II SOEs. In addition, we find that government subsidies and industry monopolies are not significant drivers of the stronger free cash flow productivity of SOEs and do not constitute alternative explanations for our findings.

[1] At the meeting of the persons in charge of central SOEs, held on 5 January 2023, the operating performance index system of central SOEs was adjusted from "two profits and four ratios" to "one profit and five ratios." The "one profit and five ratios" comprise earnings before income tax, financial leverage ratio, return on equity, R&D investment intensity, overall labor productivity and operating cash ratio (net operating cash flow to sales revenue ratio), while the "two profits and four ratios" comprise net income, earnings before income tax, financial leverage ratio, R&D investment intensity, overall labor productivity and operating income margin. Therefore, the conversion of operating income margin to operating cash ratio in the performance index system of central SOEs forms the basis of free cash flow assessment.

This paper makes the following contributions. First, this paper is the first to assess and compare the free cash flow productivity of SOEs and non-SOEs. In contrast to the traditional perceptions that SOEs are inactive, indiscriminate, big but not strong and strong but not good (Lin et al., 2004; Lu et al. 2011; Jin et al. 2016; Institute of Economic Research Group, Chinese Academy of Social Sciences, 2020), this paper finds that SOEs' free cash flow productivity is stably and significantly stronger than that of non-SOEs. In particular, the commercial class I SOEs, which mainly operate in competitive industries, perform better and have stronger free cash flow drivers, such as expense control and working capital management, than non-SOEs in the same industries. This changes our traditional impressions and perceptions of SOEs and provides new insight into the debate on the economic efficiency of SOEs and non-SOEs.

Second, this paper adds to the literature on the classification reform of SOEs, which was first proposed at the Third Plenary Session of the 18th Chinese Communist Party Central Committee in 2013 to accurately define the functions of various SOEs and promote the reform of SOEs by classification. Around this topic, the literature discusses the ideas and schemes of SOE classification reform (Huang and Yu, 2013; China Macroeconomic Analysis and Forecasting Group, 2017; Huang, 2022) and the current status of reform (Gao et al., 2014; Wei et al., 2017; Huang, 2022), but fewer studies explore the development quality of SOEs in combination with their functional positioning. This paper fills this gap in the literature to a certain extent by comparing and analyzing the differences between the free cash flow productivity of SOEs with different functional positioning and non-SOEs, and their determinants.

Third, this paper has policy implications for further advancing the SOE reforms and promoting the construction of a world-class financial management system for SOEs. Combined with SOE reform requirements and examining the actual performance and drivers of free cash flow productivity of SOEs, this paper can facilitate the assessment of the development quality of SOEs and their potential risks from the perspective of free cash flow productivity and provide an instrument for the implementation of SASAC's aforementioned guidance.

The remainder of the paper is structured as follows: Section 2 provides a review of the relevant literature and a theoretical analysis. Section 3 discusses the sample, variables and model design. Section 4 presents the validity test of the proxy for free cash flow productivity. Section 5 shows the descriptive analysis and empirical results of the differences in free cash flow productivity between SOEs and non-SOEs. Section 6 describes further investigation. Section 7 concludes the paper.

2. Literature review and theoretical analysis

2.1. Indicators for assessing the operating efficiency of SOEs

SASAC's assessment of SOEs' annual operating performance has long focused on financial indicators based on the accrual basis, such as earnings before income tax, net income, return on equity and economic value added. The conference of persons in charge of central SOEs in 2020 proposed the "two profits and four ratios," putting emphasis on R&D investment intensity and overall labor productivity, and not covering the indicators related to the free cash flow productivity of enterprises based on their cash flow. Academics also evaluate the efficiencies of SOEs mainly through accrual-based accounting performance (Sun and Tong, 2003; Chen et al., 2009; Wang and Hu, 2016), production efficiency (Yao, 1998; Liu, 2000) and corporate innovation (Wu, 2012; Tang and Zuo, 2014). Based on these indicators, two basic conclusions of the relevant literature are that in China, SOEs are less efficient than non-SOEs and that privatization is conducive to improving SOE performance (Sun and Tong, 2003; Hsieh and Song, 2015). Studies provide explanations from the perspective of policy burden (Lin et al., 1998; Lin and Tan, 1999; Lin et al., 2004), corporate governance (especially internal governance) deficiencies, and unclear property rights (Wu, 1996; Zhang, 1998, 2000). Although the assessment of SOEs has also started to focus on stronger operating cash flows in recent years,[2]

[2] For example, the 2019 edition of *Measures for Business Performance Appraisals of Person-in-Charge at Central Enterprise* mentions that "for enterprises with high levels of assets and liabilities, the assessment of indicators such as financial leverage ratio, operating cash flow and cost of capital ratio will be strengthened"; the meeting of persons in charge of central enterprises held on 5 January 2023 formally incorporated the operating cash ratio into the central enterprises' operating performance indicator system.

operating cash flows are different from free cash flows. When the net operating cash flow cannot meet the cash needs of a firm's project and R&D investments, even if the net operating cash flow is not bad, it may not generate free cash flow. In other words, a firm with high net operating cash flows may not have high free cash flows. Perhaps this is why the *Guidance on Accelerating the Construction of a World-Class Financial Management System for Central Enterprises* issued by SASAC in February 2022 explicitly included free cash flow as a key indicator for the first time.

2.2. Definition of free cash flow productivity

"Free cash flow", from the perspective of the enterprise's longevity and long-term operating sustainability, refers to the cash flow in excess of that needed to fund all NPV-positive project investments (Jensen, 1986). Specifically, it is the net operating cash flow generated by the enterprise that is free for distribution to capital providers (shareholders and creditors of financing liabilities) after it has met its cash needs for capital investments. Interest constitutes the return to creditors of financing liabilities and is a fixed priority claim by the creditors according to the associated debt contracts; this is a cash outflow not freely determined by the enterprise. Therefore, free cash flow from the perspective of shareholder value creation should also exclude the interests paid to the creditors of financing liabilities.

Only free cash flow is a sustainable source of cash when a company needs cash outflows to give back to its direct stakeholders (i.e., creditors of financing liabilities and shareholders) through interest payments and dividends or to create value for its broader stakeholders through donations, poverty alleviation and ESG practices. Once a company continuously relies on financing activities to obtain cash, then returns it to financing creditors and shareholders in the form of interest payments or dividends, there is a high probability that it is engaged in "Ponzi interests" and "Ponzi dividends" (Xie et al., 2020). However, it makes more sense to consider the free cash flow over the long run as opposed to short run. In the short term, free cash flow is subject to large fluctuations from year to year because of various factors such as the pace of project investment, working capital management, and changes in the operating environment. In the long term, however, the impacts of the operating cycle, investment cycle and economic cycle on free cash flow could be smoothed by the time factor, and therefore, cash outflows from project investment activities must eventually be recovered by net operating cash flow and create value added. Accordingly, free cash flow productivity is an important prerequisite for companies to be able to sustain themselves and create value for their stakeholders on a sustainable basis.

Unlike free cash flow, profits calculated based on the accrual basis cannot be spent, invested or distributed (Xie, 2013), and may simply exist in working capital such as accounts receivable, inventory, prepaid accounts or other non-cash assets. As a result, firms with high profits may be only wealthy on paper. In addition, surveys show that managers prefer earnings smoothing to cash flow smoothing (Graham et al., 2005). Although earnings smoothing behavior can reduce the volatility of net incomes from year to year (i.e., make such incomes more comparable across firms within the same industry and across years within the same firm), convey information about a firm's future performance to the market and reduce information asymmetry (Tucker and Zarowin, 2006), it may also be the result of opportunistic efforts by managers to hide the true performance of the firm to maximize their interests (Kirschenheiter and Melumad, 2002; Tucker and Zarowin, 2006). However, operating cash flow and free cash flow are not easily smoothed by executives. In other words, free cash flow is "earned" by operation, not "calculated" by accountants.

This paper follows the methods of Xie (2021) and Xie et al. (2020, 2022) to calculate the free cash flow on equity to compare free cash flow productivity between SOEs and non-SOEs. The larger a firm's FCFOE value, the stronger the free cash flow productivity of the firm. A FCFOE value less than 0 indicates that the net operating cash flow generated by the firm itself is not sufficient to meet its cash needs for investments and interest repayments in the long run and that it must rely on financing activities to raise new funds to support its operations and even its interest payments. The specific calculation of FCFOE is as follows:

FCFOE = Average annual free cash flow from the year of the company's initial public offering (IPO year) to the end of year t/Average annual consolidated net assets.

Average annual free cash flow = (Accumulated free cash flow from the company's IPO year to the end of year t + Net financial investments at the end of year t)/Number of years from the company's IPO year to the end of year t.

Average annual consolidated net assets = Sum of consolidated net assets from the company's IPO year to the end of year *t*/Number of years from the company's IPO year to the end of year *t*.

Free cash flow = Net operating cash flow + Net investing cash flow – Current accrued interest expenses.

Net financial investments = Trading financial assets + Available-for-sale financial assets + Held-to-maturity investments + Debt investments + Other debt investments + Investments in other equity instruments (portion measured at fair value) + Buy-back financial assets + Loans and advances issued + Other non-current financial assets + Financial investments in other current assets + Financial investments in other non-current assets + Portion of monetary funds not classified as cash and cash equivalents.

Concerning the measurement of FCFOE, two points merit mention. First, the cumulative free cash flow over a long-term window should be used to measure FCFOE rather than the free cash flow generated by the enterprise in the current year. This is because operating cycles, operating activities, investment cycles and investment activities vary between enterprises in the same fiscal year, but the cash outflows arising from project investment activities must eventually be recovered by net cash flows from operating activities and create value added, thus making the free cash flow indicator incomparable in the short term but comparable in the long term (Xie, 2021). This paper synthesizes the average status of free cash flow productivity of A-share companies and world-renowned companies, limiting the research sample to companies that have been listed for at least 10 years, to achieve the comparability of free cash flow productivity between companies. Second, the impact of corporate financial investments on FCFOE should be considered. Some A-share companies have a large number of financial investments, and the purchase or sale of their financial assets would directly affect the cash inflow and outflow of their investing activities, thus affecting the free cash flow calculation. The short-term effect of financial investments on the measurement of FCFOE can be roughly excluded by accumulating free cash flows year by year (because cash outflows from financial investments occur in the year of purchase and cash inflows occur in the year of sale). However, to further exclude the interference of financial investments, this paper assumes that all of the financial investments held by a company were sold at the end of the year and that therefore, the book value of financial investments at the end of each fiscal year must be added back when measuring FCFOE.

2.3. Analytical framework for free cash flow productivity

The five forces model of free cash flow productivity proposed by Xie (2021) provides a framework for analyzing and understanding the strength of a company's free cash flow productivity. In particular, a company with strong free cash flow productivity should have good product and service profitability, expense control, working capital management, investment planning and tax planning capability. Considering that a firm's ability to optimize capital structure is implicit in its tax-planning capability and that capital structure plays a role in shareholder value creation, mainly through the tax-saving effect of interest (Robichek and Myers, 1966), Xie et al. (2022) further extend the model to encompass six forces. If a firm excels in all six of these forces, then its free cash flow productivity will be naturally strong. However, if it excels in certain forces while falling short in others, its free cash flow productivity will not necessarily be weak, as this depends on the relative magnitude of the strengths and weaknesses of the free cash flow productivity forces.

In this framework, both SOEs and non-SOEs can improve their free cash flow productivity by first increasing their after-tax operating incomes (excluding depreciation, amortization and assets impairment losses) through the improvement of product and service profitability, period expense control ability, tax-planning ability and capital-structure optimization ability. Furthermore, even if an enterprise creates high after-tax operating incomes, if its after-tax operating incomes and capital investment costs to be recovered (i.e., depreciation and amortization) reside in its working capital for a long time without corresponding net operating cash inflow, then it is only rich on paper and cannot meet the cash needs of its daily operations and project investments. Therefore, it is necessary to consider a firm's working-capital management ability when attempting to enhance the productivity of its free cash flow. In addition, in the continuous concentration of their resources, firms are prone to a blind expansion of investment scale. As a result, to maintain a high level of free cash flow productivity, it is crucial to avoid overinvestments and inefficient investments. Of course, it is not enough for SOEs to create economic benefits; they must also take into account governmental and social objectives. However, this does not mean that assessing free cash flow productivity from the perspective of

shareholder value creation is unimportant for SOEs. Because SOEs choose to go public and become state-owned listed companies, they should also create shareholder value by generating free cash flow. Furtherly, SOEs also require a sustainable cash supply to achieve their policy goals. Undoubtedly, free cash flow is the only sustainable cash source in the long run.

In summary, free cash flow productivity not only reflects a firm's ability to create value and provide returns for stakeholders on the cash flow basis but also covers the traditional operating performance indicators based on the accrual basis and provides comprehensive information including firm strategies and cash flows from investing activities. Therefore, free cash flow productivity is a useful tool for assessing the true operating performance of the enterprise and is in line with SASAC's emphasis in recent years on the connotation of enhancing the economic impact of state-owned capital. To this end, this paper provides a comprehensive assessment and comparison of state-owned listed companies with different functional positioning and non-state-owned companies in China from the perspective of free cash flow productivity, offering an initial exploration of the possible drivers of their differences. As the focus of this paper is to diagnose firms' free cash flow productivity, we do not develop a research hypothesis but rather directly design the empirical test and analyze the results.

3. Sample, data and research design

3.1. Sample selection and data sources

This paper uses all A-share non-financial listed companies on the Shanghai and Shenzhen Stock Exchanges from 1998 to 2020 as the initial sample because the measurement of free cash flow productivity is based on historical cash flow data and A-share listed companies in China have only prepared and disclosed cash flow statements since 1998.[3] However, as mentioned above, for listed companies continuing to be in the rapid development stage in the short term after the IPO, the value of their annual free cash flow productivity indicator may be low, and this is acceptable. On the other hand, listed companies that survive for many years after their IPO while still relying on financing cash inflows may be considered weak in terms of their free cash flow productivity. For this reason, we require the sample firms to have been listed for at least 10 years to allow us to obtain at least 10 years of data for the calculation of free cash flow productivity. After excluding observations with negative cumulative consolidated net assets and missing required variables, a total of 17,134 firm-year observations are obtained for the 2007–2020 period. All of the data in this paper are obtained from the CSMAR, Wind, RESSET and CCER databases, except for financial investment data, which are manually compiled from the annual reports of the listed companies. All of the continuous variables are winsorized at the 1% and 99% levels.

3.2. Research design

Following Chen et al. (2009) and Tang and Zuo (2014), this paper constructs the following model (1) to compare the differences in free cash flow productivity between SOEs and non-SOEs.

$$FCFOE_{i,t} = \alpha_0 + \alpha_1 \times SOE_{i,t}(SOEC1_{i,t}/SOEC2_{i,t}/SOEPub_{i,t}) + \alpha_j \times Controls_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

We use the Fama and MacBeth (1973) approach to estimate model (1). The reasons for not using the ordinary least squares (OLS) or firm fixed effects models are as follows. First, this paper focuses on the difference in free cash flow productivity between SOEs and non-SOEs at a given point in time rather than the change in free cash flow productivity within one firm. Second, the coefficients estimated by the OLS model based on panel data essentially reflect the effect of the change in the independent variables on the change in the dependent variables. However, according to the definition of "free cash flow productivity," the annual change of free cash flow productivity approximates firms' free cash flow in the current period. Therefore, if the OLS model is used, the estimated coefficients do not reflect the difference in free cash flow productivity between SOEs and

[3] For the observations before 1998, although this paper can indirectly estimate the net operating cash flows, it cannot approximate the net investing cash flows of enterprises; therefore, it only measures the free cash flows from 1998 onward.

non-SOEs as of a certain point in time (e.g., the end of year t). In contrast, the Fama and MacBeth (1973) method obtains the estimates by running cross-sectional regressions for each year and taking the mean of the coefficients for all years, which allows us to identify the difference in free cash flow productivity between SOEs and non-SOEs in the same year and better addresses the effect of cross-sectional correlation of residuals on the standard errors. Therefore, adopting the Fama and MacBeth (1973) method is more useful given our research objective.

In model (1), the dependent variable $FCFOE_{i,t}$ is the free cash flow on equity, which reflects a firm's free cash flow productivity, and the independent variable $SOE_{i,t}$ is a dummy variable that takes a value of 1 for state-owned enterprises, and 0 otherwise. We compare the difference in free cash flow productivity between SOEs and non-SOEs by observing the significance and sign of the coefficient of $SOE_{i,t}$. The independent variables $SOEC1_{i,t}$, $SOEC2_{i,t}$ and $SOEPub_{i,t}$ are dummy variables: $SOEC1_{i,t}$ takes a value of 1 for commercial class I SOEs, $SOEC2_{i,t}$ takes a value of 1 for commercial class II SOEs and $SOEPub_{i,t}$ takes a value of 1 for public-benefit SOEs, and otherwise, these variables take a value of 0. We observe the significance and sign of the coefficients of $SOEC1_{i,t}$, $SOEC2_{i,t}$ and $SOEPub_{i,t}$ to compare the differences in free cash flow productivity between SOEs with different functional positioning and non-SOEs. The criteria for classifying SOEs draw on Wei et al. (2017) and related policy documents. Specifically, commercial class Ⅰ SOEs are SOEs whose main businesses are in fully competitive industries and fields. Commercial class Ⅱ SOEs are SOEs whose main businesses are in important industries and key fields related to national security and the lifeline of the national economy, and they mainly undertake major special tasks. Finally, public-benefit SOEs are SOEs whose main goals are to protect people's livelihood, serve society and provide public goods and services and the prices of whose products or services can be regulated by the government.

The classification of SOEs' functional positioning is mainly dependent on the industry type (Wei et al., 2017), and the industry factor itself affects the free cash flow productivity of enterprises (Xie et al., 2020). This implies that if non-SOEs, which are distributed among a wide variety of industries, are compared as a whole with SOEs of different functional positioning, the conclusions drawn may confound the influence of industry factors and lack comparability to some extent. Therefore, we only select non-SOEs that are in the same industries as the sample SOEs with different functional positioning as the comparison target. As a result, we classify the non-SOEs into three categories according to the SOE classification criteria and further divide our full sample into three subsamples accordingly. More specifically, the first subsample (Subsample I) includes commercial class I SOEs and non-SOEs in the same industries that have been listed for 10 years or more, the second subsample (Subsample II) includes commercial class II SOEs and Non-SOEs in the same industries that have been listed for 10 years or more, the third subsample (Subsample III) includes public-benefit SOEs and Non-SOEs in the same industries that have been listed for 10 years or more, while the full sample includes all SOEs and non-SOEs that have been listed for 10 years or more.

Model (1) controls a vector of firm-specific variables related to firm characteristics, including firm size ($Size_{i,t-1}$), firm listing age ($Age_{i,t-1}$), financial leverage ($Lev_{i,t-1}$), the largest shareholder's ownership ($Top1_{i,t-1}$), board size ($Board_{i,t-1}$), and the proportion of independent directors ($Indep_{i,t-1}$). All of the control variables are lagged by one period. To mitigate the autocorrelation problem of the residuals, we adjust the standard errors of the Fama and MacBeth (1973) regression based on Newey and West (1987) with a lag length of three periods.[4]

Next, based on the six forces model of free cash flow productivity, we construct the following regression (model (2)) to investigate the potential channels by which SOEs have stronger or weaker free cash flow productivity.

$$Sixpower_{i,t} = \alpha_0 + \alpha_1 \times SOE_{i,t}(SOEC1_{i,t}/SOEC2_{i,t}/SOEPub_{i,t}) + \alpha_j \times Controls_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Specifically, following Xie et al. (2022), we use eight dependent variables ($Sixpower_{i,t}$) to capture the six forces model of free cash flow productivity. We use the average annual operating margin ($Margin_{i,t}$) as a measure of the profitability of products and services, the average annual period expense ratio ($Expense_{i,t}$) as a measure of a firm's ability to control period expenses, the average annual working capital change ($\Delta WC_{i,t}$) as a measure of the firm's ability to manage working capital, the average annual capital expenditure level

[4] We use the method provided by Newey and West (1994) to calculate the lag, i.e., $L = 4 \times (\frac{T}{100})^{2/9}$. As our sample involves a total of 14 years of data and $T = 14$, we obtain $L = 2.58 \approx 3$.

($Invest_{i,t}$) and the average annual tangible and intangible asset turnover ($ATO_{i,t}$) as measures of investment planning capability, the average annual effective income tax rate ($ETR_{i,t}$) as a measure of tax planning capability and the average annual financing debt ratio ($FLev_{i,t}$) and the average annual debt financing cost ($Debt\text{-}Cost_{i,t}$) as measures of corporate capital structure optimization capability. The independent variables and control variables in model (2) are the same as in model (1). Furthermore, model (2) is estimated using the Fama and MacBeth (1973) method with a 3-period lagged Newey and West (1987) adjustment for standard errors. Table 1 defines the main variables of this paper in detail.

4. Validity test of free cash flow productivity indicator

4.1. Survival analysis design

Before comparing the free cash flow productivity of SOEs and non-SOEs, we use the survival analysis model to assess the effectiveness of the FCFOE indicator. We focus our assessment on the ability of FCFOE to predict the abnormal variations of a firm's viability. We use the occurrence of special treatment (ST) events related to viability as an indication of abnormal viability (Wu and Lu, 2001; Lv and Zhao, 2004).[5]

The survival analysis allows us to better estimate the probability and duration of the transition from one status to another (i.e., ST or non-ST status) by adding a temporal dimension to the analysis process (Cameron and Trivedi, 2005). Survival analysis requires us to identify the start and end times corresponding to the events of interest. We define an "event of interest" as the first time a firm changes from non-ST status to ST status during the sample period, excluding the observations after the firm enters ST status (Besedes and Prusa, 2006a, 2006b; Xu and Mao, 2016). Considering that some companies may have experienced special treatment events before having been listed for 10 years, which leads to left-censored data, we further exclude such companies and ultimately obtain 10,838 firm-year observations.[6] Based on this, we conduct a survival analysis using the Cox proportional hazards model (Cox PH model) and an accelerated failure time model (AFT model) to verify the incremental predictive effect of FCFOE on whether and how soon a firm enters ST status, controlling for other factors.[7] The model is set as follows.

$$h_i(t) = h_0(t)exp\left(\alpha_1 \times FCFOE_{i,t} + \alpha_j \times Controls_{i,t} + YearFE + IndustryFE\right) \tag{3}$$

$$lnT_i = \beta_0 + \beta_1 \times FCFOE_{i,t} + \beta_j \times Controls_{i,t} + YearFE + IndustryFE + \varepsilon_i \tag{4}$$

Model (3) is a Cox PH model, where $h_i(t)$ is the risk function of firm i at time t, $h_0(t)$ is the baseline hazard function at time t and the coefficient α_1 represents the effect of *FCFOE* on the probability of the firm's entering the ST status. Model (4) is an AFT model, where lnT is the natural logarithm of the average survival time of firm i (the average time from the event of interest not occurring to the time of occurrence) and the coefficient β_1 represents the effect of *FCFOE* on the average time taken by the firm to enter the ST status, with the oppo-

[5] ST events can be classified as being related to either viability or non-viability. ST events related to viability include the following circumstances: the audited net incomes for the past two consecutive years is negative (including when restated retroactively), the audited net assets per share for the past year is lower than the par value of the stock, the audited shareholders' equity for the past year is lower than the registered capital after deducting the unrecognized portion, the financial report for the past year was issued by the CPA with an adverse opinion or the CPA was unable to express an opinion and the company's bank account is frozen or the court has accepted the company's bankruptcy application. Consequently, having ST status means that the firm is in difficulty.

[6] To be consistent with the logic of this paper that the analysis of free cash flow productivity indicator is more suitable for long-term windows (Xie, 2021), for the survival analysis sample, we likewise select only companies that have been listed for at least 10 years and do not consider the predictive ability of *FCFOE* for abnormalities in the viability of companies that have been listed for less than 10 years.

[7] The AFT model is a parametric regression, which requires assumptions about the form of the benchmark risk function, while the Cox PH model is a semi-parametric regression, which does not require assumptions about the specific form of the benchmark risk function but must meet the assumption of equal proportional risk. When the AFT model is set accurately, the situation in which the Cox PH model does not satisfy the assumption of equal proportional risk can be avoided. However, when the AFT model is set inaccurately, the Cox PH model can be used to obtain the results closest to the accurate parametric regression. Therefore, as the two models offer complementary benefits, the estimation results of both models are reported in this paper.

Table 1
Variable definitions.

Variable	Definition
$FCFOE_{i,t}$	Average annual free cash flow/average annual consolidated net assets for company i from the IPO year to the end of year t. Average annual free cash flow = (accumulated free cash flow from company i's IPO year to the end of year t + net financial investments at the end of year t)/number of IPO years at the end of year t. Average annual consolidated net assets = sum of consolidated net assets from company i's IPO year to the end of year t/number of IPO years at the end of year t. Free cash flow = net operating cash flow + net investing cash flow - current accrued interest expenses
$SOE_{i,t}$	A dummy variable that equals 1 if company i is a state-owned enterprises at the end of year t, 0 otherwise
$SOEC1_{i,t}$	A dummy variable that equals 1 if company i is a commercial-class-Ⅰ SOE at the end of year t, 0 otherwise
$SOEC2_{i,t}$	A dummy variable that equals 1 if company i is a commercial-class-Ⅱ SOE at the end of year t, 0 otherwise
$SOEPb_{i,t}$	A dummy variable that equals 1 if company i is a public-benefit SOE at the end of year t, 0 otherwise
$Margin_{i,t}$	The sum of the annual operating margins of company i from the IPO year to the end of year t/number of IPO years at the end of year t. Operating margin = (revenues - operating costs - business taxes and surcharges)/revenues
$Expense_{i,t}$	The sum of annual expense ratios from the IPO year of company i to the end of year t/number of IPO years at the end of year t. Expense ratio = (administrative expenses + R&D expenses (applicable in 2018 and thereafter) + selling expenses + financial expenses - equity incentive expenses)/revenues
$\Delta WC_{i,t}$	The sum of annual changes in working capital from the IPO year of company i to the end of year t/number of IPO years at the end of year t. Change in working capital = working capital change/revenues
$Invest_{i,t}$	The sum of the annual capital expenditures from the IPO year of company i to the end of year t/number of IPO years at the end of year t. Capital expenditures (scaled) = (net cash paid for acquisition of fixed assets, intangible assets, and other long-term assets + net cash paid for acquisition of subsidiaries and other business units - net cash received from the disposal of fixed assets, intangible assets, and other long-term assets - net cash received from the disposal of subsidiaries and other business units)/total assets
$ATO_{i,t}$	The sum of the annual tangible and intangible asset turnover ratios from the IPO year of company i to the end of year t/number of IPO years at the end of year t. Tangible and intangible assets turnover ratio = revenues in the current year/(net tangible assets at the end of the current year + net intangible assets at the end of the current year + net tangible assets at the end of the prior year + net intangible assets at the end of the prior year) × 2
$ETR_{i,t}$	The sum of the annual effective income tax rates from the IPO year of company i to the end of year t/number of IPO years at the end of year t. Effective income tax rate = (income tax expenses - deferred income tax expenses)/total income before tax. Deferred income tax expenses = deferred income tax liabilities at the end of the current year - deferred income tax liabilities at the end of the prior year - deferred income tax assets at the end of the current year + deferred income tax assets at the end of the prior year
$FLev_{i,t}$	The sum of the annual financing liabilities ratios from the IPO year of company i to the end of year t/number of IPO years at the end of year t. Financing liabilities ratio = financing liabilities/total assets. Financing liabilities = short-term borrowings + trading financial liabilities + derivative financial liabilities + non-current liabilities due within one year + long-term borrowings + bonds payable + long-term payables + customer deposits and balances from banks and other financial institutions + deposits and balances from banks and other financial institutions
$DebtCost_{i,t}$	The sum of annual debt financing costs from the IPO year of company i to the end of year t/number of IPO years at the end of year t. Debt financing costs = accrued interest expenses in current year/(financing liabilities at the end of current year + financing liabilities at the end of the prior year) × 2
$Size_{i,t-1}$	Natural logarithm of total assets of company i at the end of year t-1
$Age_{i,t-1}$	Number of years from the company i's IPO years to the end of year t-1
$Lev_{i,t-1}$	Company i's total liabilities at the end of year t-1/total assets at the end of year t-1
$Top1_{i,t-1}$	Percentage of shares held by the largest shareholder of company i at the end of year t-1
$Board_{i,t-1}$	Number of directors of company i in year t-1
$Indep_{i,t-1}$	Company i's number of independent directors in year t-1/number of directors in year t-1

site sign of the coefficient α_1. Following Wu and Lu (2001), we control two sets of variables in our models, as described above,[8] to identify the incremental predictive power of *FCFOE* relative to forecasting models. Specifically, the first set of control variables comprises earnings growth (*X1*), return on total assets (*X2*), current ratio (*X3*), long-term debt to equity ratio (*X4*), working capital to total assets ratio (*X5*) and asset turnover ratio (*X6*). The second set of control variables comprises debt to tangible assets ratio (*Z1*), return on total assets (*Z2*), administrative expenses to revenue ratio (*Z3*), asset growth (*Z4*), the natural logarithm of total

[8] It is important to note that the two sets of control variables differ in their calculation methods. The control variables constructed based on Wu and Lu (2001) are current-period values, while the control variables constructed based on Lu and Zhao (2004) are historical averages (i.e., obtained by accumulating a firm's financial data since its IPO year and dividing by the number of years since that year).

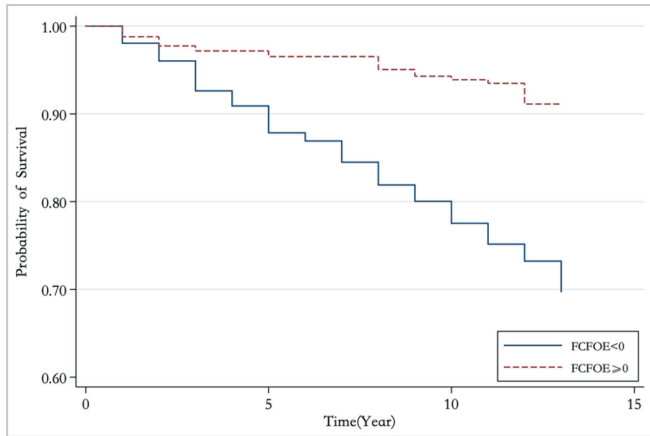

Fig. 1. Kaplan–Meier survival curve for special treatment of listed companies.

assets (*Z5*) and a dummy variable for the past year's negative net income (*Z6*). In addition, this paper includes year and industry-fixed effects in the model to absorb the effects from the macro environments and industry characteristics.

4.2. Results of survival analysis

We use whether the *FCFOE* value is larger than 0 as the classification criterion, and the K-M survival curve in Fig. 1 presents the duration of non-ST status for the two types of firms: those with positive cumulative free cash flows ($FCFOE \geq 0$) and those with negative cumulative free cash flows ($FCFOE < 0$) after having been listed for 10 years. Fig. 1 shows that although the survival rates of both types of firms show a decreasing trend, the survival rates of the firms with negative cumulative free cash flows decline significantly faster, which illustrates that firms with poor free cash flow productivity are more likely to fall into abnormal viability.

Table 2 reports the regression results based on the Cox PH model. Columns (1) and (2) do not include control variables; columns (3) and (4) include the first set of control variables, with reference to Wu and Lu (2001); and columns (5) and (6) include the second set of control variables, with reference to Lv and Zhao (2004). The results in Table 2 show that the coefficient of *FCFOE* is significant and negative with or without control variables, indicating that stronger free cash flow productivity can significantly reduce the probability of listed firms' ST because of abnormal viability and can provide incremental forecasting effects based on forecasting models. Table 3 reports the regression results based on the AFT model. The dependent variable in the AFT model is the average time a firm takes to enter ST status, and we find that the coefficient of *FCFOE* is significant and positive in all of the columns of Table 3. This indicates that free cash flow productivity can significantly prolong the time it takes for listed companies to enter ST status and, conversely, that poor free cash flow productivity accelerates companies' entrance into ST status.

In summary, Tables 2 and 3 evaluate the predictive ability of *FCFOE* on the variation of corporate abnormal viability and find that *FCFOE* has a significant incremental effect in predicting whether and when a listed company enters into ST status. This confirms the usefulness of the free cash flow productivity indicator.

5. Comparison of SOEs' and non-SOEs' free cash flow productivity

5.1. Descriptive statistics

Fig. 2 plots the overall FCFOE of SOEs with different functional positioning and non-SOEs between 2007 and 2020. We find that commercial class I SOEs have the most outstanding performance in free cash flow productivity: it is consistently stronger than that of non-SOEs and public-benefit SOEs but is gradually surpassed by commercial class II SOEs after 2018. In terms of time-series changes, the free cash flow productivity of all

Table 2
Validity test of *FCFOE*: based on the Cox PH model.

	From 10 years of listing to ST status					
	Without control variables		Control predictor variables of Wu and Lu (2001)		Control predictor variables of Lv and Zhao (2004)	
	(1)	(2)	(3)	(4)	(5)	(6)
$FCFOE_{i,t}$	−4.163***	−4.638***	−2.934***	−2.680***	−3.260***	−3.656***
	(−10.25)	(−10.35)	(−4.98)	(−4.17)	(−4.50)	(−4.91)
$X1_{i,t}$			0.372***	0.402***		
			(3.51)	(3.70)		
$X2_{i,t}$			−2.551***	−1.878**		
			(−3.38)	(−2.21)		
$X3_{i,t}$			−0.153	−0.190		
			(−1.21)	(−1.36)		
$X4_{i,t}$			0.050	0.201		
			(0.37)	(1.47)		
$X5_{i,t}$			−2.111***	−2.397***		
			(−4.69)	(−4.44)		
$X6_{i,t}$			−0.705***	−0.991***		
			(−3.63)	(−3.69)		
$Z1_{i,t}$					−0.720	−0.489
					(−1.15)	(−0.77)
$Z2_{i,t}$					−14.141***	−12.114**
					(−2.82)	(−2.47)
$Z3_{i,t}$					−4.852***	−5.248***
					(−3.83)	(−3.77)
$Z4_{i,t}$					−2.088*	−2.759**
					(−1.66)	(−2.16)
$Z5_{i,t}$					−0.013	0.010
					(−0.15)	(0.10)
$Z6_{i,t}$					10.303***	10.655***
					(10.01)	(10.02)
Year FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Obs.	10,838	10,838	10,838	10,838	10,838	10,838
Log-Likelihood	−1378	−1355	−1331	−1302	−1158	−1144

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively, with z-values in parentheses. Since we include the *nohr* option in Stata's *stcox* command in the estimation of the Cox PH model, Table 2 reports the regression coefficients of the model (3) instead of the risk ratio (Hazard Ratio).

three types of SOEs and of non-SOEs show a trend of initially decreasing and then increasing throughout the sample period, but the changes are smaller for commercial class I SOEs and non-SOEs and larger for commercial class II SOEs and public-benefit SOEs.

The reason for the above phenomenon may be that the main businesses of commercial class I SOEs are always in fully competitive industries with more market-oriented compensation systems (Wei et al., 2017). This could effectively alleviate agency conflicts and information asymmetry problems, monitor and restrain management slackness (Schmidt, 1997) and thus improve the operational and investment efficiency of such firms (Akdoğu and MacKay, 2008). Furthermore, commercial class I SOEs focus more on economic efficiency creation,[9] with more incentives and capability to overcome irrational investments in their operations, and they

[9] The *Measures for Business Performance Appraisals of Person-in-Charge at Central Enterprises* of 2019 impose classified assessment standards for SOEs according to their functional positioning. For commercial class I SOEs, economic benefits, capital return level and market competitiveness are the focus of the assessment. For commercial class II SOEs, the ability to serve national strategies, the safeguarding of national security, national economic operation, the development of forward-looking strategic industries and economic benefits are the focus of the assessment. For public-benefit SOEs, social benefits are the main focus of the assessment, supplemented by product and service quality, cost control, operational efficiency and safeguarding capability.

Table 3
Validity test of *FCFOE*: based on the AFT model.

	From 10 years of listing to ST status					
	Without control variables		Control predictor variables of Wu and Lu (2001)		Control predictor variables of Lv and Zhao (2004)	
	(1)	(2)	(3)	(4)	(5)	(6)
$FCFOE_{i,t}$	3.598***	3.404***	3.065***	2.593***	2.703***	2.929***
	(9.53)	(8.17)	(5.65)	(5.34)	(4.19)	(4.96)
$X1_{i,t}$			−0.265***	−0.237***		
			(−2.98)	(−2.92)		
$X2_{i,t}$			1.928***	1.344**		
			(2.73)	(2.08)		
$X3_{i,t}$			0.101	0.094		
			(1.07)	(1.12)		
$X4_{i,t}$			0.038	−0.074		
			(0.33)	(−0.78)		
$X5_{i,t}$			1.816***	1.812***		
			(4.53)	(4.51)		
$X6_{i,t}$			0.559***	0.632***		
			(3.71)	(3.70)		
$Z1_{i,t}$					0.868*	0.734*
					(1.80)	(1.70)
$Z2_{i,t}$					9.589**	6.755**
					(2.45)	(2.00)
$Z3_{i,t}$					3.077***	2.590**
					(2.58)	(2.37)
$Z4_{i,t}$					0.659	1.076
					(0.66)	(1.19)
$Z5_{i,t}$					0.012	−0.028
					(0.17)	(−0.45)
$Z6_{i,t}$					−9.205***	−8.096***
					(−11.12)	(−10.69)
Year FE	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes
Obs.	10,838	10,838	10,838	10,838	10,838	10,838
Log-Likelihood	−681	−646	−638	−596	−436	−409

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively, with z-values in parentheses. After comparing the model fitness using the AIC criterion, the AFT model with error terms obeying the log-logistic distribution was selected for regression in Table 3.

have fewer policy burdens than commercial class II SOEs and public-benefit SOEs; therefore, they do not have absolute efficiency disadvantages compared with their competitors, non-SOEs. These characteristics allow commercial class I SOEs to show greater vitality in generating free cash flows consistently at a stronger level.

In contrast, the main businesses of commercial class II SOEs are in important industries and key areas that are related to national security and the lifeline of the national economy, and they must balance the creation of economic and social benefits, which often requires huge investment cash outflows and entails certain economic efficiency losses (Huang and Ping, 2020). As a result, their free cash flow productivity has no significant difference from that of non-SOEs. Public-benefit SOEs focus more on the creation of social benefits, and their policy burdens are more difficult to overcome (Lin et al., 2004). Consequently, their net operating cash inflows are insufficient to cover the cash outflows required for their investments, which causes their free cash flow productivity level to remain lower. The implementation of SOE reforms has addressed this and effectively reduced the efficiency losses of commercial class II SOEs and public-benefit SOEs to a certain extent (especially the "lean-and-heal" reform implemented since 2016), thus bringing about the rapid growth of free cash flow productivity of these two types of SOEs in recent years.

Table 4 provides the descriptive statistics and the mean and median differences from the tests of free cash flow productivity for the SOEs with different functional positioning as well as for the non-SOEs in the same

industries. Overall, the free cash flow productivity of the SOEs of all three types is slightly weak, as shown by their negative mean and median *FCFOE* values, but still significantly stronger than that of the non-SOEs, as shown by the fact that the mean and median *FCFOE* values of the SOEs are significantly higher than those of the non-SOEs. Table 4, Panel A shows that the mean (median) value of *FCFOE* is –0.060 (–0.038) for the SOEs, and the mean (median) value of *FCFOE* is –0.067 (–0.050) for the non-SOEs. We differentiate the functional positioning of the SOEs, showing the results in Table 4, Panels B to D. As shown, the commercial class I SOEs have the strongest free cash flow productivity, with a mean (median) *FCFOE* of –0.055 (–0.032), the commercial class II SOEs have the second strongest mean (median) *FCFOE* at –0.064 (–0.045) and the public-benefit SOEs have the weakest free cash flow productivity with a mean (median) *FCFOE* of –0.080 (–0.062). However, the mean and median *FCFOE* of the commercial class I SOEs, commercial class II SOEs, and public-benefit SOEs are significantly higher than those of the non-SOEs in the same industries.

Table 4 also provides descriptive statistics for the indicators included in the six forces model of free cash flow productivity. Table 4, Panel A shows that in the long run, the SOEs have lower average annual operating margins (*Margin*), larger capital expenditures (*Invest*) and slower turnover of tangible and intangible assets (*ATO*) than the non-SOEs. This suggests that the SOEs are weaker than the non-SOEs in terms of product and service profitability and investment-planning capabilities. However, the SOEs also have lower average annual expense ratios (*Expense*) and lower average annual working capital changes (ΔWC) than the non-

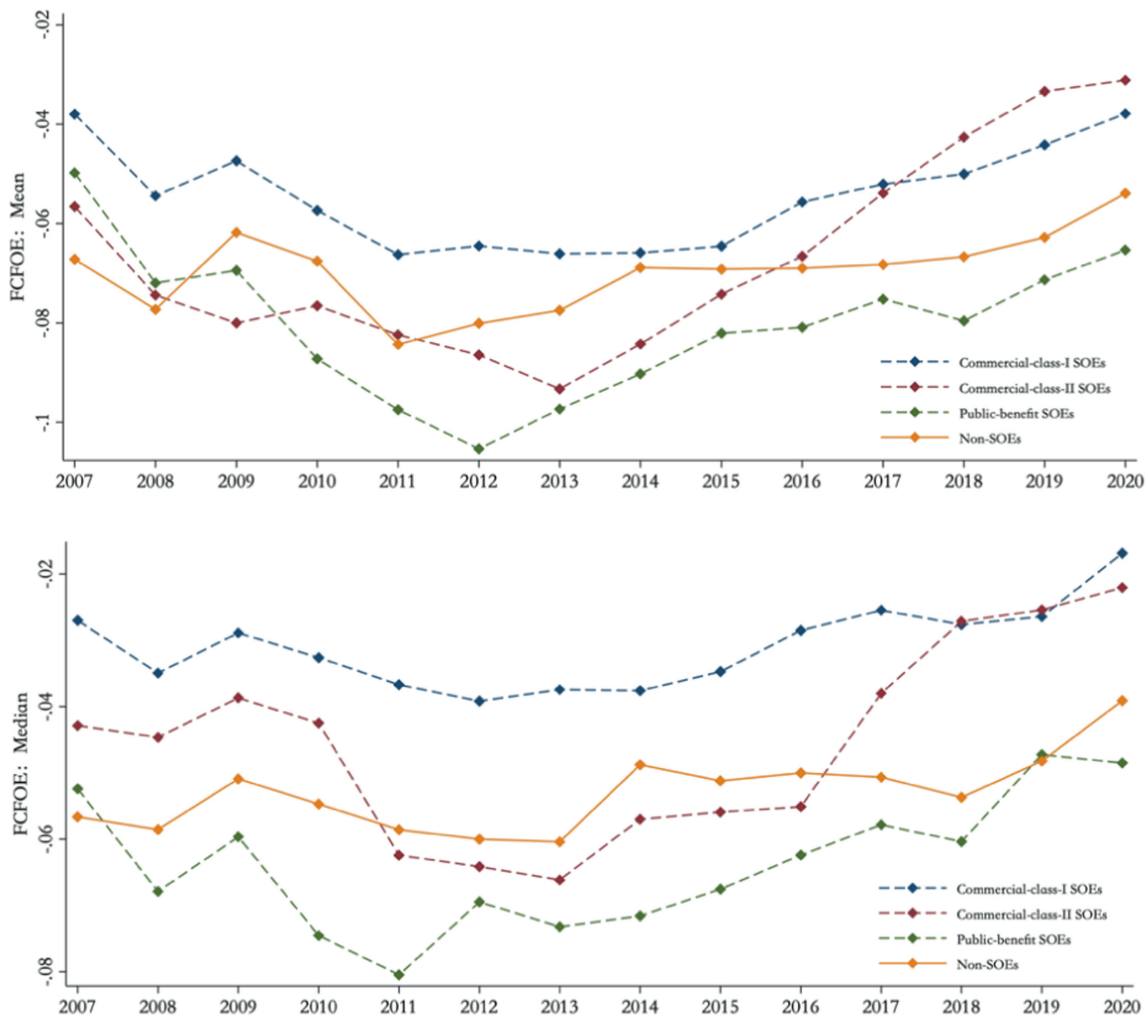

Fig. 2. Annual variation of free cash flow productivity.

SOEs, which suggests that the SOEs have an advantage over the non-SOEs in terms of expense control and working capital management capabilities. In terms of tax-planning, the average annual effective income tax rate (*ETR*) of the SOEs is higher than that of the non-SOEs, indicating that the SOEs bear a higher tax burden overall but also use more financing liabilities (*FLev*) to gain tax savings. The above descriptive statistics suggest that the stronger free cash flow productivity of the SOEs is not due to their low levels of investment, which seems to be consistent with the literature finding that state-owned listed companies are more prone to over-investment than other companies (Zhong et al., 2010; Bai and Lian, 2014). However, the literature ignores that firms vary in operating cycles and investment cycles in the same fiscal year.

The above evidence suggests that in the long term, SOEs achieve stronger free cash flow productivity through higher levels of operating cash flow. Table 4, Panels B to D also show that the SOEs with different functional positioning and the non-SOEs in the same industries also differ significantly in the performance of the indicators in the six forces model of free cash flow productivity, and the direction and extent of these differences are different from those in the overall comparison of the SOEs and non-SOEs, presented in Panel A. However, as these differences may be influenced by firm characteristics and other factors, further tests using the Fama and MacBeth (1973) model are needed.

5.2. Main regression results

To further verify the conclusions in Table 4, Table 5 reports the regression results based on model (1). Column (1) of Table 5 shows that the coefficient of $SOE_{i,t}$ remains significant and positive when controlling for variables related to firm characteristics, and its magnitude is close to the mean difference in *FCFOE* between the SOEs and non-SOEs shown in Table 4, Panel A. This indicates that the SOEs have significantly stronger free cash flow productivity than the non-SOEs in general, consistent with the findings in Table 4. Distinguishing the functional positioning of SOEs, the results in columns (2) to (4) of Table 5 show that the coefficients of $SOEC1_{i,t}$, $SOEC2_{i,t}$ and $SOEPub_{i,t}$ are all significant and positive, indicating that the free cash flow productivity of the SOEs of all three types is significantly stronger than that of the non-SOEs in the same industries.

5.3. Channel analyses: Six forces model of free cash flow productivity

As mentioned above, a firm with strong free cash flow productivity should have good product and service profitability, expense control capability, working capital management capability, investment-planning and tax-planning capability (Xie, 2021), as well as capital structure optimization capability to fully exploit the tax-saving effect of interest expenses (Xie et al., 2022). Therefore, we apply the six forces model of free cash flow productivity to identify the potential channels by which SOEs have stronger free cash flow productivity. Table 6 presents the results of the regressions based on model (2) for the SOEs with different functional positioning and the non-SOEs from the perspective of the six forces model of free cash flow productivity.

Columns (1) to (3) of Table 6, Panel A show that the coefficient of $SOE_{i,t}$ is significant and negative when the dependent variables are $Margin_{i,t}$, $Expense_{i,t}$ and $\Delta WC_{i,t}$, respectively, indicating that the SOEs perform better in expense control and working capital management but not in product and service profitability than the non-SOEs, which is consistent with the findings in Table 4. The reason that SOEs are able to perform better in working capital management is related not only to the implicit government guarantee that makes suppliers more inclined to provide them with trade credit (Hu and Wu, 2022) but also to the supply-chain bargaining power of SOEs (Zhang et al., 2012) and their superior working capital management for operating activities (Wang et al., 2016). Regarding expense control, SOEs in China are more likely to cut unreasonable expenses because of strict budget management; this is especially true for state-owned listed companies, which are also subject to the extensive monitoring of the government and social media (Jiang et al., 2014; Zhai et al., 2015). Although certain studies suggest that SOE executives tend to use implicit income (e.g., perks) to make up for the lack of explicit income (e.g., monetary compensation and equity incentives), resulting in firms' high expenditure (Chen et al., 2005), it is also argued that the overlap between managers and controlling shareholders of non-SOEs leaves more room for interest appropriation and is relatively likely to cause power abuse (Lu et al., 2008). Consequently, the perks of SOE executives are lower than those of non-SOE executives (Lu et al., 2008). This provides a possible explanation for our findings. Table 6, Panel A, column (4) shows that the coef-

Table 4
Descriptive statistics.

Panel A: SOEs vs. Non-SOEs (Full Sample)

	SOEs			Non-SOEs			Mean	Median
	Obs.	Mean	Median	Obs.	Mean	Median	Diff	Diff
FCFOE	9826	−0.060	−0.038	7308	−0.067	−0.050	0.007***	0.012***
Margin	9826	0.226	0.200	7308	0.257	0.227	−0.031***	−0.027***
Expense	9826	0.176	0.150	7308	0.240	0.197	−0.064***	−0.047***
ΔWC	9826	0.044	0.031	7308	0.059	0.045	−0.015***	−0.014***
Invest	9826	0.055	0.050	7308	0.050	0.047	0.005***	0.003***
ATO	9826	4.562	2.237	7308	4.863	2.441	−0.301***	−0.204***
ETR	9826	0.194	0.189	7308	0.183	0.173	0.012***	0.016***
FLev	9826	0.241	0.240	7308	0.225	0.227	0.016***	0.013***
DebtCost	9826	0.069	0.062	7308	0.070	0.064	−0.001***	−0.002***

Panel B: Commercial class I SOEs vs. Non-SOEs (Subsample I)

	Commercial class I SOEs			Non-SOEs			Mean	Median
	Obs.	Mean	Median	Obs.	Mean	Median	Diff	Diff
FCFOE	6609	−0.055	−0.032	6392	−0.063	−0.048	0.009***	0.016***
Margin	6609	0.220	0.197	6392	0.260	0.228	−0.041***	−0.031***
Expense	6609	0.191	0.164	6392	0.242	0.197	−0.051***	−0.033***
ΔWC	6609	0.049	0.034	6392	0.061	0.047	−0.013***	−0.013***
Invest	6609	0.049	0.043	6392	0.050	0.046	−0.001	−0.003***
ATO	6609	5.605	2.720	6392	5.060	2.503	0.545***	0.217***
ETR	6609	0.196	0.190	6392	0.183	0.173	0.013***	0.017***
FLev	6609	0.230	0.227	6392	0.220	0.222	0.010***	0.005*
DebtCost	6609	0.071	0.064	6392	0.070	0.064	0.000	0.000

Panel C: Commercial class II SOEs vs. Non-SOEs (Subsample II)

	Commercial class II SOEs			Non-SOEs			Mean	Median
	Obs.	Mean	Median	Obs.	Mean	Median	Diff	Diff
FCFOE	1943	−0.064	−0.045	572	−0.094	−0.067	0.030***	0.022***
Margin	1943	0.221	0.183	572	0.211	0.185	0.010	−0.002
Expense	1943	0.132	0.113	572	0.209	0.185	−0.077***	−0.072***
ΔWC	1943	0.035	0.023	572	0.038	0.031	−0.004	−0.008*
Invest	1943	0.070	0.068	572	0.053	0.050	0.018***	0.018***
ATO	1943	2.410	1.782	572	3.258	2.050	−0.848***	−0.268**
ETR	1943	0.190	0.189	572	0.164	0.154	0.026***	0.035***
FLev	1943	0.246	0.242	572	0.272	0.277	−0.025***	−0.035***
DebtCost	1943	0.063	0.057	572	0.071	0.065	−0.007***	−0.008***

Panel D: Public-benefit SOEs vs. Non-SOEs (Subsample III)

	Public-Benefit SOEs			Non-SOEs			Mean	Median
	Obs.	Mean	Median	Obs.	Mean	Median	Diff	Diff
FCFOE	1274	−0.080	−0.062	344	−0.098	−0.080	0.017**	0.018***
Margin	1274	0.263	0.245	344	0.269	0.271	−0.006	−0.026***
Expense	1274	0.166	0.134	344	0.255	0.215	−0.089***	−0.081***
ΔWC	1274	0.038	0.026	344	0.060	0.051	−0.022***	−0.025***
Invest	1274	0.065	0.064	344	0.059	0.055	0.006***	0.009***
ATO	1274	2.436	0.904	344	3.883	1.605	−1.447***	−0.701***
ETR	1274	0.193	0.187	344	0.212	0.201	−0.019***	−0.014
FLev	1274	0.292	0.297	344	0.242	0.245	0.050***	0.052***
DebtCost	1274	0.067	0.061	344	0.067	0.061	0.000	0.000

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

ficient of $SOE_{i,t}$ is significant and positive when the dependent variable is $Invest_{i,t}$ and negative when the dependent variable is $ATO_{i,t}$, indicating that SOEs have a long-standing tendency to invest more than non-SOEs, spending more on capital expenditures for the acquisition of fixed, intangible or other long-term assets and M&A activities. SOEs also have a lower turnover ratio and lower efficiency in the use of tangible and intangible assets, and thus have a weaker investment planning capability. Columns (5) to (7) of Table 6, Panel A also show that the coefficient of $SOE_{i,t}$ is not significant when the dependent variable is $ETR_{i,t}$ and is significant and negative when the dependent variable is $FLev_{i,t}$ or $DebtCost_{i,t}$. This is because in SOEs, taxes are implicit dividends paid by firms to SOEs' controlling shareholders but constitute costs to other shareholders. Less tax avoidance can cause the transfer of benefits from these other shareholders to the controlling shareholders (Bradshaw et al., 2019). In addition, SOE executives tend to choose conservative tax-planning behavior under the influence of promotion motives (Bradshaw et al., 2019). Therefore, we do not find that SOEs have advantages in tax planning or tax avoidance by using debt tax shields.

Table 6, Panels B to D further discuss the reasons for the differences in free cash flow productivity between the SOEs with different functional positioning and the non-SOEs in the same industries. Specifically, the subsample regression results in Panel B for the commercial class I SOEs and the non-SOEs in the same industries are generally consistent with the full-sample regression results in Panel A. This indicates that the commercial class I SOEs display better expense control and working capital management than the non-SOEs but worse product and service profitability, investment planning and capital structure optimization capabilities (although their debt-financing costs are lower). Panel C shows that the commercial class II SOEs display worse working capital management and better product and service profitability than the non-SOEs. This may be because non-competitive industries have high market entry barriers and non-SOEs that surmount these barriers tend to differ from non-SOEs in competitive industries in various aspects (e.g., firm size, market position).

Table 5
Regression results comparing the free cash flow productivity of SOEs and non-SOEs.

	$FCFOE_{i,t}$	$FCFOE_{i,t}$	$FCFOE_{i,t}$	$FCFOE_{i,t}$
	Full sample	Subsample I	Subsample II	Subsample III
	(1)	(2)	(3)	(4)
$SOE_{i,t}$	0.007***			
	(6.17)			
$SOEC1_{i,t}$		0.007***		
		(5.78)		
$SOEC2_{i,t}$			0.014**	
			(2.88)	
$SOEPub_{i,t}$				0.030***
				(10.47)
$Size_{i,t-1}$	−0.008***	−0.006***	−0.004	−0.025***
	(−3.51)	(−4.05)	(−0.77)	(−6.23)
$Age_{i,t-1}$	0.007***	0.007***	0.008***	0.005**
	(3.85)	(4.14)	(3.63)	(3.00)
$Lev_{i,t-1}$	−0.263***	−0.263***	−0.275***	−0.243***
	(−21.84)	(−15.86)	(−17.51)	(−16.78)
$Top1_{i,t-1}$	0.103***	0.089***	0.155***	0.164***
	(5.98)	(5.54)	(11.08)	(4.01)
$Board_{i,t-1}$	0.004***	0.004***	0.006**	0.005***
	(4.93)	(6.04)	(2.83)	(3.67)
$Indep_{i,t-1}$	−0.014	−0.035	0.051**	0.138***
	(−0.80)	(−1.74)	(2.19)	(3.45)
Constant	0.078**	0.059**	−0.100	0.354***
	(2.63)	(2.41)	(−1.42)	(4.47)
Obs.	17,134	13,001	2,515	1,618
R-squared	0.263	0.254	0.339	0.361

Note: This table reports the results using Fama and MacBeth (1973) regression and the 3-period lagged Newey-West adjusted t-statistics, with *, **, and *** indicating statistical significance at 10%, 5% and 1% levels, respectively.

Table 6
Channel analysis.

Panel A: SOEs vs. Non-SOEs (Full Sample)

	$Margin_{i,t}$	$Expense_{i,t}$	$\Delta WC_{i,t}$	$Invest_{i,t}$	$ATO_{i,t}$	$ETR_{i,t}$	$FLev_{i,t}$	$DebtCost_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOE_{i,t}$	−0.022***	−0.039***	−0.012***	0.004***	−0.991***	−0.002	−0.009**	−0.003***
	(−14.82)	(−13.26)	(−15.34)	(7.34)	(−8.56)	(−1.24)	(−2.80)	(−15.00)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	17,134	17,134	17,134	17,134	17,134	17,134	17,134	17,080
R-squared	0.103	0.243	0.046	0.246	0.065	0.046	0.329	0.029

Panel B: Commercial class I SOEs vs. Non-SOEs (Subsample I)

	$Margin_{i,t}$	$Expense_{i,t}$	$\Delta WC_{i,t}$	$Invest_{i,t}$	$ATO_{i,t}$	$ETR_{i,t}$	$FLev_{i,t}$	$DebtCost_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOEC1_{i,t}$	−0.031***	−0.038***	−0.012***	0.003***	−0.551***	−0.001	−0.014***	−0.002***
	(−35.68)	(−10.51)	(−8.04)	(3.41)	(−5.52)	(−0.48)	(−7.00)	(−3.45)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	13,001	13,001	13,001	13,001	13,001	13,001	13,001	12,961
R-squared	0.108	0.218	0.061	0.226	0.097	0.061	0.321	0.027

Panel C: Commercial class II SOEs vs. Non-SOEs (Subsample II)

	$Margin_{i,t}$	$Expense_{i,t}$	$\Delta WC_{i,t}$	$Invest_{i,t}$	$ATO_{i,t}$	$ETR_{i,t}$	$FLev_{i,t}$	$DebtCost_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOEC2_{i,t}$	0.013**	−0.042***	0.012**	0.005***	−0.561***	0.011*	−0.039***	−0.005**
	(2.61)	(−5.96)	(2.42)	(3.42)	(−3.16)	(2.03)	(−4.35)	(−2.25)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,501
R-squared	0.136	0.298	0.094	0.389	0.069	0.101	0.450	0.091

Panel D: Public-benefit SOEs vs. Non-SOEs (Subsample III)

	$Margin_{i,t}$	$Expense_{i,t}$	$\Delta WC_{i,t}$	$Invest_{i,t}$	$ATO_{i,t}$	$ETR_{i,t}$	$FLev_{i,t}$	$DebtCost_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOEPub_{i,t}$	0.017	−0.042***	−0.006	−0.002	−0.996	−0.018***	0.019***	−0.002
	(1.76)	(−5.75)	(−0.59)	(−0.33)	(−1.76)	(−3.37)	(3.83)	(−0.89)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,618	1,618	1,618	1,618	1,168	1,618	1,618	1,618
R-squared	0.288	0.326	0.104	0.210	0.161	0.080	0.380	0.124

Note: This table reports the results using Fama and MacBeth (1973) regression and the 3-period lagged Newey-West adjusted t-statistics, with *, **, and *** indicating statistical significance at 10%, 5% and 1% levels, respectively.

With the concentration of trade credit to firms with superior market positions (Zhang et al., 2012), the difference in working capital levels between non-SOEs and commercial class II SOEs gradually narrows, leading non-SOEs to exhibit even better working capital management than commercial class II SOEs. However, administrative monopolies also exist in the industries where the commercial class II SOEs are located (Liu and Shi, 2011), which hinders the profitability of non-SOEs to a certain extent. These two reasons make commercial class II SOEs and commercial class I SOEs perform differently in terms of working capital management, product and service profitability. Additionally, the capital structure optimization ability of the commercial class II SOEs is weaker than that of the non-SOEs in the same industries. Panel D shows that the public-benefit SOEs are not significantly different from the non-SOEs in terms of average annual operating margin, working capital change, capital expenditure or tangible and intangible asset turnover ratio. However, their capital structure optimization ability is stronger than that of the non-SOEs, and their average annual effective income tax rate is significantly lower than that of the non-SOEs. One possible explanation for this is that in addition to subjective tax avoidance motives, SOEs tend to have easier access to tax preference and lenient tax administration (Liu and Liu, 2014), especially public-benefit SOEs that bear more social burdens, which means that public-benefit SOEs carry a lower tax burden than non-SOEs.

Taken together, these findings suggest that better expense control and working capital management capabilities are the main drivers of free cash flow productivity for SOEs. However, the strengths and weaknesses of such productivity differ among SOEs with different functional positioning. In particular, better expense control is a capability shared by the SOEs of all three types, while better working capital management capability is a unique advantage of the commercial class I SOEs, better product and service profitability is a unique advantage of the commercial class II SOEs and tax-planning capability and capital structure optimization capability are distinct advantages of the public-benefit SOEs. These advantages ultimately result in better free cash flow productivity for SOEs of all three types than for non-SOEs in the same industries.

6. Further analyses

6.1. Relationship between firm ownership and free cash flow productivity

The previous section focuses on comparing and analyzing the differences in free cash flow productivity between the SOEs with different functional positioning and the non-SOEs and shows that the SOEs have significantly stronger free cash flow productivity than the non-SOEs. This section further explores whether the above findings are confounded by firm characteristics such as firm size, age, growth and ownership concentration, as well as the area where the firm is located.[10]

The full sample regressions (without distinguishing between types of SOE), presented in Table 7, Panels A to D, show that the coefficients of $SOE_{i,t}$ are significant and positive in the subsamples with different firm sizes, ages, degrees of growth, and ownership concentrations (columns (1) and (2)), indicating that the above-mentioned findings that SOEs have stronger free cash flow productivity than non-SOEs are somewhat general. After distinguishing the functional positioning of SOEs, we find that the coefficients of $SOEC1_{i,t}$ in subsample I and $SOEPub_{i,t}$ in subsample II are significant and positive for all of the groups (except for Panel E, classified by firm area), which is consistent with the results in columns (2) and (4) of Table 5. However, the coefficients of $SOEC2_{i,t}$ are significant and positive only for the firms with greater age, lower growth and lower ownership concentration and the firms located in the central region of China, which is not entirely consistent with the results in column (3) of Table 5. Interestingly, the free cash flow productivity of the commercial class I SOEs

[10] More specifically, firm size is measured as the natural logarithm of total assets, firm age is measured as the number of years since a firm's IPO, firm growth is measured as the percentage change in sales from the prior year to the current year and firm ownership concentration is measured as the percentage of shares held by the largest shareholder. We then divide our sample into two subsamples based on the industry-year median of these variables, respectively. We also sort our sample into eastern, central and western groups based on the firm location area variable, which is defined as the location of the firm's headquarters. The eastern region of China includes Beijing, Fujian, Guangdong, Hainan, Hebei, Liaoning, Jiangsu, Shandong, Shanghai, Tianjin, and Zhejiang; the central region of China includes Anhui, Jiangxi, Jilin, Heilongjiang, Henan, Hubei, Hunan, and Shanxi; the western region of China includes Chongqing, Gansu, Guangxi, Guizhou, Inner Mongolia, Ningxia, Qinghai, Shaanxi, Sichuan, Xinjiang, Tibet, and Yunnan.

and commercial class II SOEs located in Eastern & Western China is not significantly stronger than that of non-SOEs located in the same region.

Two conclusions can be drawn. First, the comparison of the commercial class I SOEs, public-benefit SOEs and non-SOEs in terms of free cash flow productivity may be generalized to firms of different sizes, ages, growth and ownership concentrations. Second, the relationship between the strength of free cash flow productivity of commercial class II SOEs and non-SOEs may change under various circumstances, which must be discussed in combination with the firms' respective characteristics and operating environments.

6.2. Exclusion of alternative explanations

6.2.1. Effects of government subsidies

Government subsidies directly affect firms' operating cash flows and vary between SOEs with different functional positioning; therefore, this phenomenon adds noise to the comparison of free cash flow productivity. For example, Kong et al. (2013) find that SOEs may receive more subsidies to offset profit declines caused by intensifying competition from non-SOEs. This implies that the stronger free cash flow productivity of the commercial class I SOEs may also stem from the increase in operating cash inflows due to government subsidies. Furthermore, because commercial class II SOEs and public-benefit SOEs are responsible for more political and social objectives than commercial class I SOEs and non-SOEs, the government may have the incentive to support them with more subsidies (Tang and Luo, 2007). This means that without the advantage of government subsidies, the free cash flow productivity of commercial class II and public-benefit SOEs may be lower than that of non-SOEs. If the free cash flow productivity of SOEs is largely driven by government subsidies rather than by their operations, the ranking of free cash flow productivity between SOEs with different functional positioning and non-SOEs would change after the net cash inflows arising from government subsidies are excluded.

To rule out the effect of government subsidies, we reconstruct the free cash flow productivity indicator of firms (*FCFOE_sub*), excluding the cash inflows generated by government subsidies from the net operating cash flows. The descriptive statistics in Table 8, Panel A show that government subsidies affected both SOEs and non-SOEs, as their free cash flow productivity decreases after government subsidies are eliminated. However, Panel A of Table 8 also shows that the effect of government subsidies on SOEs' free cash flow productivity is significantly smaller than that on those of non-SOEs[11] and that this effect is also significantly smaller on the free cash flow productivity of SOEs with different functional positioning than on that of non-SOEs in the same industries. The regression results in Panel B of Table 8 further demonstrate that when the dependent variable is replaced by $FCFOE\_sub_{i,t}$, the coefficients of the independent variables remain significant and positive and the magnitude and significance of the coefficients are comparable to those in Table 5. In summary, we believe that government subsidy does not have significant effects on our findings.

6.2.2. Effects of industry monopoly

It is noted in the literature that monopolistic industries have, overall, high gross margins (Luo and Zhao, 2013) and that it is easier for SOEs to earn excess profits than for non-SOEs in China because of industry entry barriers resulting from government regulation and control over resource allocations (Luo and Liu, 2009). In other words, unlike for non-SOEs, the free cash flow productivity of SOEs may stem from the government's distorted allocation of resources rather than from market competition. China's government has issued several documents since 2005 to encourage the influx of private capital into government-regulated monopolies such as electricity, telecommunications, railroads, civil aviation and petroleum industries. However, the existence of "the visible hand" of government means that industry monopoly factors may still be responsible for the difference in free cash flow productivity between SOEs and non-SOEs. Nevertheless, we believe that the findings in this paper are less likely to be driven by industry monopolies. First, the regressions in Tables 5 to 8 control for the effect of industry factors. Second, it is challenging for commercial class I SOEs (which have the stron-

[11] Of course, in terms of the absolute size of government subsidies, the cumulative cash inflows from government subsidies received by non-SOEs are still lower than those received by SOEs.

Table 7
Heterogeneity tests.

Panel A: Firm size

	$FCFOE_{i,t}$							
	Full sample		Subsample I		Subsample II		Subsample III	
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOE_{i,t}$	0.007*	0.008**						
	(1.86)	(2.64)						
$SOEC1_{i,t}$			0.008**	0.008**				
			(2.36)	(2.45)				
$SOEC2_{i,t}$					0.023	0.002		
					(1.60)	(0.26)		
$SOEPub_{i,t}$							0.016*	0.049***
							(1.91)	(7.47)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	8,717	8,417	6,589	6,412	1,286	1,229	842	776
R-squared	0.304	0.241	0.291	0.241	0.403	0.381	0.459	0.283

Panel B: Firm age

	$FCFOE_{i,t}$							
	Full sample		Subsample I		Subsample II		Subsample III	
	Old	Young	Old	Young	Old	Young	Old	Young
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOE_{i,t}$	0.010***	0.006**						
	(3.99)	(2.24)						
$SOEC1_{i,t}$			0.007**	0.007***				
			(2.57)	(3.33)				
$SOEC2_{i,t}$					0.021**	−0.002		
					(2.65)	(−0.45)		
$SOEPub_{i,t}$							0.027**	0.046***
							(2.76)	(4.99)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	8,725	8,409	6,560	6,441	1,322	1,193	843	775
R-squared	0.220	0.311	0.211	0.299	0.313	0.452	0.339	0.460

Panel C: Firm growth

	$FCFOE_{i,t}$							
	Full sample		Subsample I		Subsample II		Subsample III	
	High	Low	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOE_{i,t}$	0.006**	0.007**						
	(2.96)	(2.63)						
$SOEC1_{i,t}$			0.008***	0.006**				
			(3.21)	(2.19)				
$SOEC2_{i,t}$					0.005	0.027**		
					(0.84)	(2.34)		
$SOEPub_{i,t}$							0.040***	0.015*
							(9.21)	(2.02)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	8,720	8,414	6,596	6,405	1,280	1,235	844	774
R-squared	0.252	0.290	0.244	0.285	0.343	0.383	0.395	0.412

Panel D: Firm ownership concentration

	$FCFOE_{i,t}$							
	Full sample		Subsample I		Subsample II		Subsample III	
	High	Low	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOE_{i,t}$	0.008***	0.006***						
	(4.46)	(6.97)						
$SOEC1_{i,t}$			0.009***	0.005***				
			(5.48)	(3.86)				
$SOEC2_{i,t}$					−0.001	0.017***		
					(−0.10)	(3.50)		
$SOEPub_{i,t}$							0.044*	0.030*
							(1.78)	(2.09)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	8,718	8,416	6,583	6,418	1,291	1,224	844	774
R-squared	0.277	0.247	0.268	0.244	0.445	0.302	0.380	0.432

Panel E: Firm area

	$FCFOE_{i,t}$											
	Full sample			Subsample I			Subsample II			Subsample III		
	East	Central	West	East	Central	West	East	Central	West	East	Central	West
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$SOE_{i,t}$	0.004	0.026***	0.004									
	(1.19)	(3.67)	(0.93)									
$SOEC1_{i,t}$				0.003	0.028***	0.004						
				(1.62)	(3.55)	(1.48)						
$SOEC2_{i,t}$							0.007	0.030**	0.012			
							(0.61)	(2.67)	(0.76)			
$SOEPub_{i,t}$										0.013	0.090***	0.060**
										(1.06)	(4.65)	(2.60)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	10,627	3,362	3,145	8,393	2,367	2,241	1,316	635	564	918	360	340
R-squared	0.263	0.303	0.274	0.252	0.283	0.291	0.384	0.494	0.317	0.397	0.613	0.620

Note: This table reports the results using Fama and MacBeth (1973) regression and the 3-period lagged Newey-West adjusted t-statistics, with *, **, and *** indicating statistical significance at 10%, 5% and 1% levels, respectively.

gest free cash flow productivity) to achieve monopoly profits because they run their primary businesses in competitive industries and compete on a level playing field with non-SOEs in the product and service markets.

To further rule out the alternative explanation of industry monopoly, we use a substitute sample with only non-monopolistic industry firms and run the regressions again. The definitions of ''monopolistic'' and ''non-monopolistic industries'' are drawn from Yue et al. (2010). Table 9 shows that the coefficient of $SOE_{i,t}$ remains significant and positive when a sample of non-monopolistic industry firms is used and that the coefficients of $SOEC1_{i,t}$, $SOEC2_{i,t,}$ and $SOEPub_{i,t}$ remain significant and positive the functional positioning of the SOEs is differentiated, which is consistent with the results in Table 5. However, we also find that the magnitudes of the coefficients of $SOEC2_{i,t,}$ and $SOEPub_{i,t}$ are slightly lower than those in Table 5 after excluding the monopolistic industry firms, indicating that the monopolistic nature of an industry does benefit the free cash flow generation for SOEs in non-competitive industries, such as commercial class II and public-benefit SOEs.

6.3. Other robustness tests

$FCFOE_{i,t}$ reflects a firm's ability to produce free cash flow. If $FCFOE_{i,t}$ is greater than 0, it means that the sample has produced positive free cash flow cumulatively and that its free cash flow productivity is therefore

Table 8
Excluding the impact of government subsidies.

Panel A: Descriptive statistics and difference tests

		FCFOE_sub		Δ = *FCFOE_sub* – *FCFOE*	
		Mean	Median	Mean	Median
Full sample	SOEs	−0.072	−0.048	−0.012	−0.007
	Non-SOEs	−0.081	−0.062	−0.014	−0.008
	Difference test	0.009***	0.014***	0.002***	0.001***
Subsample I	Commercial class I SOEs	−0.067	−0.042	−0.012	−0.008
	Non-SOEs	−0.077	−0.058	−0.014	−0.008
	Difference test	0.010***	0.016***	0.001***	0.000***
Subsample II	Commercial class II SOEs	−0.076	−0.056	−0.012	−0.007
	Non-SOEs	−0.110	−0.080	−0.015	−0.009
	Difference test	0.033***	0.024***	0.003***	0.002***
Subsample III	Public-benefit SOEs	−0.090	−0.075	−0.010	−0.006
	Non-SOEs	−0.112	−0.099	−0.015	−0.006
	Difference test	0.022***	0.024***	0.005***	0.000

Panel B: Regression results

	$FCFOE\_sub_{i,t}$	$FCFOE\_sub_{i,t}$	$FCFOE\_sub_{i,t}$	$FCFOE\_sub_{i,t}$
	Full sample	Subsample I	Subsample II	Subsample III
	(1)	(2)	(3)	(4)
$SOE_{i,t}$	0.008***			
	(4.88)			
$SOEC1_{i,t}$		0.008***		
		(4.23)		
$SOEC2_{i,t}$			0.014**	
			(2.74)	
$SOEPub_{i,t}$				0.036***
				(11.59)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes
Obs.	17,134	13,001	2,515	1,618
R-squared	0.280	0.272	0.363	0.367

Note: This table reports the results using Fama and MacBeth (1973) regression and the 3-period lagged Newey-West adjusted t-statistics, with *, **, and *** indicating statistical significance at 10%, 5% and 1% levels, respectively. Subsamples are classified in Table 4.

strong. Conversely, if $FCFOE_{i,t}$ is less than 0, it means that the sample has produced negative free cash flow cumulatively and that its free cash flow productivity is therefore weak. Accordingly, we construct a dummy variable, $FCFOE\_dum_{i,t}$, which equals 1 if $FCFOE_{i,t}$ is greater than 0, and 0 otherwise. This measure may mitigate the autocorrelation problem caused by the construction of the $FCFOE_{i,t}$ indicator. Columns (1) to (4) of Table 10 show that only the coefficient of $SOEC1_{i,t}$ remains significant and positive when we use the alternative dependent variable, $FCFOE\_dum_{i,t}$. These results indicate that commercial class I SOEs have significantly higher free cash flow productivity. However, the percentage of commercial class II or public-benefit SOEs that generate positive cumulative free cash flow is not different from that of non-SOEs.

Columns (5) to (8) of Table 10 present the results of altering the estimation of the model (1) by replacing the Fama and MacBeth (1973) regressions with OLS regressions and controlling for year-fixed effects. The results show that the coefficients of $SOE_{i,t}$ in the full sample and of $SOEC1_{i,t}$, $SOEC2_{i,t,}$ and $SOEPub_{i,t}$ in each of the subsamples are significant and positive under the OLS estimation, which are consistent with the main results and verify the robustness of the findings in this paper.

7. Conclusion

In the context of the approval of the *Guidance on Accelerating the Construction of a World-Class Financial Management System for Central Enterprises*, this paper measures the free cash flow productivity of A-share

Table 9
Excluding the effect of industry monopoly.

	$FCFOE_{i,t}$	$FCFOE_{i,t}$	$FCFOE_{i,t}$	$FCFOE_{i,t}$
	Full sample	Subsample I	Subsample II	Subsample III
	(1)	(2)	(3)	(4)
$SOE_{i,t}$	0.007***			
	(5.69)			
$SOEC1_{i,t}$		0.007***		
		(5.78)		
$SOEC2_{i,t}$			0.009*	
			(1.93)	
$SOEPub_{i,t}$				0.026***
				(4.60)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes
Obs.	15,702	13,001	1,903	798
R-squared	0.259	0.254	0.341	0.390

Note: This table reports the results using Fama and MacBeth (1973) regression and the 3-period lagged Newey-West adjusted t-statistics, with *, **, and *** indicating statistical significance at 10%, 5% and 1% levels, respectively. Subsamples are classified in Table 4.

Table 10
Results of other robustness tests.

	Alternative dependent variables				Alternative OLS estimation			
	$FCFOE\_dum_{i,t}$				$FCFOE_{i,t}$			
	Full sample	Subsample I	Subsample II	Subsample III	Full sample	Subsample I	Subsample II	Subsample III
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SOE_{i,t}$	0.016				0.005***			
	(1.34)				(2.82)			
$SOEC1_{i,t}$		0.030**				0.005**		
		(2.43)				(2.35)		
$SOEC2_{i,t}$			−0.036				0.013**	
			(−0.95)				(2.47)	
$SOEPub_{i,t}$				0.043				0.032***
				(1.26)				(4.52)
$Controls_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Obs.	17,134	13,001	2,515	1,618	17,134	13,001	2,515	1,618
R-squared	0.154	0.153	0.206	0.246	0.254	0.247	0.309	0.327

Note: Columns (1) to (4) in this table report results and t-statistics using Fama and MacBeth (1973) regression with 3-period lag Newey-West adjustment, and Columns (5) to (8) report results and t-statistics from OLS estimation, with *, **, and *** indicating statistical significance at 10%, 5% and 1% levels, respectively. The subsamples are classified in Table 4.

non-financial companies that have been listed for at least 10 years and systematically identifies and analyzes the differences in free cash flow productivity between state-owned and non-state-owned listed companies in China from 2007 to 2020. This paper also differentiates the functional positioning of SOEs in conjunction with SOE classification reform to assess their current free cash flow productivity, to explore the drivers of free cash flow productivity and to provide implications to aid in the high-quality development of SOEs and in the application of the aforementioned guidance.

We offer the following findings. (1) The free cash flow productivity of SOEs is slightly weak in general but is significantly stronger than that of non-SOEs. (2) In terms of SOEs' functional positioning, the free cash flow productivity of commercial class I SOEs is the strongest, followed by that of commercial class II SOEs, and the free cash flow productivity of public-benefit SOEs is the weakest. Moreover, the free cash flow productivity of all three types of SOEs is significantly stronger than that of non-SOEs in the same industries. (3) Based on

the six forces model of free cash flow productivity, we find that each of the three types of SOEs has its respective strengths in expense control, working capital management, product and service profitability and tax planning. Good expense control capability is the common driver of all three types of SOEs' generation of higher free cash flow than that of non-SOEs. (4) The results of comparing the SOEs (except for commercial class II SOEs) and non-SOEs in terms of free cash flow productivity can be generalized to firms of different sizes, ages, growth and ownership concentration. (5) Government subsidies and industry monopolies cannot provide alternative explanations for the above findings.

This paper's findings have the following two implications. First, despite the criticisms of SOEs for their inefficiency, policy-related losses and zombification, SOEs are not inferior to non-SOEs in terms of free cash flow productivity. This provides new insight into the debate on the efficiency of SOEs and non-SOEs. Second, free cash flow productivity and its drivers vary among SOEs according to their functional positioning, which further supports the necessity to classify SOEs for assessment and regulation. Particularly against the background of SOE classification reform, the evaluation of commercial class I SOEs' economic efficiency, capital return and market competitiveness should include the assessment of free cash flow productivity. Even though the evaluation of the development quality of commercial class II and public-benefit SOEs emphasizes social benefits, these SOEs can better achieve their policy and social goals if they steadily improve their free cash flow productivity.

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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More words but less investment: Rookie CEOs and firms' digital transformations

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ABSTRACT

In digital economy, firm's digital transformation is an important means of achieving high-quality development. Adopting career concerns theory, we examine rookie CEOs' impact on firms' digital transformations, using Chinese A-share listed firms from 2007 to 2019. (1) Rookie CEOs disclose more digital transformation information, but invest less in substantial transformation, i.e., "more words but less investment". (2) Under high performance pressure and difficult digital transformation, rookie CEOs are more likely to adopt the above strategy. (3) Internal and external governance mechanisms help effectively monitor and mitigate such behaviors. (4) The above strategy helps CEOs decrease short-term, but not long-term, dismissal probabilities. Our findings elucidate firms' digital transformation practices and the decision styles of CEOs with different experience levels.

1. Introduction

As artificial intelligence, cloud computing, big data and blockchain technologies mature and become widely used, an increasing number of firms are entering the digital era. The report of the 19th National Congress of the Communist Party of China emphasizes the importance of integrating the substantial economy with digital technology and encourages the optimization and upgrading of industries. Digital transformation is now an important way by which firms achieve high-quality development. However, digital transformation strategies can be risky and difficult. Research shows that only 11% of firms improve performance through digital transformation and that most firms face significant risks and challenges (Ni and Liu, 2021). We find that

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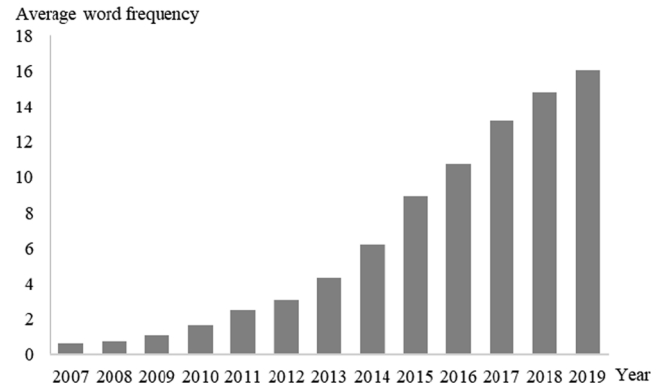

Fig. 1. Information disclosure of firms' digital transformations from 2007 to 2019.

A-share listed firms have significantly increased digital transformation disclosures in recent years (Fig. 1), but the increase in the proportion of intangible assets related to the digital economy remains relatively small (Fig. 2)[1]. In practice, although some firms successfully and profitably implement digital transformation, most firms may simply release more disclosures but actually invest less in digital transformation, that is, the real investment in digital transformation does not match the corresponding information disclosure. Therefore, identifying a firm's "more words but less investment" (MWLI) behavior for digital transformation can help investors reasonably judge the relevant information disclosed by such firms. It can also help firms achieve substantive digital transformations.

Information disclosure, especially voluntary disclosure, is an important means by which investors obtain firm-specific information such as operations, financial situation and development strategy. The literature suggests that the main purpose of voluntary disclosure is to enhance investors' confidence in firm prospects and management ability (Trueman, 1986; Francis et al., 1994; Brennan, 1999; Aboody and Kasznik, 2000; Dhaliwal et al., 2011). Complete and accurate disclosures can help investors make comprehensive and long-term judgments of firm development, but information that does not match the facts can mislead investors. Bamber et al. (2010) argue that CEO heterogeneity affects firms' voluntary disclosure choices. From the perspective of CEO heterogeneity, we examine the impact of rookie CEOs on firms' digital transformation decisions, such as digital transformation disclosure and actual digital transformation investments.

We classify CEOs as rookie or experienced depending on whether they have prior CEO experience. The development of the labor market for managers has gradually increased the mobility of CEOs across firms, providing research opportunities to explore the relevant issues of the experience level of CEOs. We find that among the CEOs of listed firms in China, the proportion of rookie CEOs is approximately 60%. These CEOs play an important role in the manager labor market. CEO experience gives us a unique opportunity to explore firms' motivations for digital transformation and analyze their digital transformation strategies. We use the theory of career concerns to analyze the impact of CEOs' experience on their decision-making styles. As rookie CEOs have no track records that can serve as references for the market, it is difficult for boards and investors to accurately assess these CEOs' management abilities. In the presence of information asymmetry, boards of directors may closely supervise rookie CEO performance. In the early stages of tenure, CEO competence is evaluated based on performance. The board may consider a timely CEO replacement if they find the rookie CEO to be unsuitable for the current position. Therefore, rookie CEOs face significant career concerns. They will closely follow the evaluations of the board and investors and have strong motivations to release good signals that can help them obtain positive feedback. The disclosure of digital transformation is an important means of getting such feedback. However, the high risk and difficulty of digital transformation cannot be ignored. A successful transformation can help rookie CEOs prove their excellent management abilities, but

[1] The average word frequency in Fig. 1 refers to the annual average word frequency of digital transformation information disclosed by A-share listed firms in their annual reports from 2007 to 2019. The specific calculation for the proportion of intangible assets related to digitalization in Fig. 2 is described in the below text.

a failed transformation can increase these CEOs' risk of being fired. Therefore, rookie CEOs' willingness to invest heavily in digital transformation depends on their attitudes toward risk, which needs to be empirically tested.

Based on listed firm data from 2007 to 2019, we explore the impact of rookie CEOs on firms' digital transformation decisions. This study makes several contributions to the literature. First, we combine digital transformation disclosure with actual investments and thus, construct a research framework for analyzing MWLI strategies for digital transformation. The literature comprehensively discusses the economic consequences of firms' digital transformations, but no studies combine digital transformation disclosure with the actual investments. From the perspective of CEO experience, we examine rookie CEOs' MWLI strategies for digital transformation; this helps us understand the impact of CEO heterogeneity on firms' digital transformation decisions. Second, we examine the management styles of rookie CEOs from the perspective of digital transformation decision-making and analyze the mechanisms by which CEO experience impacts decision-making. This supplements existing research on the economic consequences of hiring CEOs with different experience levels. Studies usually focus on improvements to CEO competence due to experience; they assess whether, with experience, CEOs perform better and help firms face difficulties, and how effective incentive contracts are drafted. We focus on the psychological characteristics and decision-making styles of rookie CEOs. We find that the lack of CEO experience worsens the career concerns of rookie CEOs in the early stages of tenure. Therefore, these CEOs have strong motivations to show their management abilities and avoid making risky investment decisions to decrease the possibility of being dismissed in the short term. Third, in terms of practice, our findings suggest that CEOs have motivations to "disclose more but invest less" in terms of digital transformation, which can prevent investors from correctly assessing the authenticity and accuracy of the information disclosed by firms. In addition, as the job market for professional managers develops, CEOs are likely to become mobile. It is therefore important for firms to account for the CEOs' experience levels when designing recruitment and incentive systems. We find that rookie CEOs are likely to be concerned about short-term performance because they face intense pressure in the early stages of tenure. The above findings provide reference for firms to recognize and evaluate CEO candidates with different experience levels and improve subsequent incentive policies.

2. Literature review and hypothesis development

2.1. Literature review

2.1.1. Literature on firms' digital transformations

A few studies examine the factors that affect firms' digital transformation decisions; their findings can be summarized in three points: environmental support, financial support and resource support for digital transformation. Shi and Wang (2022) focus on support from the business environment for digital economy development. Survey data on the business environments of private firms show that a good business environment promotes the digital transformation of firms and improves the depth of transformation. Ren et al. (2022) focus on the funds required by firms for digital transformation, investigate the impact of firm financialization on digital transformation and find that the crowd-out effect of firms' investments in financial assets inhibits digital transformation. Song and Chen (2022) discuss the external resource support generated by social capital and propose that entrepreneurs' social networks with appropriate scale, accessibility and connection strength can promote digital transformation.

There is a wealth of literature on the economic consequences of firms' digital transformations, supporting its positive effects. In terms of firm performance, Li et al. (2021) find that digital transformation can improve firm performance. Ni and Liu (2021) find that digital transformation is conducive to firm growth, but the impact is heterogeneous across firms of different sizes. Large-scale firms at the top of the industry can benefit more from digital transformation than other firms can. Zhao et al. (2021) and Wu et al. (2022) find that digital transformation promotes firm productivity. The regional digital economy plays a positive role in upgrading the manufacturing industry (Huang et al., 2022). In terms of corporate governance, Qi et al. (2020) find that digital transformation alleviates information asymmetry in a firm and encourages executives to make rational decisions, thereby improving corporate governance. Liu et al. (2020) explore the impact of firm digitalization

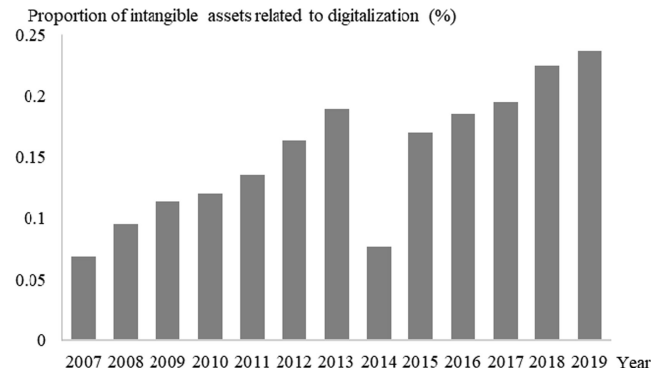

Fig. 2. Proportion of intangible assets related to the digitalization of firms from 2007 to 2019.

on organizational empowerment and find that digitalization weakens the power of management and promotes downward empowerment. In terms of capital market, Wu et al. (2021) investigate the reaction of the capital market to firms' digital transformations and find that the higher is the degree of digital transformation, the higher is the stock liquidity. In terms of corporate operation, Yuan et al. (2021) find that digital transformation improves a firm's vertical specialization. Chen and Zhang (2021) find that regional development of the digital economy enhances risk-taking by firms.

2.1.2. Motivations for voluntary disclosure

Current discussions on the motivations for firms' voluntary disclosures are relatively mature. They can be summarized in the following five points. First is the motivation to lower financing costs. As information asymmetry keeps investors at an information disadvantage, risk compensation is required. The worse is a firm's information environment, the higher is the cost of financing. Voluntary disclosure is an important channel through which investors obtain firm-specific information; this helps alleviate information asymmetry and thus, reduces firms' financing costs (Dhaliwal et al., 2011). Second is the motivation to compete for control and prevent stock prices from being undervalued. When faced with the risk of control transfer, firms are motivated to disclose positive information; this helps raise stock prices and avoid control transfer (Brennan, 1999). Third is the motivation to increase management stock compensation. When the stock portion of the management compensation contract is relatively large, managers are motivated to use information disclosures to modulate stock prices and maximize their personal returns (Aboody and Kasznik, 2000). Fourth is the motivation to reduce litigation costs (Francis et al., 1994). When a firm faces a litigation risk due to untimely and inadequate information disclosures, the management becomes inclined to disclose relevant information, especially negative information, in a timely manner. Fifth is the motivation to send good signals of managerial ability. Given considerations of reputation, status, compensation and other aspects, the management is motivated to disclose positive information, release signals of excellent management abilities and boost investors' confidence (Trueman, 1986).

2.1.3. CEO experience level

There is little literature on CEOs' experience levels, but the increase in managers' mobility in the labor market has prompted researchers to explore the impact of CEO experience on performance. Gudell (2011) collects the experience information of managers in U.S. public firms over the past three decades and finds that the proportion of experienced CEOs was close to 35% in 2005 compared with less than 5% in the early 1990 s. Elsaid et al. (2011) find that the capital market gives positive feedback to firms hiring experienced CEOs. However, some studies find that experienced CEOs perform worse than rookie CEOs (Hamori and Koyuncu, 2014). Studies on the experience level of CEOs mainly examine how CEOs' experience can enhance their management abilities, but do not focus on the impact of experience on their psychological states and management styles. Therefore, it is of theoretical and practical significance to explore the characteristics of CEOs with different experience levels in firm decision-making.

2.1.4. Career concerns

Based on the theory of career concerns, CEOs' current performance can affect the market's evaluation of their management abilities; these evaluation results can determine the possibility of increased future returns such as salary and tenure. Concerns about future career development can affect CEOs' current decisions (Gibbons and Murphy, 1992; Baginski et al., 2018). High performance pressure and the risk of being dismissed exacerbate these concerns. For example, externally hired or newly appointed CEOs are under greater pressure than other CEOs and face a relatively high risk of being dismissed, so they have significant career concerns (Gillan et al., 2009; Baginski et al., 2018; Ding and Jaggi, 2022). The possibility of earning rewards through future efforts also increases CEOs' career concerns. For example, compared with older CEOs, younger CEOs have longer career prospects and more opportunities to obtain high pay and long tenures by making sufficient efforts; however, this also brings greater career concerns (Gibbons and Murphy, 1992).

Holmstrom (1999) points out that if little information is available about a CEO's ability in the market, then more weight is given to recent performance when judging his or her ability. The accuracy of ability information gradually improves over time and the returns for reputation-building are highest when market information is dispersed. Thus, career concerns can make CEOs strive for positive evaluations in the early stages of tenure. Information disclosure is an important factor that affects the evaluation results of CEO ability. Hermalin and Weisbach (2007) focus on the relationship between managers' career concerns and information disclosure and assume that shareholders use all of the information available to evaluate the abilities of CEOs; CEOs are replaced if the evaluation results are poor. Recent research provides empirical evidence for the impact of career concerns on CEOs' information disclosure decisions (Baginski et al., 2018; Ding and Jaggi, 2022). Baginski et al. (2018) find that CEOs delay the disclosure of bad news due to career concerns. Ding and Jaggi (2022) study how CEOs alleviate their career concerns in the early stages of tenure and find that newly appointed CEOs are likely to raise the accuracy of earnings forecasts to release positive signals when their performance is good, and reduce the accuracy when their performance is poor to alleviate the negative reactions of investors.

Regarding the impact of career concerns on managers' investment decisions, the literature does not come to a clear and consistent conclusion. Career concerns may make CEOs more likely to choose risky projects. Hermalin (1993) proposes that when information about the risks of investment projects is openly available, CEOs with career concerns prefer high-risk projects that can minimize reputation risk. Zhang (2009) shows that CEOs at high risk of being fired are motivated to make risky decisions to save their careers. Li et al. (2017) find that young CEOs are motivated by implicit goals that are affected by the labor market's perceptions of their abilities. Thus, they are likely to enter new business areas and make risky investment decisions. Conversely, under the influence of career concerns, CEOs may instead avoid risky projects. Hirshleifer and Thakor (1992) show that when the market only relies on the final results of investment decisions to judge the abilities of managers, the managers are affected by the reputation mechanism and tend to choose low-risk projects. Chen (2009) argues that when the returns of high-risk projects depend on project quality and managers' abilities, managers unaware of their own abilities tend to choose projects with low-risk.

2.2. Hypothesis development

Early studies show that managers are homogeneous, they just performing the corresponding job duties under the contract. However, the upper echelons theory proposed by Hambrick and Mason (1984) broke through the traditional theoretical framework to argue that there exists heterogeneity across managers and that managers with different background characteristics have diverse management styles. CEOs' early life experiences and later study and work experiences influence their decision-making preferences (Bamber et al., 2010; Malmendier et al., 2011; Custódio and Metzger, 2014; Hoitash et al., 2016; Bernile et al., 2017; Du et al., 2018; Hu et al., 2020; Hanlon et al., 2021; Ma et al., 2021). The career experience of a CEO is an important background characteristic. Based on the theory of career concerns, we analyze the management styles of rookie CEOs and their impact on firms' digital transformation decisions.

Rookie CEOs do not have performance records for market reference, whereas experienced CEOs usually have track records of excellent management ability. Thus, there is severe information asymmetry between rookie CEOs and the market. To assess rookie CEOs' abilities in the early stages of tenure, the board and inves-

tors carefully observe and evaluate CEO performance (Fama, 1980; Gibbons and Murphy, 1992). Compared with experienced CEOs, rookie CEOs face greater career concerns. In the case of *ex ante* insufficient information, the board has no knowledge of the real management abilities of rookie CEOs. After follow-up evaluations, if rookie CEOs are found to be unsuitable for their current positions, they may be replaced (Gibbons and Murphy, 1992; Holmstrom, 1999; Zhang, 2008). If experienced CEOs fail to perform well in the early stages of tenure, the board is likely to blame the failures on something other than a management problem and maintain expectations of future performance. When evaluating the management abilities of rookie CEOs, the board tends to give high weightage to performance in the early stages of tenure (Holmstrom, 1999). Thus, the best time for rookie CEOs to build reputation is these early stages. To ease their career concerns, rookie CEOs need to focus on the evaluations of the board and investors and release positive signals to obtain positive feedback.

Information disclosure is an important means of showcasing the management abilities of CEOs. Studies find that career concerns can impact information disclosure decisions (Hermalin and Weisbach, 2007; Baginski et al., 2018; Ding and Jaggi, 2022). CEOs facing significant career concerns are likely to disclose good news and delay or obscure bad news (Baginski et al., 2018; Ding and Jaggi, 2022). In the context of a digital economy, digital transformation plays a key role in the high-quality development of a firm. The literature examines the positive impacts of firms' digital transformation strategies, such as improving corporate performance, production efficiency and corporate governance (Qi et al., 2020; Li et al., 2021; Ni and Liu, 2021; Yuan et al., 2021; Zhao et al., 2021; Wu et al., 2022). Digital transformation is supported by several policies in China. In 2021, the State-Owned Assets Supervision and Administration Commission of the State Council issued the "Circular of Accelerating the Digital Transformation of State-Owned Enterprises" to encourage the transformation of state-owned enterprises. Moreover, the capital market has a positive attitude toward firms' digital transformations; the higher is the level of digital transformation, the higher is stock liquidity (Wu et al., 2021). Therefore, digital transformation disclosure is an effective means by which firms release good signals of strategic development; this enhances the trust of the board and investors in the CEO's management abilities, elicits positive feedback from the market and relieves CEOs' short-term pressures.

However, digital transformation strategies carry significant risks and difficulties. The successful implementation of these strategies not only require excellent management abilities of CEOs, but also basic conditions for transformation such as sufficient capital, advanced technology bases and business environment support. Faced with the challenge of digital transformation, rookie CEOs may make two possible transformation investment decisions. First, if rookie CEOs choose to invest a large amount of resources in digital transformation projects but ultimately fail and bring huge losses to the firms, then the market is likely to attribute these failures to the CEOs' personal abilities due to *ex ante* information asymmetry regarding the CEOs' management abilities. Thus, for rookie CEOs, investing in risky projects increases the possibility of being fired. Therefore, it is a safe choice to appropriately increase the disclosure of transformation information without correspondingly increasing investment. Second, if rookie CEOs successfully achieve digital transformation, then their management skills will be proved. To use this opportunity to increase future career returns, rookie CEOs may choose to invest in risky projects that help establish good reputation (Zhang, 2009; Li et al., 2017).

Based on the above, we propose the following competing hypotheses:

H1a. *Compared with experienced CEOs, rookie CEOs disclose more information about digital transformation but invest less in digital transformation, that is, they follow the "more words but less investment" digital transformation strategy.*

H1b. *Compared with experienced CEOs, rookie CEOs disclose more information about digital transformation and invest more in digital transformation, that is, they follow the "more words and more investment" digital transformation strategy.*

3. Research design

3.1. Model specification and variable definition

To test the impact of rookie CEOs on firms' digital transformations, we employ the following linear regression model (1):

$$MWLI\ (MWMI) = \alpha + \beta_1 Rookie + \beta_2 \sum Control + Fixed\ Effect + \varepsilon \quad (1)$$

3.1.1. Measure of MWLI (MWMI)

The dependent variable *MWLI* is a dummy variable that indicates more words but less investment in digital transformation. Following Li (2018), *MWLI* equals 1 if the firm's disclosure of digital transformation in the current period is more than the annual industry median and the actual investment in digital transformation in the following period is less than the annual industry median; and 0 otherwise[2]. Specifically, digital transformation disclosure is measured using the natural logarithm of 1 + the word frequency related to digital transformation in the firm's annual report (Wu et al., 2021)[3]; the actual investment in digital transformation is measured using the percentage of intangible assets related to digital transformation to total assets (He and Liu, 2019; Qi et al., 2020)[4]. Similarly, *MWMI* is a dummy variable that indicates more words and more investment in digital transformation. *MWMI* equals 1 if the firm's disclosure of digital transformation in the current period is more than the annual industry median and the actual investment in digital transformation in the following period is more than the annual industry median; and 0 otherwise.

3.1.2. Measure of rookie CEO (Rookie)

Rookie equals 1 if firm *i* changes its CEO in year *t*, and the person who succeeds the CEO did not hold a CEO position for the last employer; and 0 otherwise[5]. To avoid CEO tenure effects, we retain data on the CEO succession year and the following 3 years; this helps observe rookie CEOs' decision-making style. If the CEO is a rookie, then *Rookie* equals 1 in the succession year and the following 3 years; and 0 otherwise.

When judging whether the current CEO has CEO experience, we focus on relevant positions with the last employer based on the following considerations. There may be a large difference between the size of the employer that the CEO worked for in their early years, as disclosed in the resume, and the size of the current firm. Therefore, the early experience and knowledge accumulated by the CEO may not be directly applicable to the current firm[6]. However, the period when the CEO worked for the last employer is close to the current year, and the relevant working performance can serve as a reliable reference for the current position.

Based on hand-collected CEO career experience data, we construct *Rookie* using the following methods. First, based on CEO resumes in annual reports, we collect information on their previous career experiences, such as employer name, position and start and end times of employment. We order the details of career experience based on the time of employment from far to near. If information about employment time is not disclosed, then we observe the order in which the employment information appears in the resume and assume

[2] We use digitalization-related intangible assets in the following period to measure investment in digital transformation for the following reasons. First, there is a time delay between information disclosure and actual investment implementation, with investment lagging behind the disclosure of digital transformation information. Second, CEOs may not immediately impact investment in the succession year, making it reasonable to observe the investment in the following period.

[3] Words related to digital transformation are "artificial intelligence technology," "big data technology," "cloud computing technology," "blockchain technology" and "digital technology application".

[4] We identify intangible assets containing the following related content as digitalization-related: software, management system, network, intelligent platform, cloud computing and automation. Missing values for digital transformation investment are filled with 0.

[5] Changes here refer to all of the changes made before 31 December of the current year. As long as the CEO succeeds before 31 December of a given year, it is regarded as the succession year.

[6] Based on the CEO resumes, we identify all of the employers for whom they previously held CEO positions. We then collect 2,085 observations of registered capital data of the employers through the Aiqicha website. Specifically, 991 observations show the registered capital information of the last employer and 1,094 observations show the registered capital information of other employers. After generating a log of each employer's registered capital, we conduct a t-test and find that the registered capital scale of the last employer is significantly higher than that of the other employers. This result empirically supports our focus on the last employer.

that the first is the earliest and so on. Second, we standardize the career experience information. For the employer, we use the first-level name. For example, "Department Y of Firm X" is identified as "Firm X." If the name of the listed firm has changed, then we use the latest name. The position information is adjusted based on the actual situation; for example, "General Manager of Department Y of Firm X" may be adjusted to "Department Manager of Firm X." Finally, we identify the last employer and position at the time. If an individual was not the CEO for his/her last employer, then we assume that he/she has no CEO experience and *Rookie* equals 1. Conversely, *Rookie* equals 0 if he/she was the CEO for the last employer.

To better explain the construction of *Rookie*, we provide the following examples:

(1) *Firm A* changed its CEO in 2010 and *manager I* was the CEO from 2010 to 2015. The content related to career experience in the resume publicly disclosed by *manager I* is "He was the director of *machinery factory B*, the CEO of *firm C* (registered capital of 10 million yuan), the vice president of *firm D* (registered capital of 120 million yuan) and the CEO of *firm E* (registered capital of 310.768 million yuan)."

Construction process: Identify that the last employer of *manager I* is *firm E* and the position was CEO. Therefore, *Rookie* equals 0 and the observations of *firm A* from 2010 to 2013 are retained.

(2) *Firm F* changed its CEO in 2007, and *manager II* was the CEO from 2007 to 2012. The content related to career experience in the resume publicly disclosed by *manager II* is "He was the department vice-minister and minister of *firm G* and the supervisor, secretary of the board and vice president of *firm F*."

Construction process: Identify that the last employer of *manager II* is *firm G* and the position was not CEO. Therefore, *Rookie* equals 1 and the observations of *firm F* from 2007 to 2010 are retained.

Following the literature, we control for firm and CEO characteristic variables (Table 1 shows the specific definitions of the variables)[7].

3.2. Sample and data sources

We take China's A-share main board listed firms as the initial sample. The sample period is 2007 to 2019. For further sample selection, we (1) exclude special treatment firms; (2) exclude financial firms; (3) exclude firms in the information technology (IT) service industry[8]; and (4) exclude observations missing data for the main variables. Finally, we obtain 3,457 firm-year observations. To reduce the impact of extreme values, the continuous variables are winsorized by 1%. Data related to firms' digital transformations, finance and governance are obtained from the China Stock Market and Accounting Research (CSMAR) database. The CEOs' career experience data are hand-collected from the resume information in the CSMAR database.

4. Empirical results

4.1. Descriptive statistics

Panels A and B in Table 2 show the descriptive statistics of *Rookie* based on the year and industry classification. There is no significant difference in the mean value of *Rookie* across years and industries[9]. This suggests that a firm's choice of hiring CEOs with different experience levels is independent of the year and

[7] CEOs who are hired internally may be experienced for the following reasons. First, if they served as CEO for the last employer before entering the current firm. Second, if after joining the current firm, they also served as CEO for other firms (such as subsidiary holding firms) and then moved on to the CEO position in the current firm.

[8] Firms in the IT services industry are naturally more digital. As we focus on the digital transformation of firms in traditional industries, the sample of IT service industry firms is excluded.

[9] Industry I only comprises telecommunications, radio and television and satellite transmission services after excluding the IT service firms.

Table 1
Variable definitions.

Variable	Definition
Rookie	Equals 1 if the CEO did not hold CEO position for the last employer, and 0 otherwise
MWLI	Equals 1 if the firm's disclosure of digital transformation in the current period is more than the annual industry median and the actual investment in digital transformation in the following period is less than the annual industry median, and 0 otherwise
MWMI	Equals 1 if the firm's disclosure of digital transformation in the current period is more than the annual industry median and the actual investment in digital transformation in the following period is more than the annual industry median, and 0 otherwise
Size	The natural logarithm of total assets
Lev	Total liabilities/total assets
ROA	Net profit/total assets
Growth	Growth rate of the firm's operation revenue
Soe	Equals 1 if the firm is state-owned, and 0 otherwise
Top1	The shareholding ratio of the largest shareholder
Boardsize	The natural logarithm of the number of directors
MH	The shareholding ratio of management
Duality	Equals 1 if the CEO is also the chairman of the board, and 0 otherwise
Female	Equals 1 if the CEO is female, and 0 otherwise
Age	The natural logarithm of the CEO's age
Tenure	The natural logarithm of 1 + the CEO's tenure
Internal	Equals 1 if the CEO is hired internally, and 0 otherwise
RD_back	Equals 1 if the CEO has an R&D background, and 0 otherwise

industry[10]. Panel C in Table 2 shows the descriptive statistics of all of the variables. The mean value of *Rookie* is 0.647 and the standard deviation is 0.478, indicating that rookie CEOs occupy a high proportion of the current listed firms. The mean value of *MWLI* is 0.284 and of *MWMI* is 0.144. We calculate the distribution proportion of the digital transformation strategies of rookie and experienced CEOs (Figs. 3 and 4, respectively) and find that the proportions of rookie CEOs choosing the *MWLI* and *MWMI* strategies for digital transformation are both higher than for experienced CEOs. This needs to be empirically tested.

4.2. Main evidence

Table 3 reports the regression results for Equation (1). Column (1) presents the result for regression when *MWLI* is the dependent variable and Column (2) presents the result when *MWMI* is the dependent variable. The coefficient of *Rookie* in Column (1) is positive and significant at the 5% level, whereas that of *Rookie* in Column (2) is not significant; this indicates that rookie CEOs tend to choose the MWLI strategy of digital transformation. This finding supports hypothesis H1a[11].

4.3. Robustness test

4.3.1. Endogeneity

We apply the propensity score matching and difference-in-differences model (PSM-DID) to further test the previous hypotheses and alleviate the endogeneity problem. We drop observations with temporal discontinuities during the sample period (i.e., for which the change year cannot be identified), observations with missing data, observations for which the CEO change process is complex[12] and observations of firms that always hire rookie CEOs. In the DID model, *Treat* is the group variable; firms that change from experienced CEOs to

[10] The reason for the large difference in the means of some industries may be the small sample size of these industries.
[11] The dependent variables in Columns (1) and (2) are different, implying that the sample sizes of the regressions are also different. Considering that the following analysis is mainly based on the results in Column (1), we use this regression to determine the sample size.
[12] "Complex" process of CEO change means that a firm changes its CEO several times during the sample period, including both from an experienced CEO to a rookie CEO and from a rookie CEO to an experienced CEO.

Table 2
Descriptive statistics.

Panel A: Descriptive statistics of *Rookie* for different years

Year	N	Mean	SD
2007	166	0.627	0.485
2008	182	0.621	0.487
2009	198	0.576	0.495
2010	206	0.607	0.490
2011	229	0.616	0.487
2012	269	0.617	0.487
2013	298	0.671	0.471
2014	291	0.653	0.477
2015	310	0.661	0.474
2016	329	0.696	0.461
2017	345	0.693	0.462
2018	335	0.648	0.478
2019	299	0.652	0.477

Panel B: Descriptive statistics of *Rookie* for different industries

Industry	N	Mean	SD
A Agriculture, forestry, animal husbandry and fishery	46	0.935	0.250
B Mining	86	0.802	0.401
C Manufacturing	2,060	0.639	0.480
D Production and supply of electricity, heat, gas and water	132	0.727	0.447
E Construction	91	0.582	0.496
F Wholesale and retail	314	0.602	0.490
G Transportation, storage and postal services	167	0.599	0.492
H Accommodation and catering	43	0.349	0.482
I Information transmission, software and information technology services	15	0.800	0.414
K Real estate	239	0.640	0.481
L Leasing and business services	66	0.727	0.449
M Scientific research and technical services	12	0.750	0.452
N Water conservancy, environment and public facilities management	36	0.583	0.500
O Residential services, repairs and other services	8	0.500	0.535
P Education	2	1.000	0.000
Q Health and social work	6	0.833	0.408
R Culture, sports and entertainment	66	0.788	0.412
S Other industries	68	0.735	0.444

Panel C: Descriptive statistics of variables

Variable	N	Mean	Min	p50	Max	SD
MWLI	3,457	0.284	0.000	0.000	1.000	0.451
MWMI	3,457	0.144	0.000	0.000	1.000	0.351
Rookie	3,457	0.647	0.000	1.000	1.000	0.478
Size	3,457	22.350	19.531	22.236	26.366	1.296
Lev	3,457	0.496	0.065	0.504	0.942	0.204
ROA	3,457	0.028	–0.262	0.028	0.197	0.061
Growth	3,457	0.228	–0.681	0.095	5.887	0.761
Soe	3,457	0.573	0.000	1.000	1.000	0.495
Top1	3,457	0.371	0.092	0.357	0.780	0.156
Boardsize	3,457	2.158	1.609	2.197	2.708	0.195
MH	3,457	0.044	0.000	0.000	0.683	0.125
Duality	3,457	0.122	0.000	0.000	1.000	0.327
Female	3,457	0.061	0.000	0.000	1.000	0.239
Age	3,457	3.858	3.466	3.871	4.143	0.137
Tenure	3,457	0.889	0.011	0.926	1.607	0.441
Internal	3,457	0.662	0.000	1.000	1.000	0.473
RD_back	3,457	0.158	0.000	0.000	1.000	0.364

SD: standard deviation; Min: minimum; Max: maximum; p50: 50th percentile.

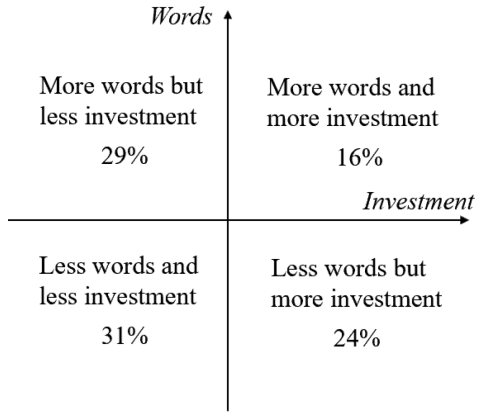

Fig. 3. Strategy distribution of rookie CEOs.

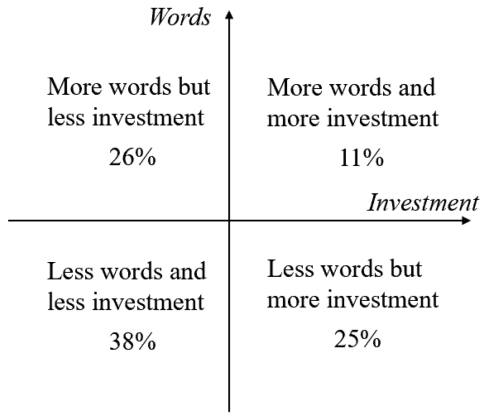

Fig. 4. Strategy distribution of experienced CEOs.

rookie CEOs belong to the treatment group, and firms that always hire experienced CEOs belong to the control group. *Treat* equals 1 if firm *i* belongs to the treatment group, and 0 otherwise. *Post* is a dummy variable that equals 1 if the CEO of firm *i* in year *t* is a rookie, and 0 otherwise. The interaction term *Treat* × *Post* is added to the model to explore the impact of rookie CEOs on firms' digital transformations. Before using the DID model, the PSM method is used to find firms in the control group similar to those in the treatment group. Specifically, we use the logit model for regression, select the firm size (*Size*), leverage (*Lev*), return on total assets (*ROA*) and revenue growth rate (*Growth*) as covariables[13] and use the nearest neighbor, without replacement, caliper 0.01 method for matching. Table 4 reports the results of testing covariate differences after matching. We find no significant differences in covariates after PSM. The results in Table 5 show that when the dependent variable is *MWLI*, the coefficient of the interaction term *Treat* × *Post* is 0.965 and significant at the 10% level; when the dependent variable is *MWMI*, the coefficient of the interaction term *Treat* × *Post* is not significant, indicating that rookie CEOs prefer to disclose more but invest less in digital transformation; this supports our main conclusions.

4.3.2. Alternative measure of variable

In the main test, we use digitalization-related intangible assets to measure investment in digital transformation. Following Wang et al. (2017), we further extract IT investment items (such as hardware and software

[13] We choose the above variables as covariates because studies show that firms with complex, large and diversified businesses and that are in trouble are likely to employ experienced CEOs (Elsaid et al., 2011; Gudell, 2011).

Table 3
Rookie CEOs and firms' digital transformations.

	(1) *MWLI* More Words but Less Investment	(2) *MWMI* More Words and More Investment
Rookie	**0.272****	**0.083**
	(2.03)	**(0.70)**
Size	0.226*	0.290***
	(1.92)	(2.95)
Lev	–0.803	0.042
	(–1.59)	(0.09)
ROA	1.433	0.005
	(1.34)	(0.00)
Growth	0.013	0.076
	(0.21)	(1.43)
Soe	–0.139	–1.445***
	(–0.40)	(–3.69)
Top1	–1.744**	–0.478
	(–2.34)	(–0.76)
Boardsize	0.774*	1.175***
	(1.65)	(2.78)
MH	–0.723	0.341
	(–0.79)	(0.38)
Duality	–0.153	–0.024
	(–0.81)	(–0.14)
Female	0.128	–0.207
	(0.49)	(–0.89)
Age	0.060	–0.298
	(0.12)	(–0.65)
Tenure	0.024	–0.087
	(0.22)	(–0.93)
Internal	0.025	0.278**
	(0.19)	(2.28)
RD_back	0.257	–0.096
	(1.41)	(–0.62)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	3457	4256
Pseudo-R^2	0.210	0.223

Note: Columns (1) and (2) show the results of Logit model regression, with z-values in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively; the same holds below.

investment) from the annual report and use the IT investment adjusted by operating revenue to measure investment in digital transformation. Based on this, we regenerate the variables of digital transformation with more words but less investment (*MWLI_IT*) and digital transformation with more words and more investment (*MWMI_IT*) for testing. Hardware investment comprises the amount of computer (large, medium and micro), electronic, communication and network equipment extracted from fixed asset items. Software investment comprises the amount of assets related to software and management systems extracted from intangible asset items. Table 6 reports the regression results, which show that the main conclusions hold when using the alternative measure of the dependent variable.

4.3.3. Exclusion of alternative explanation

Compared with experienced CEOs, rookie CEOs are disadvantaged in terms of management experience and resource allocation. In practice, the following situations may occur. Rookie CEOs may decide to increase information disclosure and investment in digital transformation at the same time, but not be familiar with firm operations in the early stages of tenure and not have established their authority with the management. It is

Table 4
Comparison of sample characteristics before and after matching.

Variable	Sample	Mean		%Bias	T
		Treated	Control		
Size	Before	22.527	22.152	27.5	8.02
	After	22.139	22.209	–5.2	–1.46
Lev	Before	0.511	0.443	33.2	9.82
	After	0.445	0.455	–4.7	–1.29
ROA	Before	0.031	0.035	–7.5	–2.21
	After	0.036	0.035	1.5	0.41
Growth	Before	0.210	0.199	1.8	0.53
	After	0.193	0.204	–1.8	–0.50

Table 5
Endogeneity test.

	(1)	(2)
	MWLI	*MWMI*
Treat* × *Post	**0.965***	**–0.445**
	(1.92)	**(–0.92)**
Size	0.183	0.364
	(0.44)	(1.22)
Lev	–3.651**	0.446
	(–2.12)	(0.34)
ROA	–6.461**	3.693
	(–2.05)	(1.06)
Growth	0.394*	0.038
	(1.68)	(0.24)
Soe	–1.434	0.500
	(–1.48)	(0.49)
Top1	0.858	0.297
	(0.39)	(0.18)
Boardsize	2.220	5.146***
	(1.23)	(3.24)
MH	–0.472	–0.668
	(–0.20)	(–0.28)
Duality	–1.072*	0.103
	(–1.89)	(0.18)
Female	–0.554	–0.954
	(–0.42)	(–1.06)
Age	3.300**	–3.443**
	(2.17)	(–2.51)
Tenure	0.089	–0.340
	(0.28)	(–1.29)
Internal	0.228	0.632
	(0.50)	(1.52)
RD_back	–0.741	–0.667
	(–1.19)	(–1.32)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	538	638
Pseudo-R^2	0.340	0.282

therefore difficult for these CEOs to skillfully deploy the corresponding resources, resulting in subpar final implementation. Thus, only information disclosure about digital transformation increases, but not related investments. To exclude the influence of the above alternative explanation, we conduct a test from the perspective of management power. We use *Duality* to measure management power. When a CEO is also the chairman of the board, we consider the CEO to have greater management power, and vice versa. Column (1) of Table 7

Table 6
Alternative measure of variable.

	(1) *MWLI_IT*	(2) *MWMI_IT*
Rookie	**0.255***	**0.054**
	(1.95)	**(0.44)**
Size	0.269**	0.213**
	(2.35)	(2.09)
Lev	–0.049	–0.712
	(–0.10)	(–1.54)
ROA	2.139*	–0.192
	(1.86)	(–0.19)
Growth	0.102*	–0.012
	(1.94)	(–0.21)
Soe	–0.328	–1.196***
	(–0.84)	(–3.26)
Top1	–1.693**	–0.407
	(–2.33)	(–0.61)
Boardsize	0.359	1.661***
	(0.80)	(3.76)
MH	0.501	–0.240
	(0.57)	(–0.28)
Duality	–0.194	0.101
	(–1.00)	(0.58)
Female	0.200	–0.441*
	(0.76)	(–1.91)
Age	–0.214	–0.213
	(–0.43)	(–0.44)
Tenure	0.011	–0.061
	(0.10)	(–0.63)
Internal	0.187	0.134
	(1.47)	(1.04)
RD_back	0.037	0.061
	(0.21)	(0.36)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	3565	3894
Pseudo-R^2	0.208	0.218

reports the regression results. The coefficient of the interaction term *Rookie* × *Duality* is not significant, indicating that our findings are not affected by management power. Thus, the alternative explanation is partially excluded.

4.3.4. Controlling for the succession-year effect of experienced CEOs

We focus on the decision-making characteristics of rookie CEOs in the early stages of tenure, but the succession year of experienced CEOs may also impact our findings. Therefore, we control for the succession-year effect of experienced CEOs. We add the interaction term *Experienced* × *Succession_year* to the model[14]. Columns (2) and (3) of Table 7 report the regression results. After controlling for the interaction term, the main results remain stable.

[14] *Experienced*: If there is a CEO change in firm *i* in year *t* and the successor held the position of CEO for the last employer, then it is regarded as a non-first-time appointment. For such cases, *Experienced* equals 1, and 0 otherwise. *Succession_year*: *Succession_year* equals 1 if the year is the CEO's succession year, and 0 otherwise. In addition, after controlling for *Experienced* × *Succession_year*, the addition of *Experienced* causes the model problem of a dummy variable and the addition of *Succession_year* is absorbed by the year fixed effect.

Table 7
Other robustness tests.

	Exclusion of alternative explanation	Controlling for the succession-year effect of experienced CEOs		Redefining the succession year	
	(1)	(2)	(3)	(4)	(5)
	MWLI	*MWLI*	*MWMI*	*MWLI*	*MWMI*
Rookie	**0.313****	**0.275***	**0.123**	**0.283***	**0.132**
	(2.19)	**(1.80)**	**(0.91)**	**(1.88)**	**(1.00)**
Rookie* × *Duality	**–0.330**				
	(–0.84)				
Experienced × *Succession_year*		0.006	0.102		
		(0.03)	(0.64)		
Size	0.223*	0.226*	0.290***	0.428***	0.354***
	(1.89)	(1.92)	(2.95)	(3.05)	(3.09)
Lev	–0.806	–0.803	0.042	–1.367**	–0.419
	(–1.59)	(–1.59)	(0.09)	(–2.27)	(–0.83)
ROA	1.452	1.434	0.011	2.622*	1.108
	(1.35)	(1.34)	(0.01)	(1.95)	(0.95)
Growth	0.013	0.013	0.072	–0.124	0.013
	(0.22)	(0.21)	(1.35)	(–1.48)	(0.17)
Soe	–0.133	–0.139	–1.449***	0.053	–1.058**
	(–0.38)	(–0.40)	(–3.70)	(0.12)	(–2.47)
Top1	–1.744**	–1.744**	–0.467	–0.866	–1.126
	(–2.34)	(–2.34)	(–0.74)	(–1.04)	(–1.61)
Boardsize	0.800*	0.774	1.171***	0.664	0.706
	(1.70)	(1.64)	(2.77)	(1.23)	(1.46)
MH	–0.767	–0.723	0.330	–0.848	–1.009
	(–0.83)	(–0.79)	(0.37)	(–0.78)	(–0.97)
Duality	0.064	–0.152	–0.023	–0.293	–0.199
	(0.20)	(–0.81)	(–0.14)	(–1.38)	(–1.01)
Female	0.118	0.128	–0.209	0.275	–0.102
	(0.46)	(0.50)	(–0.90)	(0.94)	(–0.40)
Age	0.096	0.060	–0.304	0.073	–0.253
	(0.19)	(0.12)	(–0.66)	(0.13)	(–0.50)
Tenure	0.020	0.026	–0.056	–0.085	–0.257**
	(0.18)	(0.21)	(–0.53)	(–0.62)	(–2.22)
Internal	0.023	0.025	0.278**	0.117	0.311**
	(0.17)	(0.19)	(2.28)	(0.75)	(2.29)
RD_back	0.254	0.256	–0.095	0.196	–0.048
	(1.40)	(1.41)	(–0.61)	(0.92)	(–0.28)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	3457	3457	4256	2744	3649
Pseudo-R^2	0.210	0.210	0.223	0.200	0.204

4.3.5. Redefining the succession year

In the previous section, if the CEO accepts the position before 31 December of a given year, then that year is regarded as the succession year. To enhance the robustness of the conclusion, we redefine the succession year of a CEO. Only when a CEO accepts the position before July of a given year is that year regarded as the succession year; otherwise, the next year is regarded as the succession year. Columns (4) and (5) of Table 7 report the regression results. We find that the main results hold after redefining the succession year.

5. Mechanism test

5.1. Impact of performance pressure

The above analysis shows that rookie CEOs prefer to disclose more but invest less in digital transformation. Compared with experienced CEOs, rookie CEOs face more intense performance pressure. Thus, rookie CEOs have stronger motivations to ease their career concerns and choose the MWLI strategy of digital transformation. Performance is an important criterion by which the board and investors evaluate rookie CEOs' management abilities. When rookie CEOs face high performance pressure, which makes it difficult for them to meet performance expectations through traditional operations, they are likely to adopt the MWLI strategy and prevent the board from losing confidence in their management abilities.

5.1.1. Impact of former CEO performance

Previous firm performance affects the expectations of the board and investors for the current period. Based on prospect theory, individuals care not only about absolute levels of performance, but also about relative levels, which are derived from reference points. The reference points can be either past performance or peer performance (Liu and Xue, 2015). The board's evaluation criteria for a successor CEO are then adjusted based on previous performance. If a firm's performance before CEO succession is better than that of its peers, then the performance evaluation standard after CEO succession is increased. Conversely, if a firm's performance before CEO succession is worse than that of its peers, then the performance evaluation standard after CEO succession is decreased. In addition, if the successor fails to achieve the expected goals, then the failure can be attributed to the poor development trend of the firm; this might have made it difficult to achieve performance growth in the short term. Thus, when former CEOs leave records of good performance, rookie CEOs face severe career concerns and have strong incentives to use the MWLI strategy of digital transformation.

To test the above, we generate a dummy variable *H_PROA* based on firm performance in the year before CEO succession. We use *ROA* to measure the performance. *H_PROA* equals 1 if the firm performance in the year before CEO succession is better than the annual industry median, and 0 otherwise. Column (1) of Table 8 reports the regression results with the interaction term added. We find that the coefficient of *Rookie* × *H_PROA* is positive and significant at the 10% level, indicating that the better is the performance in the year before CEO succession, the stronger is the pressure on the rookie CEO. This strengthens the rookie CEOs' motivations to choose the MWLI strategy.

5.1.2. Impact of current performance of peers

The expectations of the board and investors for firm performance after CEO succession are not only affected by previous performance, but also by the current performance of peers. The performance of peers is a source of reference points in prospect theory. Peer performance pressure plays an important role in decision-making by rookie CEOs in the early stages of tenure. If a firm's performance is better than that of its peers in the current year, then the CEO's performance evaluation reference point is improved for the next year. This increases the pressure on rookie CEOs (Thaler and Johnson, 1990). Therefore, when a firm's current performance is better than that of its peers, rookie CEOs are likely to disclose more about digital transformation but invest less to alleviate performance pressure.

To test the above, we generate a dummy variable *H_ROA* based on firm performance in the current year. *H_ROA* equals 1 if firm performance in the current year is better than the annual industry median, and 0 otherwise. Column (2) of Table 8 reports the regression results with the interaction term added. We find that the coefficient of *Rookie* × *H_ROA* is positive and significant at the 10% level, indicating that when a firm's

Table 8
Impact of performance.

	Former CEO performance	Current performance of peers
	(1)	(2)
	MWLI	*MWLI*
Rookie* × *H_PROA	**0.599***	
	(1.73)	
Rookie* × *H_ROA		**0.387***
		(1.73)
Rookie	0.158	0.113
	(0.69)	(0.70)
H_PROA	–0.457	
	(–1.51)	
H_ROA		–0.092
		(–0.48)
Size	0.384**	0.245**
	(2.30)	(2.07)
Lev	–1.376**	–0.773
	(–1.99)	(–1.53)
ROA	2.814*	0.937
	(1.95)	(0.83)
Growth	0.016	0.012
	(0.21)	(0.19)
Soe	–0.420	–0.141
	(–0.88)	(–0.40)
Top1	–0.344	–1.834**
	(–0.34)	(–2.45)
Boardsize	1.217**	0.828*
	(1.97)	(1.75)
MH	–1.846	–0.774
	(–1.06)	(–0.84)
Duality	–0.006	–0.143
	(–0.02)	(–0.77)
Female	0.312	0.158
	(0.99)	(0.61)
Age	–0.941	0.125
	(–1.39)	(0.25)
Tenure	0.225*	0.023
	(1.65)	(0.22)
Internal	0.111	0.025
	(0.62)	(0.19)
RD_back	0.339	0.248
	(1.35)	(1.37)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	2145	3457
Pseudo-R^2	0.205	0.212

performance is better than that of its peers in the same period, rookie CEOs have strong motivations to disclose more but invest less in digital transformation.

5.2. Difficulty of digital transformation

The high risk and difficulty of digital transformation is an important driver of rookie CEOs' tactical choices and their preference to disclose more but invest less. The conditions for transformation vary greatly across firms. When a firm's digital transformation is difficult, the risk of investment in transformation and possibility of failure are high. This prompts rookie CEOs to disclose more but invest less in digital transformation. We

measure the difficulty of digital transformation from two perspectives: business complexity and asset liquidity. The higher is the business complexity of a firm, the more complex is the organizational structure. In such cases, the internal and external coordination costs related to digital transformation are high and the overall planning and final implementation of transformation strategy are difficult. When a firm's asset liquidity is low, on the one hand, it is difficult to realize assets at a low cost to obtain the corresponding financial support for digital transformation; on the other hand, when facing sudden financial difficulties, the firm may have poor coping abilities, thus the risk and difficulty of digital transformation is higher (Doina and Mircea, 2008). Therefore, when business complexity is high and asset liquidity is low, rookie CEOs are likely to disclose more but invest less in digital transformation.

Following Zhang and Wang (2014), we use the number of industries involved in the operating revenue to measure the business complexity of a firm. We generate a dummy variable *H_Complicated*, which equals 1 if the business complexity of a firm is greater than the annual industry median, and 0 otherwise. We also use the ratio of current assets to total assets to measure asset liquidity and generate a dummy variable *H_LIQ*, which equals 1 if a firm's asset liquidity is higher than the annual industry median, and 0 otherwise. Table 9 reports the regression results with the interaction term added[15]. The coefficient of *Rookie* × *H_Complicated* is positive and significant at the 1% level and that of *Rookie* × *H_LIQ* is negative and significant at the 1% level. This suggests that for firms with complex business and low asset liquidity, implementing digital transformation is difficult and risky; this prompts rookie CEOs to disclose more but invest less in digital transformation.

6. Additional analyses

6.1. Internal and external governance roles

When the internal and external governance of a firm is effective, the performance assessment and supervision of the CEO are stringent. In such cases, it is difficult and costly for rookie CEOs to demonstrate management abilities using the MWLI strategy of digital transformation. We use board meeting frequency and institutional investor shareholdings to examine the impact of internal and external governance mechanisms, respectively. Meetings can help the board improve the effectiveness of supervision and are conducive to the accurate and comprehensive evaluation of CEOs (Zhang and Zeng, 2005; Niu and Li, 2007). In addition, the higher is the shareholding ratio of institutional investors, the more active they are in corporate governance and the more likely they are to professionally and effectively supervise CEOs. Therefore, when a firm has frequent board meetings and large institutional investor shareholdings, rookie CEOs are unlikely to disclose more but invest less in digital transformation.

To test the above, we generate two dummy variables, *H_BMeeting* and *H_INS*, based on the board meeting frequency and institutional investor shareholdings. *H_BMeeting* equals 1 if the board meeting frequency is more than the annual industry median, and 0 otherwise. *H_INS* equals 1 if the institutional investor shareholdings are more than the annual industry median, and 0 otherwise. Table 10 reports the regression results with the interaction term added. We find that the coefficients of both *Rookie* × *H_BMeeting* and *Rookie* × *H_INS* are negative and significant at the 5% level. These results indicate that when firms have more board meetings and institutional investor shareholdings, rookie CEOs have less motivation to disclose more but invest less in digital transformation.

6.2. Economic consequences of the MWLI digital transformation strategy

To gain positive evaluations from the board and reduce the risk of termination, rookie CEOs tend to increase information disclosure about digital transformation without a correspondingly large increase in investment, which is a relatively conservative choice. In China, the tenure of managers is generally short[16]. This is an important driver of the adoption of the MWLI strategy by rookie CEOs. The above analysis proves

[15] Firm's business complexity data are obtained from the Wind database. The data for business revenue classification by industry of some firms are missing, so these observations are different from those above.

[16] Our statistical analysis shows that the median tenure of CEOs of Chinese A-share main board listed firms is only about 3 years.

Table 9
Impact of digital transformation difficulty.

	Business complexity	Asset liquidity
	(1)	(2)
	MWLI	*MWLI*
Rookie* × *H_Complicated	**0.701*** **	
	(2.72)	
Rookie* × *H_LIQ		**–0.629*** **
		(–2.71)
Rookie	0.070	0.620***
	(0.41)	(3.31)
H_Complicated	–0.545**	
	(–2.41)	
H_LIQ		0.521**
		(2.56)
Size	0.186	0.222*
	(1.51)	(1.88)
Lev	–0.589	–0.802
	(–1.12)	(–1.59)
ROA	1.121	1.358
	(1.01)	(1.27)
Growth	0.033	0.016
	(0.54)	(0.26)
Soe	0.154	–0.124
	(0.42)	(–0.35)
Top1	–1.573**	–1.761**
	(–2.04)	(–2.35)
Boardsize	0.799	0.796*
	(1.60)	(1.69)
MH	–0.503	–0.811
	(–0.53)	(–0.87)
Duality	–0.139	–0.166
	(–0.70)	(–0.88)
Female	0.125	0.145
	(0.47)	(0.56)
Age	–0.158	0.080
	(–0.30)	(0.16)
Tenure	0.085	0.014
	(0.76)	(0.13)
Internal	0.030	0.023
	(0.22)	(0.18)
RD_back	0.320*	0.255
	(1.67)	(1.40)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	3199	3457
Pseudo-R^2	0.221	0.213

that rookie CEOs prefer this strategy. However, whether they can alleviate career concerns through this MWLI strategy and decrease the possibility of being dismissed needs to be tested. The MWLI strategy can convey good signals of potential growth and help rookie CEOs decrease the possibility of being dismissed in the short term. However, it can only help improve the evaluation of management ability in the short term and has no positive impact on firm development in the long term. In addition, the board eventually obtains more information and makes accurate assessments of the CEOs' management abilities. The MWLI strategy thus cannot help CEOs decrease the possibility of being dismissed in the long term.

To test the above, we examine the impact of the MWLI strategy on the possibility of increasing CEO tenure. Table 11 reports the regression results. The dependent variable in Column (1) is the possibility of the CEO staying in office after 3 years (*Short_Succession*); the coefficient of *MWLI* is positive and significant

Table 10
Internal and external governance roles.

	Board meeting frequency	Institutional investor shareholdings
	(1)	(2)
	MWLI	*MWLI*
Rookie* × *H_BMeeting	**–0.499****	
	(–2.29)	
Rookie* × *H_INS		**–0.473****
		(–2.16)
Rookie	0.490***	0.531***
	(2.99)	(2.93)
H_BMeeting	0.516***	
	(2.80)	
H_INS		0.232
		(1.25)
Size	0.205*	0.237**
	(1.73)	(1.98)
Lev	–0.772	–0.821
	(–1.53)	(–1.62)
ROA	1.530	1.396
	(1.43)	(1.31)
Growth	0.002	0.016
	(0.04)	(0.26)
Soe	–0.140	–0.112
	(–0.40)	(–0.32)
Top1	–1.714**	–1.727**
	(–2.30)	(–2.30)
Boardsize	0.784*	0.794*
	(1.66)	(1.69)
MH	–0.680	–0.760
	(–0.74)	(–0.83)
Duality	–0.148	–0.153
	(–0.79)	(–0.81)
Female	0.149	0.141
	(0.58)	(0.54)
Age	0.071	0.057
	(0.14)	(0.11)
Tenure	0.043	0.026
	(0.40)	(0.25)
Internal	0.028	0.029
	(0.21)	(0.22)
RD_back	0.262	0.262
	(1.43)	(1.44)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	3457	3457
Pseudo-R^2	0.213	0.212

at the 1% level. The dependent variable in Column (2) is the possibility of the CEO staying in office after 6 years (*Long_Succession*); the coefficient of *MWLI* is positive but not significant[17]. These results show that the MWLI strategy can only help CEOs decrease the possibility of being dismissed in the short term, but not in the long term.

[17] We choose a 3-year period because CEOs usually serve a 3-year term. We also conduct the test using 4 and 5 years and the results are consistent with our findings.

Table 11
Economic consequences of the MWLI digital transformation strategy.

	(1) *Short_Succession*	(2) *Long_Succession*
MWLI	**0.707*****	**0.213**
	(4.38)	**(1.00)**
Rookie	–0.029	–0.315
	(–0.19)	(–1.41)
Size	0.334**	0.476**
	(2.43)	(2.06)
Lev	–1.080*	–3.216***
	(–1.73)	(–3.33)
ROA	1.295	0.383
	(1.07)	(0.16)
Growth	–0.021	–0.039
	(–0.28)	(–0.27)
Soe	0.667*	0.435
	(1.68)	(0.77)
Top1	–0.683	–2.983**
	(–0.76)	(–2.26)
Boardsize	–0.962*	–1.150
	(–1.65)	(–1.22)
MH	1.500	–4.078**
	(1.39)	(–2.26)
Duality	0.532**	–0.020
	(2.27)	(–0.06)
Female	0.307	0.512
	(0.97)	(1.21)
Age	–1.433**	–2.003**
	(–2.37)	(–2.20)
Tenure	2.818***	1.686***
	(16.68)	(8.37)
Internal	–0.142	0.963***
	(–0.93)	(3.98)
RD_back	–0.235	0.666**
	(–1.11)	(2.14)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	2186	1194
Pseudo-R^2	0.377	0.426

7. Conclusion

As the turnover of managers in the labor market increases, it is important to explore the impact of CEOs' career experience on their decision-making styles. Based on the theory of career concerns, we analyze the impact of rookie CEOs on firms' digital transformations. We find that a lack of CEO experience increases the career concerns of rookie CEOs in the early stages of tenure. Under immense pressure, rookie CEOs focus on short-term performance. In pursuit of positive evaluations of their management abilities and relief from performance pressure, rookie CEOs have strong motivations to release positive signals by increasing disclosures of digital transformation. However, their investment in digital transformation remains relatively low, indicating the adoption of an MWLI strategy. In such cases, the degree of digital investment does not match that of information disclosure. Mechanism analysis shows that when a former CEO performs well and the firm's current performance is better than that of its peers, performance pressure on the rookie CEO is high and the motivation to adopt the MWLI strategy is strong. In addition, it is difficult to implement digital transformation when a firm has complex business and low asset liquidity; this increases the possibility of MWLI strategy adoption by rookie CEOs. Further analysis shows that when the frequency of board meetings and proportion of shareholding by institutional investors are high, rookie CEOs face strict internal and

external supervision and inspection and are less likely to choose the MWLI strategy. The test of economic consequences suggests that the MWLI strategy can only help the CEO decrease the possibility of being dismissed in the short term, but not in the long term.

The theoretical and practical implications of our conclusions are as follows. We focus on CEOs' career experience and, based on career concerns theory, explore the impact of rookie CEOs on firms' digital transformations. We examine CEOs' decision-making styles in different contexts and find that under the influence of career concerns, rookie CEOs are motivated to release positive information about digital transformation to enhance external trust in their management abilities in the early stages of tenure, but the actual increase in relevant investments is low. Our results add to the literature on the factors affecting digital transformation. We not only explore the impact of rookie CEOs on firms' information disclosure about their digital transformations, but also consider their impact on firms' substantial digital transformation investments. We thus provide a comprehensive investigation of digital transformation behaviors. This work has practical implications for investors and can help better understand firms' digital transformation behaviors.

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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Governance or reputation? Flexible tax enforcement and excess goodwill: Evidence from the taxpaying credit rating system in China

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ABSTRACT

This study investigates the effect of flexible tax enforcement on firms' excess goodwill using unique manually collected data on taxpaying credit rating in China from 2014 to 2021. We document that A-rated taxpayer firms have less excess goodwill; A-rated firms reduce excess goodwill by 0.005 vis-a-vis non-A-rated firms, which accounts for 100% of the mean value of excess goodwill. This finding holds after multiple robustness tests and an endogeneity analysis. Moreover, this negative effect is more pronounced in firms with low information transparency, that are non-state-owned and that are located in regions with low tax enforcement intensity. The channel test results suggest that taxpaying credit rating system as flexible tax enforcement reduces firms' excess goodwill through a reputation-based effect and not a governance-based effect. This study reveals that the taxpaying credit rating system in China as flexible tax enforcement can bring halo effect to A rating firms, thereby limiting irrational M&As and breaking goodwill bubble.

1. Introduction

Taxpaying and tax enforcement are a long-term game between firms and the government. There are two tax enforcement patterns in the current tax system. One is mandatory tax enforcement, in which tax compliance is enforced through administrative and legal measures and non-compliance is penalized; examples are the Internal Revenue Service (IRS) monitoring in the U.S. and the General Anti-avoidance Rule (GAAR) in China.

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The other is flexible tax enforcement, in which the government encourages firms to pay taxes by giving incentives instead of penalties. Studies tend to focus on the governance effect of mandatory tax enforcement: that is, although the primary aim of the tax authority is to collect taxes, many procedures used for enforcing firms' tax compliance indirectly improve corporate governance by reducing managers' opportunistic behaviors, such as self-dealing and tax avoidance (Dyck and Zingales, 2004; Haw et al., 2004; Desai and Dharmapala, 2006; Desai et al., 2007; Mescall et al., 2012; Yost et al., 2022). Other scholars find that mandatory tax enforcement (for example, by the IRS) has a reputation effect that confers several benefits to firms, such as lower equity financing costs (El Ghoul et al., 2011), increased bank credit (Gallemore and Jacob, 2020), improved firm performance (Mironov, 2013) and greater value relevance (Kerr, 2019). However, the literature pays little attention to whether flexible tax enforcement also has governance- and reputation-based effects. Hence, this study addresses this research gap.

The taxpayer credit rating system in China provides a unique opportunity to explore the governance- and reputation-based effects of flexible tax enforcement. The State Administration of Taxation (SAT) issued the *Tax Payment Credit Management Measures* in July 2014.[1] The *Measures* stipulates that the tax authorities should assess the credit of all taxpaying firms annually and publish the list of firms with an A rating for the previous year in April of each year. Furthermore, the tax authorities provide many incentive measures for firms with a taxpayer credit rating of A, such as green channels for tax services, use of government funds and increased financing for A-rated taxpayers. Taxpayer credit rating differs from mandatory tax enforcement in the following five aspects. First, taxpayer credit rating is applicable to all taxpaying firms, whereas tax inspection and anti-tax avoidance activities are applicable only for firms with a high tax risk. Second, a "red list" of A-rated firms is published under the taxpayer credit rating system, whereas a "black list" of firms found to violate tax laws is published under mandatory tax enforcement. Third, taxpaying firms can take the initiative to provide rating materials to the tax authorities, and firms that have objections with the rating results can apply for re-evaluation. Fourth, firms included in the taxpayer credit management system are allowed to repair their taxpayer credit rating by making credit taxpaying promises and amend taxpaying credit-breaking behaviors. Last, the tax authorities use a hierarchical management system and adopt differential taxation and incentive strategies for firms based on their taxpayer credit ratings. Therefore, the incentive measures provided under the taxpayer credit rating system give considerable discretion to firms in choosing their taxpaying strategies, which illustrate the governance- and reputation-based effects of flexible tax enforcement.

We explore the governance- and reputation-based effects of flexible tax enforcement from the perspective of excess goodwill because excess goodwill has the dual attributes of governance bias and reputation orientation. According to the managerial irrationality hypothesis and agency theory, managers tend to conduct value-destroying mergers and acquisitions (M&As) due to their personal characteristics, such as overconfidence, and to engage in empire-building or enhance their personal reputation, which create goodwill bubbles (Jensen, 1986; Malmendier and Tate, 2008; Du et al., 2011; Chung and Hribar, 2021; Stevo and Thomas, 2021). Hence, if flexible tax enforcement can exert a governance-based effect and deter the opportunistic behaviors of managers, such as conducting irrational M&As, the excess goodwill of firms will decrease. Conversely, managers over-recognize goodwill to enhance their own and their firms' reputation because goodwill is listed as an asset in the balance sheet; this inflates a firm's book value and sends an incorrect signal to the market to increase the stock price (Du et al., 2011; Li and Sloan, 2017). Moreover, managers tend to conduct impression management by over-confirming goodwill and delaying the recognition of goodwill impairment (Li et al., 2017; Glaum et al., 2018). Hence, we can expect managers to reduce excess goodwill if flexible tax enforcement exerts a reputation-based effect on firms.

The gradual relaxation in M&A policies and the availability of diverse financing channels and payment methods have led to an M&A boom in China. Firms' goodwill assets and accounting for the proportion of goodwill in net assets has shown a sustained increase. For example, the M&A data from the China Stock Market & Accounting Research (CSMAR) database shows that the scale of total net goodwill of A-share listed

[1] The details of the *Tax Payment Credit Management Measures* can be found at the following website: https://www.chinatax.gov.cn/chinatax/n810341/n810755/c1150610/content.html.

firms increased rapidly from ¥ 37.6 billion in 2007 to ¥ 1.18 trillion in 2020,[2] an indication that goodwill assets grew approximately 32 times in 13 years. However, a high level of goodwill is often accompanied by considerable impairment risks (Li et al., 2011). There have been several incidents of stock price crashes due to high goodwill impairment in the Chinese markets recently. For example, in its performance forecast released on 11 January 2021, Goldcard Smart Group Co., Ltd. stated that its net profits in 2020 decreased by 73.62% to 82.41% from the net profits of 2019 because of high goodwill impairment in its two merged subsidiaries; this resulted in a stock price decrease of 16.38% the next day.[3] Furthermore, on 24 December 2020, Beijing Shuzhi Technology Co., Ltd. announced that it had a goodwill impairment of approximately ¥ 5.6–6.1 billion due to the continued deterioration of the operating performance of its four merged companies,[4] which led to a stock price decrease of 19.93% on the same day and the eventual delisting of the firm. Therefore, excess goodwill is like the sword of Damocles for listed firms, but the literature does not explore the governance- and reputation-based effects of flexible tax enforcement on excess goodwill.

We argue that taxpayer credit rating as flexible tax enforcement decreases firms' excess goodwill through two potential mechanisms: a governance-based effect and a reputation-based effect. The governance-based effect operates through the taxpayer credit rating and restrains the opportunistic behaviors of managers by increasing corporate governance. The SAT discloses the names of A-rated taxpayer firms, which attracts the attention of media and analysts. Greater attention from the media and analysts suggests greater external corporate governance and less information asymmetry, which limits managers' opportunistic behaviors. Moreover, the SAT provides several joint incentives and punitive measures. Therefore, managers would increase their compliance to obtain an A rating, thereby reducing their opportunistic behaviors for short-term interests at the cost of long-term interests. Moreover, managers may conduct M&As rationally and reduce the over-recognition of goodwill to obtain a high taxpayer credit rating. The reputation-based effect operates through the high reputation of A-rated firms. If firms receive a taxpayer credit rating of A, the SAT publicizes their names, which shows that the government endorses their high tax compliance. In contrast, no good news is bad news. A non-A taxpayer credit rating signals to external stakeholders that a firm has poor tax compliance and its accounting information quality is low. Hence, external stakeholders tend to trust and positively evaluate A-rated firms more. The improvement in firm reputation brought by flexible tax enforcement makes it unnecessary for managers to undertake risky activities to confirm excess goodwill.

To investigate the negative relationship between flexible tax enforcement and firms' excess goodwill and test the two proposed mechanisms, we conduct multiple tests using manually collected taxpayer credit rating data from 2014 to 2021 in China. We choose Chinese listed firms as our sample for the following reasons. First, based on the *Tax Payment Credit Management Measures* issued in July 2014, the SAT assesses and publishes the "red list" of A-rated firms of the previous year in April of each year. Moreover, the tax authorities provide several incentive measures to A-rated firms, such as differential tax enforcement, taxpayer credit repair, and joint incentives, such as financing preferences. Hence, the taxpayer credit rating system in China provides a unique opportunity to capture and explore the governance- and reputation-based effects of flexible tax enforcement. Indeed, the number of M&As and firms' goodwill assets and the accounting of goodwill as a proportion of net assets have increased in China in recent years. However, a high level of goodwill carries a high risk of goodwill impairment. In the Chinese capital markets, goodwill impairment frequently causes stock price crashes and delistings. Therefore, Chinese listed firms are a representative sample for exploring the effect of flexible tax enforcement on excess goodwill and providing policy implications for other developing countries.

The following are the findings of this study. First, A-rated taxpayer firms are more likely to have less excess goodwill than non-A-rated firms, which suggests that taxpayer credit rating as flexible tax enforcement can

[2] The data are from the M&A sub-database of the *CSMAR* database.

[3] News and specific data are from the announcement on the provision for goodwill impairment for 2020 by Goldcard Smart Group Co., Ltd. (300349.SZ) on 27 April 2021. More details can be found on the website: https://quotes.money.163.com/f10/ggmx_300349_7138573.html.

[4] News and specific data are from the announcement on the decline in the business performance of the subsidiaries and the existence of goodwill impairment risk of Beijing Shuzhi Technology Co., Ltd. (300038.SZ) on 23 December 2020. More details can be found on the website: https://quotes.money.163.com/f10/ggmx_300038_6804762.html.

burst the goodwill bubble and limit the number of irrational M&As. We find that A-rated taxpayer firms reduce excess goodwill by 0.005 compared with non-A-rated firms, which accounts for 100% of the mean value of excess goodwill. Second, the negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms that are less transparent, not owned by the state and located in a province with low tax enforcement intensity. Last, we find that flexible tax enforcement does not have a governance-based effect on excess goodwill because the coverage by media and analysts, agency costs and CEOs' overconfidence do not weaken the negative effect of flexible tax enforcement on excess goodwill. In contrast, we show that flexible tax enforcement exerts a reputation-based effect on excess goodwill: reputation-enhancing news, such as optimistic analysts' forecasts and philanthropic activities, weakens the negative effect, whereas reputation-damaging news strengthens the negative effect. Our results remain robust after we address endogeneity using the instrumental variable method and propensity score matching and conduct multiple robustness tests, such as falsification tests, changing the measurement of excess goodwill, using an alternative regression model and changing the sample.

This study makes the following contributions to the literature. First, unlike previous studies that focus on mandatory tax enforcement by, for example, the IRS and the GAAR (e.g., Dyck and Zingales, 2004; Haw et al., 2004; Desai and Dharmapala, 2006; Desai et al., 2007; Mescall et al., 2012; Yost et al., 2022), this study uses the taxpayer credit rating system in China to capture the effect of flexible tax enforcement on firms' excess goodwill and reveals that flexible tax enforcement can burst the goodwill bubble, thereby enriching the literature on tax enforcement and excess goodwill from the perspective of flexible tax enforcement. Second, unlike the studies that show a governance-based effect of mandatory tax enforcement (e.g., Dyck and Zingales, 2004; Haw et al., 2004; Desai and Dharmapala, 2006; Desai et al., 2007; Mescall et al., 2012; Yost et al., 2022), this study captures the reputation-based effect, thus expanding the effects of flexible tax enforcement vis-a-vis mandatory tax enforcement and helping to open the black box of the negative effect of flexible tax enforcement on firms' excess goodwill. Last, we reveal that the negative effect of flexible tax enforcement on excess goodwill is state-dependent, which suggests that the governance- and reputation-based effects of flexible tax enforcement vary in different situations, such as CEO duality, firms' information environment, firms' property rights and the tax enforcement intensity.

The remainder of this paper is organized as follows. Section 2 presents the research background, theoretical analysis and hypothesis development. Section 3 presents the sample selection, variable definitions and research model. Section 4 shows the main results of the negative effect of flexible tax enforcement on excess goodwill and discusses the results of the robustness tests and endogeneity analysis. Section 5 tests the governance- and reputation-based effects. Section 6 discusses the results of the heterogeneity analysis. Finally, Section 7 presents the concluding remarks and the study's limitations.

2. Background and hypothesis development

2.1. Institutional background

The *Tentative Measures on the Administration of Tax Payment Credit Rating* issued by the *SAT* on 17 July 2003 stipulates that the tax authorities must assess firms' taxpayer credit rating biennially based on their performance on tax compliance. Thus, the taxpayer credit rating system has now been in operation for nearly two decades. On 1 October 2014, the *SAT* further issued the *Tax Payment Credit Management Measures* and started publishing the list of A-rated taxpayer firms annually. There are four taxpayer credit ratings (based on a maximum score of 100 points): A (above 90), B (70–90), C (40–70) and D (below 40). In 2018, the SAT announced the *Notice on Matters Related to Tax Credit Evaluation* and added the M rating for newly established firms. In November 2019, the SAT issued the *Notice Concerning Tax Payment Credit Repair*, which was implemented on 1 January 2020. This *Notice* stipulates that firms in the taxpayer credit management system can repair their taxpayer credit through credit commitments and amending their dishonest behavior. Hence, the tax authorities encourage and guide taxpaying firms to enhance their compliance with tax laws, thereby building a flexible tax supervision mechanism based on tax credit and supplement the mandatory tax enforcement mechanism.

Tax authorities have to classify and manage taxpayers at different credit levels to encourage them to maintain their credit ratings and penalize those with poor ratings. The SAT gives the following incentive measures to A-rated taxpayer firms[5]: (I) the list of A-rated firms is made public annually; (II) general taxpayers can receive the amount on their VAT invoice for 3 months at a time and use it whenever they have to adjust that amount on the VAT invoice; (III) firms can receive ordinary invoices on demand; (IV) taxpayers who receive the credit rating of A for 3 consecutive years are provided with green channels by tax authorities or assisted by specialized personnel in tax-related matters in addition to the incentives measures mentioned above; (V) joint incentive measures are provided, such as 41 preferential policies and green channels in terms of project approvals, tax services, use of fiscal funds and financing by tax authorities and other departments based on actual conditions.

2.2. Theory analysis and hypothesis development

2.2.1. Flexible tax enforcement and excess goodwill

Managers directly participate in the M&A decision-making process, such as the selection, valuation and pricing of the target firm. Studies based on the managerial irrationality hypothesis and agency theory document that managers misuse their information advantage to engage in value-destroying M&As to pursue empire-building and self-interests (Jensen, 1986; Malmendier and Tate, 2008; Du et al., 2011; Chung and Hribar, 2021; Stevo and Thomas, 2021). Furthermore, managers tend to over-recognize goodwill to enhance their own and firms' reputations by inflating firms' book value or delay the recognition of goodwill impairment to conduct impression management with external stakeholders (Du et al., 2011; Li et al., 2011; Li and Sloan, 2017; Glaum et al., 2018). Taxpayer credit rating as a flexible tax enforcement mechanism enhances firms' corporate governance. Therefore, we posit that flexible tax enforcement limits managers' opportunistic behaviors, improves firm reputation and reduces the risks or costs of overestimating goodwill through governance- and reputation-based effects.

Studies confirm that mandatory tax enforcement has a governance effect, which reduces managers' opportunistic behaviors, such as self-dealing and tax avoidance (e.g., Dyck and Zingales, 2004; Haw et al., 2004; Desai and Dharmapala, 2006; Desai et al., 2007; Mescall et al., 2012; Yost and Shu., 2022). Similarly, taxpayer credit rating as flexible tax enforcement may play a governance role by reducing firms' excess goodwill. The SAT's annual list of A-rated taxpayer firms attracts the attention of media and analysts due to the sensation or halo effect. The literature also documents that the attention of media and analysts has an external governance effect on reducing managers' opportunistic behaviors (Dyck et al., 2008; Chen et al., 2015; Dai et al., 2015; Guo et al., 2019). Therefore, the attention by media and analysts can decrease managers' opportunistic behaviors by increasing the level of corporate governance and decreasing information asymmetry, as they are information intermediaries and external monitors. Chen et al. (2019) argue that firms with greater visibility are more likely to receive greater media coverage and that managers express increasing concerns about media coverage reporting about taxes. However, the SAT also provides several incentives to A-rated firms, such as priority consideration in project approvals, tax administration, fiscal funds, foreign exchange management and import–export. The SAT also imposes sanctions for a low taxpayer credit rating (for example, a D rating), such as restrictions on financing and credit grants by financial institutions, the prohibition of high-consumption behaviors and restrictions on senior executives of D-rated taxpayers serving as legal representatives, directors, supervisors and managers in other firms. Therefore, managers have an incentive to increase their tax compliance and get an A rating to obtain preferential treatment and avoid penalties, which reduces their opportunistic behaviors, such as recognition of excess goodwill. Hence, flexible tax enforcement can decrease excess goodwill through a governance-based effect.

Taxpayer credit rating as flexible tax enforcement also exerts a reputation-based effect on decreasing excess goodwill. The evaluation indicators of tax credit rating include firms' historical tax information and other indicators, such as taxpayers' credit record in the industry, quality inspection, environmental protections, bor-

[5] Detailed incentive measures information for A-rated taxpayer firms can be found in the State Taxation Administration. Website: https://www.chinatax.gov.cn/chinatax/n810341/n810825/c101434/c480960/content.html.

rowing history. Therefore, an A rating indicates that a firm has good credit in many aspects. Moreover, the inclusion of a firm on the annual list of A-rated firms sends a positive signal to external stakeholders that the firm is compliant with tax regulations and laws, which increases the firm's reputation. In a survey conducted by Shevlin et al. (2014), more than half of the firm executives stated that they considered potential damage to firm reputation to be an important factor in their tax planning strategies. In contrast, the low taxpayer credit rating of a firm sends a negative signal to external stakeholders that the firm is unreliable, has poor tax compliance and low accounting information quality, which damages the reputation of its managers and the firm. The SAT also publishes the list of D-rated taxpayers and its senior executives along with a list of major tax cases through its enterprise credit information publicity system, which considerably damages the reputation of tax violators. Hence, external stakeholders trust A-rated firms more and evaluate them more positively. Consequently, the increase in firm reputation brought about by flexible tax enforcement makes it unnecessary for managers to conduct impression management by recognizing excess goodwill. According to efficient contracting theory, the CEO's high reputation is associated with reduced adverse selection and moral hazard, lower agency costs and greater capital investment (Milbourn, 2003; Jian and Lee, 2011). Hence, managers avoid engaging in opportunistic behaviors of over-recognizing goodwill to protect their own reputation. Therefore, flexible tax enforcement decreases firms' excess goodwill through a reputation-based effect. We propose the following hypothesis:

H1. Flexible tax enforcement is negatively associated with firms' excess goodwill.

2.2.2. Flexible tax enforcement, information transparency and excess goodwill

Desai and Dharmapala (2006) argue that tax avoidance activities are complex, and Kerr (2019) provides direct evidence that there is less tax avoidance by firms when their financial reporting is transparent. The literature confirms that both mandatory and flexible tax enforcement reduce information asymmetry (e.g., Chen et al., 2018; Guay et al., 2019). Hence, we hypothesize that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms with low information transparency. A low level of information transparency implies that external stakeholders cannot easily obtain internal, private firm information, which makes them more dependent on public information. Hence, if a firm is on the SAT's list of A-rated taxpayers, external stakeholders may interpret it as a positive signal, thus strengthening the reputation-based effect of taxpayer credit rating. In contrast, firms with low information transparency are more likely to engage in tax avoidance (Kerr, 2019) and recognize excess goodwill because managers have more discretion when conducting M&A valuation (Du et al., 2011). Thus, from the perspective of a governance-based effect, flexible tax enforcement has a more negative effect on excess goodwill in firms with low information transparency because there is a greater reduction in information asymmetry in such firms. Therefore, we propose the following hypothesis:

H2. The negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms with low information transparency than in firms with high information transparency.

2.2.3. Flexible tax enforcement, property rights and excess goodwill

There are two types of firms in China in terms of property rights: state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs). We assume that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in non-SOEs than in SOEs because non-SOEs are more sensitive to tax liability and more likely to engage in tax avoidance. Moreover, SOEs tend to be monopolies and receive considerable government support, whereas non-SOEs face greater pressure to survive because of competition and their behaviors are profit-driven. Hence, taxpayer credit rating as flexible tax enforcement can exert a greater effect on non-SOEs because they have a greater incentive to acquire a reputation of being tax compliant and obtain government incentives. The political system of governance and control make SOEs natural for them to obtain an A rating, which weakens the reputation-based effect of taxpayer credit rating. The after-tax profits of non-SOEs belong to the shareholders. Based on the economic man theory, it can be expected that tax avoidance by non-SOEs is more serious and aimed at retaining more profits for their operating and investment needs. However, the after-tax profits of SOEs belong to the state, and the restrictions placed by a highly centralized

financial system and the promotion mechanism of firm executives provide less of an incentive to SOEs to avoid tax. Thus, we expect the governance-based effect of taxpayer credit rating to be weaker in SOEs, and we propose the following hypothesis:

H3. The negative effect of flexible tax enforcement on excess goodwill is more pronounced in non-SOEs than in SOEs.

2.2.4. Flexible tax enforcement, regional tax enforcement intensity and excess goodwill

Davis et al. (2003) show that the impact of changes in tax enforcement on tax compliance depends on whether the taxpayer is initially compliant; relatively non-compliant taxpayers respond to increased tax enforcement by increasing their compliance, whereas relatively compliant taxpayers are insensitive to the changes in tax enforcement policies. Thus, tax compliance varies by regions. Similarly, in China, there are considerable differences in tax enforcement intensity across provinces, leading to a greater difference in the tax compliance of taxpaying firms located in different regions. Recent studies in the Chinese context show that the effect of tax enforcement on the decision-making and behavior of firms is more pronounced in regions with low tax enforcement than in regions with high tax enforcement (Jin and Huang, 2022). We posit that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms located in provinces with low tax enforcement intensity. Following Davis et al. (2003), we argue that firms located in regions with low tax enforcement intensity sensitively respond to flexible tax enforcement than firms located in regions with high tax enforcement intensity because relatively non-compliant taxpayers are more sensitive to increased tax enforcement than relatively compliant taxpayers. However, regional tax enforcement (at the macroeconomic level) has a substitution effect on flexible tax enforcement (at the microeconomic level), which suggests that tax avoidance and managers' opportunistic behaviors, such as over-recognizing excess goodwill, decrease in firms located in regions with high tax enforcement intensity, eventually weakening the governance- and reputation-based effects of flexible tax enforcement on excess goodwill. Therefore, we propose the following hypothesis:

H4. The negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms located in regions with low tax enforcement intensity than in firms located in regions with high tax enforcement intensity.

3. Research design

3.1. Sample and data

The taxpayer credit rating and excess goodwill data used in this study are from 2014 to 2021. We select 2014 for the following reasons. The *Tax Payment Credit Management Measures* issued by the SAT came into effect on 1 October 2014, and the tax authorities started publishing the annual taxpayer credit rating results of the previous year. To further reduce the effects of possible endogeneity, this study uses taxpayer credit rating and other control variables in period t to run the regression with excess goodwill in period $t + 1$. The following filters are used to screen the sample to enhance the reliability of our findings: firms designated as special treatment (firms labeled ST, *ST and PT), firms in the financial industry and samples with missing data are excluded. Table 1 shows the sample selection process. All of the continuous variables are winsorized at the 1st and 99th percentiles to exclude the influence of outliers. A total of 16,015 firm-year observations from

Table 1
Sample selection process.

Sample selection (2014–2021)	Obs
Original samples	24,432
Less: Observations with special treated	(774)
Less: Observations in the financial industry	(367)
Less: Observations with missing data	(7276)
Final sample	16,015

Table 2
Variables definition.

Variables	Definition
GW_excess	The regression residuals of goodwill in model (1)
Tax_flexible	1 if firms are with A taxpaying credit rating, 0 otherwise
Size	The natural logarithm of total assets
Roa	Net profit divided by total assets
Lev	Total debts divided by total assets
Growth	Growth rate of main operational revenue
Cfo	net cash flow from operating activities divided by operation revenue
Top10	Shareholding ratio of the top ten shareholder
Occupy	other receivables divided by total assets
Mhold	Shareholding ratio of the managements
Board	The natural logarithm of the umber of directors
Inst	The shareholding ratio of institutional investors
Ind	Industry dummy variable is set according to firms' industry division of CSRC
Year	Year dummy variable is set according to different years of data collection

Note: This table presents the introduction of main variables, including variables' name, abbreviation and definition.

3,383 listed firms are used in the regression analysis. Firms' taxpayer credit rating data are manually collected from the SAT's official website using web crawler technology. The data on goodwill generated by M&As are obtained from the Wind database. Other data are collected from the CSMAR database.

3.2. Variable definitions

3.2.1. Excess goodwill

Following Fu et al. (2015) and Wei and Zhu (2019), this study uses the regression residual of a goodwill expectation model as a proxy for excess goodwill. The regression model is as follows:

$$GW_{it} = \alpha_0 + \alpha_1 GW\_ind_{it} + \alpha_2 X_{it} + \sum Year + \sum Ind + \varepsilon_{it} \quad (1)$$

where *GW* denotes firms' actual goodwill standardized by total assets. *GW_ind* denotes the average goodwill of other firms in the same industry for the same year. *X* denotes the set of variables that may affect firms' goodwill: whether the M&A transaction is paid for in cash (*Cash*), firm size (*Size*), buyers' expenditure (*Buyer*), profitability (*Roa*), duality (*Dual*), firms' growth ability (*Growth*), and the shareholding ratio of managers (*Mhold*). Year and industry fixed effects are also controlled for. The residual obtained from regression Model (1) denotes the difference between actual goodwill and expected goodwill, which is used to measure excess goodwill (*GW_excess*).

3.2.2. Flexible tax enforcement

The SAT publishes the annual list of taxpayer credit rating of firms for the previous year only in April each year. The joint penalties and incentive measures of the taxpayer credit rating system can help A-rated firms to improve their corporate governance and reputation, thereby reflecting the effect of flexible tax enforcement. Hence, following Sun et al. (2019), Tao et al. (2021) and Yu and Fang (2022), this study constructs a dummy variable, *Tax_flexible*, that takes a value of 1 if a firm has a taxpayer credit rating of A, and 0 otherwise. This study uses web crawler technology to manually collect the list of firms with a taxpayer credit rating of A from the official website of the SAT.

3.2.3. Control variables

Following the literature on the factors that influence excess goodwill (Fu et al., 2015; Zhang et al., 2022), this study uses the following control variables: firm-level financial variables, such as *Size*, *Roa*, *Growth,* leverage (*Lev*) and net cash flow from operating activities (*Cfo*), and corporate governance variables, such as equity concentration (*Top10*), the capital occupation of major shareholder (*Occupy*), *Mhold*, board size (*Board*) and

the shareholding ratio of institutional investors (*Inst*). Year and industry fixed effects are also controlled for. Table 1 provides the definitions of all of the variables.

3.3. Regression model

The taxpayer credit rating system has been in place for almost 20 years since *The Tentative Measures on the Administration of Tax Payment Credit Rating* was issued on 17 July 2003. Hence, it is difficult to capture the governance- and reputation-based effects of taxpayer credit rating by taking only the *Tax Payment Credit Management Measures* issued in 2014 as an exogenous event shock. Moreover, the descriptive statistics show that only 1.9% of the sample firms had an A rating in 2014, so the policy does not seem to be a big shock. Thus, following Yu and Fang (2022), we construct Model (2) to investigate the relationship between flexible tax enforcement and firms' excess goodwill and reduce the effect of possible simultaneity:

$$GW\_\text{excess}_{i,t+1} = \alpha_0 + \alpha_1 Tax\_flexible_{i,t} + \alpha_2 \text{Controls}_{i,t} + \sum Ind + \sum Year + \varepsilon_{i,t} \quad (2)$$

where *GW_excess* denotes firms' excess goodwill. *Tax_flexible* denotes flexible tax enforcement, which is defined by whether taxpayer firms are A-rated. *Controls* denotes all of the control variables.

H1 predicts a negative relationship between flexible tax enforcement and firms' excess goodwill (α_1 less than 0).

4. Empirical results

4.1. Descriptive statistics

Panel A of Table 3 presents the descriptive statistics of the main variables. *GW_excess* has a mean value of 0.005, higher than the median value of –0.018, which suggests that the distribution of excess goodwill is skewed right and the overestimation of goodwill in M&As is quite serious for some firms in China. The mean value of *Tax_flexible* is 0.500, indicating that half of the sampled firms are A-rated. All control variables do not have abnormal values. Panel B of Table 3 shows the mean values of *Tax_flexible* and *GW_excess* by industry. There are marked differences in the excess goodwill of firms across industries. Manufacturing firms have the highest proportion of A ratings. The proportion of A-rated taxpayer firms varies across industries, and firms in the machinery, equipment and instrumentation (C4), accommodation and catering (H) and information transmission, software and information technology services (I) industries have maximum of excess goodwill recognized.

Panel C of Table 3 presents the mean values of *Tax_flexible* and *GW_excess* by year. The proportion of A-rated taxpayer firms increased from 1.9% in 2014 to 81% in 2020, while excess goodwill increased till 2017 and then decreased considerably, which may be due to an increase in the number of A-rated taxpayer firms since 2017. The sample is divided into A-rated taxpayer firms and non-A-rated taxpayer firms (*Tax_flexible)*, and Panel B of Table 3 shows the *t*-test results of the difference in the means. In the A-rated taxpayer firms group, the mean of *GW_excess* is 0.002, which is significantly lower than the mean of *GW_excess* of 0.008 in the non-A-rated taxpayer firms group. These results suggest that the higher the taxpayer credit rating of firms, the lower the amount of excess goodwill recognized by firms, which verifies the negative relationship between an A taxpayer credit rating and excess goodwill. That is, taxpayer credit rating as flexible tax enforcement limits irrational M&As by firms and bursts the goodwill bubble.

4.2. Correlation analysis

Table 4 shows the Pearson correlation coefficients of the main variables. *Tax_flexible* is negatively correlated with *GW_excess* with a coefficient of –0.036, which suggests that taxpayer credit rating as flexible tax enforcement reduces excess goodwill by deterring irrational M&As by firms and bursts the goodwill bubble. These results provide preliminary evidence in support of H1. Moreover, the correlation coefficients of the

Table 3
Descriptive Statistics.

Panel A: Descriptive Statistics for all samples

Variables	Obs	Mean	S.D.	Min	P25	Median	P75	Max
GW_excess	16,015	0.005	0.077	−0.185	−0.035	−0.018	0.007	0.443
Tax_flexible	16,015	0.500	0.500	0	0	0	1	1
Size	16,015	22.382	1.278	19.357	21.465	22.220	23.112	26.071
Roa	16,015	0.048	0.066	−0.240	0.019	0.045	0.079	0.230
Lev	16,015	0.414	0.199	0.051	0.254	0.407	0.560	0.894
Growth	16,015	0.180	0.406	−0.577	−0.013	0.112	0.273	2.592
Cfo	16,015	0.103	0.178	−0.730	0.024	0.096	0.184	0.694
Top10	16,015	0.598	0.144	0.264	0.495	0.608	0.707	0.905
Occupy	16,015	−0.016	0.038	−0.184	−0.026	−0.007	0.001	0.089
Mhold	16,015	0.156	0.199	0.000	0.000	0.036	0.295	0.710
Board	16,015	2.236	0.175	1.792	2.079	2.303	2.303	2.773
Inst	16,015	0.431	0.251	0.003	0.203	0.451	0.637	0.918

Panel B: The mean value of flexible tax enforcement and excess goodwill by industry

Industry code and name	Obs	$Tax\_flexible_t$	GW_excess_{t+1}
A: Farming, forestry, animal husbandry and fishery	185	0.378	−0.002
B: Mining	380	0.334	−0.000
C: Manufacturing			
C1: Extile, clothing, fur	1074	0.527	0.001
C2: Medicine, biological products	2948	0.563	0.007
C3: Metal, non-metal	6179	0.533	0.005
C4: Machinery, equipment, instrumentation	322	0.534	0.016
D: Electricity, heat, gas and water production and supply industries	446	0.359	−0.002
E: Construction	424	0.458	−0.002
F: Wholesale and retail	679	0.474	0.002
G: Transportation, warehousing and postal services	415	0.424	0.000
H: Accommodation and catering	50	0.260	0.017
I: Information transmission, software and information technology services	1294	0.481	0.012
K: Real estate	548	0.350	−0.007
L: Leasing and business services	222	0.419	0.002
M: Scientific research and technical services	210	0.457	0.009
N: Water, environment, and utility management	257	0.471	−0.001
P: Education	21	0.238	−0.021
Q: Health and social work	51	0.353	−0.001
R: Culture, sports and entertainment	251	0.367	0.016
S: Comprehension	61	0.131	−0.009

Panel C: The mean value of flexible tax enforcement and excess goodwill by year

Year	Obs	Tax_rank_t	GW_excess_{t+1}
2014	1833	0.019	0.004
2015	2108	0.206	0.005
2016	2301	0.327	0.009
2017	2488	0.653	0.004
2018	2477	0.631	0.005
2019	2307	0.726	0.003
2020	2215	0.810	0.002

Panel D: Mean *t* test of excess goodwill according to Tax_flexible

Tax_flexible	Obs	GW_excess_{t+1}
1	8001	0.002
0	8014	0.008
Mean difference		−0.006***(-4.50)

Note: This table shows the descriptive statistics of the main variables and the *t*-test result of the mean difference of *GW_excess* according to flexible tax enforcement (*Tax_flexible*). All variables are defined in Table 2.

Table 4
Pearson correlation analysis.

Variables	1	2	3	4	5	6	7	8	9	10	11
1GW_excess	1										
2Tax_flexible	−0.036***	1									
3Size	−0.078***	0.038***	1								
4Roa	−0.020**	0.096***	−0.092***	1							
5Lev	−0.116***	−0.052***	0.570***	−0.387***	1						
6Growth	0.153***	−0.014*	0.011	0.235***	0.015*	1					
7Cfo	0.014*	0.045***	0.036***	0.278***	−0.186***	−0.016**	1				
8Top10	−0.038***	0.023***	0.080***	0.244***	−0.069***	0.078***	0.099***	1			
9Occupy	−0.080***	0.018**	−0.050***	0.009	−0.129***	−0.031***	−0.036***	−0.040***	1		
10Mhold	0.061***	0.070***	−0.420***	0.190***	−0.306***	0.080***	0.000	0.167***	0.077***	1	
11Board	−0.063***	−0.009	0.270***	−0.022***	0.146***	−0.025***	0.046***	−0.010	−0.007	−0.216***	1
12Inst	−0.098***	−0.047***	0.453***	0.050***	0.226***	−0.007	0.076***	0.459***	−0.100***	−0.690***	0.231***

Note: This table shows the correlation between the main variables. All variables are defined in Table 2. *, **, and * indicate 10%, 5%, and 1% significant, respectively.

other control variables are generally less than 0.500 and the variance inflation factor of the subsequent regressions are also less than 2, indicating that there is no problem of multicollinearity in this study.

4.3. Regression analysis

Table 5 displays the regression results of flexible tax enforcement on firms' excess goodwill when we control for year and industry fixed-effects. Column (1) shows that when we do not control for other influencing factors, *Tax_flexible* is negatively correlated with *GW_excess* with a regression coefficient of –0.007 (t = –3.68). After we incorporate the control variables, column (2) shows that *Tax_flexible* continues to be significantly and negatively correlated with *GW_excess* with a regression coefficient of –0.005 (t = –2.90), which suggests that A-rated taxpayer firms are less likely to overestimate goodwill. Specifically, the coefficient estimate indicates that A-rated taxpayer firms reduce *GW_excess* by 0.005 compared with non-A-rated firms, which accounts for 100% of the mean value of *GW_excess*. Hence, taxpayer credit rating as flexible tax enforcement restrains irrational M&As by firms and bursts the goodwill bubble. To further reduce the effect of simultaneity, this study lags *GW_excess* by 2 years as the dependent variable. The results in columns (3) and (4) of Table 5 show that *Tax_flexible* continues to have a significant negative association with *GW_excess*. Therefore, H1 is verified that taxpayer credit rating as flexible tax enforcement reduces firms' excess goodwill.

Table 5
Flexible tax enforcement and excess goodwill: Regression analysis.

Variables	(1)	(2)	(3)	(4)
	GW_excess_{t+1}	GW_excess_{t+1}	GW_excess_{t+2}	GW_excess_{t+2}
$Tax\_flexible_t$	−0.007***	−0.005***	−0.007***	−0.005**
	(-3.68)	(-2.90)	(-2.74)	(-2.12)
$Size_t$		0.003***		−0.002
		(2.87)		(-1.35)
Roa_t		−0.146***		−0.205***
		(-8.30)		(-7.48)
Lev_t		−0.076***		−0.083***
		(-9.14)		(-8.07)
$Growth_t$		0.035***		0.034***
		(14.38)		(11.35)
Cfo_t		0.009*		0.015**
		(1.86)		(2.02)
$Top10_t$		0.007		0.006
		(0.55)		(0.37)
$Occupy_t$		−0.209***		−0.226***
		(-7.58)		(-6.41)
$Mhold_t$		−0.018		0.006
		(-1.51)		(0.39)
$Board_t$		−0.014**		−0.015*
		(-2.10)		(-1.78)
$Inst_t$		−0.036***		−0.017
		(-3.10)		(-1.23)
Year	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes
Constant	−0.003	−0.003	0.003	0.108***
	(-0.35)	(-0.12)	(0.24)	(3.10)
Obs	16,015	16,015	9303	9303
R^2	0.006	0.070	0.012	0.086
F	2.60***	9.91***	11.59***	23.86***

Note: This table presents the regression results of flexible tax enforcement on excess goodwill. Robust OLS regression is used for each column. The dependent variable is firms' excess goodwill (*GW_excess*) in t + 1 and t + 2 term, and the independent variable is flexible tax enforcement (*Tax_flexible*) in t term. Other control variables are also in t term. All variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

Table 6
Flexible tax enforcement and excess goodwill: Robustness tests.

Panel A: Falsification test

Variables	(1)	(2)
	From A to non-A	*From non-A to A*
	GW_excess_{t+1}	GW_excess_{t+1}
$Tax\_flexible_t$	0.000(0.05)	−0.009***(-3.90)
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	0.037(-1.38)	0.002(0.07)
Obs	4581	6129
R^2	0.053	0.054
F	4.45***	5.27***

Panel B: Excluding excess goodwill measurement bias

Variables	(1)	(2)	(3)
	$GW\_excess\_irra_{t+1}$	$GW\_excess\_uniden_{t+1}$	GW_excess_{t+1}
$Tax\_flexible_t$	−0.004*(-1.72)	−0.005***(-2.81)	−0.005*(-1.94)
$Cash_t$			0.014***(6.39)
$Buyer_t$			0.005***(9.25)
$Dual_t$			0.005(1.64)
$Controls_t$	Yes	Yes	Yes
Year	Yes	Yes	Yes
Ind	Yes	Yes	Yes
Constant	−0.089***(-3.18)	−0.014(-0.58)	−0.094**(-2.36)
Obs	7408	16,015	8650
R^2	0.076	0.041	0.100
F	11.84***	7.50***	10.10***

Panel C: Changing excess goodwill measurement

Variables	(1)	(2)
	$GW\_excess1_{t+1}$	$GW\_excess1_{t+2}$
$Tax\_flexible_t$	−0.006***(-3.24)	−0.005**(-2.18)
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	−0.051*(-1.90)	0.065*(1.83)
Obs	16,015	9303
R^2	0.074	0.085
F	11.09***	10.55***

Panel D: Changing samples

Variables	(1)	(3)
	GW_excess_{t+1}	$GW\_excess1_{t+1}$
$Tax\_flexible_t$	−0.009**(-2.35)	−0.011***(-2.99)
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	0.174***(2.85)	0.238***(3.73)
Obs	4652	4476
R^2	0.234	0.208
F	21.16***	17.72***

Panel E: Changing regression model

Variables	(1)	(2)
	$GW\_excess\_dum_{t+1}$	$GW\_excess1\_dum_{t+1}$
$Tax\_flexible_t$	−0.105*(-1.89)	−0.107*(-1.82)
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	0.217(0.25)	−1.852*(-1.95)
Obs	16,015	16,015
Pseudo R^2	0.042	0.054
Wald chi2	379.12***	421.86***

Note: This table presents the robustness regression results of flexible tax enforcement on excess goodwill after falsification test (Panel A), excluding excess goodwill measurement bias (Panel B), changing excess goodwill measurement (Panel C), changing samples (Panel D) and changing regression model (Panel E). Robust OLS regression is used for Panel A, B, C, D, and robust logit regression is used for Panel E. In Panel A and B, the dependent variable is firms' excess goodwill (*GW_excess*) in t + 1 term. In Panel C, the dependent variable is firms' excess goodwill (*GW_excess1*) in t + 1 and t + 2 term. In Panel D, the dependent variable is firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term. In Panel E, the dependent variable is whether firms' excess goodwill are greater than 0 (*GW_excess_dum* and *GW_excess_dum1*) in t + 1 term. The independent variable is flexible tax enforcement (*Tax_flexible*) in t term, and other control variables are also in t term. All variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

4.4. Robustness tests

4.4.1. Falsification test

We hypothesize that A-rated taxpayer firms have less excess goodwill and show that taxpayer credit rating as flexible tax enforcement reduces firms' excess goodwill. Hence, we expect this negative effect to disappear when firms disappear with an improvement in their taxpayer credit rating and increase with a deterioration in taxpayer credit rating. Based on this assumption, we exclude samples from an A rating to a non-A rating and from a non-A rating to an A rating for the falsification test. The results in Panel A of Table 6, column (1) show that *Tax_flexible* does not have a pronounced effect on *GW_excess* when firms go from an A rating to a non-A rating. Moreover, the results in column (2) show that the regression coefficient of *Tax_flexible* on *GW_excess* is –0.009 (t = –3.90), which is greater than −0.005 and indicates the increase in the negative effect of flexible tax enforcement on excess goodwill when firms go from a non-A rating to an A rating. Therefore, the reduction in firms' excess goodwill can be attributed to them obtaining an A rating.

4.4.2. Excluding bias in the measurement of excess goodwill

To show that excess goodwill reflects irrational goodwill, we add the industry complementarity of the merging firms in an M&A (*Complement*), whether the M&As involve intellectual property (*Intellect*) and whether the M&As include related party transactions (*Relation*) to the goodwill expectation model of Fu et al. (2015) and Wei and Zhu (2019) to exclude reasonable goodwill. A higher industry complementarity between the merging firms suggests that the M&A is more likely driven by a need for expansion in the scope of business and that the goodwill generated from such M&As is more reasonable. Intellectual property rights are key assets for firms. Thus, M&As involving intellectual property increase the authenticity of the M&A. In contrast, related party transactions are a tool to shift profits. Hence, M&As involving related party transactions decrease the authenticity of the M&A. The results in column (1) of Panel B of Table 6 show that *Tax_flexible* is significantly and negatively associated with *GW_excess_irra*.

According to Johnson and Pertrone (1998), purchased goodwill can be subdivided into identifiable goodwill (combination goodwill and inherent goodwill) and unidentifiable goodwill (unrecognized assets and liabilities, estimation error and loss of overconfidence due to agency problems). We remove identifiable goodwill from firms' actual goodwill to yield a better estimate of excess goodwill. The results in column (2) of Panel B of

Table 6 show that *Tax_flexible* is significantly and negatively correlated with *GW_excess_uniden* with a regression coefficient of –0.005 (t = –2.81).

Chen et al. (2018) show that using residuals as a dependent variable leads to incorrect inferences. Hence, we include the control variables of the first-stage estimation model (*Cash*, *Buyer* and *Dual*) in the second-stage regression. The results in column (3) of Panel B of Table 6 show that *Tax_flexible* continues to exert a significant and negative effect on *GW_excess*. Therefore, we conclude that our original finding remains robust after we exclude bias in the measurement of excess goodwill.

4.4.3. Changing the measurement of excess goodwill

To verify the robustness of our findings, we use the definition of abnormal goodwill given by Ramanna (2008) to redefine excess goodwill (*GW_excess1*). This measurement of excess goodwill eliminates the effect of firm size on goodwill and reflects the overestimation of a firm's goodwill vis-a-vis other firms in the same industry (Ramanna, 2008). The detailed calculation process is as follows. First, firms' net book goodwill is standardized by total assets to obtain standardized goodwill (*GW_norm*). Second, we calculate the mean value of standardized goodwill of all of the other firms in the same industry after excluding the focal firm's goodwill with that of the focal firm (*GW_ind*). Last, we use the difference between *GW_norm* and *GW_ind* to measure excess goodwill (*GW_excess1*). The regression results of flexible tax enforcement on excess goodwill are displayed in Panel C of Table 6. Column (1) shows that *Tax_flexible* is negatively correlated with *GW_excess1* with a regression coefficient of –0.006 (t = –3.24). To reduce the effect of simultaneity, this study lags *GW_excess1* by 2 years as the dependent variable. Column (2) shows that *Tax_flexible* continues to be significantly and negatively correlated with *GW_excess1*. This suggests that our finding that taxpayer credit rating as flexible tax enforcement reduces firms' excess goodwill remains robust after we change the measurement of excess goodwill.

4.4.4. Changing the sample

The descriptive statistics show that the distribution of excess goodwill is skewed right, which suggests that there is considerable over-recognition of goodwill in a few firms. Hence, we can expect the negative effect of taxpayer credit rating as flexible tax enforcement to be more pronounced in firms with high excess goodwill. Based on this, we use a subsample with excess goodwill of greater than 0 for the regression analysis. The results in columns (1) and (2) of Panel D of Table 6 show that *Tax_flexible* is significantly and negatively correlated with *GW_excess* and *GW_excess1* with regression coefficients of –0.009 (t = –2.35) and –0.011 (t = –2.99), which is greater than the regression coefficients in columns (2) and (4) of Table 5. Hence, our finding that taxpayer credit rating as flexible tax enforcement reduces excess goodwill remains robust after we change the sample.

4.4.5. Changing the regression model

We further define two dummy variables, *GW_excess_dum* and *GW_excess_dum1*, according to whether *GW_excess* and *GW_excess1* are greater than 0 and re-run the logit regression. The results in Panel E of Table 6 show that *Tax_flexible* is significantly and negatively correlated with *GW_excess_dum* and *GW_excess_dum1*, which suggests that taxpayer credit rating as flexible tax enforcement reduces the possibility of excess goodwill being recognized. Hence, our conclusion that flexible tax enforcement reduces firms' excess goodwill remains robust when we change the regression model.

4.4.6. Instrumental variable method

Taxpayer credit rating usually takes relevant credit indicators of firms' historical taxpayer information into consideration and rarely considers the M&A decisions of firms and the recognition of excess goodwill. Hence, the possibility of cause-and-effect is low. Nevertheless, we use the instrumental variable method to address this endogeneity concern. Specifically, we utilize the proportion of A-rated taxpayer firms to the total number of firms in the same industry or city as the focal firm in the current year as the instrumental variables (*A_ind* and *A_city*). According to social identity theory, imitation is quite common in business practice (Lieberman and Asaba, 2006). Moreover, the literature finds that a focal firm's decision-making is likely to be affected by its peers in the same industry and region (Dougal et al., 2015; Kelchtermans et al., 2020). For example,

Kelchtermans et al. (2020) document that other firms in the same industry affect a focal firm's usage of tax exemptions. Hence, a high proportion of A-rated taxpayer firms in the same industry or city may encourage the focal firm to pay taxes in good faith and obtain an A rating due to peer pressure or social identity motivation. However, we find that the proportion of A-rated taxpayer firms in the same industry or city in a year has little effect on the focal firm's decisions of excess goodwill. Furthermore, the p-values of the Sargan test of over-identification are 0.463 and 0.664 for *GW_excess* and *GW_excess1*, respectively, which indicates that our instrumental variables are not over-identified. The minimum eigenvalue statistic is 6,533.580, which is greater than the threshold of 10, suggesting that our instrument variables are highly endogenous. Therefore, we conclude that *A_ind* and *A_city* are appropriate instrumental variables.

Table 7 shows the two-stage least squares (2SLS) regression results of the instrumental variable method. Column (1) shows that *A_ind* and *A_city* have a positive relationship with *Tax_flexible*, which supports the findings of Lieberman and Asaba (2006), Dougal et al. (2015) and Kelchtermans et al. (2020). Column (2) shows that the regression coefficient between *Tax_flexible* and *GW_excess* is –0.004 (t = –2.30). To check the robustness of our conclusions, we replace *GW_excess* with *GW_excess1* to re-run the regression analysis and find that the results in column (3) are consistent with those of column (2). Hence, our finding that taxpayer credit rating as flexible tax enforcement reduces firms' excess goodwill remains robust when we consider cause-and-effect.

4.4.7. Propensity score matching

The literature shows that some factors, such as managers' overconfidence and desire for empire-building, affect M&A decisions, the confirmation of goodwill and goodwill impairment (Jensen, 1986; Malmendier and Tate, 2008; Du et al., 2011; Chung and Hribar, 2021; Stevo and Thomas, 2021). That is, some unobserved factors can affect firms' recognition of excess goodwill, resulting in omitted variable bias. To reduce this possibility, we use 1:1 nearest neighbor propensity score matching to run our regression analysis again. We divide the sample into A-rated taxpayer firms and non-A-rated taxpayer firms and then take all of the control variables as co-variables to calculate the propensity score. Fig. 1 shows the kernel density map. The difference between the treatment and control groups decreases significantly with 1:1 nearest neighbor matching. Table 8

Table 7
Flexible tax enforcement and excess goodwill: Instrumental variable method.

Variables	(1)	(2)	(3)
	1st stage	*2nd stage*	
	$Flexible\_tax_t$	GW_excess_{t+1}	$GW\_excess1_{t+1}$
A_ind_t	0.134***(8.00)		
A_city_t	0.908***(65.86)		
$Flexible\_tax_t$		−0.004**(-2.30)	−0.004**(-1.98)
$Controls_t$	Yes	Yes	Yes
Year	Yes	Yes	Yes
Ind	Yes	Yes	Yes
Constant	−0.346***(-4.89)	0.009(0.65)	−0.046***(-3.16)
Obs	16,015	16,015	16,015
R^2	0.463	0.068	0.071
F or Wald chi2	1149.01***	1144.47***	1213.98***
Sargan test (p value)	–	0.547	0.664
Minimum eigenvalue statistic	–	6533.580	6533.580

Note: This table shows the endogenous problem analysis of flexible tax enforcement on excess goodwill using the 2SLS Instrumental variable method. The dependent variable in column (1) is flexible tax enforcement (*Tax_flexible*) in t term, and we utilize the proportion of the number of firms with A taxpayer credit rating to the total number of firms in the same industry or city with focal firm within the current year as the instrumental variables (*A_ind* and *A_city*). In columns (2) and (3), the dependent variables are firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term, and the independent variable is flexible tax enforcement (*Tax_flexible*) in t term. All other variables are defined in Table 2. The z and t statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

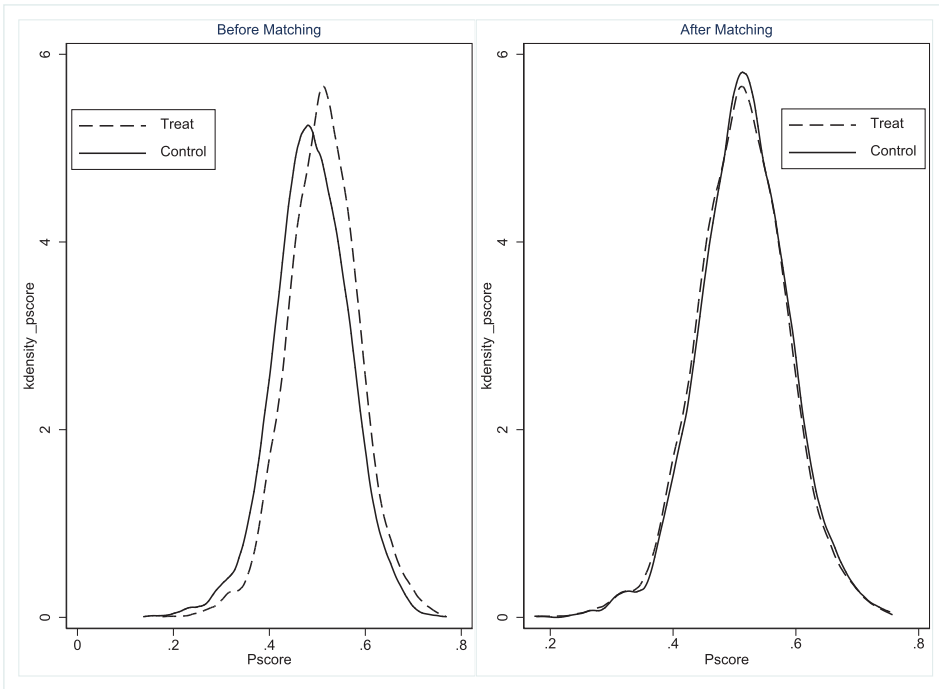

Fig. 1. kernel density diagram.

presents the regression results using the matched sample. Columns (1) and (2) show that *Tax_flexible* is significantly and negatively correlated with *GW_excess* and *GW_excess1* with regression coefficients of –0.006 (t = –2.82) and –0.006 (t = –3.03), respectively. Hence, our initial finding that taxpayer credit rating as flexible tax enforcement reduces firms' excess goodwill holds after we address omitted variable bias.

This figure shows the probability density function diagram of propensity score value before and after matching.

Table 8
Flexible tax enforcement and excess goodwill: Propensity score matching.

Variables	(1)	(2)
	GW_excess_{t+1}	$GW\_excess1_{t+1}$
$Tax\_flexible_t$	*−0.006***(-2.82)*	*−0.006***(-3.03)*
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	−0.011(-0.38)	−0.059**(-2.08)
Obs	12,335	12,335
R^2	0.070	0.074
F	8.05***	9.05***

Note: This table presents the endogenous analysis of flexible tax enforcement's effect on excess goodwill using propensity score matching. Robust OLS regression is used for all columns. This study employs 1:1 nearest neighbor propensity to match samples according to whether firms have A taxpayer credit rating or not. The dependent variable is firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term, and the independent variable is flexible tax enforcement (*Tax_flexible*) in t term. All control variables as co-variables in t term. All variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

Table 9
Flexible tax enforcement and excess goodwill: Governance-based effect.

Panel A: Coverage of medias and analysts

Variables	(1)	(2)	(3)	(4)
	Medias		*Analysts*	
	GW_excess_{t+1}	$GW\_excess1_{t+1}$	GW_excess_{t+1}	$GW\_excess1_{t+1}$
$Tax\_flexible_t$	−0.004(-1.60)	−0.005*(-1.84)	−0.002(-0.41)	−0.003(-0.83)
$Coverage_t$	−0.000(-0.27)	0.000(0.34)	0.008***(4.76)	0.009***(5.21)
$Tax\_flexible*Coverage_t$	−0.001(-0.72)	−0.001(-0.71)	−0.002(-1.49)	−0.002(-1.15)
$Controls_t$	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes
Constant	−0.006(-0.22)	−0.051*(-1.84)	0.044(1.48)	0.003(0.09)
Obs	15,706	15,706	13,830	13,830
R^2	0.071	0.075	0.082	0.087
F	9.57***	10.59***	9.99***	11.26***

Panel B: CEO perquisites

Variables	(1)	(2)
	GW_excess_{t+1}	$GW\_excess1_{t+1}$
$Tax\_flexible_t$	−0.004(-1.33)	−0.004(-1.26)
$Perks_t$	0.146***(2.96)	0.200***(3.89)
$Tax\_flexible*Perks_t$	−0.045(-0.81)	−0.081(-1.43)
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	−0.006(-0.21)	−0.022(-0.77)
Obs	14,744	14,774
R^2	0.078	0.134
F	10.56***	16.59***

Panel C: CEO overconfidence

Variables	(1)	(2)	(3)	(4)
	GW_excess_{t+1}	GW_excess_{t+1}	$GW\_excess1_{t+1}$	$GW\_excess1_{t+1}$
	Yes	*No*	*Yes*	*No*
$Tax\_flexible_t$	−0.008(-1.36)	−0.006***(-3.12)	−0.009(-1.53)	−0.007***(-3.24)
$Controls_t$	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes
Constant	−0.134*(-1.92)	0.013(0.46)	−0.181***(-2.58)	−0.036(-1.21)
Obs	1642	10,062	1642	10,062
R^2	0.142	0.073	0.142	0.077
F	–	8.34***	–	8.87***
Suest		0.000		0.000

Note: This table presents the governance-based effect regression results of flexible tax enforcement on excess goodwill from the perspective of the coverage of medias and analysts (Panel A), CEO perquisites (Panel B) and CEO overconfidence (Panel C). Robust OLS regression is used for all columns. The dependent variable is firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term, and the independent variable is flexible tax enforcement (*Tax_flexible*). In Panel A, we use the natural logarithm of total media coverage or analyst number to proxy for the coverage of medias and analysts (*Coverage*). In Panel B, we follow Luo et al. (2011) and employ Model (3) to measure CEO perquisites (*Perks*). Grouping variable is whether CEO is overconfident in Panel C. Control variables are also in t term. All other variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

5. Channel analysis

We provide convincing evidence for the negative effect of flexible tax enforcement on firms' excess goodwill while confirming that robustness tests and endogeneity concerns do not drive our conclusions. Next, we explore the governance- and reputation-based effects through which taxpayer credit rating as flexible tax enforcement reduces firms' excess goodwill.

5.1. Governance-based effect

5.1.1. Coverage by media and analysts

As we discussed earlier, media and analysts pay more attention to A-rated taxpayer firms in the SAT's list due to the sensation or halo effect, which increases external corporate governance and decreases managers' opportunistic behaviors (Dyck et al., 2008; Chen et al., 2015; Dai et al., 2015; Guo et al., 2019). Based on this assumption, we expect the coverage by media and analysts to strengthen the negative effect of flexible tax enforcement on excess goodwill if taxpayer credit rating has a governance-based effect. Hence, following Dyck et al. (2008) and Guo et al. (2019), we use the natural logarithm of total media coverage or the number of analysts following a firm as a proxy for coverage by media and analysts. Columns (1) to (4) of Panel A of Table 9 show that *Tax_flexible*Coverage* is nonsignificant with *GW_excess* and *GW_excess1,* which indicates that coverage by media and analysts does not have a significant influence on the negative effect of flexible tax enforcement on excess goodwill. Therefore, we conclude that there is no governance-based effect of coverage by media and analysts.

5.1.2. CEO perquisites

Jensen (1986) states that managers are more likely to engage in irrational M&As because of self-interest, such as by empire-building due to the principal–agent problem, thus resulting in excess goodwill. In China, where the institutional environment (at the macroeconomic level) and the governance mechanism (at the microeconomic level) are weak, CEO perquisites are likely to be a waste of shareholders' wealth and to reflect high agency costs (Cai et al., 2011; Xu et al., 2014). Hence, we assume the negative effect of taxpayer credit rating on excess goodwill to be more pronounced in firms that have higher CEO perquisites if taxpayer credit rating has a governance-based effect on restraining managers' opportunistic behaviors. Based on this assumption, following Luo et al. (2011), we use Model (3) to run our regression by year and industry. The residual represents the difference between the actual and expected perquisites, which denotes abnormal CEO perquisites for a given year.

$$\frac{Perks_t}{Assets_{t-1}} = \alpha_0 + \alpha_1 \frac{1}{Assets_{t-1}} + \alpha_2 \frac{\Delta Sales_t}{Assets_{t-1}} + \alpha_3 \frac{PPE_t}{Assets_{t-1}} + \alpha_4 \frac{Inventory_t}{Assets_{t-1}} + \alpha_5 \frac{Lnemploy_t}{Assets_{t-1}} + \varepsilon_t \quad (3)$$

where $Perks_t$ denotes the total amount of CEO perquisites in year t, which is taken as the aggregate of six types of expenses related to managers: travel expenses, business entertainment expenses, overseas training expenses, bus fare, directors' compensation and conference expenses. $Assets_{t-1}$ denotes total assets in the year t–1. $\triangle Sales_t$ denotes the change in operating revenue in year t. PPE_t denotes the net value of plant, property, equipment and other fixed assets in the year t–1. $Inventory_t$ denotes net inventory for year t. $LnEmployee_t$ denotes the natural logarithm of the total number of employees.

The results are displayed in Panel B of Table 9. *Perks* has a positive and significant correlation with *GW_excess* and *GW_excess1*, which suggests that CEOs receiving more perquisites are more likely to recognize excess goodwill, thereby verifying the agency view of perquisites. *Tax_flexible*Perks* has a negative but nonsignificant correlation with *GW_excess* and *GW_excess1* in columns (1) and (2), which indicates that CEO perquisites do not have a significant influence on the negative effect of taxpayer credit rating on firms' excess goodwill. Therefore, we conclude that there is no governance-based effect of CEO perquisites.

5.1.3. CEO overconfidence

Studies show that managers are more likely to acquire firms at a premium and unlikely to recognize goodwill impairment due to personal characteristics, such as overconfidence (Malmendier and Tate, 2008; Chung

and Hribar, 2021; Stevo and Thomas, 2021). Hence, we expect the negative effect of flexible tax enforcement on excess goodwill to be more pronounced in firms with overconfident CEOs if taxpayer credit rating has a governance-based effect on deterring managers' irrational behaviors. Hence, we measure CEO overconfidence based on whether CEOs refuse to reduce their shareholding in the firm when their firm's stock return is less than the market's return. Model (3) shows the specific measurement method. The variable *Longholder* is used as a proxy for CEO overconfidence, following the literature (Kaplan et al., 2022).

The two criteria for determining whether a CEO is overconfident are as follows:

$$\begin{cases} H_{year_t} \geqslant H_{year_{t-1}} \\ \frac{P_{year_t}}{P_{year_{t-1}}} < \frac{Index_{year_t}}{Index_{year_{t-1}}} \end{cases} \tag{4}$$

where H_{year_t} denotes a CEO's shareholding in their firm at the end of year t. P_{year_t} denotes the firm's stock price at the end of year t. $I\text{ndex}_{\text{year}_t}$ denotes the CSI 300 index value at the end of year t.

The results in columns (1) and (3) of Panel C of Table 9 show that *Tax_flexible* has a negative but non-significant correlation with *GW_excess* and *GW_excess1* with regression coefficients of –0.008 (t = –1.36) and –0.009 (t = –1.53), respectively, which indicates that flexible tax enforcement does not have a significant effect on the excess goodwill of firms with overconfident CEOs. In contrast, columns (2) and (4) show that *Tax_flexible* has negative and significant effects on *GW_excess* and *GW_excess1* with regression coefficients of –0.006 (t = –3.12) and –0.007 (t = –3.24), respectively, which suggests that flexible tax enforcement has a significant and negative effect on the excess goodwill of firms whose CEOs are not overconfident. Moreover, the p-value of the suest test for differences between the regression coefficients of different groups is 0.000. These empirical results do not support our assumption that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms with overconfident CEOs if taxpayer credit rating has a governance-based effect. Therefore, we conclude that there is no governance-based effect of CEO overconfidence.

5.2. Reputation-based effect

5.2.1. Analysts' forecast optimism

Analysts play an important role in transmitting information in the markets as an information intermediary between firms and investors. Optimistic analysts' forecasts can send a positive signal to the market that firms are operating well and have a high investment value; this shows their reputation effect on firms. The annual list of A-rated taxpayer firms published by the SAT also sends a positive signal to external stakeholders that firms have high credit in taxpaying, quality inspection, banking and other departments. Therefore, we expect analysts' forecast optimism to weaken the negative effect of flexible tax enforcement on firms' excess goodwill if taxpayer credit rating has a reputation-based effect. To test this assumption, following Kong et al. (2019), we divide the mean value of analysts' forecast optimism by the absolute value of firms' earning per share (EPS) to measure analysts' forecast optimism (*Fopt*). The specific calculation formula is as follows:

$$F\text{opt}_{it} = \frac{Mean\left(Feps_{ijt}\right) - A\text{eps}_{it}}{A\text{bs}(Aeps_{it})} \tag{5}$$

where $Feps_{ijt}$ denotes analyst j's predicted value of firm i's EPS in year t. $Aeps_{it}$ denotes firm i's actual EPS. A high *Fopt* value denotes greater optimism in analysts' forecasts.

The results in Panel A of Table 10 show that *Tax_flexible*Fopt* has a significant and positive effect on *GW_excess* and *GW_excess1* with regression coefficients of 0.001 (t = 1.98) and 0.001 (t = 1.66), respectively, which suggests that analysts' forecast optimism has a reputation substitution effect on a taxpayer credit rating of A—that is, optimistic analysts' forecasts weaken the negative effect of taxpayer credit rating as flexible tax enforcement on firms' excess goodwill. Therefore, we conclude that analysts' forecast optimism has a reputation-based effect.

5.2.2. Philanthropy

Studies show that philanthropy is an effective means for managers to improve firm reputation and manage reputational risk (e.g., Brammer and Millington, 2015; Hogarth et al., 2018; Luo et al., 2018). Hence, we

Table 10
Flexible tax enforcement and excess goodwill: Reputation-based effect.

Panel A: Analyst forecast optimism

Variables	(1)	(3)
	GW_excess_{t+1}	$GW\_excess1_{t+1}$
$Tax\_flexible_t$	−0.007***(-3.50)	−0.008***(-3.69)
$Fopt_t$	−0.001**(-2.15)	−0.000(-1.31)
$Tax\_flexible*Fopt_t$	0.001**(1.98)	0.001*(1.66)
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	0.000(0.01)	−0.049*(-1.84)
Obs	16,015	16,015
R^2	0.070	0.074
F	9.61***	10.75***

Panel B: Philanthropy

Variables	(1)	(3)
	GW_excess_{t+1}	$GW\_excess1_{t+1}$
$Tax\_flexible_t$	−0.015*(-1.84)	−0.018**(-2.11)
$Donation_t$	−0.001(-1.12)	−0.002(-1.29)
$Tax\_flexible*Donation_t$	0.003*(1.74)	0.003**(2.04)
$Controls_t$	Yes	Yes
Year	Yes	Yes
Ind	Yes	Yes
Constant	0.025(0.55)	−0.060(-1.29)
Obs	1637	1637
R^2	0.092	0.104
F	2.26***	3.06***

Panel C: News of violations

Variables	(1)	(2)	(3)	(4)
	GW_excess_{t+1}	GW_excess_{t+1}	$GW\_excess1_{t+1}$	$GW\_excess1_{t+1}$
	Yes	*No*	*Yes*	*No*
$Tax\_flexible_t$	−0.015**(-2.55)	−0.008(-1.29)	−0.016***(-2.66)	−0.009(-1.51)
$Controls_t$	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes
Constant	−0.195(-1.44)	−0.065(-0.82)	−0.161**(-2.13)	−0.106(-1.35)
Obs	1380	993	1380	993
R^2	0.083	0.089	0.083	0.089
F	–	–	–	–
Suest		0.000		0.000

Note: This table presents the reputation-based effect regression results of flexible tax enforcement on excess goodwill from the perspective of the analyst forecast optimism (Panel A), philanthropy (Panel B) and the news of violations (Panel C). Robust OLS regression is used for all columns. The dependent variable is firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term, and the independent variable is flexible tax enforcement (*Tax_*flexible). In Panel A, we utilize the mean value of analysts forecast optimism divided by the absolute value of firms' EPS to measure analysts forecast optimism (*Fopt*). In Panel B, we employ the natural logarithm of firms' social donation expenditure to measure their philanthropy (*Donation*). Grouping variable is whether firms are with the news of violations in Panel C. All control variables are also in t term. All other variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

expect that firms increase their reputation through an increased expenditure on philanthropic activities, such as donations for social causes, so we manually collect social donation data from firms' annual social responsibility report and then use the natural logarithm of firms' social donation expenditure to measure their philanthropic effort (*Donation*). We expect the negative effect of taxpayer credit rating on excess goodwill to be

weakened by firms' philanthropic behaviors if taxpayer credit rating as flexible tax enforcement has a reputation-based effect. The empirical results in Panel B of Table 10 show that *Donation* is negatively correlated with *GW_excess* and *GW_excess1* while *Tax_flexible*Donation* is positively and significantly correlated with *GW_excess* and *GW_excess1* with regression coefficients of 0.003 (t = 1.74) and 0.003 (t = 2.04), respectively, which suggests that firms' philanthropic efforts weaken the negative effect of taxpayer credit rating on excess goodwill. To understand the reasons for these results, we posit that firms' philanthropic activities, such as social donations, send a positive signal to the markets, thereby improving the reputations of managers and firms; this shows the substitution effect on weakening the reputation-based effect of taxpayer credit rating on reducing firms' excess goodwill. Therefore, we conclude that philanthropy has a reputation-based effect.

5.2.3. News of violations

The literature argues that violations damage firm reputation and that managers defend firm reputation in response to different violations (Bundy et al., 2021). Furthermore, some scholars use violations as a reverse proxy for firm reputation (Omer, 2021). Firms being sanctioned by the China Securities Regulatory Commission (CSRC) for violations would send a negative signal to external stakeholders, thereby damaging their reputation. Hence, we expect the negative effect of taxpayer credit rating on excess goodwill to be more pronounced in firms that are reported to be violators if taxpayer credit rating as flexible tax enforcement has a reputation-based effect. Following Omer (2021), we manually collect data on firms under sanctions for violations from the CSRC's website and divide the sample into firms being sanctioned by CSRC for violations and firms not being sanctioned by CSRC for violations. The results in columns (1) and (3) of Panel C of Table 10 show that *Tax_flexible* has negative and significant effects on *GW_excess* and *GW_excess1* with regression coefficients of –0.015 (t = –2.55) and –0.016 (t = –2.66), respectively, which reveals that the negative effect of taxpayer credit rating on excess goodwill is more pronounced in firms that are reported to be violators. In contrast, the results in columns (2) and (4), show that taxpayer credit rating does not have a negative and significant effect on excess goodwill in firms that have not been sanctioned. Moreover, the p-value of the suest test for the differences between the regression coefficients of different groups is 0.000, which suggests that the negative effect of taxpayer credit rating on excess goodwill is more pronounced in firms whose reputation has suffered due to the news of violations. Therefore, we conclude that news about violations by firms has a reputation-based effect.

6. Heterogeneity analysis

6.1. Information transparency

To verify H2 that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms with low information transparency, we use the information disclosure rating of listed firms issued by the Shenzhen Stock Exchange to measure information transparency. The information disclosures of listed firms are graded from high to low using the letters A, B, C and D. We divide the sample into two groups: firms with an information disclosure rating of A are in the high information transparency group and firms with an information disclosure rating other than A are in the low information transparency group. The results in column (1) of Table 11 show that *Tax_Flexible* has a negative but nonsignificant relationship with *GW_excess*, with a regression coefficient of –0.001 (t = –0.21) for firms in the high information transparency group. *Tax_Flexible* has a negative and significant correlation with *GW_excess*, with a regression coefficient of –0.007 (t = –3.26) for firms with the low information transparency group. The p-value of the suest test for differences between the regression coefficients is 0.000, which indicates that there are marked differences in the regression coefficients in columns (1) and (2). To increase the robustness of our conclusions, we use *GW_excess1* to re-run our regression. The results in columns (3) and (4) are consistent with those of columns (1) and (2). This supports H2 that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms with low information transparency.

Table 11
Flexible tax enforcement and excess goodwill: Information transparency.

Variables	(1)	(2)	(3)	(4)
	GW_excess_{t+1}	GW_excess_{t+1}	$GW\_excess1_{t+1}$	$GW\_excess1_{t+1}$
	High	*Low*	*High*	*Low*
$Tax\_flexible_t$	−0.001(-0.21)	−0.007***(-3.26)	−0.001(-0.28)	−0.007***(-3.58)
$Controls_t$	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes
Constant	0.035(0.61)	−0.010(-0.37)	−0.017(-0.30)	−0.057**(-2.07)
Obs	2288	13,727	2288	13,727
R^2	0.096	0.072	0.092	0.077
F	5.67***	8.90***	6.80***	10.08***
Suest test		0.000		0.000

Note: This table presents the heterogeneity analysis regression results of flexible tax enforcement's negative effect on firms' excess goodwill from the perspective of information transparency. Robust OLS regression is used for each column. The dependent variable is firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term, and the independent variable is flexible tax enforcement (*Tax_flexible*) in t term. Grouping variable is information transparency. Other control variables are also in t term. All variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

6.2. Property rights

To verify H3 that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in non-SOEs, we divide the sample into two groups according to property rights. The results in Columns (1) and (2) of Table 12 show that *Tax_Flexible* has a negative but nonsignificant correlation with *GW_excess*, with a regression coefficient of –0.000 (t = –0.11) for the SOE group and a negative and significant correlation with *GW_excess* with a regression coefficient of –0.008 (t = –3.30) for the non-SOE group. Moreover, the p-value of the suest test for the differences between the regression coefficients is 0.000, which indicates that there are marked differences in the regression coefficients of columns (1) and (2). We then substitute *GW_excess* with *GW_excess1*, and we find that the results in columns (3) and (4) are consistent with those of columns (1) and (2). This supports H3 that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in non-SOEs.

6.3. Regional tax enforcement intensity

To test H4 that regional tax enforcement has a substitution effect on flexible tax enforcement, which reflects that the negative effect of flexible tax enforcement on excess goodwill is more pronounced in firms located in regions with low tax enforcement intensity, we divide the sample into high and low groups according to regional tax enforcement intensity. Following Xu et al. (2011), we construct Models (6) and (7) to measure regional tax enforcement intensity. We first use Model (5) to estimate the predicted $Tax_{i,t}/Gdp_{i,t}$ used in Model (7) and then utilize Model (7) to calculate regional tax enforcement intensity. Then, we generate the regional tax enforcement intensity dummy variable based on whether tax enforcement intensity of a focal city is higher than the median value of other cities in the same year.

$$\frac{Tax_{i,t}}{Gdp_{i,t}} = \theta_0 + \theta_1 \frac{Ind1_{i,t}}{Gdp_{i,t}} + \theta_2 \frac{Ind2_{i,t}}{Gdp_{i,t}} + \theta_3 \frac{Openness_{i,t}}{Gdp_{i,t}} + \varepsilon_{i,t} \tag{6}$$

$$Region\_tax_{i,t} = \frac{Tax_{i,t}/Gdp_{i,t}}{\mathrm{Pr}edict\left(Tax_{i,t}/Gdp_{i,t}\right)} \tag{7}$$

Table 12
Flexible tax enforcement and excess goodwill: Property rights.

Variables	(1)	(2)	(3)	(4)
	GW_excess_{t+1}	GW_excess_{t+1}	$GW\_excess1_{t+1}$	$GW\_excess1_{t+1}$
	SOE	*Non-SOE*	*SOE*	*Non-SOE*
$Tax\_flexible_t$	−0.000(-0.11)	−0.008***(-3.30)	−0.001(-0.22)	−0.009***(-3.71)
$Controls_t$	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes
Constant	0.019(0.82)	−0.109***(-2.64)	−0.053**(-2.26)	−0.160***(-3.86)
Obs	4709	10,936	4709	10,936
Adj_R^2	0.127	0.084	0.149	0.086
F	16.79***	8.82***	12.07***	9.70***
Suest test		0.000		0.000

Note: This table presents the heterogeneity analysis regression results of flexible tax enforcement's negative effect on firms' excess goodwill from the perspective of property rights. Robust OLS regression is used for each column. The dependent variable is firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term, and the independent variable is flexible tax enforcement (*Tax_flexible*) in t term. Grouping variable is property rights. Other control variables are also in t term. All variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

where *Tax* denotes the actual tax revenues of city *i* for the current year *t*. *Ind1*, *Ind2* and *Openness* denote the output value of the primary industry, the output value of the secondary industry and the total imports and exports of each city, respectively.

The results in columns (1) and (2) of Table 13 show that *Tax_Flexible* has a negative but nonsignificant correlation with *GW_excess* with a regression coefficient of –0.004 (t = –1.56) for firms located in regions with high tax enforcement intensity and a negative and significant correlation with *GW_excess* with a regression coefficient of –0.007 (t = –2.67) for firms located in regions with low tax enforcement intensity. The p-value of the suest test for the differences between the regression coefficients is 0.000, which suggests that there are marked differences in the regression coefficients of columns (1) and (2). We replace *GW_excess* with *GW_excess1* to check the robustness of our conclusions, and we find that the results in columns (3) and (4)

Table 13
Flexible tax enforcement and excess goodwill: Regional tax enforcement intensity.

Variables	(1)	(2)	(3)	(4)
	GW_excess_{t+1}	GW_excess_{t+1}	$GW\_excess1_{t+1}$	$GW\_excess1_{t+1}$
	High	*Low*	*High*	*Low*
$Tax\_flexible_t$	−0.004(-1.56)	−0.007***(-2.67)	−0.005*(-1.81)	−0.007***(-2.94)
$Controls_t$	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes
Constant	−0.045(-1.21)	0.036(1.09)	−0.090**(-2.41)	−0.014(-0.42)
Obs	7243	8772	7243	8772
R^2	0.082	0.073	0.087	0.076
F	6.99***	6.74***	7.68***	7.01***
Suest test		0.000		0.000

Note: This table presents the heterogeneity analysis regression results of flexible tax enforcement's negative effect on firms' excess goodwill from the perspective of regional tax enforcement intensity. Robust OLS regression is used for each column. The dependent variable is firms' excess goodwill (*GW_excess* and *GW_excess1*) in t + 1 term, and the independent variable is flexible tax enforcement (*Tax_flexible*) in t term. Grouping variable is regional tax enforcement intensity. Other control variables are also in t term. All variables are defined in Table 2. The t-statistics computed using standard errors clustered at firm level are reported in parentheses. *, **, and *** indicate 10%, 5%, and 1% significant, respectively.

are consistent with those in columns (1) and (2). This supports H4 that the negative effect of flexible tax enforcement on excess goodwill is more pronounced for firms located in regions with low tax enforcement intensity.

7. Conclusions and limitations

Using unique manually collected data on the taxpayer credit rating system in China from 2014 to 2021, we investigate the effect of flexible tax enforcement on firms' excess goodwill and its underlying mechanisms and discover the following. First, A-rated taxpayer firms are more likely have less excess goodwill, which suggests that taxpayer credit rating as flexible tax enforcement can burst the goodwill bubble and limit irrational M&As. Second, the negative effect of taxpayer credit rating on excess goodwill is more pronounced in firms that have low information transparency, that are not state-owned and that are located in provinces with low tax enforcement intensity, which suggests that this negative effect is not universal but is state-dependent. Last, coverage by media and analysts, agency costs and CEO overconfidence do not weaken the negative effect of flexible tax enforcement on excess goodwill. However, reputation-enhancing news, such as optimistic analysts' forecasts and philanthropic activities, weaken the negative effect, whereas reputation-damaging news strengthens the negative effect. Hence, unlike mandatory tax enforcement that has a governance-based effect, taxpayer credit rating as flexible tax enforcement reduces excess goodwill through a reputation-based effect and not a governance-based effect.

Nevertheless, this study has the following limitations, which provide research opportunities for future studies on flexible tax enforcement. Flexible tax enforcement may operate through other channels to deter managers' opportunistic behaviors in addition to having a reputation-based effect. There is also room for future studies to explore the economic consequences of flexible tax enforcement in addition to excess goodwill, such as the effect of increments in information from the perspective of stock price synchronicity.

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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Repairing damaged reputations through targeted poverty alleviation: Evidence from private companies' strategies to deal with negative media coverage

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ABSTRACT

When negative media coverage causes reputational crises, companies must find suitable tools to repair their reputation and reverse their negative image. As a CSR activity with political- and livelihood-related implications, targeted poverty alleviation may be an effective tool. Using data on negative media coverage of Chinese A-share private listed companies, we examine whether companies engage in targeted poverty alleviation in response to reputational crises caused by negative media coverage. We find that negative media coverage leads private companies to engage more actively and intensively in targeted poverty alleviation because of the significant increase in public attention to the bad news. These companies must urgently rebuild their positive image using targeted poverty alleviation to resolve their public opinion crisis. Further analyses suggest that original and in-depth negative media coverage is more likely to cause companies' active participation in targeted poverty alleviation. In addition, negative media coverage is more likely to lead companies to engage in targeted poverty alleviation when they are in heavily polluting industries or face greater pressure from external investors. Finally, we find that active involvement in targeted poverty alleviation helps companies improve their market reputation and thus effectively manage public relations crises caused by negative media coverage.

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1. Introduction

The surge in negative media coverage of companies in recent years is closely related to the development of information technologies and the popularity of new media (Zhu and Yang, 2021). The Internet can bring these high-profile events closer to the public, which allows people to observe and discuss these events closely. Additionally, the Internet helps negative news to spread with incredible speed and explosive negative impact. As the Chinese saying goes, "a good deed goes unnoticed, but a scandal spreads fast." Individuals' generally skewed mentality toward their negative biases makes negative news far more powerful and destructive than positive news; hence, exposed companies often quickly become the focus of public criticism. Following the spread of negative public opinion, companies will adopt a series of crisis management strategies to mitigate the serious damage to their reputation and brand image, in addition to repairing their stakeholder relationships (Fang et al., 2011), such as silencing (Griffin, 1991) and "accommodative–defensive" strategies (Coombs, 1998). However, these strategies in direct response to negative criticism are not always effective. The damage to a company's reputation caused by negative media coverage can seriously undermine its stakeholders' trust in the company; therefore, any clarification the company makes may not be helpful (Zhao et al., 2010; Xiong et al., 2011; Yang et al., 2017). Therefore, companies caught in a negative public opinion crisis must use a tool with a high level of social attention to repair their reputation and reverse their negative image.

As a heavily debated buzzword in all sectors of society, targeted poverty alleviation has distinct political attributes and profound connotations for individuals' livelihoods. This positive social influence potentially makes it an effective tool for dealing with reputational crises because its basic qualities underlie general corporate social responsibility (CSR) activities, such as helping companies to send positive signals to the public that they are responsible and value their good reputation. Thus, companies can build their good social image. More importantly, targeted poverty alleviation's unique characteristics make it fundamentally different from general CSR activities (Zhen et al., 2021; Luo et al., 2022).

First, participation in targeted poverty alleviation is a specifically positive response to the major national policy task, the political significance of which far exceeds that of general CSR activities, such as charitable donations. In 2015, the Chinese Communist Party's Central Committee proposed that poverty eradication was an important political task, in which companies are an indispensable force in implementing targeted poverty alleviation measures under this national policy (Du et al., 2019). Following the 18th Party Congress, the central government has made targeted poverty alleviation an important part of its national governance policies. General Secretary Xi Jinping has consistently emphasized the need to mobilize and involve the entire Party and society in fully implementing this policy because they share responsibility in alleviating poverty and developing society. To this end, the State Council's Poverty Alleviation Office and other government departments have launched targeted poverty alleviation initiatives, such as "10,000 Enterprises Helping 10,000 Villages" and "Companies plus Farmers," to guide and encourage companies to engage in efforts to alleviate poverty. Participation in targeted poverty alleviation not only reflects companies' positive response to the national strategy, but also highlights their good image because these companies have taken initiative by assuming political responsibility. However, the political attributes of targeted poverty alleviation are not a feature of general CSR activities.

Second, against the backdrop of an era in which common prosperity is always a concern and discussed widely, the significance of targeted poverty alleviation to livelihoods is quite different from that of general CSR activities. Eradicating poverty, improving people's livelihoods and achieving common prosperity are essential requirements of socialism.[1] Targeted poverty alleviation demonstrates the social perspective that the people's heart is in the right place and the people's livelihood is in need. Participating in targeted poverty alleviation is a concrete manifestation of companies' practical activities to promote social well-being; that is, these initiatives not only demonstrate companies' CSR and brand culture that values people's livelihoods, but also enable these companies to effectively connect with a wide range of stakeholders. Therefore, these compa-

[1] While inspecting efforts to alleviate poverty and develop Fuping county, Hebei province, Xi Jinping gave a speech, "Being a Jiao Yulu-style county party secretary" (29 and 30 December 2012).

nies can accumulate reputational capital through targeted poverty alleviation. As pointed out by Hu and Zhang (2020), due to the national concern with targeted poverty alleviation, companies' participation in this initiative can be evaluated positively by society, which in turn increases their trust in and recognition of companies' CSR activities.

Targeted poverty alleviation can have a great positive social impact because of its political and livelihood significance. Fig. 1. shows a Baidu index for the keywords "targeted poverty alleviation," "social responsibility," and "charitable donation" from 2015 to 2021. The figure shows that targeted poverty alleviation has continued to attract more interest since 2015, with the search volume far exceeding that of social responsibility or charitable donations. Participation in targeted poverty alleviation may have a greater social impact than general CSR activities, such as charitable donations, which means that the effect of quickly improving reputation following targeted poverty alleviation will be more obvious for companies. Therefore, from a crisis management perspective, we examine whether companies use targeted poverty alleviation, which is a CSR activity with political and livelihood implications, as a tool to repair their reputation when faced with negative media coverage.

However, there is no shortage of these cases in practice. In 2016, New Hope Group was involved in a major food safety case involving the illegal sale of expired dairy products. Although New Hope Group immediately declared that this issue was irrelevant to their business, this case still caused serious damage to their social reputation because the company that broke the law in this case, Shanghai Jiawai International Trade Co., Ltd., had a close and substantial relationship with New Hope Group.[2] New Hope Group subsequently launched the "New Hope 1 + 1 Targeted Poverty Alleviation Plan" in 2017. In the 2017 China Excellent Poverty Alleviation Case Report published by *People's Daily Online*, New Hope Group was hailed as one of the outstanding examples of companies promoting targeted poverty alleviation.[3] In addition, netizens even called New Hope Group "the most poverty-alleviating agricultural enterprise." Similarly, a Chinese real estate company, Country Garden, experienced more than 10 civil engineering quality accidents in 2017–2018 that resulted in multiple casualties. At the same time, a considerable surge of rights protection cases involving Country Garden broke out in many places across China.[4] This succession of negative news caused the public to doubt Country Garden because it neglected engineering quality and safety management in its developments. As a result, its corporate image was downgraded from the "No. 1 real estate company in the universe" to the "most scolded real estate company." Amid the continuous occurrence of safety incidents in 2018, Country Garden announced the establishment of a targeted poverty alleviation and rural revitalization group. The company proposed to elevate poverty alleviation to the height of its main business and received the "2018 Annual Contribution to Targeted Poverty Alleviation Award."[5] Both New Hope and Country Garden have chosen to actively engage in targeted poverty alleviation. Through this approach, these companies have raised public awareness of their positive image after negative press coverage led to a reputational crisis.

Based on theoretical extrapolations and practical insights, this paper specifically examines the impact of negative media coverage on companies' targeted poverty alleviation activities using news coverage data from over 400 online media and 600 newspapers and magazines. Taking Chinese A-share private listed companies from 2016 to 2020 as the research object, we verify whether companies use targeted poverty alleviation to cope with their reputation crises. We find that an increase in negative media coverage makes private companies more likely to engage in targeted poverty alleviation. In addition, the intensity of their poverty alleviation efforts increases significantly. This finding holds after robustness tests that consider the multi-period impact of negative media coverage, using an instrumental variable approach and alternative measures for the targeted

[2] After 6 months, the Shanghai police cracked a major case involving processing and selling expired baking dairy products. Shanghai Jiawai International Trade Co., Ltd. sold 276 tons of expired milk powder from New Zealand and 19 people were convicted. The controlling shareholder of the company was Grassroots Knowledge Co., Ltd., an industrial investment platform owned by New Hope Group. See https://shipin.people.com.cn/n1/2016/1026/c85914-28807860.html.

[3] The event brought together representatives of social organizations and enterprises, including New Hope, to share their practical experiences in poverty alleviation. See https://house.people.com.cn/GB/413975/415218/index.html.

[4] For more information, please refer to https://baijiahao.baidu.com/s?id=1607568206952700367&wfr=spider&for=pc.

[5] Country Garden received the "2018 Precise Poverty Alleviation Contribution Award" at the 2019 Health and Wellness Industry Leadership Summit and Annual Social Responsibility Conference, held under the guidance of the China Disabled Persons' Federation, in recognition of its contribution to the well-being of society. See https://www.myzaker.com/article/5d7269df8e9f091405403588/.

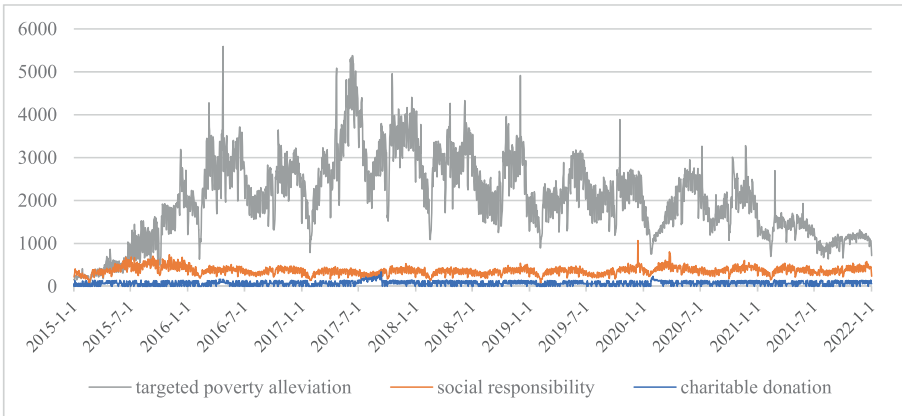

Fig. 1. Comparison of Baidu index for targeted poverty alleviation, social responsibility and charitable donation.

poverty alleviation intensity and regression models. The mechanism analysis also finds that negative media coverage significantly increases the companies' participation in targeted poverty alleviation activities by increasing Internet users' attention to these companies and discussions related to them. Furthermore, considering news coverage attributes, original and in-depth negative coverage are both more likely to lead to companies' active participation in targeted poverty alleviation activities. Moreover, negative media coverage increases companies' participation in targeted poverty alleviation activities when these companies are in heavily polluting industries or face pressure from their external investors. Finally, this paper also finds that private companies' targeted poverty alleviation activities induced by negative media coverage significantly improve their market reputation, as shown specifically by an increase in their trade credit and the proportion of their credit loans, suggesting that companies should respond to public opinion crises using targeted poverty alleviation as an effective impression management strategy.

The main contributions of this paper are as follows. First, most existing studies analyze the governance role of the media from an ex-ante defense perspective of companies. However, few studies examine how companies respond to reputation crises caused by negative media coverage, that is, from an ex-post crisis perspective. Specifically, most scholars find that media attention plays an ex-ante monitoring and external corporate governance role, that is, companies self-regulate to deal with the public pressure from negative media attention (Li and Shen, 2010; Xu et al., 2011; Yang and Zhao, 2012; Luo, 2012; Kong et al., 2013; Zhou et al., 2016; Yang and Zhang, 2021). From an ex-post perspective, in addition to direct coping strategies, such as denial, silence and correction of misconduct, companies may also use impression management as a roundabout way to deal with the public opinion crises caused by negative news. That is, not only does media coverage of negative news have a monitoring and governance effect on companies, but these companies can also use media attention to deflect the public's attention and thereby repair their damaged reputation. Therefore, this paper examines strategies for managing corporate public relations crises from the perspective of after-the-fact media coverage, which is an important addition to the literature on the relationship between media attention and corporate behavior.

Second, while existing studies mainly emphasize the positive effects of targeted poverty alleviation on companies in terms of their performance improvement and risk reduction (Hu and Zhang, 2020; Zhen and Wang, 2021; Yi et al., 2021), this paper finds that companies use this particular CSR activity as an effective means for responding to public opinion crises, thus broadening research perspectives on corporate engagement in targeted poverty alleviation activities. The existing literature finds that CSR can act as a powerful reputational insurance against the risk of damage to corporate image posed by potentially adverse events. In addition, the extent to which a company engages in CSR prior to a negative event affects the effectiveness of the company's adoption of response strategies after the negative event (Goss and Roberts, 2011; Minor and Morgan, 2011; Song et al., 2017; Liu and Lu, 2018; Liu et al., 2019; Zhu and Yang, 2021). However, few studies take the perspective of remedial measures after negative events, focusing on the fact that targeted poverty alleviation, which has great political and livelihood significance, can be an effective means of restoring a company's pos-

itive image when it is already experiencing a reputational crisis. Therefore, this study provides new evidence to better understand the motivation of companies to participate in targeted poverty alleviation activities.

This study also has important practical implications: that is, companies should adopt an appropriate crisis management approach to deal with emerging negative news. In addition to direct coping strategies such as silence, acknowledgment or denial, companies can also adopt the indirect strategy of "doing good deeds" to rebuild their positive image. In this age of new media, news reports are extremely powerful and influential, which makes it difficult for companies to avoid the pressure from public scrutiny. However, these companies can also manage these public impressions by appropriately using media attention to promote their positive image. From the public's perspective, private companies that engage in targeted poverty alleviation activities show a concrete manifestation of their CSR. In contrast, this paper finds that public opinion crises can also lead companies to engage in targeted poverty alleviation activities. Therefore, the public should treat media reports rationally in the context of information explosions, make judgments and express their interests after ascertaining the basic facts, to achieve healthy interactions between the public, media and companies.

This paper is organized as follows. Section 2 presents the literature review, theoretical analysis and research hypothesis, while Section 3 describes the research design, Section 4 gives the empirical results and analysis and finally Section 5 concludes.

2. Literature review, theoretical analysis and hypothesis development

2.1. Literature review

2.1.1. Motivations for targeted poverty alleviation and CSR activities

Companies' targeted poverty alleviation activities are a concrete manifestation of CSR in China. Their motives can be divided into altruism and self-interest (Zhen et al., 2021). Considering companies' altruistic motives, they may engage in altruistic behavior without expecting anything in return (Campbell et al., 1999; Li et al., 2011; Xu and Li, 2016). Li et al. (2020) point out that the main motivation for CSR activities in China is to achieve the goal of corporate value creation rather than making a pure contribution to social welfare. Therefore, the relevant studies, which are mainly based on self-interest motives, explore two types of opposing hypotheses for CSR activities: that is, the value and instrumental hypotheses. Specifically, the CSR value hypothesis, which is also known as the shareholder value hypothesis, argues that being socially responsible provides companies with access to strategic resources, helps to enhance corporate reputation and ultimately increases shareholder value. First, companies that are socially responsible send positive signals to the market, which helps these companies to build a positive image of prosocial behavior, thereby building stable relationships with stakeholders such as shareholders, customers, employees and the government (Goss and Roberts, 2011; Jiang and Lan, 2022). Gelb and Strawser (2001) argue that companies with better social responsibility performance disclose more high-quality information than companies with poor social responsibility performance. Thus, CSR helps to reduce information asymmetry and increase transparency, which results in improving access to finance and reducing financing costs (Cheng et al., 2014; Zhou et al., 2016b). Second, taking on social responsibility helps companies to build good relationships with the government and reduce the risk of political uncertainty, thereby gaining access to more government resources (Dai et al., 2014). Indeed, as pointed out by Li (2012a), the social responsibility undertaken by companies in China is not entirely voluntary, but is largely performed according to the central government's strategic needs. Moreover, political affiliations can bring economic benefits to companies in various ways, such as government subsidies (Li et al., 2012b; Zhang et al., 2013) and access to finance (Li et al., 2015). As can be seen, the CSR value hypothesis is more reflective of shareholderism and long-term value preferences, where companies engage in social responsibility to pursue economic benefits and build political connections.

Also known as the management self-interest hypothesis, the CSR instrument hypothesis suggests that fulfilling social responsibility is a management strategy to cover up corporate misconduct. Social responsibility helps companies to build a good ethical image; therefore, management may use CSR disclosures as a tool for opportunistic behavior. The cover-up effect of social responsibility information reduces the difficulty and cost for shareholders and management to conceal bad news out of self-interest, but increases the difficulty for investors to detect bad news in a timely manner (Tian and Wang, 2017). Gao et al. (2012) find that private

companies often use charitable donations as an instrumental "green scarf" to hide or deflect external attention from their inherent lack of social responsibility. Therefore, companies tend to actively disclose their social responsibility information to communicate to the public that they are performing good activities, which thereby diverts stakeholders' attention from negative information or misconduct to reduce the damage to their reputation (Hemingway and Maclagan, 2004; Quan et al., 2015).

Targeted poverty alleviation is a more advanced form of social responsibility than charitable donations and other philanthropic activities (Guo and Yu, 2006). In addition, companies' motivation for participating in targeted poverty alleviation activities is often considered to be more in line with the CSR value hypothesis because it can enhance corporate confidence, alleviate financing constraints and ultimately align corporate interests and social welfare (Deng et al., 2020; Pan et al., 2021; Zhu et al., 2021). However, by distinguishing between two paths of industrial poverty alleviation in China, that is, integrating poor households' production into the local industrial system and giving cash to poor households, Li (2017) finds that although the former can improve poor households' production and achieve economies of scale in terms of technology and industrial integration, companies prefer the latter. Therefore, companies do not aim to improve poor households' disadvantaged position in the long run. There are also two opposing hypotheses using the value and instrumental motives for companies to participate in targeted poverty alleviation activities. The key to this issue should be to assess companies' motives according to different application scenarios.

2.1.2. Negative media coverage and crisis management strategies

The rapid development of new media has changed the channels through which people obtain and disseminate information. As You and Wu (2012) show, following the expansion of audiences and the speed of information dissemination, the media's social influence and authority continues to increase and establishes the majority opinion, which then dominates public opinion. As a result, negative media reports can spread quickly and attract widespread attention, which quickly creates negative public opinion about the exposed company and leads to a crisis in the company's reputation. Specifically, negative media coverage can negatively affect companies in the following two ways. From an operational perspective, customers and suppliers will not only have less confidence in the exposed company, but will also be less likely to cooperate with it out of concern that their reputation will be jeopardized, which increases the company's business risk. From a financial perspective, negative media coverage will reduce the confidence of financial institutions in the exposed company, decreasing its financing capacity and increasing its financing costs, which may lead to financial stress (Chen et al., 2011; Yao et al., 2011; Liu et al., 2014; Liu et al., 2017). These exposed companies must actively adopt crisis management strategies to minimize the damage to their corporate reputations caused by negative news. Seeger et al. (2003) argue that the real stakeholders in a crisis event (e.g., employees, customers, society) determine whether crisis management is successful. CSR not only helps to enhance reputation but is also an effective way to respond to the demands of core stakeholders. Specifically, crisis management consists of preventive work before a crisis erupts followed by post-crisis work.

From an ex-ante perspective, if a company is actively engaged in social responsibility activities, the public will tend to believe that any negative news is due to bad luck rather than bad behavior, that is, social responsibility can act as a powerful insurance policy for corporate reputations (Minor and Morgan, 2011). Hence, companies can use CSR activities as a risk management tool to deal with potentially adverse event shocks (Goss and Roberts, 2011; Song et al., 2017). Zhu and Yang (2021) find that companies' ex-ante implementation of social responsibility may moderate the effectiveness of their coping strategies after the onset of an adverse event.

From an ex-post perspective, crisis management coping strategies can be divided into direct and indirect coping strategies. The direct coping strategy refers to strategies that are appropriate for the crisis situation when the exposed company chooses among coping methods, such as silence, denial, justification, or apology. Zheng et al. (2011) find that the more negative media coverage attracts public attention, the greater the potential reputational damage to managers. Therefore, reputation-conscious managers would modify their behavior in response to the negative coverage and improve their company's performance. However, it is difficult to rely solely on direct market-based strategies to fully reverse negative perceptions formed by people's preconceptions. In contrast, impression management is a nonmarket-based strategy that actively responds to stakeholders, which has a positive effect on restoring credibility and repairing corporate image (Yang and Guo, 2017). Wang and Cui (2013) observe that the best way to resolve public opinion crises and protect corporate image is

to change the public's negative perception of the exposed company. Therefore, these companies can change their bad public image by engaging in social responsibility activities. That is, they can adopt impression management as an indirect response to the reputational damage caused by public opinion crises.

2.2. Theoretical analysis and hypothesis development

Targeted poverty alleviation is a CSR activity that includes political attributes and livelihood connotations. Its large social influence also has the positive effect of significantly improving corporate reputations (Zhen and Wang, 2021). First, targeted poverty alleviation is a major national strategy strongly advocated and promoted by the Chinese government. Participation in targeted poverty alleviation activities shows companies' positive response to the national policy and its political significance is much greater than that of general CSR activities such as charitable donations. Alleviating poverty is one of the major battles that China must win to build a moderately prosperous society and it is also a necessary method for achieving common prosperity. The Communist Party of China considers efforts to solve the poverty problem as an essential requirement of socialism; therefore, targeted poverty alleviation activities are accorded an extremely high political status. Furthermore, social issues stemming from poverty have always been the most acute and challenging governance problems in developing countries; therefore, the Party's Central Committee has made targeted poverty alleviation a major political task for China and has mobilized the whole society to participate fully and make concerted efforts to eradicate poverty (Yan, 2020). Compared with charitable donations in a general sense, engaging in government-initiated and -led targeted poverty alleviation activities not only reflects companies' political responsibilities, but is also a concrete manifestation of these companies' active response to the government's call to win the battle against poverty. Hence, targeted poverty alleviation activities in companies' development strategies are aligned with national policies.

Second, apart from being a political task, targeted poverty alleviation is a social public issue that is close to people's hearts and required by people's livelihoods. Therefore, participation in targeted poverty alleviation is companies' positive response to public demands (Xing et al., 2021). Targeted poverty alleviation has a profound connotation for people's livelihood; hence, participation in targeted poverty alleviation activities reflects companies' social responsibility to help the poor escape poverty and become rich, which is of great significance in narrowing the gap between the rich and the poor and improving people's living standards (Xiu et al., 2022). In particular, the topic of common prosperity has always been of interest and widely discussed throughout society; thus, participation in targeted poverty alleviation activities demonstrates that these companies are taking practical measures to solve the problems of people's livelihood in poor areas. In addition, targeted poverty alleviation can create a social atmosphere in which companies and individuals can be united in their pursuit of common prosperity. Thus, participation in targeted poverty alleviation initiatives not only enables companies to effectively connect with a wide range of stakeholders, but also reflects their brand culture by attaching importance to people's livelihoods. This helps to enhance external recognition and trust in these companies. In summary, compared with other CSR activities, the unique political attributes and livelihood connotations of alleviating poverty give companies engaging in targeted poverty alleviation great positive social influence, which allows these companies to gain widespread public attention and social recognition, and thereby accumulate a large amount of reputational capital.

Modern media have great power to shape public opinion following the development of Internet technologies, which has increased the efficiency of news reporting greatly. Therefore, companies being reported on can quickly become the focus of public attention. Moreover, the human psychology of negative biases makes people more inclined to pay attention to and learn about negative news than positive news. Hence, negative news attracts more interest and is readily communicated widely (Lobue and Deloache, 2010; Trussler and Soroka, 2014). That is, negative media coverage can quickly increase public attention to and discussions about the exposed company, with an explosive negative impact on its reputation. In response to such crises, exposed companies can adopt various strategies such as defending and correcting their misconduct (Joe et al., 2009; Li and Shen, 2010). However, it is difficult for these exposed companies to restore their damaged reputations simply by responding directly to the negative news if the public loses trust in them.

As mentioned earlier, targeted poverty alleviation has both political and livelihood implications, and can have a huge positive impact on society. It can help companies to gain widespread public attention. In addition,

exposed companies may use this particular CSR activity to repair their damaged reputations and reverse negative images when they find themselves embroiled in public opinion crises. This is essentially an indirect impression management strategy to deal with reputational crises, that is, the exposed company directs its external stakeholders' perceptions of the company's image by consciously presenting certain information to them (Bozeman and Kacmar, 1997; Carlos and Lewis, 2018). As noted by Yang and Guo (2017), a company will emphasize what it does well and undermine concerns about what it does not do well to shape individuals' perceptions of its image. Specifically, depending on the market's initial reaction to a negative event, companies can strategically release noisy information to distract stakeholders' attention from the focal negative event, which reduces the damage to their image (Jin et al., 2022). Correctly identifying stakeholders' demands, reversing their negative perceptions and building a positive image are key to successful crisis management (Coombs, 2007; Wang and Cui, 2013). Thus, companies can use targeted poverty alleviation activities to effectively connect with their stakeholders, which in turn can influence external perceptions of these companies and their reputation in the market. At the same time, because strategic noise with a high social impact is more likely to attract public attention and targeted poverty alleviation is an important development strategy that is highly encouraged by the state in addition to being a public focus, it can help to divert the public's attention from negative news. When companies face public opinion crises, targeted poverty alleviation can be used as an impression management tool to help them effectively reverse their negative image and repair the damage to their reputation.

State-owned companies are also under compulsory pressure to participate in targeted poverty alleviation; therefore, they are more likely to become executors of the state's will. The 13th Five-Year Plan released by the State Council differentiated between the roles of state-owned and private companies in targeted poverty alleviation activities, with a call to "strengthen the responsibility of state-owned companies to help, and encourage and guide private companies to participate in poverty alleviation and development." Du et al. (2019) also observe that not only are state-owned companies generally subject to political pressure from local governments, but national policies and systems also set clear requirements for these state-owned companies to engage in targeted poverty alleviation activities. Compared with state-owned companies, private companies have a higher degree of voluntary autonomy in taking part in targeted poverty alleviation activities. Therefore, this paper focuses only on private listed companies and analyzes whether they use targeted poverty alleviation as a means of ameliorating public opinion crises. Hence, this paper proposes Hypothesis 1:

H1. Private companies with more negative media coverage are more likely to participate in targeted poverty alleviation activities than companies with less negative media coverage, and the intensity of targeted poverty alleviation is greater.

3. Research design

3.1. Sample selection and data source

In 2016, the Shanghai and Shenzhen stock exchanges formulated format specifications for listed companies to disclose social responsibility information for targeted poverty alleviation. Only since then have listed companies started to disclose information in their annual reports about their fulfillment of social responsibility through activities to alleviate poverty.[6] As state-owned companies are likely to participate in targeted poverty alleviation following compulsory pressure and the need to undertake political tasks, the inclusion of state-owned companies in the research sample may lead to biased research results. Therefore, this paper takes Chi-

[6] In September 2016, the CSRC issued the Opinions of the CSRC on Playing the Role of the Capital Market to Serve the National Strategy for Poverty Alleviation, which supported and encouraged listed companies to fulfill their social responsibility to serve the national strategy for poverty alleviation and required the Shanghai and Shenzhen stock exchanges to formulate format guidelines for information disclosures on listed companies' fulfillment of social responsibility through alleviating poverty and to disclose them in their annual reports. In December 2016, the Shanghai and Shenzhen stock exchanges issued the Notice on Further Improving Information Disclosure on Poverty Alleviation Work of Listed Companies and the Notice on Improving Information Disclosure on Poverty Alleviation Work of Listed Companies, respectively, which comprehensively refined the information disclosure requirements for social responsibility work related to poverty alleviation by listed companies.

nese A-share private listed companies from 2016 to 2020 as the research sample. The initial number of sample observations is 11,358. Excluding 465 observations with missing data from media reports, 403 observations coded as special treatment (ST) or *ST, 172 observations from financial companies and 87 observations with missing data on control variables results in a total of 10,231 valid samples. The data sources for this paper mainly include data on the independent variable for negative media coverage from the China Research Data Service (CNRDS), and data on the independent variable for corporate targeted poverty alleviation and other control variables from the China Stock Market & Accounting Research database. To avoid the effect of outliers, all of the continuous variables are winsorized at the upper and lower 1% levels.

Table 1 presents the descriptive statistics of the sample. Both the number and proportion of private companies involved in targeted poverty alleviation show a general increasing trend year by year until 2020. Targeted poverty alleviation across China was gradually completed by 2020, which may explain the slight decline in the number of companies involved in targeted poverty alleviation activities. This result indicates that 22.19% of private companies actively participated in poverty alleviation activities throughout the implementation of the targeted poverty alleviation policy.

3.2. Measures and model design

3.2.1. Dependent variables

Following Luo et al. (2022), we use whether companies participate in targeted poverty alleviation and the intensity of targeted poverty alleviation as the independent variables in Models (1) and (2), respectively. Specifically, if a company discloses the amount of money invested in targeted poverty alleviation projects in the year, it is defined as participating in poverty alleviation, that is, *Poverty* is taken as 1, otherwise it is 0. We measure the intensity of corporate targeted poverty alleviation (*lnPoverty*) by taking the natural logarithm of the total amount of money invested in poverty alleviation plus 1. Further, we also decompose companies' targeted poverty alleviation inputs into monetary (*lnPov_money*) and material (*lnPov_material*) inputs, both of which are processed by taking the logarithm after adding 1 to the amount.

3.2.2. Independent variable

Following Yu et al. (2011) and Yang and Zhang (2021), this paper measures negative media coverage by the total amount of negative news that a company receives in the media. The media coverage data are obtained from the CNRDS, which includes over 400 online media outlets and over 600 newspaper publications. The database is based on tens of millions of original news reports with extensive data cleaning and matching. We further classify the sentiments of news reports based on their contents, from which we identify news reports with a negative tone and then count the number of negative news reports per year for each private listed company. Specifically, we use a machine learning approach to identify the tone of news reports. First, we define the sentiment of news reports as positive, negative or neutral, and manually label the data. Second, we automatically obtain data from the labeled category dataset as a "training dataset," and then we use a supervised support vector machine learning algorithm to learn from the training dataset and obtain a classification model. Finally, we use the classification model to predict the category of the "test dataset" (with an

Table 1
Descriptive statistics of the sample.

Year	Companies engaged in targeted poverty alleviation	Companies did not engage in targeted poverty alleviation	Total of private companies	Percentage of companies engaged in targeted poverty alleviation
2016	228	1,469	1,697	13.44%
2017	380	1,497	1,877	20.25%
2018	569	1,699	2,268	25.09%
2019	580	1,668	2,248	25.80%
2020	513	1,628	2,141	23.96%
Total	2,270	7,961	10,231	22.19%

accuracy of 85%) and thus obtain the sentiment category for the news reports. In this paper, we use the natural logarithm of the number of negative news stories plus 1 to measure the level of negative media coverage of a company (*lnMedia_Neg*).

Table 2 presents the results for the descriptive statistics of media coverage. There were over 1.7 million newspaper media news reports and over 6.6 million online media news reports for listed companies. As can be seen, the top 10 providers of newspaper news coverage are *China Securities Journal*, *Shanghai Securities News*, *Securities Daily*, *Securities Times*, *21st Century Business Herald*, *Southern Daily*, *Qilu Evening News*, *China Business Journal*, *Economic Daily* and *Beijing News*. Among them, *China Securities Journal*, *Shanghai Securities News*, *Securities Daily* and *Securities Times* are the four major official securities newspapers in China with timely in-depth content and great influence; therefore, they are defined as authoritative media in this paper. The top 10 mainstream websites for media news coverage are *Eastmoney*, *JRJ.com*, *Hexun.com*, *Sina.com*, *Business.Sohu.com*, *CNFOL.com*, *ChemCp.com*, *QQ.com*, *p5w.net* and *Finance.ifeng.com*. These 10 online media sites not only lead China in terms of their data and quality of financial news coverage but are also the mainstream financial websites that investors frequently visit to obtain information about listed companies. In addition, Table 2 shows that the number of news reports by online media is much higher than that of newspaper media. That is, the development of Internet technologies has made information dissemination faster and more influential.

3.2.3. Construction of an empirical model

To test whether negative media coverage leads private companies to actively participate in targeted poverty alleviation, specifically in the sense that companies are more likely to engage in and invest more money in targeted poverty alleviation, we construct the following regression model:

$$\begin{aligned} logit(Poverty_t) = \Phi(&\beta_0 + \beta_1 \boldsymbol{lnMedia\_Neg_{t-1}} + \beta_2 Top1_{t-1} + \beta_3 BOD_{t-1} + \beta_4 Duality_{t-1} + \beta_5 LEV_{t-1} \\ &+ \beta_6 ROA_{t-1} + \beta_7 Growth_{t-1} + \beta_8 Sales_{t-1} + \beta_9 Size_{t-1} + \beta_{10} CFO_{t-1} + \sum Year \\ &+ \sum Industry + \varepsilon) \end{aligned} \quad (1)$$

Table 2
Descriptive statistics of media coverage.

Descriptive statistics of newspaper media			Descriptive statistics of online media		
Newspapers	Number of reports	Percentage	Websites	Number of reports	Percentage
China Securities Journal	68,059	3.93%	*Eastmoney*	672,550	10.11%
Shanghai Securities News	54,810	3.17%	*JRJ.com*	513,059	7.71%
Securities Daily	26,932	1.56%	*Hexun.com*	429,878	6.46%
Securities Times	24,068	1.39%	*Sina.com*	305,048	4.59%
21st Century Business Herald	24,044	1.39%	*Business.Sohu.com*	300,228	4.51%
Southern Daily	23,324	1.35%	*CNFOL.com*	269,046	4.04%
Qilu Evening News	15,493	0.90%	*QQ.com*	208,940	3.14%
China Business Journal	13,442	0.78%	*p5w.net*	181,497	2.73%
Economic Daily	13,223	0.76%	*ChemCp.com*	154,593	2.32%
Beijing News	11,394	0.66%	*Finance.ifeng.com*	142,785	2.15%
Other newspapers	1,455,065	84.11%	Other websites	3,475,167	52.24%
Total	1,729,854	100%	Total	6,652,791	100%

$$lnPoverty_t = \beta_0 + \beta_1 \boldsymbol{lnMedia\_Neg}_{t-1} + \beta_2 Top1_{t-1} + \beta_3 BOD_{t-1} + \beta_4 Duality_{t-1}1 + \beta_5 LEV_{t-1} + \beta_6 ROA_{t-1} + \beta_7 Growth_{t-1} + \beta_8 Sales_{t-1} + \beta_9 Size_{t-1} + \beta_{10} CFO_{t-1} + \sum Year + \sum Industry + \varepsilon \quad (2)$$

The dependent variable in Model (1) is the participation in targeted poverty alleviation (*Poverty*), which is a dummy variable; therefore, we use the logit model for estimation. In Model (2), we use the amount of money that companies invest in targeted poverty alleviation (*lnPoverty*), which is the natural logarithm of the total amount of targeted poverty alleviation inputs plus 1, as the dependent variable. There are a large number of 0 values because the majority of private companies do not engage in targeted poverty alleviation, that is, the data on the dependent variable are left-truncated. Therefore, we use the Tobit model for estimation and use other regression models in the robustness tests. We also use robust standard errors to calculate the significance of the parameters. In this paper, we argue that an increase in negative media coverage around companies leads to more active participation in targeted poverty alleviation activities; therefore, we expect that β_1 in Models (1) and (2) will be significantly positive. To control for the impact of other factors on corporate targeted poverty alleviation behavior, this paper also includes a series of control variables: shareholding ratio of the largest shareholder (*Top1*), number of directors on the board (*BOD*), duality (*Duality*), financial leverage (*LEV*), return on assets (*ROA*), sales growth (*Growth*), sales revenue (*Sales*), total assets (*Size*) and net cash flow from operations (*CFO*), in addition to controlling for year and industry fixed effects. Given that there may be a certain lag in the decision of companies to engage in targeted poverty alleviation activities in response to negative news reports, this paper treats all independent variables with a one-period lag. Table 3 provides specific definitions of the variables.

Table 3
Variable definitions.

Variables	Variable definitions
Poverty	Dummy variable for targeted poverty alleviation: equals 1 if companies participate in targeted poverty alleviation and 0 otherwise
lnPoverty	Intensity of targeted poverty alleviation: natural logarithm of 1 plus the total amount of targeted poverty alleviation inputs
lnPov_money	Monetary input of targeted poverty alleviation: natural logarithm of 1 plus the total amount of money inputs
lnPov_material	Material input of targeted poverty alleviation: natural logarithm of 1 plus the total amount of material inputs
lnMedia_Neg	Negative media coverage: the total amount of negative news about a company in the media
Pollution	Dummy variable for heavy pollution: equals 1 if companies are in heavily polluting industries and 0 otherwise
Coverage	Dummy variable for analysts following the company: equals 1 if the number of analysts following the company is greater than the median and 0 otherwise
Attention	Dummy variable for reports issued by analysts: equals 1 if the number of reports is greater than the median and 0 otherwise
Top1	The shareholding ratio of the large shareholder: the share owned by the largest shareholder / total shares
BOD	Number of directors on the board
Duality	Duality: equals 1 if the CEO and the chairman of the board are the same person and 0 otherwise
LEV	Leverage: total debt / total assets
ROA	Return on assets: net profit / total assets
Growth	Operating income growth rate
Sales	Natural logarithm of total sales revenue
Size	Natural logarithm of total assets
CFO	Free cash flow: net cash flow from operating activities / total assets at the end of the period
Year/Industry	Dummy variable for year / industry

Table 4
Descriptive statistics.

Variables	N	Mean	Median	S.D.	Min	Max
Poverty	10,231	0.2219	0.0000	0.4155	0.0000	1.0000
lnPoverty	10,231	2.4905	0.0000	5.3633	0.0000	17.8556
lnPov_money	10,231	2.3913	0.0000	5.2510	0.0000	17.7482
lnPov_material	10,231	0.7611	0.0000	2.9403	0.0000	14.5456
lnMedia_Neg	10,231	3.9227	3.8918	0.9924	1.6094	7.1397
BOD	10,231	8.1434	9.0000	1.4731	5.0000	14.0000
Top1	10,231	31.5874	29.8200	13.6246	8.7300	74.1800
Duality	10,231	0.3871	0.0000	0.4871	0.0000	1.0000
LEV	10,231	0.3776	0.3637	0.1882	0.0595	0.8696
ROA	10,231	0.0416	0.0433	0.0651	–0.2714	0.1933
Growth	10,231	0.2175	0.1308	0.4613	–0.5347	2.8858
Sales	10,231	21.1917	21.0830	1.2624	18.4999	25.5854
Size	10,231	21.9154	21.7950	1.1074	19.9083	26.1859
CFO	10,231	0.0476	0.0460	0.0681	–0.1521	0.2409

3.3. Descriptive statistics of variables

Table 4 shows the descriptive statistics for the main variables. The percentage of the sample participating in targeted poverty alleviation (*Poverty*) is 22.19%, which shows that more than one fifth of private listed companies have actively participated in targeted poverty alleviation. The minimum and maximum values of *lnPoverty* are 0 and 17.86, respectively, with a standard deviation of 5.36, which indicates that the total amount of targeted poverty alleviation investment by companies shows a large difference. The mean values of *lnPov_money* and *lnPov_material* are 2.39 and 0.76, respectively, which means that private companies are more inclined to make monetary investments than material investments in targeted poverty alleviation activities. The minimum value of *lnMedia_Neg* is 1.61, the maximum value is 7.14, the mean value is 3.92 and the standard deviation is 0.99, indicating that the level of negative media coverage varies widely for different companies. In the sample, the mean value of *BOD* is 8.14, the mean value of *Top1* is 31.59, 38.71% of companies have the same chairman and chief executive officer (*Duality*), the mean value of *LEV* is 0.38, the mean value of *ROA* is 0.04, the mean value of *Growth* is 0.22, the mean value of *Sales* is 21.19, the mean value of *Size* is 21.92 and the mean value of *CFO* is 0.05.

4. Empirical results and analysis

4.1. Negative media coverage and private companies' targeted poverty alleviation behavior

We investigate the influence of negative media coverage on the behavior of private companies in targeted poverty alleviation activities using Models (1) and (2), respectively, and show the regression results in Table 5. Column 1 presents the regression results for negative media coverage and whether private companies participate in targeted poverty alleviation activities. The coefficient of *lnMedia_Neg* is 0.1640 and is significantly positive at the 1% level, indicating that private companies with more negative media coverage are more inclined to participate in targeted poverty alleviation activities. The coefficient of *lnMedia_Neg* in Column 2 is 1.3679, which is also significantly positive at the 1% level, implying that negative media coverage also leads private companies to invest more in targeted poverty alleviation activities. We further distinguish the intensity of targeted poverty alleviation into the intensity of targeted poverty alleviation inputs in terms of capital (*lnPov_money*) and materials (*lnPov_material*), and regress the negative media reports separately to test whether negative media coverage has a consistent effect on both items. The regression results are shown in Columns 3 and 4 of Table 5. An increase in negative media coverage leads private companies to invest more money and more material in targeted poverty alleviation activities. Taken together, these results suggest that private companies are more active and invest more money and materials in targeted poverty alleviation initiatives when faced with more negative media coverage to repair the damaged reputations, thus validating *H1* in this paper.

Table 5
The impact of negative media coverage on targeted poverty alleviation behavior of private companies.

Variables	(1)	(2)	(3)	(4)
	Poverty	*lnPoverty*	*lnPov_money*	*lnPov_material*
lnMedia_Neg	0.1640***	1.3679***	1.3376***	2.3708***
	(5.66)	(4.45)	(4.31)	(5.05)
BOD	0.0610***	0.5416***	0.5385***	0.7672***
	(3.42)	(2.87)	(2.83)	(2.66)
Top1	−0.0024	−0.0301	−0.0286	0.0134
	(-1.24)	(-1.44)	(-1.36)	(0.43)
Duality	0.0624	0.5242	0.5100	0.7148
	(1.17)	(0.92)	(0.88)	(0.81)
LEV	0.2998*	1.2746	1.4459	−3.7435
	(1.65)	(0.64)	(0.72)	(-1.24)
ROA	3.2860***	33.4072***	34.3218***	18.1515**
	(6.08)	(5.75)	(5.80)	(1.97)
Growth	−0.1451**	−1.4492**	−1.2858**	−1.7791*
	(-2.37)	(-2.22)	(-1.96)	(-1.71)
Sales	0.1433***	1.4558***	1.3410***	1.4588*
	(3.05)	(2.85)	(2.60)	(1.90)
Size	0.2532***	2.9953***	3.2057***	4.1224***
	(4.74)	(5.28)	(5.59)	(4.86)
CFO	1.4214***	16.4028***	15.5967***	27.0374***
	(3.38)	(3.60)	(3.38)	(3.86)
Constant	−10.7538***	−123.6467***	−125.9217***	−170.1465***
	(-17.58)	(-19.70)	(-19.94)	(-17.89)
Year/Industry FE	Yes	Yes	Yes	Yes
N	10,231	10,231	10,231	10,231
Pseudo R^2	0.086	0.039	0.040	0.060

Note: The t-statistics reported in parentheses are calculated based on robust standard errors in the table, ***, ** and * indicate significance at the 1%, 5% and 10% respectively, as below.

4.2. Robustness tests

4.2.1. Impact of multi-period negative media coverage on targeted poverty alleviation

Considering that there is a certain lag in the coping strategies adopted by companies in response to negative news, we use an independent variable with a 1-year lag (*lnMedia_Neg*) in the main test. To verify that the effect of negative media coverage on companies' targeted poverty alleviation behavior mainly exists in the 1-year lagged data, this paper conducts robustness tests on negative media coverage in different periods. Specifically, we include negative media coverage in 2-year ahead ($lnMedia\_Neg_{t+2}$), 1-year ahead ($lnMedia\_Neg_{t+1}$), current year ($lnMedia\_Neg_{t}$), 1-year lagged ($lnMedia\_Neg_{t-1}$), 2-year lagged ($lnMedia\_Neg_{t-2}$) and 3-year lagged ($lnMedia\_Neg_{t-3}$) data in Models (1) and (2). Table 6 shows the regression results. Only 1-year lagged negative media reports significantly affect the private companies' targeted poverty alleviation, while the negative media reports in the other time periods have no significant effect on targeted poverty alleviation. Negative reports do not have an impact on targeted poverty alleviation before the news appears; meanwhile, it is difficult for companies to immediately invest more in their targeted poverty alleviation activities and disclose them in response to the negative impact of news reports in the current year. As a result, companies affected by negative media coverage are more likely to actively engage in targeted poverty alleviation activities in the following year to repair their damaged reputations.

4.2.2. Using instrumental variables to address endogeneity issues

To further mitigate the endogeneity problem of possible omitted variables affecting both the negative media coverage and the targeted poverty alleviation behavior of companies, this paper uses the instrumental variables approach to test the main findings. First, according to a study by You et al. (2018), the geographical

Table 6
Considering the impact of multi-period negative media coverage on targeted poverty alleviation.

Variables	(1)	(2)
	Poverty	*lnPoverty*
$lnMedia\_Neg_{t+2}$	0.0011	−0.5714
	(0.02)	(-0.82)
$lnMedia\_Neg_{t+1}$	−0.0543	0.1879
	(-0.89)	(0.27)
$lnMedia\_Neg_{t}$	−0.0057	−0.1501
	(-0.09)	(-0.22)
$lnMedia\_Neg_{t-1}$	0.1877***	1.5897**
	(2.89)	(2.22)
$lnMedia\_Neg_{t-2}$	0.0796	0.4587
	(1.05)	(0.56)
$lnMedia\_Neg_{t-3}$	0.0609	0.8729
	(0.93)	(1.25)
Controls	Yes	Yes
Year/Industry FE	Yes	Yes
N	4518	4532
Pseudo R^2	0.107	0.050

Note: *Controls* include all control variables in the model, same below.

distance between the location of the listed company and the location of the media is closely related to media news coverage, so we choose the company-to-media distance as an instrumental variable. First, the local government can intervene with local media to make them reduce negative coverage of local companies; second, the convenience of geographical distance gives companies more opportunities to establish good relationships with the media, thus reducing the exposure of negative news. Therefore, the smaller the geographical distance between the location of the company and the location of the media, the more likely it is that media news coverage will be constrained by the administrative intervention of the local government and the relationship between the company and the media, thus reducing the coverage of negative news about the company. That is, the distance between the company and the media satisfies the relevance requirement of the instrumental variable. However, the location of the company's registered office is relatively exogenous to the location of the media and we argue that this instrumental variable largely satisfies the exogeneity requirement. Specifically, we obtain the latitude and longitude of each company's registered location and the latitude and longitude of the cities where the top 41 financial media outlets are located using xGeocoding software, and then calculate the weighted distance between the company and the top 41 financial media based on the number of reports.[7]

Second, we use the mean value for the negative media coverage of other companies in the same industry and the same region as an instrumental variable. Companies in the same industry and region may have similar industry characteristics and external environment. If other companies in the same industry and region are exposed to negative media coverage, it may draw public attention to the company, but the negative media coverage of other companies should not directly affect that company's decision to engage in targeted poverty alleviation activities. Therefore, this paper considers that this instrumental variable basically meets the requirements of relevance and exogeneity.

Columns 1–3 of Table 7 show the regression results using the company-to-media distance as the instrumental variable, while Columns 4–6 of Table 7 show the regression results using the mean value of negative media coverage of other companies as the instrumental variable. Columns 1 and 4 demonstrate the results of the first-

[7] We select financial media whose own reports account for more than 0.3% of the total number of media reports, including 34 online media and seven newspaper media, located in Beijing, Shanghai, Dalian, Shenzhen, Guangzhou, Fuzhou, Xiamen, Tianjin, Nanning, Wenzhou and Jinhua. These 41 media reports account for 68.62% of all media reports, which not only include authoritative media, comprising nearly 70% of the news quantity, but also have a wide distribution with good representativeness.

Table 7
Instrumental variables regression.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	lnMedia_Neg	*Poverty*	*lnPoverty*	*lnMedia_Neg*	*Poverty*	*lnPoverty*
	First stage		Second stage	First stage		Second stage
		company-to-media distance		mean value of negative media coverage of other companies		
IV	0.0002***			0.4096***		
	(5.21)			(20.24)		
lnMedia_Neg		3.5871***	57.0629***		0.2596***	5.1448***
		(4.94)	(4.87)		(2.97)	(3.16)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year/Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	9045	9045	9045	10,225	10,225	10,225
F statistic	115.44	–	–	131.17	–	–
Wald test	–	*chi2* = 134.74	*chi2* = 116.58	–	*chi2* = 8.89	*chi2* = 10.14
[p-value]		[0.0000]	[0.0000]		[0.0029]	[0.0015]
AR test	–	*chi2* = 24.45	*chi2* = 23.74	–	*chi2* = 8.83	*chi2* = 10.01
[p-value]		[0.0000]	[0.0000]		[0.0030]	[0.0016]

Note: The sample size here is slightly smaller than the baseline regression due to a small number of missing values for instrumental variables.

stage regression, where the company-to-media distance and the mean value of negative media coverage of other companies are each significantly and positively correlated with negative media coverage. That is, the greater the geographical distance between the locations of the company and media, and the greater the mean value of negative media coverage of other companies in the same industry and the same region, the greater the negative media coverage of the company. Columns 2, 3, 5 and 6 report the results of the second-stage regression, where *lnMedia_Neg* remains significantly positive. That is, negative media coverage makes companies more likely to engage in targeted poverty alleviation. Both instrumental variables have F-statistics well above 10 in the first stage and both the AR and Wald tests reject the weak instrumental variable hypothesis, indicating that the two instrumental variables used in this paper are not weak. As can be seen, the endogeneity issue does not affect the main findings of this paper.

4.2.3. Alternative measurement of the targeted poverty alleviation intensity and regression model

In the baseline regression, we measure the targeted poverty alleviation effort using the natural logarithm of 1 plus the total amount of targeted poverty alleviation and test Model (2) using a Tobit regression model based on the data characteristics of companies' targeted poverty alleviation input (*lnPoverty*). To prevent estimation bias caused by the definition of key variables or model selection from affecting the robustness of this paper's conclusions, we reexamine the results by changing the definition of poverty alleviation intensity and replacing the regression model, respectively. Specifically, we first redefine the intensity of targeted poverty alleviation as the ratios of targeted poverty alleviation inputs to total assets (*PovertyRate1*) and total operating income (*PovertyRate2*), then replace the dependent variables in Model (2) for the regression. Columns 1 and 2 of Table 8 show the regression results. Second, we reexamine the relationship using the ordinary least squares (OLS) and Poisson models, where the dependent variables of the OLS model are the same as in Model (2). We apply the Poisson regression to the count variables and replace the dependent variable (*Pov_money*) in Model (2) with the total amount of targeted poverty alleviation inputs. Columns 3 and 4 of Table 8 present the regression results, which show that negative media coverage and private companies' targeted poverty alleviation intensity are significantly and positively correlated at the 1% level. That is, the measurement of the targeted poverty alleviation intensity and choice of regression model do not affect the robustness of our findings.

Table 8
Alternate measurement of targeted poverty alleviation intensity and regression model.

Variables	(1)	(2)	(3)	(4)
	PovertyRate1	*PovertyRate2*	*lnPoverty*	*Pov_money*
		Alternative measures	*OLS*	*Poisson*
lnMedia_Neg	0.0103***	0.0194***	0.4338***	0.1828***
	(4.69)	(4.25)	(6.94)	(3.14)
Controls	Yes	Yes	Yes	Yes
Year/Industry FE	Yes	Yes	Yes	Yes
N	10,231	10,231	10,231	10,231
Pseudo/Adj. R^2	0.232	0.123	0.101	0.347

4.2.4. Threshold regression model to further test the nonlinear relationship between negative media coverage and targeted poverty alleviation

Given that there may be a nonlinear relationship between negative media coverage and targeted poverty alleviation, this paper conducts tests based on the threshold model of Hansen (1999), which requires testing two basic hypotheses. The first hypothesis is that the threshold effect is significant and the second is that the estimated value of the threshold is equal to its true value. For the first hypothesis, we test it in the order of no threshold, one threshold, two thresholds and three thresholds. For the second hypothesis, the null hypothesis is $\gamma = \gamma\_0$, and the corresponding likelihood ratio statistic LR(γ) is calculated. The null hypothesis cannot be rejected if $LR(\gamma) \leq -2\ln(1-\sqrt{1-\alpha})$, where α represents the significance, which we take to be 5%. The corresponding critical value for LR is 7.35. Specifically, we set up the single-threshold model as shown in Model (3), and the other variables in Model (3) are defined as in Model (2). We estimate the model parameters using a cross-sectional threshold model:

$$\begin{aligned} lnPoverty_t = {} & \beta_0 + \boldsymbol{\beta_1 lnMedia\_Neg_{t-1} I(lnMedia\_Neg < T)} + \boldsymbol{\beta_2 lnMedia\_Neg_{t-1} I(lnMedia\_Neg} \\ & \boldsymbol{> T)} + \beta_3 Top1_{t-1} + \beta_4 BOD_{t-1} + \beta_5 Duality_{t-1} + \beta_6 LEV_{t-1} + \beta_7 ROA_{t-1} + \beta_8 Growth_{t-1} \\ & + \beta_9 Sales_{t-1} + \beta_{10} Size_{t-1} + \beta_{11} CFO_{t-1} + \sum Year + \sum Industry + \varepsilon \end{aligned} \tag{3}$$

For Model (3), Table 9 and Fig. 2 show the results of the two tests described above, where Table 9 shows that the *F* statistic for the single threshold is significant at the 1% level, while the *F* statistic for the double threshold is not significant. Additionally, the LR(γ) value for the second threshold is below the critical value, as shown in Fig. 2, which results in a confidence interval that is too large to reject the null hypothesis. Combining the results of the two tests shows that the single-threshold model is suitable in this paper.

According to the results of the threshold regression model (see Table 9), there is a single threshold effect on the impact of negative media coverage on private companies' targeted poverty alleviation. We divide the negative media coverage into two intervals using the threshold value as the boundary, that is, *lnMedia_Neg* less than 5.638 and *lnMedia_Neg* $\geq$ 5.638, which are denoted as *lnMedia_Neg_1* and *lnMedia_Neg_2*. Table 10 presents the empirical results, where the coefficients of both *lnMedia_Neg_1* and *lnMedia_Neg_2* are significantly positive and the coefficient of *lnMedia_Neg_1* is smaller than that of *lnMedia_Neg_2*. In addition,

Table 9
Threshold estimates.

Model	*F statistic*	*P-value*	Estimate		Critical values		
			I	II	1%	5%	10%
Single threshold	10.575***	0.000	5.638		6.683	4.215	2.983
Double threshold	2.484	0.130	4.710	5.638	6.119	3.880	2.835

Note: (1) ***, ** and * denote significance levels of less than 1%, 5% and 10% respectively. p-values are the results obtained from 500 iterations of sampling using the bootstrap method. (2) During each threshold test, when a new threshold is identified, the previous threshold is recorrected.

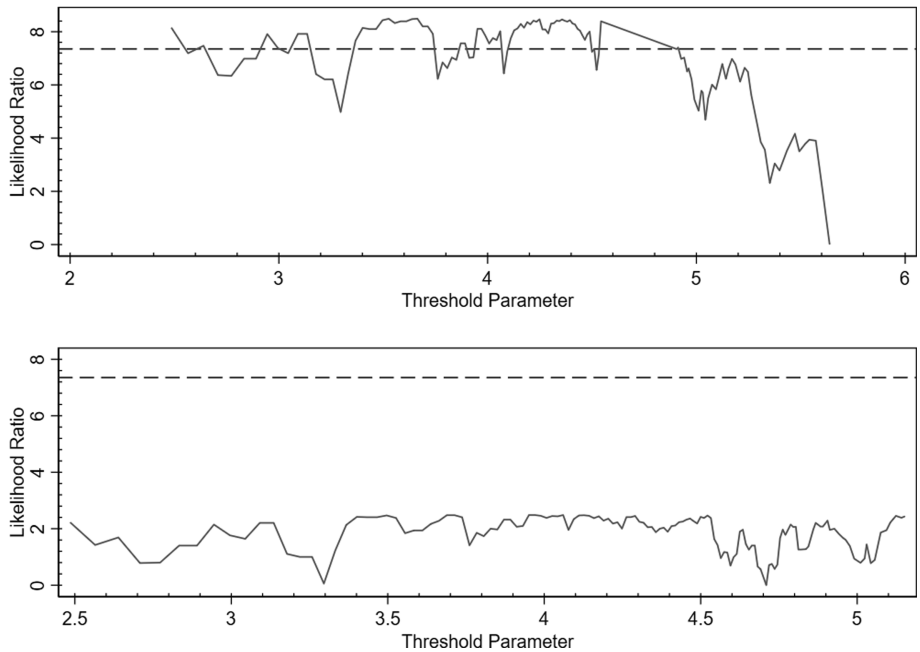

Fig. 2. Threshold estimates and confidence intervals.

the test of difference between the two coefficients is significantly positive. This result indicates that when the level of negative media coverage exceeds the threshold, the effect of negative media coverage in promoting active participation of companies in targeted poverty alleviation is stronger.

4.2.5. Impact of negative media coverage on the intensity of private companies' different forms of targeted poverty alleviation

Targeted poverty alleviation is mainly a public good expenditure for companies, but the specific methods for industrial development to alleviate poverty can create new value for both companies and society (Du et al.,

Table 10
Regression estimates: single threshold model.

Variables	(1)	
	lnPoverty	
lnMedia_Neg_1	0.3229***	*Test of Diff.*
	(4.70)	[*p-value*]
lnMedia_Neg_2	0.4674***	7.1740***
	(7.12)	[0.0074]
Controls	Yes	
Year/Industry FE	Yes	
N	10231	
Adj. R^2	0.102	

2019; Deng et al., 2020). Compared with other forms of alleviating poverty, industrial poverty alleviation has been shown to be the most effective way to eliminate poverty because it is a blood-generating form of poverty alleviation with both philanthropic and investment functions (Li et al., 2020b; Zhen and Wang, 2021). However, industrial poverty alleviation requires companies not only to integrate helping the poor with their own businesses, but also to invest resources sustainably over the long term. If private companies participate in targeted poverty alleviation only to cope with the reputational damage caused by negative media reports, that is, considering their instrumental motives, they should prefer to choose a form of targeted poverty alleviation that can replace government and public goodwill with short-term or one-off investments to quickly achieve the purpose of crisis public relations.

We further investigate whether private companies that receive negative media coverage have different levels of involvement in different forms of targeted poverty alleviation, based on a sample of companies that have participated in targeted poverty alleviation activities. Specifically, we refer to the study by Pan et al. (2021), which classifies five forms of targeted poverty alleviation activities by companies: that is, developing competitive industries (*Industrial*), improving education (*Education*), guaranteeing basic living standards for people unable to work and alleviating social poverty (*Social*), providing better health care and ecological protection (*Health*) and finding jobs elsewhere and relocating (*Employ*). Only the coefficient of *lnMedia_Neg* in Column 4 of Table 11 is significantly positive; that is, the more negative the media coverage, the more private companies invest in providing better health care and ecological protection, while there is no significant effect on other types of targeted poverty alleviation, i.e., industrial poverty alleviation.

Considering these results in detail, first, the concrete ways in which companies participate in providing better health care mainly include investing in medical and health resources in poor areas, helping poor people to receive assistance for major illnesses and conducting medical insurance cooperation to alleviate poverty. The aim is to ensure that poor people can enjoy basic medical and healthcare services, and to solve the problem of difficult, distant and expensive access to healthcare and medical services in poor areas. Compared with industrial development and the improvement of human capital, life and health are more basic needs for people's survival and development. The Health China strategy proposed by the Central Committee and the State Council is to "give priority to people's health." Second, private listed companies mainly participate in providing better ecological protection and poverty alleviation by means such as ecological protection and construction, safe drinking water projects and greening of living environments. Environmental protection is also related to the vital interests of the general public. General Secretary Xi Jinping has repeatedly stressed that "clear water and lush mountains are invaluable assets," which also makes "green" and "environmental protection" extremely topical issues in China.

Therefore, health and ecological issues are currently of great concern for all sectors of society, and companies are able to quickly gain the attention of the media and public, which is helpful in mitigating the impact of negative public opinion crises on their reputations. In summary, private companies are more likely to engage in forms of poverty alleviation that have a greater social influence, are more appealing and attract more public attention to repair the reputational damage caused by negative media coverage, rather than in industrial and educational poverty alleviation, which are longer-term and slower-acting forms that have a better effect on

Table 11
The impact of negative media coverage on different forms of targeted poverty alleviation.

Variables	(1)	(2)	(3)	(4)	(5)
	Industrial	*Education*	*Social*	*Health*	*Employ*
lnMedia_Neg	0.1133	0.2285	−0.2178	2.1507***	−0.8413
	(0.22)	(0.77)	(-0.85)	(3.60)	(-0.97)
Controls	Yes	Yes	Yes	Yes	Yes
Constant	−84.0424***	−49.8762***	−41.9426***	−115.6671***	−82.3388***
	(-8.44)	(-8.17)	(-8.16)	(-9.50)	(-5.24)
Year/Industry FE	Yes	Yes	Yes	Yes	Yes
N	2270	2270	2270	2270	2270
Pseudo R^2	0.026	0.016	0.014	0.056	0.042

poverty alleviation (Pan et al., 2021). This result also demonstrates that companies do use targeted poverty alleviation as a means of dealing with their reputational crises.

4.2.6. Are companies more likely to engage in targeted poverty alleviation in locations with negative media coverage?

Having previously shown that increased negative media coverage leads companies to choose to engage in targeted poverty alleviation, it follows that companies should be able to repair their reputation more significantly by alleviating poverty in locations where negative media coverage occurs. Therefore, this paper identifies the locations for negative media coverage and companies participating in targeted poverty alleviation, and then distinguishes the sample of companies engaged in targeted poverty alleviation into those that alleviate poverty at the location of negative media coverage and those that do not. Specifically, we take *Same_prov* as 1 if the company is engaged in targeted poverty alleviation in the province where the source of negative media coverage is located and as 0 if the company is not engaged in targeted poverty alleviation. We take *Different_prov* as 1 if the company is not engaged in targeted poverty alleviation in the province where the source of negative media coverage is located and as 0 if the company is not engaged in targeted poverty alleviation. Similarly, we take *Same_city* as 1 if the company is engaged in targeted poverty alleviation in the city where the source of negative media coverage is located and as 0 if the company is not engaged in targeted poverty alleviation, while we take *Different_city* as 1 if the company is not engaged in targeted poverty alleviation in the city where the source of negative media coverage is located and as 0 if the company is not engaged in targeted poverty alleviation.

Table 12 shows the regression results, where Columns 1 and 2 show the results for companies that engage in targeted poverty alleviation in the provinces where they receive negative media coverage and for companies that do not engage in targeted poverty alleviation in the provinces where they receive negative media coverage, respectively. The coefficients on *lnMedia_Neg* are both significantly positive, but the coefficient values and significance in Column 1 are greater than in Column 2; therefore, negative media coverage is more likely to lead companies to engage in targeted poverty alleviation in the province where the source of coverage is located. The between-groups difference test also shows that the coefficients for *lnMedia_Neg* in Columns 1 and 2 are significantly different. Columns 3 and 4 present the results of the regressions for companies that do and do not engage in targeted poverty alleviation in the cities where they have negative media coverage, which are similar to the results in Columns 1 and 2. Taken together, the results in Table 12 validate the expectation that companies are more likely to engage in targeted poverty alleviation in the location of negative media coverage to repair their reputation.

4.3. Mechanism analysis

We explore how negative media coverage leads companies to become more active in targeted poverty alleviation activities. The exposure of negative media reports quickly raises the public's awareness of bad news

Table 12
The locations of companies received negative media coverage and participated in targeted poverty alleviation.

Variables	(1)	(2)	(3)	(4)
	Same_prov	*Different_prov*	*Same_city*	*Different_city*
lnMedia_Neg	0.4384***	0.0624*	0.5275***	0.0984***
	(8.65)	(1.91)	(7.98)	(3.19)
Controls	Yes	Yes	Yes	Yes
Year/Industry FE	Yes	Yes	Yes	Yes
N	8535	9622	8133	9900
Pseudo R^2	0.156	0.061	0.158	0.072
Test of Diff.		38.60***		45.19***
[*p-value*]		[0.0000]		[0.0000]

about a company because the rapid development of Internet technologies makes it easier for the public to observe and discuss these issues closely. Hence, the public can search for and discuss negative media reports about a company via the Internet, which can greatly increase the spread and impact of negative news and cause the company to face enormous public pressure and a reputational crisis. Therefore, by actively participating in targeted poverty alleviation activities, the exposed company may be able to shift the focus of public attention from bad news to its good deeds to highlight its good socially responsible image and repair its damaged reputation. To test this mechanism, we use path analysis and construct the following structural equation model following Pevzner et al. (2015):

$$Focus_t = \alpha_0 + \alpha_1 \boldsymbol{lnMedia\_Neg_{t-1}} + \alpha_2 Top1_{t-1} + \alpha_3 BOD_{t-1} + \alpha_4 Duality_{t-1} + \alpha_5 LEV_{t-1} + \alpha_6 ROA_{t-1} + \alpha_7 Growth_{t-1} + \alpha_8 Sales_{t-1} + \alpha_9 Size_{t-1} + \alpha_{10} CFO_{t-1} + \sum Year + \sum Industry + \varepsilon \quad (4)$$

$$logit(Poverty_t) = \Phi(\beta_0 + \boldsymbol{\beta_1 lnMedia\_Neg_{t-1}} + \boldsymbol{\beta_2 Focus_t} + \beta_3 Top1_{t-1} + \beta_4 BOD_{t-1} + \beta_5 Duality_{t-1} + \beta_6 LEV_{t-1} + \beta_7 ROA_{t-1} + \beta_8 Growth_{t-1} + \beta_9 Sales_{t-1} + \beta_{10} Size_{t-1} + \beta_{11} CFO_{t-1} + \sum Year + \sum Industry + \varepsilon) \quad (5)$$

$$lnPoverty_t = \gamma_0 + \boldsymbol{\gamma_1 lnMedia\_Neg_{t-1}} + \boldsymbol{\gamma_2 Focus_t} + \gamma_3 Top1_{t-1} + \gamma_4 BOD_{t-1} + \gamma_5 Duality_{t-1} + \gamma_6 LEV_{t-1} + \gamma_7 ROA_{t-1} + \gamma_8 Growth_{t-1} + \gamma_9 Sales_{t-1} + \gamma_{10} Size_{t-1} + \gamma_{11} CFO_{t-1} + \sum Year + \sum Industry + \varepsilon \quad (6)$$

The dependent variable in Model (4) and the independent variables in Models (5) and (6) capture netizens' attention to the company (*Focus*). We use two indicators to measure this distinction: *Baidu_Search* and *Guba_NegPost*.[8] First, Baidu is the largest search engine in China. To measure the Baidu index, we take the search volume of netizens on Baidu as the database and each company's stock code as the statistical object to calculate the weighted sum of the search frequency of each company on Baidu's website, which reflects the attention of netizens to the focal company. Second, Guba is an online platform for investors to communicate stock information. We count the number of all negative posts related to each company in Guba and then take the natural logarithm of 1 plus the number of posts to measure the volume of negative posts. This indicator reflects the degree of discussion of negative events about companies among netizens; the data were obtained from the CNRDS.

Models (4) and (5) form a set of structural equation models. The interaction of the coefficient α_1 of *lnMedia_Neg* in Model (4) and the coefficient β_2 of netizens' attention of *Focus* in Model (5) represents the indirect effect of negative media coverage on targeted poverty alleviation. That is, negative media coverage has an impact on whether companies choose to participate in targeted poverty alleviation activities following netizens' attention. Here we use the method of Sobel (1982) to test whether the indirect effect is significant. The coefficient β_1 of *lnMedia_Neg* in Model (5) represents the direct effect of negative media coverage on whether companies participate in targeted poverty alleviation activities. Models (4) and (6) form another set of structural equation models where the interaction of $\alpha 1$ and $\gamma 2$ represents the indirect effect of negative media coverage on the intensity of poverty alleviation through netizens' attention, and $\gamma 1$ represents the direct effect of *lnMedia_Neg* on the intensity of poverty alleviation. Table 13 presents the results of testing the direct and indirect effects of negative media coverage, where Columns 1 and 2 show the results from using the Baidu index and the number of negative posts in Guba as mediating variables, respectively.

Panel A of Table 13 shows that the coefficients of $\alpha 1$ in Model (4) are significant for both the Baidu index and the number of negative posts in Guba as measures of netizens' attention, indicating that negative media coverage is positively related to netizens' attention. The coefficient of β_2 is also significant in both Columns 1 and 2, indicating that online attention increases the likelihood of private companies participating in targeted poverty alleviation activities. The coefficients of $\alpha 1 \times \beta 2$ are significantly positive, indicating that negative media coverage has an indirect effect on whether private companies participate in poverty alleviation following

[8] The Internet attention in year t is used to alleviate the reverse impact of this mediating variable on negative media reports. Meanwhile, the Internet attention in year t-1 is also used as the mediating variable for the regression and the result remains unchanged.

Table 13
Mechanism analysis.

Panel A: Direct and indirect effects of negative media coverage on whether companies participate in targeted poverty alleviation		
Mediating Variables	(1)	(2)
	Baidu_Search	*Guba_NegPost*
Indirect effects		
α_1	0.0902***	0.1664***
	(20.15)	(21.54)
β_2	0.0591***	0.0140**
	(4.32)	(2.36)
$\alpha_1 \times \beta_2$	0.0053***	0.0023**
	(4.23)	(2.35)
Direct effects		
β_1	0.0300***	0.0304***
	(5.48)	(6.45)
N	7672	10,231
Sobel test	4.227	2.351
	[0.0000]	[0.0187]
Panel B: Direct and indirect effects of negative media coverage on the intensity of targeted poverty alleviation input		
Mediating Variables	(1)	(2)
	Baidu_Search	*Guba_NegPost*
Indirect effects		
α_1	0.0902***	0.1664***
	(20.15)	(21.54)
γ_2	0.7672***	0.1476*
	(4.32)	(1.95)
$\alpha_1 \times \gamma_2$	0.0692***	0.0246*
	(4.23)	(1.94)
Direct effects		
γ_1	0.4040***	0.4092***
	(5.67)	(6.78)
N	7672	10,231
Sobel test	4.228	1.944
	[0.0000]	[0.0520]

Note: The sample size in column 1 has been reduced due to the presence of some missing samples in the Baidu Search index; the *p-value* of the *sobel test* is shown in square brackets.

the influence of netizens' attention. The results of the Sobel test also show that these indirect effects are significant at the 1% and 5% levels, respectively. The coefficient of *β1* in Model (5) is significantly positive, indicating that negative media coverage also has a direct effect on whether private companies participate in targeted poverty alleviation activities. The results in Panel B are fully consistent with those in Panel A. The combined results in Table 13 show that negative media coverage not only directly affects the behavior of private companies in targeted poverty alleviation activities, but also makes private companies more likely to participate in targeted poverty alleviation activities by increasing netizens' attention to the company's negative news and discussion about the company.

4.4. Cross-sectional analysis

To further test the argument that negative media coverage leads companies to participate in poverty alleviation, we analyze the heterogeneous effects of negative media coverage on companies' targeted poverty alleviation behavior from three perspectives: negative media coverage attributes, heavily polluting companies and pressure from external investors.

4.4.1. Negative media coverage attributes

Following Yang and Zhang (2021), we investigate whether different negative media coverage attributes have heterogeneous effects on private companies' targeted poverty alleviation behavior from the perspectives of two textual characteristics: the originality of negative news and the depth of negative news. First, we classify negative news into reports with strong or weak originality using the cosine similarity method. Specifically, if the similarity between a negative report and any other report within 15 days is less than 0.5, we classify it as a negative report with strong originality (*lnMedia_Neg_Ori*), otherwise we classify it as a negative report with weak originality (*lnMedia_Neg_NonOri*). Columns 1 and 2 of Table 14 present the regression results. Second, we classify negative reports into in-depth and non-in-depth negative reports based on their total number of sentences. Specifically, if the total number of sentences of a negative media report is greater than the median of the sample, we define it as an in-depth negative report (*lnMedia_Neg_Deep*), otherwise we define it as a non-in-depth negative report (*lnMedia_Neg_NonDeep*). Columns 3 and 4 of Table 14 present the regression results.

Columns 1 and 2 of Table 14 show that the coefficients of *lnMedia_Neg_Ori* are both significantly positive, while the coefficients of *lnMedia_Neg_NonOri* are both non-significant, indicating that more original negative reports lead to private companies being more likely to participate in targeted poverty alleviation, while less original negative reports do not have this effect. This result is because original news contain more first-hand and incremental information that is gathered authentically, which is a reliable source of information about the company for the public. Therefore, original negative reports will have a more serious impact on the company's image and give it a stronger incentive to use targeted poverty alleviation to repair its reputation. Columns 3 and 4 show that the coefficients of *lnMedia_Neg_Deep* are both significantly positive and the coefficients of *lnMedia_Neg_NonDeep* are both non-significant. These results suggest that the effect of negative media coverage on private companies' participation in alleviating poverty is mainly due to in-depth negative coverage, while non-in-depth negative coverage does not have this effect. The reason for this result is that in-depth coverage is more persuasive and has a stronger influence on corporate image; therefore, companies are more likely to choose to participate in targeted poverty alleviation to escape the reputation crisis caused by negative media coverage.

4.4.2. Heavily polluting companies

Companies in heavily polluting industries are characterized by negative environmental externalities in their production and operation; therefore, their social reputation is inherently potentially high risk. The media often prefers to expose negative information about heavily polluting companies to gain more attention and resonance among the public (Li et al., 2018). As a result, heavily polluting companies receive more public attention when they are exposed to negative news, which makes them more likely to use targeted poverty alleviation

Table 14
The attributes of negative media coverage.

Variables	(1)	(2)	(3)	(4)
	Poverty	*lnPoverty*	*Poverty*	*lnPoverty*
lnMedia_Neg_Ori	0.2370***	2.1019***		
	(5.43)	(4.43)		
lnMedia_Neg_NonOri	−0.0018	−0.0568		
	(-0.06)	(-0.18)		
lnMedia_Neg_Deep			0.0874***	0.8128***
			(3.19)	(2.73)
lnMedia_Neg_NonDeep			0.0640	0.3679
			(1.46)	(0.77)
Controls	Yes	Yes	Yes	Yes
Year/Industry FE	Yes	Yes	Yes	Yes
N	10,226	10,226	10,226	10,226
Pseudo R^2	0.087	0.040	0.086	0.039

activities as a form of moral capital to gain the goodwill and trust of their stakeholders (Godfrey, 2005). Brammer and Millington (2005) find that companies with higher levels of philanthropic spending have a better reputation, and this effect varies significantly across industries. That is, the effect is more pronounced for companies with significant environmental externalities. The impact of negative publicity on heavily polluting companies' image and reputation tends to make matters worse, which gives these companies stronger incentives to adopt the coping strategy of engaging in targeted poverty alleviation activities to repair their reputation. Therefore, to test the heterogeneous effect of negative media coverage on poverty alleviation between companies in heavily and non-heavily polluting industries, we include the interaction of negative media coverage and the dummy variable for the heavily polluting industries in Models (1) and (2), respectively. Specifically, we refer to the study by Zhou et al. (2021) to define the heavily polluting industries. *Pollution* equals 1 if a company is in a heavily polluting industry and 0 otherwise.

Table 15 presents the regression results, where the coefficients of *lnMedia_Neg* × *Pollution* are both significantly positive, indicating that negative media coverage is more likely to induce companies in heavily polluting industries to participate in poverty alleviation than those in non-heavily polluting industries. The results support the theoretical expectation that negative media coverage will lead to more severe reputational crises for heavily polluting companies, giving them a greater incentive to build a good image through targeted poverty alleviation.

4.4.3. Pressure from external investors

In addition to high risk within companies, pressure from external investors may also make them more vulnerable to reputation crises when they encounter negative publicity, which strengthens these companies' motivation to manage impressions. To investigate the effect of pressure from external investors on the relationship between negative media coverage and targeted poverty alleviation behavior, we include an interaction of negative media coverage and a dummy variable for pressure from external investors in Models (1) and (2), respectively. Specifically, a larger number of analysts followed and more reports issued by analysts may lead to a clearer understanding of a company by their external investors, which means that the company's every word and action may be scrutinized by investors. When external analysts use the information reported in the media frequently, the media coverage will bring greater pressure on companies from the market (Yu et al., 2011). In this case, the emergence of negative news may have a more significantly negative impact on companies' reputation. According to Liu and Li (2018), analysts' interpretation of news reports may further amplify the impact of negative media coverage.

Therefore, we use analysts' attention to measure the pressure that companies face from their external investors, including the number of analysts following the company (*Coverage*) and the number of reports issued by analysts (*Reports*). *Coverage* equals 1 if the number of analysts following the company is greater than the sample median and 0 otherwise; *Reports* equals 1 if the number of reports issued by analysts is greater than the

Table 15
Heavily polluting companies.

Variables	(1)	(2)
	Poverty	*lnPoverty*
lnMedia_Neg × *Pollution*	0.1610***	1.9696***
	(2.84)	(3.43)
lnMedia_Neg	0.1232***	0.8259**
	(3.67)	(2.31)
Pollution	−0.2139	−3.3939
	(-0.91)	(-1.39)
Controls	Yes	Yes
Year/Industry FE	Yes	Yes
N	10,231	10,231
Pseudo R^2	0.089	0.041

Table 16
Pressure from external investors.

Variables	(1)	(2)	(3)	(4)
	Poverty	*lnPoverty*	*Poverty*	*lnPoverty*
	Number of analysts followed		Number of reports issued by analysts	
lnMedia_Neg × Coverage	0.1874***	1.1660**		
	(3.56)	(2.10)		
Coverage	−0.7490***	−5.4081**		
	(-3.55)	(-2.43)		
lnMedia_Neg × Reports			0.2096***	1.4551***
			(3.97)	(2.62)
Reports			−0.8750***	−7.0484***
			(-4.14)	(-3.16)
lnMedia_Neg	0.0571	0.7103	0.0433	0.5366
	(1.36)	(1.57)	(1.02)	(1.18)
Controls	Yes	Yes	Yes	Yes
Year/Industry FE	Yes	Yes	Yes	Yes
N	10,231	10,231	10,231	10,231
Pseudo R^2	0.087	0.040	0.088	0.040

sample median and 0 otherwise. Table 16 shows the regression results, where the coefficients of *lnMedia_Neg × Coverage* and *lnMedia_Neg × Reports* are both significantly positive, indicating that negative media coverage is more likely to lead companies to participate in targeted poverty alleviation when they face greater pressure from their external investors.

4.5. Further analysis: Economic consequences test

We show above that negative media coverage can lead private companies to engage in targeted poverty alleviation because negative reports significantly increase the public's attention to bad news about these companies. Thus, these companies tend to cope with serious reputational crises by engaging in this particular CSR activity. From the perspective of economic consequences, we further examine whether active participation in targeted poverty alleviation has an impact on a company's reputation in the marketplace when negative media coverage of the company increases.

Theoretically, engaging in targeted poverty alleviation activities can send positive signals to stakeholders that the company values social benefits and actively undertakes social responsibility activities to improve its social impact and integrity. According to Pan et al. (2021), a company's participation in targeted poverty alleviation creates a positive image of being socially responsible, which is helpful in increasing the level of trust in the upstream and downstream supply chain. Therefore, we expect that when faced with an increase in negative media coverage, companies' participation in targeted poverty alleviation activities contributes to improving their reputations in market transactions to be able to obtain more trade credit and credit loans. Therefore, we develop Model (7) to test this expectation:

$$\begin{aligned} Credit_{t/t+1} = {} & \beta_0 + \boldsymbol{\beta_1 lnMedia\_Neg}_{t-1} \times \boldsymbol{Poverty}_t + \beta_2 lnMedia\_Neg_{t-1} + \beta_3 Poverty_t + \beta_4 Top1_{t-1} \\ & + \beta_5 BOD_{t-1} + \beta_6 Duality_{t-1} + \beta_7 LEV_{t-1} + \beta_8 ROA_{t-1} + \beta_9 Growth_{t-1} + \beta_8 Sales_{t-1} \\ & + \beta_9 Size_{t-1} + \beta_{10} CFO_{t-1} + \sum Year + \sum Industry + \varepsilon \end{aligned} \quad (7)$$

We use corporate credit as the dependent variable in Model (7) and add an interaction of negative media coverage and whether companies participate in targeted poverty alleviation in Model (7). First, we follow the treatment of Lu and Yang (2011) by dividing the sum of accounts payable, notes payable and deposits received by total assets to measure the trade credit (*TradeCredit*) received from companies' suppliers. Second,

Table 17
Impact of negative media coverage and poverty alleviation on companies' market reputation.

Variables	(1)	(2)	(3)	(4)
	$TradeCredit_t$	$TradeCredit_{t+1}$	$CreditLoans_t$	$CreditLoans_{t+1}$
lnMedia_Neg × Poverty	0.0049**	0.0041*	0.0173**	0.0145*
	(2.58)	(1.93)	(2.36)	(1.73)
lnMedia_Neg	−0.0030***	−0.0021*	−0.0119***	−0.0115**
	(-2.71)	(-1.67)	(-2.89)	(-2.35)
Poverty	−0.0241***	−0.0207**	−0.0479	−0.0336
	(-3.13)	(-2.38)	(-1.57)	(-0.96)
Controls	Yes	Yes	Yes	Yes
Year/ Industry FE	Yes	Yes	Yes	Yes
N	10,231	7761	10,231	7761
Adj. R^2	0.395	0.370	0.053	0.058

we use the ratio of credit loans to the total amount of loans to measure the proportion of credit loans (*CreditLoans*). We use the trade credit received by companies and the proportion of credit loans as measures of the dependent variable *Credit* in Model (7). According to theoretical expectations, the regression coefficient β_1 should be significantly positive.

Table 17 shows the regression results, where Columns 1 and 2 demonstrate the effects of negative media coverage and targeted poverty alleviation on companies' trade credit in year t and $t+1$, respectively. The coefficients of *lnMedia_Neg × Poverty* are both significantly positive, and the coefficients and significance of the interaction tend to decrease in year t and $t+1$, indicating that as negative media coverage increases, active participation in targeted poverty alleviation improves companies' trade credit with their suppliers, but this effect diminishes over time. Similarly, Columns 3 and 4 present the effects of negative media coverage and targeted poverty alleviation on the proportion of companies' credit loans in year t and $t+1$, respectively. The results show that engaging in targeted poverty alleviation increases companies' credit loans when negative media coverage increases, but this positive relationship weakens over time. Taken together, the above results show that the relationship between negative media coverage and companies' targeted poverty alleviation helps to improve companies' creditworthiness, which manifests itself in the form of more trade credit and credit loans.

5. Conclusion

Negative media reports frequently erupt in the new media era, with an extremely fast dissemination speed and a wide social impact, leading to a decline in public trust in relevant companies and even causing these companies to experience serious public opinion crises. To deal with this issue, these exposed companies must find effective strategies to reduce the damaging effect of negative news on their credibility and repair their damaged reputation as much as possible. Specifically, companies can use direct coping strategies, such as defense, reconciliation and silence, or indirectly reduce the negative impact of negative news on their corporate image using the impression management strategy of making strategic noise. Based on the anomaly of the divergence between CSR images and actual behaviors, we focus on whether companies use targeted poverty alleviation, which is a national strategy that has attracted much attention, as a reputation repair tool to divert public attention from their bad news to their good behavior using misdirection strategies. We also examine the mechanisms and economic consequences of negative media coverage that lead private companies to engage in targeted poverty alleviation activities.

We find that negative media coverage leads private companies to adopt coping strategies, such as active engagement in targeted poverty alleviation, because negative media coverage significantly increases netizens' attention to bad news about the companies. This leads to these companies' urgent need to repair their repu-

tation using a particular CSR activity: namely, targeted poverty alleviation. Furthermore, considering the attributes of news coverage, original or in-depth negative coverage is more likely to induce companies' targeted poverty alleviation activities. Moreover, negative media coverage is more likely to lead companies to engage in targeted poverty alleviation when these companies are in heavily polluting industries or face greater pressure from external investors. Finally, we also find that private companies can significantly improve their market reputation by participating in targeted poverty alleviation activities to effectively manage the public opinion crises caused by negative media coverage.

The implications of this study are as follows. First, while negative media coverage can seriously affect companies' reputation, they can also respond positively by adopting crisis management strategies. In addition to direct coping strategies such as acknowledgment and denial, this study provides evidence for the effectiveness of using targeted poverty alleviation as a coping strategy in impression management because actions speak louder than words. Companies can rebuild their positive image through the indirect strategy of performing good deeds. In the age of new media, news coverage is extremely powerful and influential, which makes it difficult for companies to avoid the pressure from public scrutiny. However, exposed companies can also adopt impression management strategies by appropriately using media attention to promote their corporate image. Second, from the public's perspective, the participation of private companies in targeted poverty alleviation activities is an important manifestation of their CSR. However, we find that the occurrence of public opinion crises may also lead to companies engaging in targeted poverty alleviation activities. The results show that in the context of information explosions, the public should treat media reports rationally, make judgments and express their demands after clarifying the basic facts to realize a healthy interaction among the public, media and companies.

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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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Local government centralization and corporate ESG performance: Evidence from China's county-to-district reform

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ABSTRACT

As a city–county consolidation with Chinese characteristics, China's county-to-district (CtD) reform transfers a county's autonomy to a city, thereby strengthening the administrative, decision-making, fiscal and other powers of the prefecture-level municipal government, which effectively enables the centralization of local governments. Based on this exogenous quasi-natural experiment, we use a difference-in-differences (DID) approach to empirically examine the impact of prefecture-level municipal government centralization on companies' ESG performance. The results show that municipal government centralization can significantly promote corporate ESG performance, which represents environmental protection, social responsibility and corporate governance behavior. The mechanism analysis also shows that the CtD reform can address market segmentation, alleviate policy uncertainty and reduce rent-seeking, which further improves ESG performance.

1. Introduction

With global warming and environmental degradation, almost all countries in the world are pursuing a greener and more sustainable mode of development. Companies, as the most important economic entities, seek to improve their environmental protection (E), social responsibility (S) and corporate governance (G)

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performance, which is one of the most effective practices to achieve sustainable development (Lioui and Tarelli, 2022). ESG refers to corporate strategies aimed at achieving green development, fulfilling social responsibility and optimizing corporate governance, and it requires companies to focus on win–win outcomes in all three of these areas (Gillan et al., 2021). It also reflects the company's positive externalities, contributing to an image of responsibility that indicates the overall management quality and investment value of the company (Baker et al., 2021; Flammer, 2021). Good ESG performance makes it easier to obtain external financing (Lins et al., 2017), reduce corporate costs (Dhaliwal et al., 2011) and thus increase corporate value (Albuquerque et al., 2019). In addition, in "Who Cares Wins," a report released in 2015, the United Nations Global Compact mentions that in the context of long-term investment strategies, ESG can promote the sustainable development of society through corporate green development. In other words, companies' ESG practices are closely associated with development benefits for society as a whole. Good ESG performance can also improve the regional ecological environment, economic quality and social welfare (Gillan et al., 2021). Therefore, improving corporate ESG performance is of practical importance for realizing the "double dividend" of corporate performance and regional performance.

Among the factors that can influence companies' ESG performance, local government power has always been crucial (Liu et al., 2021; Zhang et al., 2022), especially in China, a country with a strong government. Local governments' green finance policies, fiscal and taxation policies and public services can all significantly affect a company's ESG behavior (Kramon and Posner, 2013; Burgess et al., 2015; Xue et al., 2023). In fact, China's local governments have strong autonomy and intervention capabilities in almost all production factors that are crucial to companies (Li et al., 2008). Consequently, if local government power is expanded or concentrated, which makes it easier to allocate more resources, how are corporate ESG behaviors affected? We expect that the concentration of prefecture-level municipal governments significantly improves corporate ESG performance through three mechanisms. First, after the reform, municipal governments can carry out unified planning and industrial layout development, address market segmentation between districts and counties under their jurisdiction and provide an integrated and competitive market for companies' development. Second, municipal governments can ensure the consistency, continuity and stability of economic policies and mitigate the adverse effects of economic policy uncertainty on companies. Finally, the centralization of municipal governments can also weaken the ties between lower-level government and companies, which leads to fewer rent-seeking activities.

However, to verify the above theoretical expectations, we need to identify an exogenous policy, and China's county-to-district (CtD) reform is a quasi-natural experiment that meets this requirement. On the one hand, with the CtD reform, the fiscal and administrative autonomy of the original county-level units is transferred to the city-level units; as the new district-level units, they must obey the unified organization of the prefecture-level municipal government. In other words, the CtD reform is an important symbol of the centralization of municipal governments. On the other hand, the reform is promoted by the higher-level government, and the influence of a single company on the decision to carry out a CtD adjustment is negligible. Thus, the change in municipal government power caused by the CtD reform provides an opportunity to examine how the centralization of municipal governments affects corporate behavior. Specifically, A-share listed companies in China, for the 2011–2020 period, are used as the research sample, and we construct a quasi-natural experiment using the CtD reform, incorporating the difference-in-differences (DID) method to conduct empirical analysis. Our results show that the centralization of municipal governments promotes companies' ESG performance, and this finding is still valid after the parallel trend test, the implementation of the causal forest algorithm and a series of robustness checks. Moreover, the centralization of municipal governments can improve ESG performance mainly by weakening market segmentation, alleviating corporate perceptions of economic policy uncertainty and reducing rent-seeking activities. In other words, all of our expectations are verified.

This study mainly contributes to three fields. First, it supplements the literature on government–business relations. The literature shows that corporate behavior is largely influenced by political connections. Boubakri et al. (2012) point out that the possibility of obtaining credit resources is greater if companies have political connections than if they do not. Zhang et al. (2022) mention that if the chairman has a political relationship, the company is likely to contribute to poverty alleviation, which may be manifested as increased funding for this purpose. Liu et al. (2021) argue that political connections can generate an information transmission effect, which enables companies to adopt risk avoidance behaviors in a timely manner. Differing from

the literature, we focus on changes in local government power, examining the impact on companies' ESG behaviors of municipal government centralization, rather than exploring the impact of corporate political resources. In addition, endogeneity receives little attention in the literature (Liu et al., 2021; Xiao and Shen, 2022). Good corporate performance may promote the connection between local officials and corporate executives, making it difficult to determine the causal relationship between political power and corporate behavior. China's CtD reform is an appropriate quasi-natural experiment reflecting the centralization of prefecture-level municipal governments, providing an opportunity to effectively overcome the endogeneity problem and understand the logical relationship between municipal government power and corporate behavior.

Second, the study complements the related literature on changes in government power. Most of the literature is dedicated to exploring macroeconomic consequences (Jia et al., 2021; Ming et al., 2022), such as promoting economic growth (Bo and Cheng, 2021) and attracting foreign companies (Gong et al., 2021), while the analysis of the microeconomic effects is insufficient. Thus, we focus on the micro-level effects of changes in local government power, focusing on how municipal government centralization affects corporate behavior. Our results show that municipal government centralization facilitates the improvement of corporate ESG performance, by addressing market segmentation, alleviating economic policy uncertainty and reducing rent-seeking.

Finally, the application of machine learning-based causal inference is also expanded. We combine the causal forest algorithm proposed by Athey et al. (2019) with our quasi-natural experiment to conduct accurate causal inference on municipal government centralization and corporate ESG performance, which provides a useful basis for related studies.

The remainder of the manuscript is structured as follows. The second section presents the institutional background and our research hypotheses. The third section presents the empirical strategy and the data. The fourth section presents the empirical results. The fifth section presents the mechanism analysis. The last section contains the conclusions and policy implications.

2. Institutional background and research hypotheses

2.1. The background of China's county-to-district reform

China's CtD reform refers to the transformation of a county or county-level city under the jurisdiction of a prefecture-level city into a district of the city. Similar to the city–county consolidation in Western countries such as the United States, the main purpose of this type of adjustment is to unify government jurisdiction. However, unlike Western countries' "voluntary" and "anarchical" consolidation, China's city–county consolidation also involves the concentration of municipal government power (Bo and Cheng, 2021). The main reason is the difference in government power between districts and counties.

In China, government power exhibits a "central–local" vertical hierarchy. A local government is empowered by the central government and has administrative autonomy within its jurisdiction (Gong et al., 2021). As shown in Fig. 1, China's local administrative units are mainly divided in terms of "province–city–county–township" (except for minority autonomous regions), and each administrative unit has a certain degree of autonomy within its jurisdiction (Jia et al., 2021). Importantly, the district and county under a prefecture-level city are two units with the same administrative level but with great differences in government power. In terms of geographical characteristics, municipal districts are usually located within the central city, and their non-agricultural industries are more developed, while most counties are located farther from the central city and have a larger proportion of agricultural and rural population. In terms of the power–responsibility relationship with the prefecture-level city, districts are subordinate units of the city, implementing the decisions and plans of the higher-level government and having no administrative autonomy within their jurisdictions. Meanwhile, counties are autonomous administrative units that are one level lower than cities, with decision-making, fiscal and other powers over their own jurisdictions, and can independently decide on their economic, social, financial and other related matters, such as the free allocation of county fiscal funds or public resources. To summarize, the district-level administrative units mainly follow the procedures of the

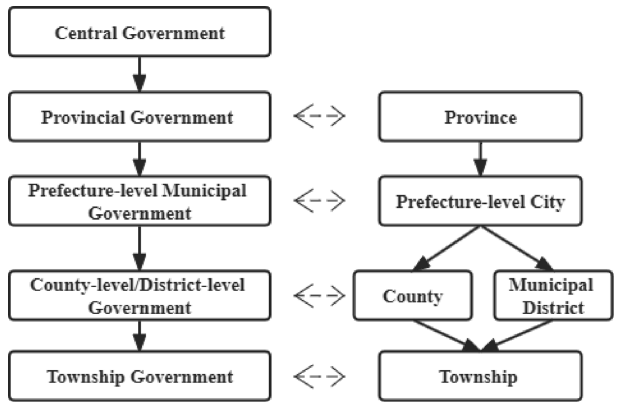

Fig. 1. China's government hierarchy and administrative division.

prefecture-level municipal government and rely on its support, and their independence and autonomy are weaker than those of county-level administrative units.

The CtD reform has transformed independent county-level administrative units into district-level administrative units that are attached to the prefecture-level municipal government. The autonomy of the original county-level government is also transferred to the municipal government, enabling the municipal government to carry out unified planning for the original sub-districts and new sub-districts (districts transformed by counties) at the same time; thus, government power is greatly improved. More importantly, the reform also provides an exogenous experimental opportunity to observe the influence of municipal government centralization on companies' ESG behavior.

2.2. Research hypotheses

Bénabou and Tirole (2010) argue that ESG behavior is a form of entrusted charity, which is a task entrusted to companies, requiring them to effectively integrate into society and participate in social governance by doing good things. Moreover, ESG principles require investors to pay attention to non-financial performance, which encourages companies to be more proactive in complying with recognized social norms (Arora et al., 2022). However, ESG behavior also has high costs and slow returns. It requires companies to improve their operation and management modes, engage in philanthropy and promote technological innovation, among others (Jia and Li, 2020); the slow returns cause companies to adopt the attitude of not daring to do it, not being willing to do it or not knowing how to do it. Therefore, ESG behavior usually requires the guidance of local governments.

With the CtD reform, the autonomy of the original county-level government is transferred to the city-level government, which enables the prefecture-level municipal government to better allocate resources within its jurisdiction. Furthermore, the reform maintains the continuity and unity of local economic policies, which is conducive to the timely correction of market failures in ESG investment. Thus, municipal governments can better supervise and guide the ESG practices of their companies. For example, due to the reform, municipal governments can establish unified ESG evaluation standards and disclosure systems within their jurisdictions, increase their support for corporate ESG behaviors and discourage non-compliant behaviors. However, the mechanism by which such changes affect companies in the jurisdiction is unclear.

First, the concentration of the prefecture-level municipal government can break down the administrative barriers within the jurisdiction, which weakens market segmentation and promotes companies' ESG strategies. As the county is a provincial administrative unit stipulated in the constitution, it has relatively independent fiscal and administrative powers and has the motivation to protect local companies, which leads to serious market segmentation between county-level and district-level administrative units (Yuan et al., 2022). With the CtD reform, the power of the municipal government is expanded, and the autonomy of the county-level government is reduced as it is now a district-level government (Bo, 2020). Thus, the municipal

government can carry out unified planning within its jurisdiction, which reduces local protectionism and friction between government agencies in various administrative units and greatly reduces market segmentation (Li and Du, 2021). Furthermore, the reduction of market segmentation allows optimized resource allocation and ensures that capital, labor and other production factors are concentrated in high-quality companies (He et al., 2021); it can also expand the market scope and profitability of companies and enhance competition among companies in the jurisdiction (Shao et al., 2019). All of these allow companies to pay more attention to ESG strategies. In addition, after regional integration, municipal governments are more capable of supporting the development of high-quality companies (Bai et al., 2020), such as green and high-tech companies, by combining fiscal subsidies, transfer payments, tax rate adjustments and other means, which can also have a positive impact on the implementation of ESG practices.

Second, the centralization of prefecture-level municipal governments can ensure the unity and stability of policies in their jurisdiction, which reduces economic policy uncertainty and thus improves corporate ESG performance. The CtD reform weakens the original county-level government in terms of affairs such as decision-making and policy issuance and reduces its economic construction and expenditure responsibilities (Bo, 2020), while the corresponding functions of municipal governments are strengthened, which is conducive to the overall planning of administrative affairs (Li and Du, 2021). Furthermore, the reform ensures the continuity and stability of policies as much as possible when conducting unified urban planning and industrial layout development, and it eliminates the inconsistency and instability of policies caused by the original county-level government's preference for specific local companies. Meanwhile, when companies in the jurisdiction face the same economic policies, they tend to trust the stable, long-term policies formulated and implemented by the higher-level government. In corporate ESG performance, policy uncertainty is an important obstacle to sustainable business development (Hafner et al., 2020). Criscuolo and Menon (2015) show that long-term and stable environmental policies are more effective in promoting companies' green development than other policies. Xue et al. (2023) point out that the policies issued by local governments can significantly affect local companies' ESG performance. Therefore, when companies perceive that the economic policy uncertainty of local governments is greatly reduced, they are more motivated to improve their ESG performance.

Finally, the concentration of prefecture-level municipal governments can optimize the business environment and reduce corporate rent-seeking behaviors, which can also improve ESG performance. With the existence of incentives for political tournaments in China (Li and Zhou, 2005), governments, within the limits of their power, may provide companies with convenient services that enable them to win the same-level tournaments (Zhou and Yang, 2022), and companies also take the initiative to obtain administrative protection through non-productive activities (such as rent-seeking) to facilitate the acquisition of their own resources (Liu et al., 2021). Under the CtD reform, power is transferred to the city-level administrative unit, which can weaken the original political connections between the county-level government and its companies and reduce the partiality of the government and the rent-seeking behaviors of companies (Cao et al., 2021), thus strengthening governments' integrity and the fairness of corporate competition. Dyck et al. (2019) mention that a highly regulated external environment can improve the non-financial performance of companies—for example, through the better fulfillment of social or environmental responsibility—which can significantly improve their ESG performance. Therefore, the concentration of municipal governments induced by the CtD reform can weaken the relationship between county-level governments and companies, which is conducive to reducing rent-seeking and encouraging companies to improve their ESG performance.

On the basis of the above, we put forward the following research hypotheses.

Hypothesis 1. The centralization of prefecture-level municipal governments caused by the CtD reform can improve corporate ESG performance.

Hypothesis 2. The centralization of prefecture-level municipal governments can promote ESG performance by weakening market segmentation.

Hypothesis 3. The centralization of prefecture-level municipal governments can promote ESG performance by alleviating economic policy uncertainty.

Hypothesis 4. The centralization of prefecture-level municipal governments can promote ESG performance by reducing rent-seeking.

3. Empirical strategy and data

3.1. Model setup

To empirically examine how municipal government centralization affects companies' ESG performance, following Mbanyele et al. (2022), we construct a quasi-natural experiment using the CtD reform. We perform the analysis mainly through the following DID model:

$$ESG_{i,m,t} = \beta_0 + \beta_1 Treat_m \times Post_t + \beta_2 X_{i,m,t} + \delta_i + \theta_t + \varepsilon_{i,m,t} \quad (1)$$

where i, m and t index the company, city and year, respectively. *Treat* is a dummy variable, indicating whether a city is placed under the CtD reform; it takes a value of 1 if so and 0 otherwise. *Post* is a dummy variable that reflects whether the CtD reform is implemented in a given year; it takes a value of 1 after the CtD reform and 0 otherwise. *ESG* is the explained variable, which is a company's ESG performance. X represents a set of control variables. δ_i represents firm fixed effects. θ_t represents year fixed effects. $\varepsilon_{i,m,t}$ represents the random error term. The coefficient β_1 of $Treat_m \times Post_t$ represents the marginal effect of the CtD reform on ESG performance.

3.2. Variables' descriptions

(1) **Explained variable: ESG performance**

We use the ESG evaluation of the Sino-Securities Index Information Service to measure ESG performance, and we assign a value of 1 to 9 to C, CC, CCC, B, BB, BBB, A, AA and AAA ratings, respectively. For the measurement of corporate ESG behavior, most of the literature uses ESG ratings from Bloomberg, MSCI, or Refinitiv Asset4 (Zhang et al., 2021; Arora et al., 2022; Huang et al., 2022; Lioui and Tarelli, 2022). Although these ESG evaluation systems have greater international influence, their integration with Chinese companies is difficult. Moreover, they do not fully cover all listed companies in China. Some studies are aware of this problem and choose ESG evaluation systems from domestic institutions for their research, such as SynTao Green Finance or Sino-Securities Index Information Service (Chen and Xie, 2022; Li et al., 2022). Among these systems, the Sino-Securities ESG evaluation system was developed earlier, and its evaluation criteria are relatively mature. Based on the international standard of ESG evaluation, it is composed of 3 top-level indicators, 14 s-level indicators, 26 third-level indicators and more than 130 bottom-level indicators. The second-level indicators cover environmental management, green operations, social contributions, operational risk and external disposition, among others. Real data that reflect China's current development are also integrated into the evaluation system, such as penalties from the China Securities Regulatory Commission and corporate information disclosures (Xue et al., 2023). In other words, the evaluation system combines the core aspects of international ESG and China's characteristic development, making it a suitable evaluation index for China's capital market. Thus, Sino-Securities' ESG ratings are chosen as the explained variable as they comprehensively reflect the ESG performance of China's A-share listed companies. In addition, we use the ESG scores of Bloomberg as an alternative in the robustness test to avoid the phenomenon of "cherry picking."

(2) **Core explanatory variable: municipal government centralization**

The core explanatory variable is prefecture-level municipal government centralization, as measured by a quasi-natural experiment using the CtD reform. If a city undergoes a CtD adjustment, it is included in the treated group in the relevant year and subsequent years, with a value of 1; otherwise, it is included in the control group, with a value of 0. The records of the CtD reform are obtained from the China Administrative Division Network, where the transformation of a "county"-level administrative unit into a "district"-level administrative unit is regarded as a CtD adjustment. Meanwhile, it should be noted that in addition to directly adjusting "county" to "district," there are cases in which part of the "county" is included in the existing

municipal district. This type of change is termed "district expansion from county division," which can be regarded as another strategy of the CtD reform. Therefore, in the empirical test, we use a mixed sample covering "CtD" and "district expansion from county division." If one of the two adjustments is present, the prefecture-level city is considered to be impacted by the CtD reform. Fig. 2 shows the distribution of the prefecture-level cities involved in China's CtD reform from 2011 to 2020. Overall, most of the cities affected by the reform are located in China's eastern coastal and central regions. Moreover, the reform peaks in 2014–2016, with more prefecture-level cities, a wider scope and a greater impact.

(3) **Control variables**

Corporate ESG performance may be affected by other characteristics, so we use a series of control variables. First, characteristics such as asset structure, financial information, executive power and property rights may affect corporate strategies. For example, companies with higher profitability, greater scale of assets and higher governance levels are better able to bear the costs of ESG projects than other companies (Fan and Wang, 2021), and their regional influence is more likely to attract the attention of the local government. Moreover, as the local government can intervene in the establishment and daily operations of state-owned companies (Bo and Cheng, 2021), property rights may affect their ESG behaviors. Therefore, referring to Zhang et al. (2021) and Mbanyele et al. (2022), company characteristics such as net income to total assets, asset size, sales revenue growth rate, return on equity, dual identities of executives, property rights, management shareholding ratio and the company's book value to the market are chosen as control variables. Second, the economic development of prefecture-level cities may also affect the forward-looking strategic development of local companies. The government of developed cities can provide companies with more favorable land policies and tax

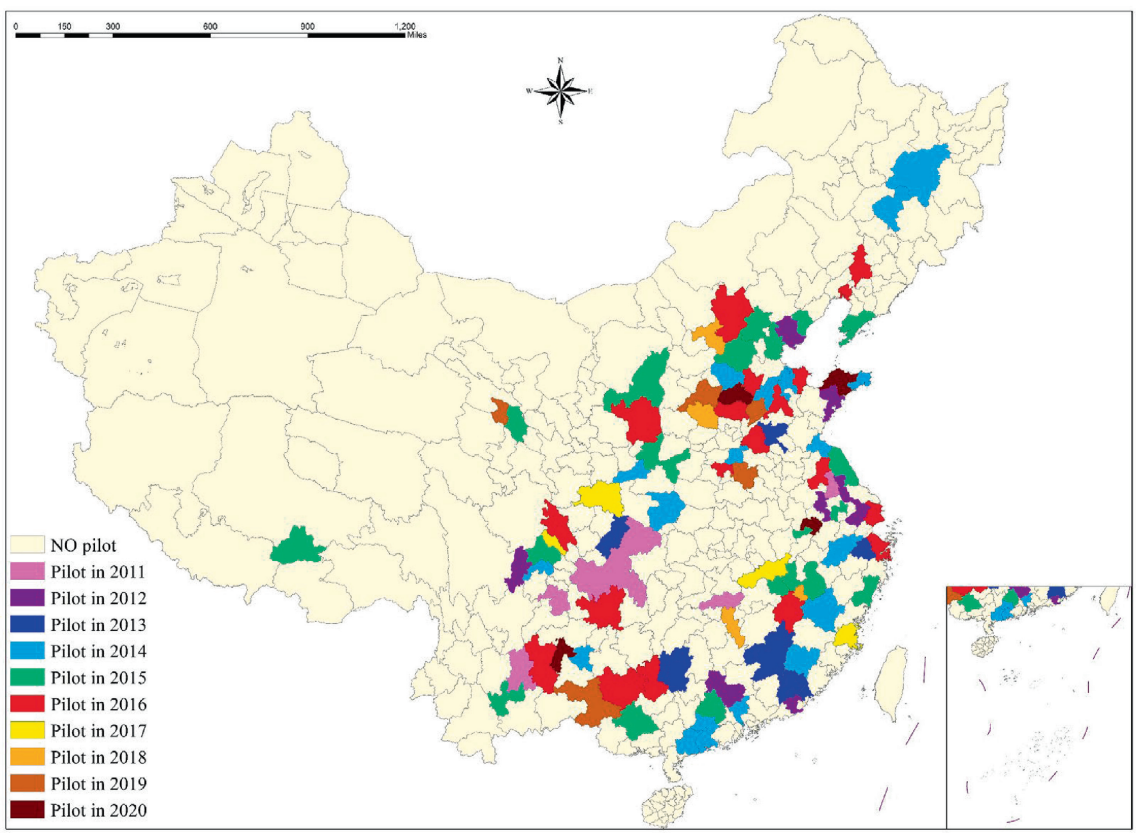

Fig. 2. The distribution of China's CtD reform (2011–2020).

policies than the government of less developed cities, which is conducive to a more accessible development environment (Bai et al., 2020). Therefore, regional GDP per capita is also controlled. Table 1 presents the specific definition of each variable.

3.3. Data

We take China's A-share listed companies as the research sample. The data cover the period from 2011 to 2020. Specifically, the ESG data are obtained from the Wind database, company information is obtained from the China Stock Market and Accounting Research database and the CtD reform data are obtained from the records of the China Administrative Division Network. To ensure data quality, we further process the original data as follows: (1) removal of companies whose shares are insolvent and anomalous; (2) removal of banking, security, insurance and other financial listed companies; (3) removal of companies without complete data for the core and control variables; and (4) double siding by 1% for all continuous variables. Table 2 presents the descriptive statistics of the main variables, including the mean, standard deviation and 25th, 50th and 75th quantiles. According to the descriptive statistics, there is no significant difference in corporate ESG performance.

4. Results

4.1. Baseline regression

Table 3 presents the results of the regression of prefecture-level municipal government centralization on companies' ESG performance. Column (1) reports the results of the univariate test for the effect of the CtD reform on corporate ESG performance, controlling for firm and year fixed effects. According to the coefficient of *Treat* × *Post*, the reform has a significant and positive effect on ESG performance at the 10% level. Columns (2)–(4) report the results after adding the control variables, industry × year and city fixed effects in sequence on the basis of Column (1). The coefficients of *Treat* × *Post* are also significant and positive at the 5% level, and it can be concluded that the centralization of municipal governments has a positive impact on corporate ESG performance. Based on the above empirical results, Hypothesis 1 is confirmed.

The regression results for the control variables are essentially in line with the literature (Arora et al., 2022; Cai et al., 2022). For example, *ROA*, *Size*, *Growth*, *Manage*, *MarketRatio* and *lnpGDP* are all positively related to companies' ESG performance. At the same time, the coefficient of *Position* is significant and negative, indicating that the CEO serving simultaneously as the chair of the board is unfavorable to the company's ESG behavior.

Table 1
Definitions of variables.

Variable	Definition
Treat × *Post*	CtD reform
ESG	The company's ESG performance
ROA	Net income to total assets
Size	Total assets to the company's market value
Growth	Sales revenue growth rate
ROE	Net profit to average shareholders' equity
Position	Whether the CEO is also the chair of the board
Property	The property rights of the company
Manage	Number of managerial holdings to total company shares
MarketRatio	The company's book value to the market
lnpGDP	The natural logarithm of regional GDP per capita

Table 2
Descriptive statistics.

Variable	Mean	Std. Dev	25%	Median	75%
Treat × Post	0.415	0.493	0	0	1
ESG	6.526	1.153	6	6	7
ROA	0.034	0.063	0.012	0.034	0.062
Size	22.287	1.274	21.390	22.110	23.020
Growth	1.939	1.793	0.781	1.412	2.415
ROE	0.049	0.151	0.026	0.064	0.110
Position	0.256	0.436	0	0	1
Property	0.388	0.487	0	0	1
Manage	11.558	18.079	0	0.260	19.702
MarketRatio	0.329	0.154	0.217	0.309	0.421
lnpGDP	11.152	0.446	10.836	11.187	11.481

Table 3
Municipal government centralization and corporate ESG performance.

Variable	(1)	(2)	(3)	(4)
	ESG	*ESG*	*ESG*	*ESG*
Treat × Post	0.0504*	0.0615**	0.0613**	0.0613**
	(0.0296)	(0.0290)	(0.0282)	(0.0284)
ROA		0.6798**	0.6352**	0.6352**
		(0.3141)	(0.3037)	(0.3057)
Size		0.1834***	0.1906***	0.1906***
		(0.0236)	(0.0240)	(0.0242)
Growth		0.0239***	0.0194**	0.0194**
		(0.0082)	(0.0084)	(0.0084)
ROE		0.1172	0.0890	0.0890
		(0.1222)	(0.1195)	(0.1203)
Position		−0.0454*	−0.0493*	−0.0493*
		(0.0267)	(0.0270)	(0.0272)
Property		0.0923	0.1095*	0.1095*
		(0.0596)	(0.0601)	(0.0605)
Manage		0.0079***	0.0069***	0.0069***
		(0.0013)	(0.0013)	(0.0013)
MarketRatio		0.3401***	0.2646***	0.2646***
		(0.0846)	(0.0849)	(0.0855)
lnpGDP		0.2655***	0.2390***	0.2390***
		(0.0835)	(0.0803)	(0.0808)
Constant	6.5039***	−0.8495	−0.6733	−0.6733
	(0.0123)	(1.0573)	(1.0362)	(1.0431)
Observations	20,280	20,280	20,231	20,231
R-squared	0.6894	0.6974	0.7195	0.7195
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry × Year FE	No	No	Yes	Yes
City FE	No	No	No	Yes

Notes: (1) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (2) the values in brackets are the standard errors clustered by firm.

4.2. Parallel trend test

It is necessary to validate the parallel trend assumption when using DID (Jiang et al., 2022), i.e., the treated and control groups should follow the same trend before being impacted by the focal event. To this end, we must ensure that the companies show a consistent trend in ESG performance before the CtD reform. To examine whether the research sample satisfies the parallel trend assumption, referring to Mbanyele et al.

(2022), a series of time dummy variables related to the CtD reform are used to expand model (1). According to the results of the parallel trend test, shown in Table 4, the coefficients of the four years before the reform and the current year (i.e., the coefficients of *d_4*, *d_3*, *d_2*, *d_1* and *current*) are not significant, while those of the four years or more after the reform (i.e., the coefficients of *d1*, *d2*, *d3*, *d4* and *d5*) are all significant and positive, indicating that the ESG performance of the treated and control groups follows the same trend before the reform. In addition, to illustrate the dynamic effect, the coefficients are plotted in Fig. 3. It can be intuitively concluded that the baseline regression satisfies the parallel trend assumption.

4.3. Causal forest algorithm

To confirm the causal relationship between municipal government centralization and companies' ESG performance, we also use the causal forest algorithm to conduct causal inference. Causal forest is a machine learning algorithm that can estimate the CtD reform's average treatment effect (ATE). It is expressed as $\tau(x) = E[ESG_i(1) - ESG_i(0)|X_i = x]$, where $ESG(1)$ and $ESG(0)$ are the estimated results of the treated and control groups, respectively. $\tau(x)$ is the reform's conditional average treatment effect (CATE), as the ATE should be estimated under some characteristic variables, i.e., X. Then, it is possible to obtain estimates satisfying consistency and asymptotic normality based on the unconfoundedness assumption, as causal forest estimations are consistent with random conditions in the presence of characteristic variables (Athey et al., 2019). The CATE $\widehat{\tau}(x)$ is obtained as follows:

Table 4
Parallel trend test.

Variable	*ESG*
d_4	−0.0132
	(0.0525)
d_3	0.0596
	(0.0585)
d_2	0.0981
	(0.0634)
d_1	0.0942
	(0.0667)
current	0.1139
	(0.0694)
d1	0.1322*
	(0.0710)
d2	0.1402*
	(0.0730)
d3	0.1617**
	(0.0757)
d4	0.1964**
	(0.0782)
d5	0.1551*
	(0.0840)
Control Variables	Yes
Constant	−0.7716
	(1.0462)
Observations	20,231
R-squared	0.7198
Firm FE	Yes
Year FE	Yes
Industry × Year FE	Yes
City FE	Yes

Notes: (1) *d_4*, *d_3*, *d_2*, *d_1* represent the four years before the reform, *current* represents the current year of the reform, and *d1*, *d2*, *d3*, *d4*, *d5* represent the four years or more after the reform; (2) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (3) the values in brackets are the standard errors clustered by firm.

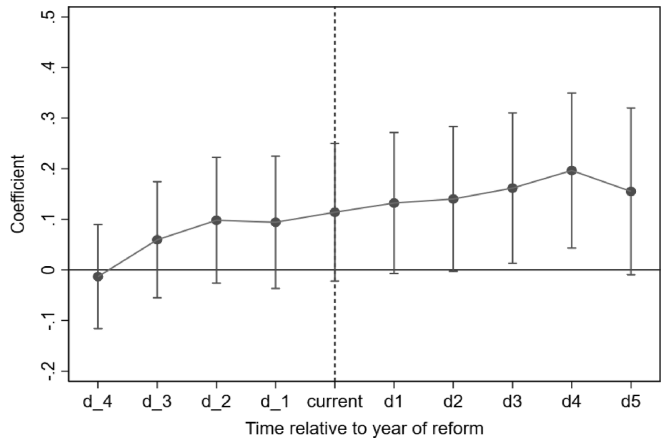

Fig. 3. Parallel trend test.

$$\widehat{\tau}(x) = \frac{\sum_{i=1}^{n} \alpha_i(x)\left(ESG_i - \widehat{m}^{(-i)}(X_i)\right)\left(Policy_i - \widehat{e}^{(-i)}(X_i)\right)}{\sum_{i=1}^{n} \alpha_i(x)\left(Policy_i - \widehat{e}^{(-i)}(X_i)\right)^2} \tag{2}$$

where $Policy_i$ is the same as $Treat \times Post$ in model (1). It indicates whether the prefecture-level city in which company i is located is subjected to the CtD reform. *ESG* is a company's ESG performance. $\alpha_i(x)$ is a data-driven kernel function. $m(X_i) = E[ESG_i|X_i = x]$ represents the reform's predicted value. $e(X_i) = P[Policy_i|X_i = x]$ is the propensity score. $\widehat{m}^{(-i)}(X_i)$ and $\widehat{e}^{(-i)}(X_i)$ are derived from out-of-bag estimation.

Table 5 reports the causal forest results. Columns (1)–(4) present the causal inference results of 500, 1,000, 2,000 and 3,000 trees, respectively. The ATE of the CtD reform is significant and positive at 5%. In other words, the centralization of municipal governments has a significant and positive impact on corporate ESG performance, which indicates that our main conclusion is still valid.

4.4. Robustness tests

To further confirm the robustness of our findings, we conduct other tests, such as DID based on propensity score matching (PSM-DID), a placebo test, replacing the explained variable, eliminating concurrent policy interference, controlling for missing variables and changing the econometric method.

(1) **PSM-DID**

The influence of prefecture-level municipal government centralization on companies' ESG practices may be related to their individual characteristics. Thus, we use the PSM method to correct for sample differences

Table 5
Causal forest results.

Variable	(1)	(2)	(3)	(4)
	ESG	*ESG*	*ESG*	*ESG*
ATE	0.0804**	0.0786**	0.0794**	0.0791**
	(0.0327)	(0.0312)	(0.0318)	(0.0320)
Control Variables	Yes	Yes	Yes	Yes
Observations	20,231	20,231	20,231	20,231
Number of trees	500	1,000	2,000	3,000

Notes: (1) *ATE* is the CtD reform's average treatment effect; (2) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (3) the values in brackets are the standard errors clustered by firm.

(Mbanyele et al., 2022), and we then use DID to retest the robustness of our findings above. We first use 1:2 nearest neighbor (NN) matching with replacement. At the same time, we use a caliper restriction as an alternative. Referring to Shipman et al. (2017), the caliper distance is set to 0.03, which is also used in the literature. We choose matching with replacement instead of matching without replacement, mainly because the latter method may result in lower-quality results than the former (Shipman et al., 2017), and the former method can reduce bias by matching each treated observation with the most similar control observation. Columns (1)–(2) of Table 6 present the results of PSM-DID. They show that the coefficients of *Treat* × *Post* are all significant and positive at the 5% level in both NN matching and caliper matching, indicating that our main conclusion still holds.

(2) **Placebo test**

A placebo test is conducted to determine whether the results differ. We further exclude the possibility that other characteristics of the cities experiencing the CtD reform contribute to the baseline results by randomly selecting a treatment year. Specifically, we carry out placebo treatment tests for the two or three years before the reform. If the cities undergoing the CtD reform during the sample period have certain characteristics that lead to greater improvement in corporate ESG performance, the same results should be obtained when the reform period is brought forward. According to Columns (1)–(2) of Table 6, the coefficients of the two (*Treat* × *Post2*) and three years (*Treat* × *Post3*) before the reform are not significant, which indicates that the improvement in ESG performance is not caused by the cities' characteristics. Therefore, our baseline regression conclusion still holds after the placebo test.

(3) **Replacement of the explained variable**

Referring to Huang et al. (2022), we also replace Sino-Securities' ESG ratings with Bloomberg's ESG scores as the explained variable. Bloomberg monitors corporate ESG disclosures globally and evaluates them annually, with an ESG score range of [0, 100]. Column (1) of Table 7 presents the results after replacing the explained variable. The coefficient of *Treat* × *Post* is still significant and positive at the 5% level. In other words, the substitution of the explained variable still leads to the same baseline conclusion.

Table 6
PSM-DID and placebo test results.

Variable	PSM-DID		Placebo test	
	(1)	(2)	(3)	(4)
Treat × *Post*	0.0561**	0.0601**		
	(0.0285)	(0.0284)		
Treat × *Post2*			0.0564	
			(0.0351)	
Treat × *Post3*				0.0660
				(0.0422)
Control Variables	Yes	Yes	Yes	Yes
Constant	−0.4792	−0.6672	1.1416	1.4937
	(1.0692)	(1.1058)	(1.7667)	(1.9852)
Observations	19,136	17,152	12,798	10,520
R-squared	0.7236	0.7342	0.7590	0.7764
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes

Notes: (1) *Treat* × *Post2* represents the two year before the reform, and *Treat* × *Post3* represents three year before the reform; (2) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (3) the values in brackets are the standard errors clustered by firm.

Table 7
Other robustness tests.

Variable	Bloomberg's ESG	Concurrent policies	Political changes	Cultural factors	Industry clustering	Tobit
	(1)	(2)	(3)	(4)	(5)	(6)
Treat × *Post*	0.6023**	0.0639**	0.0627**	0.0568**	0.0613*	0.1088***
	(0.3029)	(0.0287)	(0.0284)	(0.0286)	(0.0316)	(0.0177)
LocPolitical			0.0111			
			(0.0110)			
CorPolitical			−0.0141			
			(0.0257)			
Confucian				−0.0001		
				(0.0002)		
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−2.6391	−0.5546	−0.7051	3.0605	−0.6733	−1.6089**
	(9.3492)	(1.0655)	(1.0439)	(9.4578)	(1.2293)	(0.6575)
Observations	6,444	19,354	20,231	19,848	20,231	20,396
R-squared	0.8760	0.7233	0.7196	0.7208	0.7195	
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes	
City FE	Yes	Yes	Yes	Yes	Yes	
Industry FE						Yes
Province FE						Yes

Notes: (1) *LocPolitical* represents the change of municipal government officials, *CorPolitical* represents the political backgrounds of corporate executives, and *Confucian* represents the regional Confucian culture; (2) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (3) the values in brackets are the standard errors clustered by firm.

(4) **Elimination of concurrent policy interference**

The studied period covers 2011 to 2020, and there may be other policies that affect corporate ESG performance at this time, such as the environmental protection interview (EPI) policy introduced in 2014 (Pan et al., 2013). Cities that are subject to the EPI are likely to focus on environmental governance, which may exert a positive influence on the ESG practices of their companies. Therefore, we exclude the cities affected according to the EPI list.[1] The results are shown in Column (2) of Table 7. After eliminating the interference of the EPI policy, the coefficient of *Treat* × *Post* is still significant and positive at 5%, which is in line with our baseline regression conclusion.

(5) **Exclusion of political changes**

There may be other influences that need to be excluded based on the current analysis. For example, officials of the prefecture-level municipal government can influence the selection of counties subjected to the CtD reform. Meanwhile, the political tournament system and the incentive for political promotion may also cause local officials to attach great importance to corporate ESG behaviors, which can contribute to regional performance (Li and Zhou, 2005). Thus, the influence of municipal government officials (*LocPolitical*[2]) may inter-

[1] The cities involved in the EPI include Liupanshui, Anyang and Shenyang in 2014; Cangzhou, Chengde, Lvliang, Wuxi, Ma'anshan, Xingtai, Zhengzhou, Nanyang, Baise and Dezhou in 2015; Changzhi, Anqing, Jining, Shangqiu, Xianyang, Yangquan and Weinan in 2016; Linfen, Harbin, Jiamusi, Shuangyashan, Hegang, Hengshui, Yuncheng, Shijiazhuang, Tangshan and Handan in 2017; and Jincheng, Baoding and Xinxiang in 2018. [Source: Pan et al. (2013)].

[2] *LocPolitical* is a dummy variable that is set according to whether there is a change in the mayor or the secretary of the municipal party committee during the sample period; it takes a value of 1 if there is a change and 0 otherwise.

fere with the baseline result, so we control for this effect. In addition, many studies examine the impact of government–business relations based on the political backgrounds of corporate executives (Liu et al., 2021; Zhang et al., 2022). As the centralization of municipal governments may potentially affect the political connections between executives and officials, the political backgrounds of corporate executives (*CorPolitical*[3]) also need to be controlled. Column (3) of Table 7 shows the results after controlling for the influence of municipal government officials and the political backgrounds of corporate executives. The coefficient of *Treat* × *Post* is still significant and positive at the 5% level, which indicates again that our main conclusion is robust.

(6) **Control for cultural factors**

Corporate behavior may also be influenced by social institutions, such as regional differences in religion, culture and other social aspects, which are formed due to long-term historical developments. As benevolence, righteousness and integrity promoted by Confucian culture coincide with the ESG concept (He et al., 2022), and the influence of Confucian culture varies in different cities in China, it is possible that the extent of Confucian culture in the city where the company is located affects its ESG performance. Thus, a regional factor for Confucian culture (*Confucian*[4]) is further controlled. According to Column (4) of Table 7, the coefficient of *Treat* × *Post* is still significant and positive at the 5% level, which indicates that the promotional effect of municipal government centralization on corporate ESG performance still exists.

(7) **Changes to clustering selection**

Our baseline regression mainly controls for corporate characteristics through firm clustering. However, the results may be affected by industry characteristics. For example, companies in the same industry may exist in a similar investment and development environment. Thus, industry characteristics are further controlled through industry clustering. Column (5) of Table 7 presents the regression results after clustering at the industry level. The results show that the coefficient of *Treat* × *Post* is significant and positive at 10%, indicating that our main finding is still robust.

(8) **Changes to the econometric model**

As the explained variable, Sino-Securities' ESG ratings, is within the range [1, 9], it is a restricted variable. To eliminate the effect of our chosen econometric method, the tobit model is used as a substitute. The results are shown in Column (6) of Table 7. The results show that after applying another econometric model, the coefficient of *Treat* × *Post* is still significant and positive at the 1% level; the results of the tobit model confirm that municipal government centralization has a significant promotional effect on companies' ESG performance, verifying the robustness of our main conclusion.

5. Mechanism analysis

The above theoretical and empirical analyses indicate that the CtD reform significantly promotes the improvement of corporate ESG performance. Next, we focus on the mechanism involved and analyze it from three perspectives: market segmentation, policy uncertainty and rent-seeking.

5.1. Weakening market segmentation

The CtD reform reduces the autonomy of district and county governments, which can effectively weaken local protection behaviors, break down market barriers and promote regional integration (Yuan et al., 2022). Regional integration enhances the competitiveness of companies (Shao et al., 2019), causing them to

[3] *CorPolitical* is a dummy variable that takes a value of 1 if the corporate executive has a political background and 0 otherwise.
[4] *Confucian* is the sum of the number of Confucian colleges, Confucian academies and Confucian temples in each city.

Table 8
Breakdown of market segmentation.

Variable	(1)	(2)
	MarketSegment	*ESG*
Treat × *Post*	−0.0038***	0.0137
	(0.0014)	(0.0330)
MarketSegment		−0.6799*
		(0.3478)
Control Variables	Yes	Yes
Constant	0.0089	2.0069
	(0.0638)	(1.9296)
Observations	9,435	9,435
R-squared	0.4860	0.7747
Firm FE	Yes	Yes
Year FE	Yes	Yes
Industry × Year FE	Yes	Yes
City FE	Yes	Yes

Notes: (1) *MarketSegment* represents the city's market segmentation index; (2) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (3) the values in brackets are the standard errors clustered by firm.

pay more attention to ESG strategies; in addition, prefecture-level municipal governments are more likely to implement policies that favor ESG behaviors and stimulate the enthusiasm of companies. To verify that the centralization of municipal governments promotes corporate ESG performance by weakening market segmentation, referring to the relevant literature (Shao et al., 2019; He et al., 2021), we develop an index that reflects each city's market segmentation (*MarketSegment*)[5] using the price index method. The higher the index, the stronger the local protectionism and the more severe the market segmentation.

The results are shown in Table 8. According to Column (1), the coefficient of *Treat* × *Post* is negative and significant at 1%, which indicates that the CtD reform can weaken market segmentation. Moreover, referring to Ferris et al. (2017), we add *MarketSegment* to model (1) to further examine this mechanism. The coefficient of *MarketSegment* is significant and negative, while the coefficient of *Treat* × *Post* is not significant, which indicates that the reduction of local protectionism is conducive to the improvement of companies' ESG performance, and that the CtD reform's effect of promoting corporate ESG improvement can be achieved by weakening market segmentation. Based on the above results, Hypothesis 2 is confirmed.

5.2. Alleviating policy uncertainty

As mentioned above, the CtD reform is an important administrative plan for the concentration of prefecture-level municipal governments. With this reform, they can formulate comprehensive urban development plans and construct unified industrial layouts (Li and Du, 2021), effectively reducing economic policy uncertainty in cities where companies are located. Moreover, a more stable policy environment can alleviate the uncertainty perceived by companies, which can promote the planning of their long-term and sustainable development (Hafner et al., 2020), such as ESG strategies. To verify that municipal government centralization can promote corporate ESG performance by alleviating economic policy uncertainty, we use the annual reports of listed companies to construct the corporate policy uncertainty perception index (*Uncertainty*). Specifically, the index is calculated as the ratio of the number of sentences reflecting economic policy uncer-

[5] The calculation steps of the market segmentation index are as follows. First, calculate the absolute value of the relative prices of the two cities, i.e., $\left|\Delta Q_{ijt}^{k}\right|$. The calculation of ΔQ_{ijt}^{k} is as follows: $\Delta Q_{ijt}^{k} = \ln\left(P_{it}^{k}/P_{jt}^{k}\right) - \ln\left(P_{it-1}^{k}/P_{jt-1}^{k}\right) = \ln\left(P_{it}^{k}/P_{it-1}^{k}\right) - \ln\left(P_{jt}^{k}/P_{jt-1}^{k}\right)$, where i and j represent the two adjacent cities. Second, for non-additive effects, we use the elimination method of removing the mean, i.e., $q_{ijt}^{k} = \left|\Delta Q_{ijt}^{k}\right| - |\Delta Q_{t}^{k}|$, where $|\Delta Q_{t}^{k}|$ represents the relative price average among adjacent cities. Then, calculate the fluctuation in q_{ijt}^{k}, which is recorded as $Var\left(q_{ijt}^{k}\right)$. Finally, the average value of the relative price variance between the city and all of its adjacent cities is calculated as its market segmentation index.

Table 9
Alleviating policy uncertainty.

Variable	(1)	(2)
	Uncertainty	*ESG*
Treat × *Post*	−0.0923*	0.0574**
	(0.0540)	(0.0286)
Uncertainty		−0.0166***
		(0.0050)
Control Variables	Yes	Yes
Constant	2.4044	−1.0737
	(2.1410)	(1.0985)
Observations	18,481	18,481
R-squared	0.5262	0.7038
Firm FE	Yes	Yes
Year FE	Yes	Yes
Industry × Year FE	Yes	Yes
City FE	Yes	Yes

Notes: (1) *Uncertainty* represents corporate policy uncertainty perception index; (2) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (3) the values in brackets are the standard errors clustered by firm.

Table 10
Reducing rent-seeking.

Variable	(1)	(2)
	Hospitality	*ESG*
Treat × *Post*	−0.4892*	0.0320
	(0.2891)	(0.0314)
Hospitality		−0.0035**
		(0.0016)
Control Variables	Yes	Yes
Constant	−58.3632***	−0.8125
	(15.0731)	(1.1519)
Observations	16,456	16,456
R-squared	0.9767	0.7078
Firm FE	Yes	Yes
Year FE	Yes	Yes
Industry × Year FE	Yes	Yes
City FE	Yes	Yes

Notes: (1) *Hospitality* represents corporate rent-seeking behavior; (2) ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively; (3) the values in brackets are the standard errors clustered by firm.

tainty to the total number of sentences in the "Management Discussion and Analysis" section of the annual report. The higher the index, the stronger the company's perception of economic policy uncertainty.

The results are reported in Table 9. According to Column (1), the coefficient of *Treat* × *Post* is significant and negative at the 10% level, which indicates that the CtD reform can reduce companies' perceptions of economic policy uncertainty. Meanwhile, after adding *Uncertainty* to model (1), the coefficient of *Uncertainty* is significant and negative at 1% and the coefficient of *Treat* × *Post* is significant and positive at 5% (Column (2)). This indicates that the promotional effect of the CtD reform on ESG performance can be partly achieved by alleviating economic policy uncertainty. Based on the above results, Hypothesis 3 is confirmed.

5.3. Reducing rent-seeking

The centralization of prefecture-level municipal governments due to the CtD reform weakens the connections between the original county-level government and companies, which reduces the rent-seeking behavior of

companies and strengthens the fairness of competition (Li and Guo, 2022); thus, it stimulates ESG activities. To verify that municipal government centralization can promote corporate ESG performance by reducing rent-seeking, referring to Cao et al. (2021), we use corporate business hospitality (*Hospitality*) to measure rent-seeking. The higher the company's hospitality expenditure, the more serious the company's rent-seeking behavior.

The results are reported in Table 10. According to Column (1), the coefficient of *Treat* × *Post* is significant and negative at 10%, which indicates that the CtD reform reduces corporate rent-seeking. Furthermore, after adding *Hospitality* to model (1), the coefficient of *Hospitality* is significant and negative at the 5% level, while the coefficient of *Treat* × *Post* is not significant (column (2)), which indicates that the reduction of business hospitality is conducive to the promotion of corporate ESG performance, and that the CtD reform's positive effect on ESG can also be realized through the reduction of corporate rent-seeking. Based on the above results, Hypothesis 4 is confirmed.

6. Conclusions and policy implications

This study takes China's A-share listed companies as the research sample, draws on the quasi-natural experiment using the CtD reform and uses the DID method to explore how the centralization of municipal governments can affect corporate ESG performance. The results show that the centralization of prefecture-level municipal governments can significantly promote corporate ESG performance. This finding still holds after applying the parallel trend test and the causal forest algorithm, as well as other robustness tests, such as PSM-DID, a placebo test and the exclusion of political changes. Furthermore, from the perspectives of market segmentation, policy uncertainty and rent-seeking, we explore the mechanism through which municipal government centralization can affect corporate ESG performance. The results show that the CtD reform can address market segmentation, alleviate economic policy uncertainty and reduce rent-seeking, which is conducive to improving ESG performance.

Based on the above conclusions, this work has the following policy implications. First, it demonstrates the positive impact of prefecture-level municipal government centralization on corporate sustainable development behavior. Thus, companies should be encouraged to enhance their own competitiveness through ESG strategies and contribute to the long-term development of the regional economy to achieve a "win–win" scenario facilitating corporate performance and regional performance. Second, we find that municipal government centralization can promote corporate ESG performance by weakening market segmentation, easing economic policy uncertainty and reducing rent-seeking activities. Therefore, municipal governments should commit to creating a high-quality market featuring fair competition, stability and transparency and guarantee the successful development of companies to the greatest extent possible.

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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Market manipulation by rumormongers: Evidence from insiders' stock selling

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ABSTRACT

Using a large sample of data on insiders' stock selling and rumors about A-share listed companies in China, this study empirically tests whether and how rumors about companies are used to manipulate the market in the context of insiders' stock selling. We find that the probability of a rumor's occurrence, especially that of a favorable rumor, significantly increases in the 30 days before the first transaction in a round of insiders' stock selling and remains high for 30 days afterward, showing clear signs of manipulation. These results are robust to several endogeneity tests. The probability of manipulation via rumor increases with a company's degree of information asymmetry. In addition, large-scale stock selling, centralized bidding, and transactions involving CEOs or chairmen (or their relatives) have a significantly higher probability of manipulation via rumor, while transactions made by directors, supervisors, or senior executives (but not their relatives) have a significantly lower probability of manipulation via rumor. Further examination shows that using rumor to manipulate the market increases insiders' transaction returns but leads to stock price reversal in the long term.

1. Introduction

"Insider trading" refers to transactions in which a company's shares are bought or sold by its directors, supervisors, or executives or their relatives (Wu and Zhang, 2009). Since the implementation of China's amended Company Law in 2006, insider trading has become prevalent in the Chinese securities market, attracting the attention of both regulators and market participants (Zhu et al., 2011). On May 6, 2017, the China Securities Regulatory Commission (CSRC) released provisions to further refine the supervision

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of insiders' stock selling and related information disclosures. However, both the frequency and the volume of insiders' stock selling have increased in recent years, showing a trend of blowout (Yi et al., 2017), especially since 2019, when the stock selling market has been exceptionally active. Whether there exists stock price "hyping" to facilitate insider trading has become a widespread concern among investors,[1] and some companies received regulation letters from supervisory authorities regarding such issues.[2]

The strategic release of information to enable trading arbitrage constitutes information-based market manipulation (Allen and Gale, 1992). Such behavior deliberately influences stock prices or trading volume by calibrating the timing, tone, and/or other aspects of information disclosure to achieve a desired outcome. Information-based manipulation takes various forms, such as the strategic disclosure of corporate information (Cheng and Lo, 2006; Lu et al., 2017; Zeng et al., 2018), media management (Yi et al., 2017), and the dissemination of rumors (Allen and Gale, 1992; Ahern and Sosyura, 2015). Of these, rumors are the most unobtrusive and difficult to trace, thus, market manipulation via rumor belongs to a regulatory gray zone. Rumor is defined as "an unverified account or explanation of an event. (Peterson and Gist, 1951, p. 159)" or "any information not capable of objective verification (Clarkson et al., 2006, p. 31)". Before information technology became ubiquitous, word-of-mouth was the main channel for the interpersonal transmission of rumors (Van Bommel, 2003). With the development of social media, unconfirmed information, including false information, can be easily spread by users at a low cost. It is difficult for investors with bounded rationality to verify such information or trace its source. Therefore, social media have become a "rumor mill" in which unconfirmed information proliferates and price distortion effects intensify (Jia et al., 2020). In China, stock forums and major social media platforms have become prolific incubators of rumors. Investors often take the view of "no smoke without fire" regarding rumors, and even disinformation can affect investors' risk attitudes (Lei et al., 2016). Therefore, the perceived veracity of rumors can significantly affect investors' trading strategies. If investors believe a rumor, they are likely to adopt a "buy on the rumor and sell on the news" strategy (Peterson, 2002; Schmidt, 2020); otherwise, they are likely to trade in the opposite direction. Therefore, although their sources are unknown or unconfirmed, rumors can affect the capital market. Research consistently shows that the market reacts to rumors (Clarkson et al., 2006; Zhao et al., 2010; Ahern and Sosyura, 2015), but the factors that influence capital market rumors remain largely unexplored. If rumors can significantly affect the trading of stocks in the capital market, some stakeholders may use rumors to manipulate the market. Indeed, in cases inspected by the CSRC in 2017, insiders illegally spread false information on platforms such as Internet discussion sites and then sold their shares at a profit after stock prices surged. Are these isolated cases, or do they reflect a widespread trend in the capital market?

This study uses data on insiders' stock selling involving A-share listed companies in China from 2017 to 2020 to test whether manipulation via rumor occurs around the transaction period and, if so, to identify the influencing factors and determine whether such manipulation helps the insiders obtain higher returns than they would otherwise. The results are as follows. (1) The probability of a rumor's occurrence, especially that of a favorable rumor, significantly increases in the 30 days before the first transaction in a round of insiders' stock selling and remains high for 30 days afterward, showing clear signs of manipulation. These results are robust to a series of endogeneity tests. (2) The higher the degree of a company's information asymmetry, the greater the likelihood that rumors about that company will occur in the run-up to a round of insiders' stock selling. (3) The characteristics of both transactions and their participants significantly affect the probability of manipulation via rumor. Specifically, large-scale stock selling, centralized bidding, and transactions involving CEOs or chairmen (or their relatives) have significantly higher probability of rumor manipulation, while transactions involving directors, supervisors, or senior executives (but not their relatives) have significantly lower probability of rumor manipulation. (4) Insiders can earn excess profits by inflating a company's stock price via rumors before selling their shares; however, such manipulation leads to the reversal of this upward trend in stock price in the long term.

This paper contributes to the literature in the following ways. First, it provides empirical evidence of the factors that influence rumors from the perspective of insiders' self-interest, thereby expanding empirical

[1] https://baijiahao.baidu.com/s?id=1631292183616814965&wfr=spider&for=pc.
[2] https://baijiahao.baidu.com/s?id=1663916820817047499&wfr=spider&for=pc.

research on capital market rumors. Second, it enriches the literature on information-based market manipulation. The literature shows that insiders sometimes engage in strategic information disclosure or media management before selling their shares, and our analysis of the changes in rumors around the transaction period confirms that rumors have become an information-based manipulation tool for insiders. Third, this study uses data from the "Rumor Verification" column of Eastmoney.com, which is the largest stock message board in China. The rumor data is sourced from the rumor verification Q&A sections on the interactive investor platforms Shanghai Stock Exchange e-Interaction and Shenzhen Stock Exchange Hudongyi. Compared with the clarification announcement data used in previous studies (Zhao et al., 2010; Peng and Tang, 2019), our data are more comprehensive, mitigating the potential problem of companies' giving selective responses. This study also classifies rumors using the Word2Vec text analysis model to focus on the underlying content after eliminating questioners' sentiments. As Word2Vec represents every word in a text as a vector in the high-dimensional vector space, it captures the contextual information of the text and is widely considered suitable for short texts.

2. Related literature and hypothesis development

The literature shows that insider trading typically yields excess returns, based on insiders' ability to time their trades (Zeng, 2008). This ability derives from three main sources. First, insiders have superior information on market pricing and future earnings performance (Piotroski and Roulstone, 2005; Zhu et al., 2011). Second, insiders can manipulate a company's market value via earnings management, dividend distribution, etc. (Bartov and Mohanram, 2004; Wu and Zhang, 2009; Xie et al., 2016). Third, insiders can manipulate information, i.e., they can conduct information-based manipulation. Information is the core factor responsible for stock price fluctuations (Fama, 1965), and insiders can strategically release information to manipulate stock prices in their preferred direction. Xu et al. (2021) point out that insiders have the advantage of participating in a company's decision-making and operating activities and thus are likely to engage in information-based manipulation. For instance, insiders can spread favorable rumors before selling their shares to inflate the stock price, the "pump and dump" strategy increases their wealth at the expense of naive investors. The literature on information-based manipulation focuses on two main areas, as follows.

(1) Corporate announcements. Mandatory and voluntary information disclosures, such as periodic financial reports (Zeng et al., 2018) and earnings forecasts (Aboody and Kasznik, 2000; Cai, 2012; Lu et al., 2017), affect stock prices. Management can make strategic decisions on the timing, tone, content, and even presentation of information disclosures. For example, Cheng and Lo (2006) find that when managers plan to purchase shares, they increase the number of bad news forecasts to reduce the purchase price, especially if the trades are initiated by the CEO. Zeng et al. (2018) find that companies manipulate the market by managing the tone of their annual reports to align with their insider trading intentions. Xu et al. (2021) identify several specific types of information involved in insiders' market manipulations including information on high stock dividends, expected business growth, and mergers and acquisitions (M&As). Huang et al. (2018) use the number of quantitative items in an earnings press release headline as a proxy for headline salience and find that managers are likely to choose headlines with greater salience before selling shares in the post-announcement period.
(2) Media coverage. The literature on active media management suggests that management may collude with the media, especially during important corporate events such as IPOs (Fang, 2014; Wang et al., 2015), M&As (Ahern and Sosyura, 2014; Shao and Cai, 2020), and insider trading (Yi et al., 2017). Companies are motivated to manipulate the media to obtain biased reports. Related research infers such manipulation by comparing abnormal changes in media coverage before and after such events. Some studies attempt to obtain evidence that the media are "bribed" by companies according to whether a company hires an investor relations firm or pays public relations or media advertising fees (Gurun and Butler, 2012; Shao et al., 2015; Wang and Li, 2016). However, there is no direct evidence that the media engage in "paid reporting."

The information-based manipulation literature has gradually expanded to consider "soft" as well as "hard" information. Yi et al. (2017) argue that while companies face strict regulations on the disclosure of accounting information, media reports can be vague and difficult to verify; thus, they are soft information. In this sense, rumors belong to the even "softer" spectrum of information. In recent years, with the rapid development of information technology, rumors have become increasingly prominent in the stock market (Peng and Tang, 2019). The defining features of rumors are that they are unverified and of unknown origin (Schmidt, 2020). As rumors are unverified, the accuracy of the information they contain is unknown, making it easy for those who spread them to manipulate perceptions to their advantage. Moreover, because the sources of rumors are unknown and they can be quickly and easily transmitted to a wide audience via social media, the manipulation behind them is covert. In addition, uninformed investors often adopt a credulous attitude toward market rumors and adjust their trading decisions accordingly. Regulatory authorities in China have introduced regulations on rumors; for example, Article56 of the Securities Law explicitly prohibits "fabricating and disseminating false information to disrupt the securities market," and the Administrative Measures for the Disclosure of Information of Listed Companies regulate information disclosure liabilities of listed companies in the circumstances of rumors. However, compared with corporate announcements and media reports, rumors are more difficult to regulate, and they remain a major source of disruption to China's capital market. This study examines rumormongers' incentives for fabricating and spreading rumors. Are rumors purely unfounded noise or are they intentionally spread by market manipulators? As company insiders are known to exploit their informational advantages through strategic behaviors during transactions (Cheng and Lo, 2006; Yi et al., 2017), they may also engage in manipulation via rumor, which is a form of information-based manipulation. These issues have not yet been thoroughly explored, although insiders' use of rumors to manipulate stock prices is logically feasible.

First, from the perspective of profit maximization, informed traders have a motivation to manipulate rumors. Van Bommel (2003) constructs a Kyle (1985) auction model and concludes that for informed traders with limited wealth, the expected profits from spreading rumors (whether true or false) are higher than the expected profits from remaining silent. While Van Bommel (2003) focuses on rumormongers' reputation concerns and regulations as sources of credibility, Schmidt (2020) finds that rumormongers' investment horizons also affect their information sharing: a short-term rumormonger has an incentive to share information truthfully, whereas a long-term rumormonger prefers to lie. Both studies demonstrate that rumors are driven by strategic information exchanges between market players. Second, empirical studies find consistent evidence that stock prices move in response to rumors (Zhao et al., 2010; Ahern and Sosyura, 2015). In practice, CSRC inspections show that rumors that spread rapidly online cause significant stock price fluctuations and disrupt market order.[3] Taken together, this indicates that rumors may be an effective way for investors to manipulate the market. In addition, it is more difficult to determine the sources, timing, and initiators of rumors than those of other types of information, such as corporate announcements or media reports; thus, the reputation loss and legal risks associated with rumor manipulation are relatively low.

Studies of rumors in the Chinese context mainly focus on their capital market consequences and collect rumor data from clarification announcements by listed companies. These studies document significant market responses to rumors but find that the effectiveness of clarification announcements is limited, especially for negative rumors, which are adversely affected by clarification announcements (Liu and Zhang, 2012; Jia et al., 2014). Lei et al. (2016) conducts a lab experiment and find that rumors, including false rumors, influence investors' emotions and decisions. Peng and Tang (2019) show that rumors significantly reduce the value relevance of accounting information by capturing investors' attention and raising doubts about companies' information disclosures. Few empirical studies focus on the factors underlying capital market rumors. We use insiders' stock selling as the research scenario because insiders have information advantages and self-interested motivations to maximize their trading returns. For example, the empirical results of Li and Zhang (2017) indicate that insiders earn excess returns by exploiting their information advantages, particularly through stock selling. Moreover, information manipulation by management is more closely associated with selling high than with buying low (Zhang et al., 2017). Studies suggest that insiders take advantage of information asymmetry

[3] https://www.gov.cn/xinwen/2018–05/11/content_5290360.htm.

and limited attention from investors to engage in information-based manipulation (Lu et al., 2017; Yi et al., 2017). Does information-based manipulation include rumors? To address this question, this study draws on the literature on strategic disclosure and media management to examine the possibility that rumors are a form of price manipulation by analyzing the changes in company-related rumors before and after insiders' stock sales. That is, insiders may fabricate or spread rumors to increase the company's stock price so that they can sell their shares at an inflated price. We hypothesize as follows:

H1. The probability of the occurrence of company-related rumors increases in the run-up to and during insiders' stock selling events.

Insiders use rumors to obtain higher profits when selling their shares, an opportunistic behavior that transfers wealth from uninformed investors to themselves. Information asymmetry is an important antecedent of opportunism (Williamson, 1975; Moschandreas,1997). When the degree of information asymmetry between external shareholders and insiders increases, insiders have greater information advantages and more opportunities to engage in manipulation via rumor. Taking the opportunistic behavior perspective, Frankel and Li (2004) even use insider trading as a proxy for information asymmetry. Other measures of information asymmetry include earnings quality (Aboody et al., 2005) and ratings of corporate information transparency (Gu and Li, 2012). These studies show that the greater a company's information asymmetry, the larger its deal size and the more profitable its insider trading. Zeng et al. (2018) find that the lower the degree of a company's information transparency, the more likely insiders are to manipulate the tone of annual reports. In addition, according to theories of rumor from psychology and communication studies, external investors' access to information from official channels becomes more limited as a company's information asymmetry increases, which creates space for rumors. Thus, we hypothesize as follows:

H2. The probability of the occurrence of favorable company-related rumors in the run-up to a round of insiders' stock selling is affected by the company's degree of information asymmetry.

From a cost–benefit perspective, insiders weigh the costs of information manipulation, including reputation loss and litigation costs, against the excess profits that information-based manipulation yields. The literature suggests that the size of insiders' stock sales affects their manipulation motivation. The size of insiders' stock sales is positively correlated with the probability of strategic information disclosure (Wu and Wu, 2010) and media management (Yi et al., 2017). Thus, it can be inferred that insiders' motivation to manipulate a company's stock price via rumors is stronger if their trades are expected to have a greater impact on their wealth. Different types of transactions may also affect insiders' incentives to manipulate the market via rumor. In a block trade, the buyer and seller are required to inform the exchange when they reach an agreement on price and volume before the transaction (Jiang and Jiang, 2019). Thus, compared with insiders using centralized bidding, block selling insiders have less motivation to manipulate the stock price, resulting in fewer such manipulations. Accordingly, we test the effects of deal size and the type of transaction on stock price manipulation via rumor.

In addition, insiders' characteristics may influence their use of rumor to manipulate the company's stock price. The extent of internal information that insiders can access varies depending on their position, and their participation in management decisions also varies. According to the information hierarchy hypothesis, insiders' timing ability increases with their ranks in the company. Zhu et al. (2011) find that supervisors earn less profit than do directors or executives from their trades. Wu and Wu (2010) find that controlling shareholders exhibit stronger signs of information manipulation and obtain more profit than do other major shareholders when selling their shares. However, core insiders are subject to greater scrutiny and supervision by the market and regulatory authorities. Thus, they may minimize their manipulative behaviors to avoid legal risk. Zeng (2008) finds that when selling company stock, supervisors and independent directors profit more than chairmen and CEOs but less than other insiders do. Yi et al. (2017) find no signs of a significant effect on media coverage when a chairman or CEO is involved in stock selling. Therefore, this study examines how insider characteristics influence the use of rumors for stock price manipulation from two perspectives: insiders' position within the company and insiders' identity (i.e., whether they are directors, supervisors, or senior executives or relatives of directors, supervisors, or senior executives). We hypothesize as follows:

H3. The probability of the occurrence of favorable company-related rumors in the run-up to insiders' stock selling is affected by the characteristics of the transactions and insiders involved.

3. Research design

3.1. Sample and data

3.1.1. Rumors and insiders' stock selling

This study uses data on Chinese A-share companies listed on the Shanghai and Shenzhen stock exchanges, excluding companies in the financial industry. Our sample period is 2017–2020, based on the availability of rumor data. We use rumor data from the "Rumor Verification" column of Eastmoney.com, which originates from the Q&A sections of Shanghai Stock Exchange e-Interaction and Shenzhen Stock Exchange Hudongyi. These are official platforms on which investors interact with listed companies and seek confirmation of rumors from the relevant companies. Questioners often use phrases such as "rumor has it," "it is said," and "online rumors" to refer to rumors with unclear sources. Information is also cited from conventional and new media, analyst reports, and industry websites. This provides a rich and comprehensive source of data on rumors and reflects company events that investors are concerned about. This study uses the text of the questions as the rumor data and treats the question date as the rumor date. We classify each rumor as favorable or unfavorable using a support vector machine and construct a word-list model as a supplement. The final sample contains 33,913 rumors about 3,545 companies. Of these rumors, 25,386 are positive (74.86%).

Data on insiders' stock selling comes from the CSMAR database, which includes transactions involving directors, supervisors, or executives or their relatives. Referring to Yi (2017) and Chen and Chen (2019), multiple transactions within 30 days are defined as one round of transactions, and observations with incorrect transaction amounts or unavailable financial data and those involving fewer than 5,000 shares are excluded. This process yields a final sample of 7,383 observations of insiders' sales of the stock of 1,729 companies. The media coverage data are from the CNRDS database, which includes online and print financial news. The remaining data on company finances, stock returns, analysts forecasts, institutional ownership etc. are from the CSMAR database. All of the continuous variables are winsorized at the 1st and 99th percentiles.

3.1.2. Merged firm-day sample

Referring to the information-based manipulation literature, this study selects 3,545 companies that experienced a rumor during the sample period as the research subjects and constructs an initial sample of 4,551,727 firm-day observations during the sample period (excluding observations before listing and after delisting). The number of and propensity for rumors are set to zero if there are no rumors on a given day. After excluding observations with abnormal trading status or missing information, the final sample includes 3,080 listed firms and 3,978,039 firm-day observations. The sample selection process is presented in Table 1. The insiders' stock selling data are next merged with the firm-day sample. Of the 3,080 companies in the sample, 1,590 experienced insiders' stock selling during the sample period, with 6,744 such events. *Dpre* is a dummy variable that equals one if a day is within the 30 days before the first transaction in a round of insiders' stock selling, and zero otherwise. *Dcur* is a dummy variable that equals one if a day is within the 30 days after the first transaction date in a round of insiders' stock selling, and zero otherwise. For companies with no insiders' stock selling events during the sample period, *Dpre* and *Dcur* both take the value of zero.

Table 1
Sample Selection.

	Firms	Obs
Merged firm-Calendar Day observations based on rumor companies	3,545	51,79,245
Observations before listing and observations after delisting deleted	3,492	45,51,727
Observations with abnormal transaction status deleted	3,353	43,67,070
Observations with missing information deleted	3,080	39,78,039

3.1.3. Sample description

Table 2 reports the yearly distribution of insiders' stock selling and company rumors during the 2017–2020 sample period. Panel A presents the distribution of the 28,460 rumors related to the listed companies in the sample. Panel B presents the distribution of the 6,744 rounds of stock selling by directors, supervisors, and related personnel. Both the number of rumors and insiders' stock sales show a steadily increasing trend, with a drastic increase in 2019. The number of rumors increased by 56.57% in 2019 (relative to 2018) and by 43.30% in 2020 (relative to 2019). Moreover, the number of favorable rumors increased by 67.56% in 2019 (relative to 2018) and by 43.22% in 2020 (relative to 2019). The number of companies with rumors, the annual average number of rumors, and the annual average number of favorable rumors also increased throughout the sample period. Meanwhile, insiders' stock sales increased dramatically after 2018, with the number of rounds increasing by 91.89% and the number of affected companies increasing by 46.90% in 2019.

3.2. Empirical models

3.2.1. Changes in the probability of occurrence of rumors, favorable rumors, and unfavorable rumors around insiders' stock selling events

$$Rumor/Rpos/Rneg_{it} = \alpha_0 + \alpha_1 Dpre + \alpha_2 Dcur + \alpha_3 CVs + \alpha_4 Ind + \alpha_5 Year + \varepsilon \quad (1)$$

We perform logit regression on model (1). The independent variables are *Rumor*, *Rpos*, and *Rneg*, which represent the probability of occurrence of rumors, favorable rumors, and unfavorable rumors, respectively. When a rumor, a favorable rumor, or an unfavorable rumor about a company occurs, *Rumor*, *Rpos*, or *Rneg*, respectively, takes the value of one, and zero otherwise. Referring to the classification of rumors by Zhao et al. (2010), a rumor is defined as favorable when it contains information that may positively affect the company's performance, operations, dividend distribution, etc. Otherwise, the rumor is considered unfavorable. Thus, rumors related to events such as completing orders, winning projects, embarking on M&As, or paying high dividends are deemed favorable. Rumors related to events such as shutdowns, salary arrears, litigation, or financial fraud are deemed unfavorable. We label each rumor as favorable or unfavorable using a machine learning method. Specifically, we convert the words in the rumor text into word vectors using Word2Vec. Word2Vec is a deep learning algorithm based on the neural networks proposed by Mikolov et al., (2013). It transforms individual words in the text into vectors in a single high-dimensional space through training and transforms the processing of the text into operations of word vectors accordingly. We next randomly select approximately 38% of the raw rumor data and manually label each rumor according to the classification criteria. The manually labeled data are used to generate a training set and a test set at a ratio of 7:3. A support

Table 2
Sample Description.

Panel A: Rumors					
Distribution of rumors by year	2017	2018	2019	2020	Total
Total Number of rumors	4,129	5,059	7,921	11,351	28,460
Total Number of favorable rumors	2,742	3,727	6,245	8,944	21,658
Percentage (%) of favorable rumors	66.41	73.67	78.84	78.79	76.10
Number of rumored firms	1,245	1,637	1,958	2,419	3,080
Annual average of rumors	3.32	3.09	4.05	4.69	3.79
Annual average of favorable rumors	2.20	2.28	3.19	3.70	2.84
Panel B: Insiders' Stock Selling					
Distribution of transactions by year	2017	2018	2019	2020	Total
Total number of transaction rounds	1,116	1,204	2,190	2,234	6,744
Total number of firms involved	638	678	996	1,043	1,590
Annual average of transaction rounds	2.37	2.45	3.10	2.93	2.71
Proportion of shares sold (‰)	4.29	4.99	5.14	5.26	5.01

vector machine model is used to fit the training set. Following commonly used processing methods for short texts, we take the average of all of the word vectors of a rumor text as the input to the support vector machine model and obtain a trained classifier with about 82% accuracy on the test set. Finally, we construct a word list for favorable and unfavorable rumors as a supplemental classification procedure.

Our main explanatory variables are two dummy variables related to the timing of insiders' stock selling: the run-up (*Dpre*) and current (*Dcur*) periods. For a round of insiders' stock selling, the 30 days before the first trading day represent the run-up period, and *Dpre* takes the value of one for observations in this period. The 30 days after the first trading day represent the current period, and *Dcur* takes the value of one for observations in this period. Referring to Bartov et al. (2018), model (1) controls for the number (*Media_num*) and sentiment (*Media_sent*) of concurrent media reports as well as the number (*Ann_num*) and tone (*Ann_sent*) of concurrent corporate announcements. *Media_sent* is the ratio of the difference between the number of positive and negative media reports and the total number of media reports. *Ann_sent* is based on the abnormal return calculated using the market-adjusted model during the [-1, 1] window around the announcement date. When the abnormal return is greater than zero, *Ann_sent* takes the value of one; when the abnormal return is less than zero, *Ann_sent* takes the value of minus one; and when the abnormal return is zero, *Ann_sent* takes the value of zero.

Referring to studies on rumor (Ahern and Sosyura, 2014; Schmidt, 2020) and insider trading (Lu et al., 2017; Yi et al., 2017), we include the following control variables on the company's financial, stock trading, and corporate governance characteristics: log of total assets (*Size*), return-on-assets ratio (*ROA*), debt-to-assets ratio (*Leverage*), book-to-market ratio (*BTM*), revenue growth rate (*Growth*), sales expense to revenue (*Sales_fee*), quarterly average (*Avg_return*) and volatility (*Volatility*) of stock returns, shareholding ratio of the largest shareholder (*Top1*), ownership concentration (*Herf_5*), proportion of tradable shares (*Tradables*), years since listing (*Age*), a state-owned enterprise dummy (*SOE*), institutional shareholding ratio (*Inst_hold*), and analyst coverage (*Analysts*). All of the control variables are lagged by one quarter, and detailed definitions are provided in Table 3.

3.2.2. Effect of information asymmetry on the probability of favorable rumors' occurring during the run-up to a round of insiders' stock selling

$$Rpos_{it} = \alpha_0 + \alpha_1 Dpre \times Asy_{i,t} + \alpha_2 Dpre + \alpha_3 Asy_{i,t} + \alpha_4 Dcur + \alpha_5 CVs + \alpha_6 Ind + \alpha_7 Year + \varepsilon \quad (2)$$

Insiders who intend to sell their shares have an incentive to release positive information to increase the stock price, enabling them to sell their shares at inflated prices to maximize their wealth. Thus, favorable rumors in the run-up to insiders' stock selling are the key indicator of stock price manipulation via rumor. In model (2), the dependent variable is the probability of occurrence of a favorable rumor (*Rpos*) and the main independent variables are the run-up period (*Dpre*) and current period (*Dcur*) dummies. To examine the moderating effect of information asymmetry, we add an interaction term between the run-up period dummy (*Dpre*) and information asymmetry (*Asy*). Three proxies are used to measure information asymmetry (*Asy*): a comprehensive index of analyst forecasts (*Analysts_forecast*), information disclosure ratings from the Shenzhen Stock Exchange (*Trans*), and an indicator of real earnings management (*REM*).

First, analysts are important information intermediaries and an external governance mechanism in the capital market (Healy and Palepu, 2001). Li and Zhang (2017) find that insiders' profits are significantly lower in firms that are followed by more analysts. Zeng et al. (2018) use analyst following as a proxy for information transparency and find that analyst following reduces management manipulation of the tone of annual reports before insiders trade the company's stocks. In addition, studies generally document that information asymmetry is greater in companies with lower forecast accuracy and greater divergence between analysts' forecasts (Chen and Xu, 2014; Zhang and Zhou, 2019). Referring to Niu and Zhao (2012), we construct a comprehensive indicator of analyst forecasts (*Analyst_forecast*). Specifically, we sort our sampled companies in ascending order according to the number of analysts following, and we sort forecast errors and dispersion in descending order. Next, we divide each indicator into 10 segments and assign a score from one to ten to each segment in order. Last, we sum the scores for the three indicators to obtain a comprehensive indicator of analysts' forecasts, with a higher value representing less information asymmetry.

Table 3
Variable Definitions.

Variable	Definition
Rumor	A dummy variable that equals one if rumors about a company occur, zero otherwise
Rpos	A dummy variable that equals one if favorable rumors about a company occur, zero otherwise
Rneg	A dummy variable that equals one if unfavorable rumors about a company occur, zero otherwise
Rumor num	Number of rumors about a company occurring in a day, zero if no rumors occur
Pos_rumor	Number of favorable rumors about a company occurring in a day, zero if no rumors occur
Neg_rumor	Number of unfavorable rumors about a company occurring in a day, zero if no rumors occur
Rumor_sent	*Pos_rumor* minus *Neg_rumor* divided by *Rumor num*, zero if no rumors occur in a day
Profits	(1) Cumulative abnormal returns during the 5, 10, 20, 30 windows before the first transaction date of a round of insiders' stock selling minus the cumulative abnormal returns over the corresponding windows thereafter (2) Average trade price of a round of insiders' stock selling minus benchmark price divided by benchmark price, where benchmark price is the average closing price over the during the [-120,-91], [-90,-61], [-60,-31] windows before the first transaction date
Dpre	A dummy variable that equals one for the 30 days before the first transaction date of a round of insiders' stock selling, zero otherwise
Dcur	A dummy variable that equals one for the 30 days after the first transaction date of a round of insiders' stock selling, zero otherwise
Rumor_pre	Number of favorable rumors minus the number of unfavorable rumors that occur in the run-up to insiders' stock selling
Media_num	Number of media reports about a company in a day, zero if no media coverage
Media_sent	Number of positive media reports minus number of media reports divided by total number of media reports, zero if no media coverage
Ann_num	Number of company announcement on a day, zero if no announcement released
Ann_sent	Determined based on market-adjusted excess return on the announcement date, *Ann_sent* equals one if excess return is greater than zero, minus one if excess return is less than zero, and zero if excess return is zero
Media_pre	Number of positive media articles minus number of negative media articles in the run-up to insiders' stock selling
Ann_pre	Number of positive corporate announcements minus number of negative corporate announcements in the run-up to insiders' stock selling
R_ratio	Ratio of shares traded in a round of insiders' stock selling to the number of total shares
Size	Log of total assets
ROA	Ratio of net income to total assets
Leverage	Ratio of total liabilities to total assets
BTM	Ratio of total assets to market value
Growth	Growth rate of operating revenue
Sales_fee	Ratio of sales expenses to operating revenue
Avg_return	Average of daily stock return over the quarter
Volatility	Standard deviation of daily stock return over the quarter
Top1	Proportion of shares hold by the largest shareholder
Herf_5	The sum of squares of the proportions of shares held by the top five shareholders
Tradables	Ratio of tradable shares to total number of shares
Age	Years since listing
SOE	SOE equals one if the firm is under control by the state, zero otherwise
Inst_hold	Proportion of shares hold by the institutional investors
Analysts	Log of one plus the number of analysts following the firm
Error	Absolute value of the average of forecast errors of all analysts divided by the absolute value of the actual earnings of the year
Dispersion	Standard deviation of forecasts of all analysts divided by the absolute value of forecast average
Analyst_forecast	Comprehensive index based on the number of analysts following the firm (*Analysts*), forecast error (*Error*)and forecast dispersion (*Dispersion*)
Trans	*Trans* equals one if the ratings of information disclosure of Shenzhen Stock Exchange are "excellent", zero otherwise
REM	*REM* equals one if the real earnings management level is greater than its sample mean, and zero otherwise. Real earnings management level is calculated based on Roychowdhury (2006) model
Bigsell	*Bigsell* equals one if the transaction size divided by the total compensation of directors, supervisors or senior executives is greater than its sample median, zero otherwise. Transaction size is calculated as the number of shares sold in a round of insiders' stock selling multiplied by the average trading price
Bidsell	*Bidsell* equals one if there is a centralized bidding transaction during a round of insiders' stock selling, zero otherwise
Position	*Position* equals one if there is CEOs, Chairmen, or their relatives participated, zero otherwise

(*continued on next page*)

Table 3 (*continued*)

Variable	Definition
Self	*Self* equals one if the directors, supervisors or senior executives personally participate in a round of insiders' stock selling, zero otherwise
Relative	*Relative* equals one if there are relatives of CEOs and Chairmen participate in a round of insiders' stock selling, zero otherwise

Second, the Shenzhen Stock Exchange has evaluated the quality of listed companies' information disclosure in accordance with its listing rules since 2001. These evaluations result in one of four ratings: "unqualified," "qualified," "good," or "excellent." These ratings are relatively objective and are accepted by most market participants (Chen and Kong, 2012; Chen and Xu, 2014). Therefore, we use them to measure information asymmetry. Specifically, referring to Xu and Wang (2021), if a company's rating is "excellent," the proxy for information transparency (*Trans*) takes the value of one; otherwise, it takes the value of zero.

Third, earnings management reduces the reliability of financial statements, causing information asymmetry within and outside the company. Compared with accrual earnings management, real earnings management is more covert (Li and He, 2012) and easier to hide from external supervision (Rennekamp et al., 2020). In addition, managers have a capital market motivation to engage in real earnings management. Irani and Oesch (2016) find that management can improve a company's short-term stock price performance through real earnings management to meet analysts' expectations. Wu and Zhang (2009) use real earnings management indicators to measure earnings management and observe a significant correlation between earnings management and insider trading. Therefore, we use a company's real earnings management level, calculated using Roychowdhury's (2006) model, to measure the quality of its accounting information. When a company's real earnings management level is higher than the sample median, the true earnings management indicator (*REM*) takes the value of one, indicating a high degree of information asymmetry.

other control variables are the same as in model (1).

3.2.3. Effects of transaction and participant characteristics on the probability of favorable rumors during the run-up to insiders' stock selling

$$Rpos_{it} = \alpha_0 + \alpha_1 Dpre \times Sell(Seller)_{i,t} + \alpha_2 Dpre + \alpha_3 Sell(Seller)_{i,t} + \alpha_4 Dcur + \alpha_5 CVs + \alpha_6 Ind + \alpha_7 Year + \varepsilon \quad (3)$$

The dependent variable in model (3) is the probability of occurrence of a favorable rumor (*Rpos*), and the main independent variables are the run-up (*Dpre*) and current (*Dcur*) period dummies. We interact the transaction (*Sell*) and seller (*Seller*) characteristics variables with the run-up period dummy (*Dpre*). The transaction characteristics (*Sell*) include the size and type of trades, and two dummy variables, *Bigsell* and *Bidsell*, are constructed accordingly. We define transaction size as the number of shares sold in a round of insiders' stock selling multiplied by the average trading price. Next, we calculate the ratio of transaction size to the total annual compensation of directors, supervisors, and senior executives. If the ratio is greater than the sample median, *Bigsell* takes the value of one, which implies that insiders' stock selling greatly influences their wealth, otherwise, *Bigsell* takes the value of zero. *Bidsell* takes the value of one if there is a centralized bidding transaction during a round of insiders' stock selling, and zero otherwise. Two dummy variables are constructed to measure sellers' characteristics (*Seller*): *Position* and *Self*. *Position* equals one if the CEO or chairman is involved in insiders' stock selling, and zero otherwise. Furthermore, according to Zeng (2008), "when the seller is a relative of a director, supervisor, or senior executive, the seller's position is considered as the same." Thus, *Position* also takes the value of one in such cases. *Self* represents the identity of the insiders. If they are directors, supervisors, or senior executives, *Self* takes the value of one; if they are relatives of directors, supervisors, or senior executives, *Self* takes the value of zero.

Other control variables are the same as in models (1) and (2).

4. Empirical results

4.1. Descriptive statistics

Table 4 presents the descriptive statistics for the main variables. The daily number of rumors about the companies in the sample is much smaller than the daily number of media reports and announcements. A potential explanation is that the probability that a rumor will arise about a company is lower than the probability that the company will be discussed in the media or that the company will issue an announcement. Unlike media articles and corporate announcements, rumors emerge from informal channels and are not a main source of information in the financial market. Another possibility relates to the study's treatment of the rumor date. A rumor is likely to have been circulating for a period of time before it is questioned, and it may continue to spread afterwards. However, this study uses the date on which investors question a company about a rumor on an interactive platform as the rumor date, resulting in zero rumors for many observations. In robustness tests, we use the tobit model to alleviate the potential problem of censored rumor data.

Table 5 reports the Pearson correlation coefficients of main variables in this study, with significant correlation coefficients at the 10% and above displayed in bold. The number of rumors (*Rumor_num*) has a positive and significant correlation with the number (*Media_num*) and tone (*Media_sent*) of media reports, and with the number of corporate announcements (*Ann_num*), but not with the tone of corporate announcements (*Ann_sent*). The favorable tendency of rumors (*Rumor_sent*) is strongly positively correlated with the number (*Media_num*) and tone (*Media_sent*) of media reports, and with the number (*Ann_num*) and tone (*Ann_sent*) of corporate announcements. That is, if there are more media reports or corporate announcements about a company, there are also more rumors about the company, and if the media and the company release more positive company-related information, the rumors about the company are also more favorable. In addition, the number (*Media_num*) and tone (*Media_sent*) of media reports are strongly positively correlated with the number (*Ann_num*) and tone (*Ann_sent*) of corporate announcements, which indicates that the various

Table 4
Descriptive Statistics.

	N	Mean	Std. Dev.	Min	Median	Max
Rumor	39,78,039	0.006	0.079	0	0	1
Rpos	39,78,039	0.005	0.069	0	0	1
Rneg	39,78,039	0.002	0.040	0	0	1
Rumor_num	39,78,039	0.007	0.100	0.000	0.000	15.000
Pos_rumor	39,78,039	0.005	0.087	0.000	0.000	12.000
Neg_rumor	39,78,039	0.002	0.046	0.000	0.000	14.000
Rumor_sent	39,78,039	0.003	0.078	−1.000	0.000	1.000
Media_num	39,78,039	0.891	2.736	0.000	0.000	19.000
Media_sent	39,78,039	0.043	0.336	−1.000	0.000	1.000
Ann_num	39,78,039	0.076	0.390	0.000	0.000	3.000
Ann_sent	39,78,039	−0.003	0.214	−1.000	0.000	1.000
Size	39,78,039	22.296	1.301	20.036	22.125	26.300
ROA	39,78,039	0.027	0.036	−0.088	0.020	0.156
Leverage	39,78,039	0.406	0.197	0.058	0.396	0.863
BTM	39,78,039	0.634	0.246	0.133	0.626	1.178
Growth	39,78,039	−0.728	2.234	−10.662	0.331	0.751
Sales_fee	39,78,039	0.081	0.097	0.000	0.046	0.500
Avg_return	39,78,039	0.000	0.003	−0.008	0.000	0.011
Volatility	39,78,039	0.026	0.009	0.010	0.025	0.055
Top1	39,78,039	33.542	14.394	8.483	31.265	71.987
Herf_5	39,78,039	0.154	0.108	0.015	0.127	0.522
Tradables	39,78,039	0.737	0.272	0.114	0.822	1.000
Age	39,78,039	11.105	7.801	1.000	9.000	30.000
SOE	39,78,039	0.313	0.464	0.000	0.000	1.000
Analysts	39,78,039	1.422	1.193	0.000	1.386	3.807
Inst_hold	39,78,039	0.622	0.637	0.007	0.487	3.855

Table 5
Correlation Coefficients.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 *Rumor_num*																				
2 *Rumor_sent*	0.473																			
3 *Media_num*	0.029	0.010																		
4 *Media_sent*	0.006	0.008	0.095																	
5 *Ann_num*	0.007	0.003	0.062	0.011																
6 *Ann_sent*	−0.000	0.003	0.008	0.023	−0.058															
7 *Size*	0.015	0.003	0.261	0.068	−0.024	0.004														
8 *ROA*	−0.007	−0.006	0.020	0.030	−0.008	0.006	−0.038													
9 *Leverage*	0.005	0.002	0.112	0.028	−0.014	0.001	0.553	−0.297												
10 *BTM*	0.002	0.003	0.065	0.017	−0.036	0.001	0.588	−0.226	0.436											
11 *Growth*	−0.002	−0.001	0.020	0.019	−0.042	0.005	0.024	0.290	0.008	0.026										
12 *Sales_fee*	0.002	0.000	0.022	−0.006	0.015	−0.001	−0.190	0.049	−0.249	−0.209	−0.066									
13 *Avg_return*	0.010	0.007	0.033	0.011	0.016	0.000	0.017	0.033	0.000	−0.176	−0.146	0.015								
14 *Volatility*	0.013	0.009	−0.033	−0.010	0.054	−0.008	−0.275	−0.092	−0.091	−0.236	−0.168	0.037	0.278							
15 *Top1*	−0.017	−0.011	0.058	0.015	−0.038	0.004	0.175	0.113	0.051	0.111	0.009	−0.047	0.001	−0.094						
16 *Herf_5*	−0.018	−0.011	0.075	0.016	−0.037	0.004	0.195	0.123	0.039	0.116	0.009	−0.043	0.004	−0.089	0.959					
17 *Tradables*	0.009	0.005	0.066	0.015	−0.047	0.003	0.302	−0.184	0.252	0.065	−0.009	−0.075	0.023	−0.186	−0.092	−0.148				
18 *Age*	0.006	0.002	0.094	0.018	0.062	0.004	0.455	−0.157	0.330	0.280	−0.008	−0.113	−0.010	−0.209	−0.018	−0.050	0.603			
19 *SOE*	−0.005	−0.002	0.070	0.020	−0.071	0.005	0.361	−0.117	0.265	0.263	−0.006	−0.168	−0.014	−0.176	0.222	0.200	0.349	0.526		
20 *Analysts*	0.008	−0.003	0.161	0.061	0.035	0.004	0.418	0.285	0.062	−0.065	0.034	0.012	0.012	−0.139	0.056	0.062	−0.015	−0.032	−0.023	
21 *Inst_hold*	−0.009	−0.007	0.047	0.010	−0.024	0.004	0.158	0.113	0.022	0.127	−0.051	−0.029	−0.006	−0.010	0.388	0.448	−0.400	−0.086	0.120	0.082

types of information related to a company interact, jointly forming the company's information environment. Therefore, in our empirical models, we control for the effects of media coverage and corporate announcements.

4.2. Changes in rumors around insiders' stock selling events

4.2.1. Changes in rumors during the [-90, 90] window around the first transaction in a round of insiders' selling

Fig. 1 plots the changes in rumor occurrence from 90 days before the first transaction to 90 days after the first transaction in a round of insiders' stock selling. The rumors are summed in 30-day increments. We include the total number of rumors (*Total_rumor*), the number of favorable rumors (*Pos_rumor*), and the number of unfavorable rumors (*Neg_rumor*) and report the mean values for each period. Favorable rumors occur more frequently than unfavorable rumors, accounting for the majority of the sampled rumors. The number of rumors increases during the run-up to insiders' stock selling. In the 30 days before the first transaction, the number of favorable rumors significantly increases, and in the 30 days after the first transaction, the number of total rumors and the number of favorable rumors peak. Unfavorable rumors also increase around insiders' stock selling events [-60, −31], falling slightly in the 30 days before the first transaction and rebounding afterward.

4.2.2. Baseline regression analysis

Table 6 reports the logit regression results for model (1). The dependent variables in columns (1), (2), and (3) indicate the probability of the occurrence of rumors (*Rumor*), favorable rumors (*Rpos*), and unfavorable rumors (*Rneg*), respectively. The regression results show that in the run-up to and during each round of insiders' stock selling, the probability that rumors, especially favorable rumors, will occur increases substantially. The probability that unfavorable rumors will occur decreases, although the decrease is not statistically significant. These results hold after controlling for the number and tone of concurrent media reports and corporate announcements. These results are consistent with the hypothesis that insiders manipulate stock prices via rumors before selling their company stock. Meanwhile, the probability of the occurrence of rumors, including favorable and unfavorable rumors, is positively correlated with the number of media reports and corporate announcements. Furthermore, as the tone of media coverage and corporate announcements becomes more positive, the probability of the occurrence of a favorable rumor increases. Conversely, the probability of

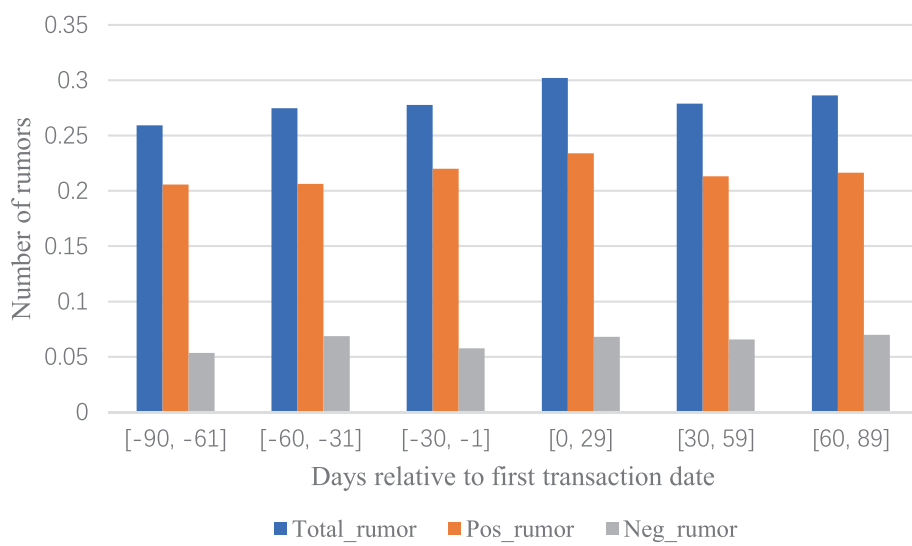

Fig. 1. Average number of rumors, favorable rumors, and unfavorable rumors during each 30-days period around the first transaction date of a round of insiders' stock selling.

Table 6
Changes in probability of rumor occurrence around the insiders' stock selling period.

	Rumor	*Rpos*	*Rneg*	*Rumor*	*Rpos*	*Rneg*
	(1)	(2)	(3)	(4)	(5)	(6)
Dpre	0.071*	0.107***	−0.071	0.084**	0.126***	−0.083
	(0.039)	(0.042)	(0.069)	(0.041)	(0.044)	(0.077)
Dcur	0.155***	0.185***	0.071	0.171***	0.197***	0.084
	(0.038)	(0.040)	(0.069)	(0.039)	(0.042)	(0.070)
Media_num	0.066***	0.065***	0.067***	0.006***	0.005***	0.005***
	(0.004)	(0.004)	(0.005)	(0.001)	(0.001)	(0.001)
Media_sent	0.142***	0.252***	−0.198***	0.201***	0.310***	−0.122***
	(0.022)	(0.024)	(0.044)	(0.024)	(0.026)	(0.047)
Ann_num	0.086***	0.079***	0.079***	0.018***	0.017***	0.016**
	(0.017)	(0.019)	(0.030)	(0.004)	(0.004)	(0.007)
Ann_sent	−0.025	0.064**	−0.270***	−0.021	0.078*	−0.298***
	(0.028)	(0.033)	(0.053)	(0.035)	(0.041)	(0.065)
Size	0.279***	0.222***	0.449***	0.302***	0.242***	0.470***
	(0.037)	(0.041)	(0.041)	(0.036)	(0.040)	(0.040)
ROA	−1.962***	−2.081***	−1.823***	−0.897***	−0.916***	−0.836***
	(0.475)	(0.495)	(0.697)	(0.177)	(0.184)	(0.290)
Leverage	−0.277**	−0.214*	−0.502***	−0.206*	−0.152	−0.354*
	(0.125)	(0.129)	(0.182)	(0.120)	(0.120)	(0.189)
BTM	-0.0238**	−0.045	−0.782***	−0.293***	−0.093	−0.850***
	(0.110)	(0.112)	(0.160)	(0.112)	(0.116)	(0.157)
Growth	0.008*	0.012**	0.000	−0.001*	0.000	−0.001**
	(0.004)	(0.005)	(0.007)	(0.000)	(0.000)	(0.000)
Sales_fee	0.030	−0.085	0.440	0.012	−0.028	0.154
	(0.200)	(0.191)	(0.319)	(0.103)	(0.111)	(0.096)
Avg_return	−2.958	3.513	–22.184***	2.037	4.531*	−2.513
	(3.265)	(3.532)	(5.171)	(2.438)	(2.381)	(3.844)
Volatility	14.356***	12.824***	19.606***	12.330***	11.807***	13.121***
	(1.458)	(1.518)	(2.329)	(1.186)	(1.173)	(1.838)
Top1	0.014***	0.013**	0.016**	0.010*	0.008	0.013*
	(0.005)	(0.006)	(0.007)	(0.005)	(0.005)	(0.007)
Herf_5	−4.241***	−4.135***	−4.375***	−3.620***	−3.395***	−4.054***
	(0.714)	(0.729)	(1.000)	(0.662)	(0.687)	(0.924)
Tradables	0.119	0.146	0.057	0.187*	0.210**	0.118
	(0.100)	(0.104)	(0.145)	(0.102)	(0.105)	(0.145)
Age	−0.002	−0.003	0.000	−0.004	−0.004	−0.004
	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.006)
SOE	−0.182***	−0.128*	−0.344***	−0.162***	−0.114*	−0.299***
	(0.064)	(0.066)	(0.083)	(0.062)	(0.065)	(0.082)
Analysts	−0.011	−0.024	0.033	−0.008	−0.022	0.040
	(0.019)	(0.021)	(0.025)	(0.020)	(0.021)	(0.025)
Inst_hold	−0.037	−0.040	−0.026	0.000	0.000	−0.014
	(0.038)	(0.041)	(0.051)	(0.000)	(0.000)	(0.029)
Cons	−11.734***	−11.094***	−16.030***	−12.275***	−11.638***	−16.347***
	(0.718)	(0.790)	(0.834)	(0.704)	(0.780)	(0.802)
Ind&Year	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.032	0.031	0.036	0.025	0.025	0.029
N	3,978,039	3,978,039	3,978,039	3,892,377	3,892,377	3,892,377
Delete	No	No	No	Yes	Yes	Yes

Standard errors are in parentheses.
*** p <.01, ** p <.05, * p <.1.

the occurrence of an unfavorable rumor increases as the tone of media coverage and corporate announcements becomes more negative.

In addition, company size (*Size*), revenue growth rate (*Growth*), quarterly stock price volatility (*Volat*), and the proportion of shares held by the largest shareholder (*Top1*) are strongly positively correlated with the

probability of a rumor's occurring. These results are largely consistent with the findings of Zhao et al. (2010). Stock price volatility reflects uncertainty about a company's operations, indicating that rumors are more likely to occur when investors face greater uncertainty, which is consistent with theories of rumors from social psychology studies (Zhao et al., 2013). Li and Lu (2007) point out that "controls over the listed companies by major shareholders are stronger if they have larger shareholding ratios, and they are more likely to expropriate the minority shareholders through manipulation of the generation and disclosure of information." We find that major shareholders not only manipulate accounting information but also use rumors to manipulate a company's stock price. However, the coefficient of ownership concentration (*Herf_5*) is significant and negative, which implies that a moderately concentrated ownership structure is conducive to reducing the occurrence of rumors. In addition, company profitability (*ROA*), debt-to-assets ratio (*Leverage*), book-to-market ratio (*BTM*), and state control (*SOE*) are significantly and negatively correlated with the probability of a rumor's occurring, and the probability of the occurrence of an unfavorable rumor decreases as a company's quarterly average of stock returns increases.

Insiders may instigate rumors based on private company information, which is then distorted to some extent in word-of-mouth communication (Shen et al., 2012). Rumors may also originate from both traditional media coverage and new media. For example, Zhao et al. (2010) find that financial media, including media outlets designated by the CSRC for corporate information disclosures, can become rumormongers and that unconfirmed information is often forwarded on the Internet, which promotes the spread of rumors. This study uses the text of inquiries about rumors on two interactive investor platforms. We find that questioners usually describe the source of a rumor with vague terms such as "rumor has it," "it is said that," and "Internet buzz" (28,305 rumors, accounting for 83.46% of the rumor sample). Only a small number of questioners clearly state that the information they seek to verify comes from sources such as media articles, WeChat accounts, online stock forums, research reports by analysts or brokers, or industry websites. Of these, only 319 questions are about company announcements, and most of these questions involve misunderstandings or distortions of the announcement contents. Meanwhile, 5,289 questions (15.60% of the rumors in the sample) include the phrase "according to news reports," but only 895 of these questions cite a specific newspaper or online media outlet. Although rumors originating from media reports account for only part of the sample, to further distinguish between rumor manipulation and media manipulation, we exclude 5,608 rumors that explicitly cite media sources or corporate announcements, resulting in a subsample of 28,305 rumors and 3,436 companies (*Delete*). A firm-day merged subsample is constructed to test model (1). The results are reported in columns (4), (5), and (6) of Table 6 and are consistent with the results for the full sample. The probability of the occurrence of rumors and favorable rumors in the run-up to the first transaction in a round of insiders' stock selling substantially increases, but the probability of unfavorable rumors does not appreciably change.

4.2.3. Robustness tests

A common endogeneity problem in information-based manipulation studies relates to whether the information is driven by the transaction or the transaction is driven by the information. A possible scenario is that when rumors are already growing about a company's positive prospects, insiders take advantage of the hype and time their transactions accordingly, rather than actively using rumors to build momentum before selling their shares. Another possibility is that companies associated with insider trading have certain characteristics that make them more susceptible to rumors. To prove that the observed increase in rumors is caused by insiders' stock selling, we conduct the following tests to alleviate endogeneity concerns. The results are shown in Table 7.

First, using quarterly data on rumors and insiders' stock selling, we use a two-stage instrumental variable approach to address potential reverse causality (whether rumors drive insiders' stock selling or insiders' stock selling drives rumors). Referring to Xie et al. (2016) and Xu et al. (2021), we choose instrumental variables based on the expiration of stock lockup, for two reasons. First, investors have strong incentives to sell their previously restricted shares after lockup expires (Field and Hanka, 2001; Tan and Wu, 2018). Thus, lockup expiration is closely related to insiders' stock selling. Second, the instrumental variables include dummy variables for whether an unlock event took place in the quarter before the first transaction in a round of insiders' stock selling (*Offlock*) and for the proportion of unlocked shares (*Offlock_ratio*). An unlock event in the previous quarter is considered public information (Tan and Wu, 2018) and has little relevance to stock price fluc-

Table 7
Robustness Tests.

	Insidersell_q	*Rumor_q*	*Rumor_q*	*Rumor_q*	*Rumor_num*	*Rumor_sent*
	(1)	(2)	(3)	(4)	(5)	(6)
Insidersell_q		10.428**	0.084*	1.360***		
		(5.166)	(0.045)	(0.151)		
Offlock	0.047***					
	(0.010)					
Offlock_ratio	0.132***					
	(0.048)					
Passivesell_q				0.233		
				(0.151)		
Media_q	0.000***	0.000***	0.000**	0.002***		
	(0.000)	(0.000)	(0.000)	(0.000)		
Ann_q	0.000***	0.002	0.005**	0.005***		
	(0.000)	(0.002)	(0.002)	(0.001)		
Dpre					0.088*	0.109***
					(0.046)	(0.042)
Dcur					0.192***	0.183***
					(0.046)	(0.041)
Media_num					0.083***	0.068***
					(0.005)	(0.005)
Media_sent					0.162***	0.255***
					(0.025)	(0.023)
Ann_num					0.110***	0.086***
					(0.021)	(0.019)
Ann_sent					−0.026	0.071**
					(0.034)	(0.033)
Size	0.017***	1.826***	0.274***	1.211***	0.324***	0.210***
	(0.005)	(0.192)	(0.054)	(0.177)	(0.042)	(0.037)
ROA	−0.002	−3.102	−1.034*	−4.868**	−2.286***	−2.025***
	(0.079)	(2.140)	(0.560)	(2.087)	(0.540)	(0.473)
Leverage	−0.037*	−1.680***	−0.326**	−1.730***	−0.328**	−0.206*
	(0.021)	(0.578)	(0.137)	(0.624)	(0.142)	(0.121)
BTM	−0.080***	−1.562**	−0.348***	−0.705	−0.298**	−0.047
	(0.021)	(0.644)	(0.125)	(0.567)	(0.129)	(0.108)
Growth	0.000	−0.040	0.011*	−0.011	0.009*	0.011**
	(0.001)	(0.040)	(0.005)	(0.022)	(0.005)	(0.005)
Sales_fee	0.016	−0.793	0.003	−0.887	0.027	−0.122
	(0.032)	(0.773)	(0.223)	(0.779)	(0.230)	(0.180)
Avg_return	6.472***	−113.487**	2.222	−30.467*	−3.592	3.379
	(0.857)	(44.263)	(3.885)	(17.956)	(3.806)	(3.464)
Volatility	0.459	154.720***	10.178***	134.003***	16.731***	12.935***
	(0.341)	(10.278)	(1.619)	(8.722)	(1.657)	(1.452)
Top1	0.001	0.067***	0.004	0.060**	0.017***	0.013**
	(0.001)	(0.020)	(0.006)	(0.024)	(0.006)	(0.005)
Herf_5	−0.246**	−16.892***	−1.919***	−15.164***	−4.834***	−3.986***
	(0.118)	(2.913)	(0.685)	(3.423)	(0.810)	(0.682)
Tradables	−0.104***	0.506	−0.019	−0.147	0.121	0.125
	(0.016)	(0.620)	(0.113)	(0.417)	(0.115)	(0.097)
Age	−0.003***	0.001	0.004	−0.028	−0.002	−0.002
	(0.001)	(0.036)	(0.006)	(0.023)	(0.005)	(0.004)
SOE	−0.014	−0.826***	−0.034	−0.551*	−0.215***	−0.127**
	(0.008)	(-3.789)	(0.065)	(0.300)	(0.072)	(0.061)
Analysts	0.011***	−0.405***	−0.059***	−0.198**	−0.012	−0.021
	(0.003)	(0.106)	(0.020)	(0.082)	(0.022)	(0.020)

Table 7 (*continued*)

	Insidersell_q	*Rumor_q*	*Rumor_q*	*Rumor_q*	*Rumor_num*	*Rumor_sent*
Inst_hold	−0.064***	0.163	0.015	−0.415***	−0.028	−0.030
	(0.007)	(0.430)	(0.036)	(0.157)	(0.042)	(0.037)
Cons	−0.119	−42.333***	−5.351***	−27.679***	−15.891***	−12.956***
	(0.112)	(3.434)	(1.025)	(3.612)	(0.809)	(0.713)
Ind& Year	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.076	0.072	0.053	0.132	0.027	0.027
N	23,912	23,912	21,046	23,535	3,978,039	3,978,039

Standard errors are in parentheses.
*** p <.01, ** p <.05, * p <.1.

tuations or rumors around insiders' stock selling in the current quarter. In the first stage, a probit regression is conducted on the dummy variable *Insidersell_q* using the instrumental variables *Offlock* and *Offlock_ratio*. As shown in column (1) of Table 7, the coefficients of the two instrumental variables are positive and significant at the 1% level, which indicates that they meet the relevance requirements for an endogenous variable. In column (2) of Table 7, we report the estimation results of the second-stage regressions; as expected, the coefficient of *Insidersell_q* is significant and positive, which confirms that insiders' stock selling leads to an increase in rumors.

Next, we use the propensity score matching method to test the effect of a company's experiencing insiders' stock selling in a particular quarter (*Insidersell_q*) on the number of rumors (*Rumor_q*) about the company in that quarter. The final sample consists of 3,080 companies that experienced rumors during the sample period, of which 1,590 also experienced insiders' stock selling during that period. A dummy variable (*Treat*) is generated to indicate whether a company experienced insiders' stock selling during the sample period. Companies that experienced insiders' stock selling during the sample period are placed in the treatment group (*Treat* equals one). Next, we use the control variables in model (1) including company size (*Size*), book-to-market ratio (*BTM*), debt-to-assets ratio (*Leverage*), sales expense to revenue ratio (*Sales_fee*), quarterly stock price volatility (*Volat*) etc. to match companies in the treatment group to companies in the control group. Finally, an ordinary least squares regression is performed on the matched sample, with *Insidersell_q* as the explanatory variable and *Rumor_q* is the dependent variable. The results are shown in column (3) of Table 7. The coefficient of *Insidersell_q* is significant and positive, which means that among companies with a similar probability of experiencing insiders' stock selling, the number of rumors is greater for those that experienced (compared with those that did not experience) insiders' stock selling in the sample period.

Further, to prove that the market manipulation motivation of insiders when selling their shares leads to an increase in company rumors, we examine the changes in rumors around stock sales by passive funds. Funds can be classified as active or passive according to their investment style. Unlike active funds, which aim to beat a designated benchmark, passive funds simply attempt to track their index to deliver average market returns. Therefore, we assume that relative to active funds, passive funds are less likely to engage in information-based manipulation during their transactions. Ownership data for passive funds are obtained from the CSMAR database. If the holdings of a passive fund decrease in a given quarter, it is considered to have sold shares in that quarter, and the dummy variable for stock selling in that quarter (*Passivesell_q*) takes the value of one. In our sample, 42.48% of the firm-quarter observations include stock selling by passive funds. We conduct a regression analysis in which *Passivesell_q* is the independent variable and the quarterly number of rumors (*Rumor_q*) is the dependent variable. The results are shown in column (4) of Table 7. The coefficient of *Passivesell_q* is not significant, whereas the coefficient of *Insidersell_q* is significant and positive. These results demonstrate that rumors around stock selling differ greatly between passive funds and company insiders, further indicating that insiders' market manipulation motivation leads to a significant increase in rumors in the run-up to a round of insiders' stock selling.

Finally, we address potential estimation problems associated with our treatment of rumor date. This study takes the date on which investors question a rumor on an interactive platform as the date of the rumor's occur-

Table 8
Impacts of information asymmetry.

	Rpos	*Rpos*	*Rpos*	*Rpos*
	(1)	(2)	(3)	(4)
Dpre	0.405***	0.151***	−0.047	0.219*
	(0.114)	(0.045)	(0.057)	(0.123)
Dpre* × *Analyst_forecast	−0.022***			−0.016**
	(0.008)			(0.008)
Analyst_forecast	−0.024***			−0.025***
	(0.004)			(0.004)
Dpre* × *Trans		−0.231*		−0.149
		(0.122)		(0.127)
Trans		0.089		0.100*
		(0.061)		(0.060)
Dpre* × *REM			0.303***	0.258***
			(0.081)	(0.081)
REM			0.012	0.009
			(0.038)	(0.037)
Dcur	0.174***	0.185***	0.185***	0.175***
	(0.040)	(0.040)	(0.040)	(0.040)
Media_num	0.066***	0.065***	0.065***	0.066***
	(0.004)	(0.004)	(0.004)	(0.004)
Media_sent	0.253***	0.252***	0.253***	0.253***
	(0.024)	(0.024)	(0.024)	(0.024)
Ann_num	0.076***	0.079***	0.079***	0.076***
	(0.019)	(0.019)	(0.019)	(0.019)
Ann_sent	0.065**	0.064**	0.065**	0.065**
	(0.032)	(0.033)	(0.033)	(0.032)
Size	0.216***	0.217***	0.221***	0.210***
	(0.041)	(0.039)	(0.041)	(0.040)
ROA	−1.680***	−2.121***	−1.998***	−1.660***
	(0.484)	(0.500)	(0.500)	(0.495)
Leverage	−0.227*	−0.197	−0.212*	−0.207
	(0.128)	(0.127)	(0.129)	(0.126)
BTM	−0.098	−0.035	−0.054	−0.092
	(0.111)	(0.110)	(0.111)	(0.109)
Growth	0.010**	0.012**	0.011**	0.010**
	(0.005)	(0.005)	(0.005)	(0.005)
Aales_fee	−0.065	−0.087	−0.042	−0.033
	(0.189)	(0.191)	(0.196)	(0.195)
Avg_return	3.266	3.539	3.564	3.332
	(3.525)	(3.533)	(3.532)	(3.526)
Volatility	11.831***	13.007***	12.769***	12.018***
	(1.528)	(1.535)	(1.517)	(1.544)
Top1	0.013**	0.013**	0.013**	0.013**
	(0.006)	(0.006)	(0.006)	(0.006)
Herf_5	−4.080***	−4.165***	−4.119***	−4.092***
	(0.724)	(0.727)	(0.729)	(0.723)
Tradables	0.127	0.141	0.143	0.119
	(0.103)	(0.105)	(0.103)	(0.104)
Age	−0.001	−0.002	−0.003	−0.001
	(0.004)	(0.004)	(0.004)	(0.004)
SOE	−0.121*	−0.134**	−0.127*	−0.127*
	(0.066)	(0.065)	(0.066)	(0.065)
Analysts	0.002	−0.029	−0.023	−0.003
	(0.022)	(0.022)	(0.021)	(0.023)
Inst_hold	−0.024	−0.037	−0.040	−0.020
	(0.041)	(0.040)	(0.041)	(0.040)
Cons	−10.438***	−10.996***	−11.086***	−10.297***
	(0.805)	(0.765)	(0.791)	(0.777)

Table 8 (*continued*)

	Rpos	*Rpos*	*Rpos*	*Rpos*
Ind&Year	Yes	Yes	Yes	Yes
Pseudo R^2	0.032	0.031	0.031	0.032
N	3,978,039	3,978,039	3,978,039	3,978,039

Standard errors are in parentheses.
*** p <.01, ** p <.05, * p <.1.

rence, but in reality, the rumor may have been circulating in the financial market before that date and may continue to spread after it. Therefore, for many of the observations for which the daily rumor amount variable (*Rumor_num*) is set to zero, a rumor may actually have been circulating on that day. To address potential estimation problems associated with censored data, we use a tobit regression model to examine Hypothesis (1). The dependent variables are *Rumor_num* and *Rumor_sent*, with zero as the lower limit. The test results are shown in columns (5) and (6) of Table 7. The main explanatory variables are the dummy variables for the run-up (*Dpre*) and current (*Dcur*) periods of a round of insiders' stock selling. Their coefficients are significant and positive, consistent with the main test results.

4.3. Factors influencing favorable rumors in the run-up to insiders' stock selling

4.3.1. Information asymmetry

Table 8 presents the results of model (2). First, information asymmetry is measured using the comprehensive indicator of analyst forecasts (*Analyst_forecast*), with a higher value representing less information asymmetry about a company. In column (1), the coefficient of the interaction term *Dpre* × *Analyst_forecast* is significant and negative, which suggests that analysts, as important information intermediaries in the capital market, play a monitoring role in suppressing favorable rumors in the period before insiders sell stocks. Second, information asymmetry is measured using the information disclosure ratings of the Shenzhen Stock Exchange (*Trans*). In column (2), the coefficient of the interaction term *Dpre* × *Trans* is significant and negative, meaning that if a company's information disclosure evaluation rating is "excellent (compared with other rating levels including "unqualified", "qualified", or "good")" the probability that positive rumors will occur in the period before insiders' stock selling is significantly reduced. Third, information asymmetry is measured using an indicator of a company's true earnings management (*REM*). In column (3), the coefficient of the interaction term *Dpre* × *REM* is significant and positive, which indicates that companies with real earnings management greater than the sample median have lower quality accounting information, greater information asymmetry, and a higher probability of positive rumors in the period before insiders' stock sales. In sum, the results of model (2) indicate that the greater a company's information asymmetry, the more likely its insiders are to use rumors to manipulate the stock price before selling their shares. Consistent with communication studies, the information environment in which the company operates plays a key role in rumor dissemination.

4.3.2. Insiders' stock selling characteristics

Next, we examine how the characteristics of trades and traders influence the probability of rumors' occurring in the run-up to a round of insiders' stock selling. The trade characteristics considered comprise the scale and type of transaction. If the ratio of stocks sold to the annual compensation about a company's directors and supervisors is greater than the sample median, the transaction is considered a large-scale stock sale, and the dummy variable *Bigsell* equals one. Another dummy variable, *Bidsell*, is related to the type of trade; it equals one if the shares are sold via a centralized bidding method. The trader characteristic variables include the position and identity of the insiders. First, CEOs and chairmen are core insiders who have the greatest information advantages and decision-making authority; however, they are also subject to the strictest supervision by the market and regulators. Thus, we construct the dummy variable *Position*, which equals one if the stock selling insiders are CEOs or chairmen or their relatives. Trading by the relatives of directors, supervisors, and senior executives is an important focus of insider trading studies. Zhang and Zeng (2011) find that the relatives of directors, supervisors, and senior executives conduct many more transactions and short swing

Table 9
Impacts of insiders' stock selling characteristics.

	Rpos	*Rpos*	*Rpos*	*Rpos*	*Rpos*	*Rpos*
	(1)	(2)	(3)	(4)	(5)	(6)
Dpre	0.038	−0.199**	0.048	0.465***	0.077*	−0.024
	(0.055)	(0.094)	(0.050)	(0.089)	(0.044)	(0.146)
Dpre* × *Bigsell	0.128*					0.174**
	(0.078)					(0.083)
Dpre* × *Bidsell		0.418***				0.401***
		(0.102)				(0.100)
Dpre* × *Position			0.166*			0.120
			(0.085)			(0.103)
Dpre* × *Self				−0.434***		−0.369***
				(0.100)		(0.118)
Dpre* × *Relative					0.545***	0.094
					(0.179)	(0.229)
Dcur	0.184***	0.184***	0.183***	0.188***	0.187***	0.186***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
Media_num	0.065***	0.065***	0.065***	0.065***	0.065***	0.065***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Media_sent	0.253***	0.252***	0.252***	0.252***	0.252***	0.252***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Ann_num	0.079***	0.079***	0.079***	0.079***	0.079***	0.080***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Ann_sent	0.064**	0.064**	0.064**	0.064**	0.064**	0.064**
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Size	0.221***	0.223***	0.221***	0.221***	0.222***	0.222***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
ROA	−2.076***	−2.064***	−2.071***	−2.077***	−2.078***	−2.049***
	(0.495)	(0.494)	(0.494)	(0.493)	(0.494)	(0.492)
Leverage	−0.213*	−0.216*	−0.214*	−0.211*	−0.215*	−0.214*
	(0.129)	(0.128)	(0.129)	(0.128)	(0.129)	(0.128)
BTM	−0.043	−0.046	−0.044	−0.047	−0.045	−0.046
	(0.112)	(0.112)	(0.112)	(0.112)	(0.112)	(0.112)
Growth	0.012**	0.012**	0.012**	0.012**	0.012**	0.011**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Sales_fee	−0.085	−0.081	−0.086	−0.085	−0.087	−0.082
	(0.191)	(0.190)	(0.191)	(0.190)	(0.190)	(0.190)
Avg_return	3.523	3.461	3.526	3.533	3.544	3.504
	(3.532)	(3.534)	(3.533)	(3.531)	(3.533)	(3.535)
Volatility	12.789***	12.802***	12.786***	12.87***	12.842***	12.766***
	(1.519)	(1.516)	(1.518)	(1.518)	(1.518)	(1.516)
Top1	0.013**	0.013**	0.013**	0.013**	0.013**	0.013**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Herf_5	−4.135***	−4.115***	−4.134***	−4.119***	−4.126***	−4.101***
	(0.729)	(0.727)	(0.729)	(0.729)	(0.729)	(0.727)
Tradables	0.149	0.151	0.145	0.140	0.143	0.149
	(0.104)	(0.104)	(0.104)	(0.104)	(0.104)	(0.104)
Age	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
SOE	−0.128*	−0.128*	−0.127*	−0.127*	−0.126*	−0.127*
	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)
Analysts	−0.024	−0.024	−0.024	−0.024	−0.024	−0.024
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Inst_hold	−0.039	−0.040	−0.039	−0.042	−0.041	−0.039
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Cons	−11.087***	−11.129***	−11.089***	−11.091***	−11.091***	−11.112***
	(0.790)	(0.789)	(0.790)	(0.789)	(0.789)	(0.788)
Ind&Year	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.031	0.031	0.031	0.031	0.031	0.032
N	30978,039	30978,039	30978,039	30978,039	30978,039	30978,039

Standard errors are in parentheses.
*** p <.01, ** p <.05, * p <.1.

trades and profit more from such trading than do the directors, supervisors, and senior executives themselves. Therefore, stock trading by relatives may be a way to circumvent regulations. Accordingly, we construct a second dummy variable, *Self*; if no relatives of insiders participate in a round of insiders' stock selling, *Self* equals one.

The results are reported in Table 9. As shown in column (1), the probability of a favorable rumor's occurring in the period before insiders sell their stock is higher for large-scale transactions (i.e., *Bigsell* equals one) than for small-scale transactions. When insiders' stock sales have a greater impact on their wealth, their self-interested motivation is stronger, which in turn affects their market manipulation behavior. The results in column (2) show that if a centralized bidding transaction takes place in a round of stock selling (i.e., *Bidsell* equals one), the probability of a favorable rumor's occurring in the run-up period increases. Compared with block trading, in which the price is typically agreed by the buyer and seller in advance, centralized bidding gives traders a stronger incentive to engage in information-based manipulation. As shown in columns (3) and (4), the coefficient of the interaction term $Dpre \times Position$ is significant and positive, while the coefficient of the interaction term $Dpre \times Self$ is significant and negative. If CEOs or chairmen or their relatives sell their shares (i.e., *Position* equals one), the probability of a favorable rumor (*Rpos*) occurring in the run-up period increases; however, if the sellers are themselves directors, supervisors, or senior executives (i.e., *Self* equals one), the probability of a favorable rumor (*Rpos*) decreases.

These results are consistent with the information hierarchy hypothesis. Compared with other insiders, CEOs and chairmen exhibit more obvious signs of using rumors for stock price manipulation. Their relatives have a similar informational advantage, but they receive less attention from the market and regulatory authorities. Therefore, motivated by opportunism, the relatives of CEOs and chairmen may be more likely to use rumors to manipulate stock prices. Another possible explanation is that insiders other than relatives directly participate in a company's operations and decision-making, which gives them access to more channels for manipulation, such as earnings management (Wu and Zhang, 2009), strategic information disclosures (Cai, 2012), and media management (Yi et al., 2017). In contrast, the manipulation channels available to relatives are limited. As spreading rumors to hype a stock is easy and inexpensive, it may be an effective way for relatives to manipulate stock prices.

Thus, we further infer that the relatives of CEOs and chairmen belong to the category of insiders with the strongest incentives to use rumors to manipulate stock prices. Accordingly, we construct a dummy variable for relatives of the CEO or chairman (*Relative*) that equals one if these relatives participate in a round of insiders' stock selling. We then examine the effect of the interaction term $Dpre \times Relative$ on the probability that a favorable rumor will occur during the run-up to a round of insiders' stock selling (*Rpos*). The results are presented in column (5) and are in line with our expectations. The coefficient of $Dpre \times Relative$ is significant and positive, indicating that stock price manipulation via rumor is more likely to occur when relatives of the CEO or chairman sell shares during a round of insiders' stock selling.

4.4. Additional analyses

Xu et al. (2021) argue that an important motivation for insiders to manipulate information is to sell their shares at inflated prices. An extensive body of literature demonstrates the feasibility of profiting from strategic information disclosures and media management (Gu and Li, 2012, Lu et al., 2017). Similarly, we believe that the self-interested motives of insiders are the underlying reason for the substantial changes in the occurrence of rumors around insiders' stock selling events. Insiders use rumors to build momentum before selling their shares to maximize their returns. Hence, we estimate the impact of favorable rumors in the period before insiders' stock sales on their trading profits, using model (4).

$$Profits_i = \alpha_0 + \alpha_1 Rumor\_pre + \alpha_2 Media\_pre + \alpha_3 Ann\_pre + \alpha_4 CVs + \alpha_5 Ind + \alpha_6 Year + \varepsilon \quad (4)$$

The main explanatory variable in model (8) is the difference between the number of favorable rumors and the number of unfavorable rumors during the run-up to insiders' stock selling, which represents the overall favorable tendency of rumors. We refer to the methods of Zeng (2008), Wu and Wu (2010), and Yi et al. (2017) to construct two proxy indicators for stock selling profits. Zeng (2008) measures such profits using the 40-day cumulative abnormal return (*CAR*), which is the difference between the 20-day cumulative abnor-

Table 10
Rumors' effect on insiders' stock selling profits.

	CAR	*CAR*	*CAR*	*CAR*	*Return*	*Return*	*Return*
	[-5,+5]	*[-10,+10]*	*[-20,+20]*	*[-30,+30]*	*[-60,-31]*	*[-90,-61]*	*[-120,-91]*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rumor_pre	0.008***	0.013***	0.022***	0.028***	0.063***	0.074***	0.073***
	(0.003)	(0.004)	(0.005)	(0.006)	(0.011)	(0.013)	(0.015)
Media_pre	0.001***	0.001***	0.002***	0.003***	0.004***	0.004***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Ann_pre	0.001***	0.001***	0.002***	0.002***	0.003***	0.004***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
R_ratio	−0.001***	−0.001***	−0.002***	−0.001***	−0.005***	−0.007***	−0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Size	−0.003**	−0.006***	−0.011***	−0.016***	−0.036***	−0.017**	−0.009
	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)	(0.007)	(0.008)
ROA	−0.03	−0.004	−0.007	−0.081	0.784***	0.461**	0.268
	(0.042)	(0.055)	(0.074)	(0.084)	0.163)	0.189)	0.222)
Leverage	0	0.013	0.009	0.011	0.117***	0.172***	0.162***
	(0.009)	(0.013)	(0.016)	(0.018)	(0.038)	(0.046)	(0.056)
BTM	0.003	0.001	0.018	0.001	0.137***	−0.043	−0.195***
	(0.007)	(0.010)	(0.012)	(0.015)	(0.029)	(0.036)	(0.043)
Growth	0	0	0	0	0.008***	0.013***	−0.032***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	(0.004)
Top1	0	0	0	0	0	0.002	0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Herf_5	0.046	−0.003	0.008	0.032	−0.045	−0.291	−0.194
	(0.049)	(0.066)	(0.081)	(0.095)	(0.199)	(0.250)	(0.285)
SOE	0.002	0.002	0.001	0	0.018	0.013	0.022
	(0.005)	(0.006)	(0.009)	(0.011)	(0.019)	(0.023)	(0.026)
Cons	0.087**	0.165***	0.263***	0.381***	1.316***	0.915***	0.716***
	(0.034)	(0.049)	(0.065)	(0.070)	(0.135)	(0.166)	(0.194)
Ind&Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.021	0.032	0.048	0.038	0.075	0.070	0.124
N	5,808	5,808	5,808	5,808	5,700	5,622	5,529

Standard errors are in parentheses.
*** p <.01, ** p <.05, * p <.1.

mal return before the trading day and the 20-day cumulative abnormal return after the trading day. We first calculate the cumulative abnormal return for 10, 20, 40, and 60 days around the transaction date to measure stock selling profits. We use the market model to calculate the cumulative abnormal return, with the first transaction date of a round of insiders' stock selling as the event date and the [-240, -91] window before the event date as the estimation period. Our second measure of stock selling profits is based on Yi et al. (2017). First, a benchmark price is calculated using the average closing price for the window [-60, -31] before the first transaction date. Next, the profits are calculated by subtracting the benchmark price from the average selling price and dividing the difference by the benchmark price. The proxies for the stock selling profits are Return [-60, -31], Return [-90, -61], and Return [-120, -91] based on the corresponding benchmark windows.

The model includes controls for positive media coverage (*Media_pre*) and positive company announcements (*Ann_pre*) during the run-up to insiders' stock selling. In addition, referring to the literature (Wu and Wu, 2010; Lu et al., 2017), we include the following control variables: proportion of shares sold (*R_ratio*), company size (Size), return-on-assets ratio (*ROA*), debt-to-assets ratio (*Leverage*), book-to-market ratio (*BTM*), revenue growth rate (*Growth*), shareholding ratio of the largest shareholder (*Top1*), ownership concentration (*Herf_5*), and a state-owned enterprise dummy (*SOE*).

The results are presented in Table 10. In columns (1) – (4), the stock selling profits are calculated using the first method, and in columns (5) – (7), the stock selling profits are calculated using the second method. The results from both methods show that favorable rumors in the period before insiders' stock sales (*Rumor_pre*)

Table 11
Long-term effect of rumor manipulation during insiders' stock selling.

	Return [150,180]	*Return [240,270]*	*Return [330,360]*
	(1)	*(2)*	*(3)*
Rumor_pre	-0.016***	-0.013*	-0.017
	(0.006)	(0.008)	(0.010)
Media_pre	0.000	-0.001	-0.001
	(0.000)	(0.000)	(.001)
Ann_pre	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
R_ratio	0.002***	0.002***	0.001*
	(0.000)	(0.001)	(0.001)
Size	0.011**	0.016**	0.030***
	(0.005)	(0.007)	(0.009)
ROA	0.164	-0.153	-0.384*
	(0.124)	(0.165)	(0.217)
Leverage	0.004	-0.013	-0.059
	(0.028)	(0.040)	(0.052)
BTM	0.010	-0.065*	-0.130***
	(0.024)	(0.035)	(0.046)
Growth	0.006***	0.022***	0.019***
	(0.002)	(0.003)	(0.003)
Top1	-0.001	-0.003*	-0.004**
	(0.001)	(0.001)	(0.002)
Herf_5	0.078	0.360*	0.575**
	(0.146)	(0.206)	(0.255)
SOE	-0.014	-0.015	-0.016
	(0.012)	(0.015)	(0.020)
Cons	-0.628***	-0.680***	-0.981***
	(0.110)	(0.156)	(0.194)
Ind&Year	Yes	Yes	Yes
R-squared	0.124	0.150	0.199
N	4,986	4,399	4,044

Standard errors are in parentheses.
*** p<.01, ** p<.05, * p<.1.

are positively related to the resulting profits. Based on this evidence, we conclude that rumors are an effective form of information-based manipulation and that insiders may use rumors to manipulate a company's stock price before selling their shares to increase their profits, which further illustrates the economic considerations of insiders' manipulation of stock prices via rumor.

Additionally, we examine the long-term effects of stock price manipulation via rumor. Referring to Yi et al. (2017), we use the following benchmark windows after the transaction date: [150,180], [240,270], and [330,360]. Three benchmark prices are calculated as the average closing price over the benchmark windows, and the dependent variables (Return [150,180], Return [240,270], and Return [330,360]) are calculated by dividing the difference between benchmark price and average transaction price by the average transaction price respectively. The other variables and settings are the same as in model (4). The results are shown in Table 11. The coefficients of *Rumor_pre* are significant and negative in columns (1) and (2), but in column (3), the coefficient of *Rumor_pre* is negative but nonsignificant. In sum, rumor-hyping by insiders in the period before they sell stock exacerbates stock price volatility, but in the long term, the rationality of the market is restored and the upward fluctuation in stock price caused by favorable rumors reverses.

5. Conclusion

This study examines changes in the occurrence of company-related rumors in the period around insiders' stock selling events, using 2017–2020 data on insiders' stock selling and rumors involving Chinese A-share listed companies. The results show that in the run-up to and during insiders' stock selling events, the proba-

bility of the occurrence of rumors and favorable rumors significantly increases, while the probability of an unfavorable rumor's occurring shows no significant change. This indicates that insiders use favorable rumors to build momentum before selling their companies' stocks. Endogeneity tests further demonstrate that insiders' stock selling drives the growth of company-related rumors.

This study also investigates the factors that influence stock price manipulation via rumor. The results show that the level of a company's information asymmetry is significantly and positively correlated with the probability of a favorable rumor's occurring in the run-up to insiders' stock selling. That is, for companies with more accurate analyst forecasts, more transparent information disclosure, and less real earnings management relative to their peers, insiders are less likely to engage in stock price manipulation via rumor before selling their companie's stocks. In addition, the characteristics of both trades and traders substantially affect the probability of a rumor's occurrence. Specifically, if the transactions substantially impact insiders' personal wealth, if the shares are sold through centralized bidding, and/or if the company's CEO or chairman or their relatives are selling their shares, the probability of a pre-transaction rumor increases. However, if the sellers are directors, supervisors, or senior executives (but not their relatives), the probability of a pre-transaction rumor decreases. Further analysis shows that favorable rumors occurring in the run-up to insiders' stock selling boost insiders transaction returns in the short term but lead to stock price reversals in the long term. This paper concludes that insiders seek to maximize their wealth by spreading favorable company rumors before selling their shares.

Hyping stocks via rumors has become a prominent issue in China's financial market, and the CSRC aims to closely monitor and crack down on such market manipulation. Our findings will be of interest to regulators and investors. We find that manipulation via rumor is particularly severe at certain times, such as when insiders are preparing to sell their shares. Extra attention should be paid to rumors that arise in such sensitive periods, and uninformed investors should be particularly cautious about rumors, as buying stocks based on a rumor without considering the company's intrinsic value may be contrary to their interests.

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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