China Journal of Accounting Research

Volume 12, 4 (2019)

Website:
http://www.cnjar.com
http://www.cb.cityu.edu.hk/research/cjar

12
4

China Journal of Accounting Research Vol. 12/4 (2019) 337–430

ELSEVIER

Volume 12 • Issue 4 • December 2019

China Journal *of* Accounting Research

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Available online at www.sciencedirect.com
ScienceDirect

ISSN 1755-3091

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Production and hosting by Elsevier

Radarweg 29, 1043 NX Amsterdam, The Netherlands

ISSN 1755-3091

Founded by Sun Yat-sen University and City University of Hong Kong

Sponsored by: CPA Hong Kong Institute of Certified Public Accountants 香港會計師公會

Published quarterly in March, June, September, and December

China Journal of Accounting Research has been indexed by Emerging Sources Citation Index (ESCI), Cabell's Directory, Scopus, CNKI, Australian Business Deans Council (ABDC) Journal Quality List and Excellence in Research for Australia (ERA) Journal List.

http://www.elsevier.com/journals/china-journal-of-accounting-research/1755-3091/guide-for-authors

CHINA JOURNAL OF ACCOUNTING RESEARCH

Volume 12/4 (2019)

China Journal of Accounting Research 12 (2019) 337–355

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Contents lists available at ScienceDirect

China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

The effect of shared auditors in the supply chain on cost stickiness☆

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ARTICLE INFO

Article history:
Received 31 May 2018
Accepted 3 September 2019
Available online 16 October 2019

Keywords:
Shared auditors
Cost stickiness
Management expectations
Information environment
Supply chain

ABSTRACT

Do supply chain audits have real effects? We focus on the effect of shared auditors in the supply chain on corporate cost stickiness. When a supplier shares auditors with its customers, the shared auditors provide informational advantages for suppliers' managers, thus revising their optimistic or pessimistic expectations and influencing suppliers' cost stickiness. Using a sample of Chinese A-share listed companies from 2009 to 2017, we explore the relationship between shared auditors and suppliers' cost stickiness conditional on management expectations. The results show that shared auditors in the supply chain reduce suppliers' cost stickiness significantly when suppliers' managers hold optimistic expectations, and increase suppliers' cost stickiness in cases of pessimistic expectations. Furthermore, the greater the number of shared auditors, the stronger the effect. Such effects are more pronounced when supplier firms share auditors with important customers, have higher demand uncertainty, and use big 10 auditors.

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☆ We are indebted to the editor, Donghui Wu, and two anonymous reviewers for their excellent suggestions and positive feedback throughout the review process. We also appreciate the detailed and constructive comments of Zhihong Chen (our discussant) and participants at CJAR Summer Workshop (2018) as well as the 7th Forum on Audit Theory Innovation Development (2017). We thank the National Social Science Foundation of China (Major Project 13&ZD146) and the Fundamental Research Funds for the Central Universities of China (No. JBK19072018153) for their support. We also appreciate the valuable writing guidance on our English version from the English editors and young faculty in SWUFE including Lin Liao, Li He, Ning Hu as well as Jing Wang. All errors are ours.

https://doi.org/10.1016/j.cjar.2019.09.001
1755-3091/

1. Introduction

Cost and expense management are important and core issues for an enterprise to optimize its internal structure, earn profits, and maintain healthy development (Ma and Zhang, 2013). Understanding cost behavior is essential to cost and management accounting (Anderson et al., 2003). A fundamental assumption in cost accounting is that the magnitude of change in costs is the same for equivalent increases or decreases in activity volume (Noreen, 1991). Anderson et al. (2003) use the term 'sticky costs' to describe costs that increase faster than they decrease as demand fluctuates. Using a sample of US listed firms, they find that selling, general, and administrative (SG&A) costs increase, on average, at a rate of 0.55% per 1% increase in sales but decrease only 0.35% per 1% decrease in sales.

Studies show that managers' optimistic expectations lead to cost stickiness (Anderson et al., 2003; Banker et al., 2011, 2014). If managers' future sales expectations are optimistic, this optimism increases their willingness to acquire additional resources when sales increase and to retain unused resources when sales decrease, resulting in cost stickiness (Banker et al., 2014). However, if a manager is pessimistic about the future of the company, he or she will immediately reduce input resources when sales decline and not acquire additional resources or acquire insufficient resources when sales increase, resulting in weak cost stickiness or cost anti-stickiness. Managers' expectations and judgments regarding future sales are based on existing information, which indicates that the information environment affects the accuracy of managers' expectations.

Auditors not only play an important role in improving the credibility and reliability of financial statements but also facilitate the flow of information and ease information asymmetry (Dhaliwal et al., 2016a). When a supplier uses the same audit firm as its customers (hereafter shared auditors in the supply chain or shared auditors), the shared auditors gain client-specific information from both sides. Such information may add to overall information for suppliers' managers in both contracted and non-contracted manners, which in turn helps improve the accuracy of management expectations and thus subsequent expense decisions.

To examine the effect of shared auditors on suppliers' cost stickiness, we use a sample of Chinese A-share listed companies from 2009 to 2017, of which about 9.1% share an auditor with at least one of their top five customers. We measure managers' expectations using the prior period's change in sales, whether the manager is overconfident or not, and economic growth. The results show that shared auditors help reduce supplier cost stickiness significantly when suppliers' managers hold optimistic expectations, as indicated by a sales increase in the prior period, management overconfidence, and high economic growth, and increase supplier cost stickiness in cases of pessimistic expectations, as indicated by a sales decrease in the prior period and low economic growth. Furthermore, the greater the number of shared auditors, the stronger the effect. Additional tests suggest that such effects are stronger for supplier firms that share auditors with important customers, have higher demand uncertainty, and use big 10 auditors. We use a change model and adopt firm fixed effects to attenuate the potential endogeneity problem. The main conclusions remain unchanged.

Our study contributes to the literature in a number of ways. First, we add to the research on supply chain audits. The literature generally focuses on supply chain audit quality (Chen et al., 2012a; Huang et al., 2014; Johnstone et al., 2014). However, little is known about the real effects of supply chain audits.[1] We extend the literature by exploring the effect of supply chain audits on cost stickiness and document evidence consistent with supply chain auditors acting as information intermediaries and influencing firms' cost stickiness.

Second, this paper contributes to the emerging literature on the auditor's information role. Dhaliwal et al. (2016a) and Cai et al. (2016) find that a common auditor during merger and acquisition (M&A) transactions can help merging firms reduce uncertainty throughout the process, which allows managers to more efficiently allocate capital, resulting in higher quality M&As. Bae et al. (2017) declare that knowledgeable auditors provide informational advantages to their clients in a generalized investment setting, resulting in higher client investment efficiency. We enrich this literature by confirming the information role of supply chain auditors.

[1] Two recent studies examine the effect of supply chain audit on relationship-specific investment and corporate credit risk (Wang and Huang, 2014; Dhaliwal et al., 2016b).

Third, our study contributes to the supply chain literature that illustrates the importance of information sharing between supply chain partners. For example, the exchange of detailed customer demand and inventory information within the supply chain is associated with reduced supply chain costs (Chen, 1998; Cachon and Fisher, 2000) and improved efficiency in the use of resources (Matsumura and Schloetzer, 2014). We enrich this literature by exploring how supplier companies benefit in terms of enhanced accuracy of cost decision making when they purchase auditing services from the same audit firm as a major customer.

The remainder of this paper is organized as follows. We review the literature in Section 2 and pose our hypotheses in Section 3. Section 4 describes the sample selection, measures, and research design. We report our empirical findings in Section 5 as well as additional analyses and robustness tests in Section 6. Section 7 concludes this paper.

2. Literature review

2.1. Research on shared auditors in the supply chain

Research shows that a shared auditor in the supply chain is associated with higher audit quality (Chen et al., 2012a; Huang et al., 2014; Johnstone et al., 2014; Yang et al., 2015) and lower audit fees (Johnstone et al., 2014). Specifically, Chen et al. (2012a) document that firms that share an auditor with at least one of their major customers are less likely to misstate accounting numbers compared with firms that do not have such links. Huang et al. (2014) argue that a supply chain audit firm, coupled with firm-level industry expertise, results in low discretionary accruals and low restatement probability. Johnstone et al. (2014) find that auditor supply chain knowledge at the city level is associated with higher audit quality and lower audit fees compared with auditors with supply chain knowledge at the national level or without supply chain knowledge.

Moreover, a shared auditor in the supply chain can alleviate information asymmetry and mitigate investment inefficiency in relationship-specific assets, leading to an increase in relationship-specific investments (Dhaliwal et al., 2016b). Lastly, shared auditors in the supply chain help decrease credit risk (Wang and Huang, 2014).

2.2. Research on cost stickiness

Studies have predominantly explained cost stickiness with economic factors such as management opportunism, adjustment costs, and management expectations.

Management opportunism theory declares that managers' opportunistic behaviors, such as perks and empire-building incentives, motivate managers to increase costs rapidly when sales rise and to decrease costs slowly when sales fall, resulting in cost stickiness (Anderson et al., 2003; Banker et al., 2011; Chen et al., 2012b). Several studies examine management opportunism theory. For example, Chen et al. (2012b) document that cost asymmetry increases with managers' empire-building incentives due to the agency problem, but strong corporate governance mitigates the effects of the agency problem on SG&A cost asymmetry (Steliaros et al., 2006; Chen et al., 2012b; Xue and Hong, 2016). When managers face incentives to avoid losses or earnings decreases or to meet financial analysts' earnings forecasts, they expedite downward adjustment of slack resources for sales decreases, which lessens the degree of cost stickiness (Dierynck et al., 2012; Kama and Weiss, 2013). Upward earnings management decreases cost stickiness (Jiang et al., 2015; Xue and Hong, 2016), while downward earnings management increases cost stickiness (Jiang et al., 2015).

Adjustment costs theory suggests that committed resources invested by a manager, such as human capital and fixed capital, are more costly to decrease than increase (Jaramillo et al., 1993; Pfann and Palm, 1993, 1997; Goux et al., 2001; Balakrishnan et al., 2004; Cooper and Haltiwanger, 2006; Banker and Chen, 2006; Balakrishnan and Gruca, 2008). Sticky costs occur if committed resources are not reduced to the minimum level necessary to support a reduced activity demand while increased to the maximum level for an increased activity demand. The literature measures adjustment costs with asset intensity, employee intensity, business importance, stringent degree of labor protection law, and organizational capital and finds that adjustment costs are positively associated with cost stickiness (Anderson et al., 2003; Balakrishnan et al., 2004; Banker et al., 2013).

Management expectation theory argues that if managers' expectations for future sales are optimistic, they will be more willing to acquire additional resources when sales increase and to retain unused resources when sales decrease; pessimistic expectations have the opposite effect (Anderson et al., 2003; Banker et al., 2011, 2014). The literature uses economic growth, a successive decrease in sales, industry growth, sales change in the prior period, as well as managers' overconfidence as proxies for management expectation and finds that managers' optimistic (pessimistic) expectation is positively (negatively) associated with cost stickiness (Anderson et al., 2003; Banker et al., 2011, 2014; Liang, 2015).

3. Hypothesis development

Because the activity level cannot exceed the capacity of the resources committed to an activity, an increase in demand puts immediate and direct pressure on managers to increase committed costs. However, a decrease in demand for an activity does not put similar pressure on managers to decrease committed costs. Sticky costs occur if committed resources are not reduced to the minimum level necessary to support the reduced demand. Managers weigh the expected cost of slack resources and the expected adjustment cost of committed resources when sales fall and reduce committed resources more readily when the decline in demand is not transitory. That is, expected slack resource costs increase with the permanence of a decline in activity demand. Therefore, expectations about the duration of a change in sales influence managers' decisions on cost adjustment.

The literature suggests that managers' optimistic expectations drive cost stickiness (Anderson et al., 2003; Banker et al., 2011, 2014). Optimistic managers acquire additional committed resources rapidly when sales increase and retain unused resources when sales decrease, resulting in cost stickiness (Banker et al., 2014). Correspondingly, pessimistic managers reduce input resources immediately when sales decline and do not acquire additional resources or acquire insufficient resources when sales increase, resulting in weak cost stickiness or cost anti-stickiness. Managers' expectations about future sales are based on available information, indicating that the information environment affects the accuracy of managers' expectations.

Auditors are usually regarded as assurance providers; however, they can also be viewed as a component of management's information environment and a potential information intermediary in some respects (Bae et al., 2017). Auditors have extensive knowledge about their clients' operations coupled with broad knowledge of the industries in which their clients operate. Such knowledge can benefit clients not only by reducing their risk of audit failure but also through informational advantages if clients seek this additional resource.[2] Therefore, auditors may be an efficient and low-cost information source for managers.

Meanwhile, auditors also have incentives and opportunities to provide information to managers. Auditing is a low-growth industry, and audit fees typically do not increase substantially absent significant regulatory changes. Further, auditing has been frequently viewed as a commodity product (Christensen et al., 2012). To retain ongoing audit contracts, auditors must provide value in the eyes of their clients. Therefore, auditors have incentives to provide incremental information to clients through formal or informal discussions. In addition, auditors have frequent contact with their client's management throughout the year and, therefore, have opportunities to provide such valuable information to their clients. External auditors have unique access to senior executives, participate in audit committee meetings, and have access to board meeting minutes and general information about a firm (Dhaliwal et al., 2016a). Beginning with the reviews of quarterly financial statements and planning for the year-end audit, auditors meet with client management regularly to stay up to date on the activities of the company as well as to keep clients informed on regulatory matters and developments regarding accounting and auditing standards (Bae et al., 2017). Interactions with client management throughout the year take place in formal or informal meetings, such as lunch and dinner meetings. Thus, opportunities for soft talk and informational discussions regarding risks and opportunities facing the client firm are readily available.

In addition, according to "Chinese Auditing Standard No. 1324 - Going Concern Issue," auditors should evaluate whether there are events or circumstances that may cast doubts on the going concern assumption for

[2] Our interviews with audit practitioners suggest that audit firms have significant internal knowledge gathered from clients and such knowledge cleansed of specific client information can be shared in the aggregate. Such communications are usually informal and verbal.

a client during the risk assessment process. If a manager has made a preliminary assessment of the firm's going concern ability, auditors should discuss it with the manager and evaluate whether the manager has identified circumstances that may result in significant doubts about the firm's going concern, either alone or in the aggregate. If a manager has identified such issues, auditors should discuss a plan to deal with the issues with the manager. If the manager has not preliminarily assessed the firm's going concern ability, auditors should discuss with the manager the rationality of applying the going concern assumption and ask whether there are issues against the going concern assumption. In short, auditors are required to evaluate and discuss with managers a firm's going concern condition, which includes a forward-looking evaluation of future cash flows and planned activities for the firm (Bae et al., 2017). Therefore, auditors have the ability and opportunity to provide incremental information to managers during such discussions.

While all auditors have opportunities and incentives to provide value through information to their clients, the quality of information available from auditors is not expected to be uniform. Supply chain auditors have higher levels of supply chain expertise and knowledge resources, so we anticipate that the quality of information resources is likely higher coming from shared auditors in the supply chain in a similar nature to audit quality being influenced by the auditor's expertise and resources (Francis and Yu, 2009). Information is complementary between partners in the supply chain (Clement and Tse, 2005). When a supplier shares an auditor with its major customers, the shared auditor can gain deep understanding of the state of the businesses, potential developments, and business risks of the supplier during the audit process, such as information about market demand, customer satisfaction, the possibility of losing major customers and so on, thus helping managers develop more accurate expectations and make better operational decisions.

Therefore, shared auditors in the supply chain have incentives, abilities, and opportunities to provide information, and suppliers' managers have corresponding demands.[3] In summary, shared auditors in the supply chain facilitate information flow, reduce information asymmetry between suppliers and customers, and weaken management's optimistic or pessimistic expectations, thus affecting suppliers' cost stickiness.

After analyzing the effect of shared auditors in the supply chain on managers' information environment, we use the model to derive the effect of the improvement in the information environment on cost stickiness.

Assuming that the signal of future demand changes received by managers is ΔS, ΔS=+\$1 means that sales will increase by one unit, and ΔS=-\$1 means that sales will decrease by one unit. The probability that the signal truly reflects future demand changes (in other words, demand changes are permanent) is p. The change in sales is due to changes in quantity, and price does not change over time.

After receiving the signal ΔS, managers should increase or decrease cost (SG&A) by C. At the same time, changes in cost result in adjustment costs. Adjustment cost brought about by increasing cost by C is $\lambda_1 C$, and adjustment cost incurred by reducing cost by C is $\lambda_2 C$, where $0 < \lambda_1 < \lambda_2 < 1$.[4] Thus, the total cost of increasing cost by C is $(1 + \lambda_1)C$ and the total savings of reducing cost by C is $(1-\lambda_2)C$. To ensure that the utility of additional resource inputs is positive when demand increases, we assume that $1 - (1 + \lambda_1)C > 0$.

When a supplier and customer do not share an auditor, the supplier's manager does not know whether the change in demand is temporary or permanent (incomplete information); if there is a shared auditor, the supplier's manager knows whether the change in demand is temporary or permanent (complete information).

According to Fig. 1, after receiving the signal of $\Delta S = +\$1$, the manager may increase SG&A or do nothing if there is not a shared auditor (incomplete information). If the manager chooses to increase cost by C, the company's utility will be $1 - (1 + \lambda_1)C$ when future demand increases by one unit and $-(1 + \lambda_1)C$ if future demand does not change. Therefore, the expected utility of increasing SG&A is $p - (1 + \lambda_1)C$.[5] If the manager chooses to do nothing, the company's utility will be 0 when future demand increases by one unit or stays

[3] Because the value of supply chain relationships to suppliers/customers depends on each company's prospects, supply chain partners may use earnings management to inflate earnings to favorably influence the perception of suppliers/customers and their willingness to undertake continuing relationship-specific investment (Raman and Shahrur, 2008). As a result, managers have incentives to obtain more reliable information from independent third parties, such as auditors.

[4] Adjustment cost of reducing committed resources is higher than that of increasing committed resources (Jaramillo et al., 1993; Pfann and Palm, 1993, 1997; Goux et al., 2001; Balakrishnan et al., 2004; Cooper and Haltiwanger, 2006; Banker and Chen, 2006; Balakrishnan and Gruca, 2008).

[5] $[1 - (1 + \lambda_1)C] * p + [-(1 + \lambda_1)C] * (1 - p) = p - (1 + \lambda_1)C$.

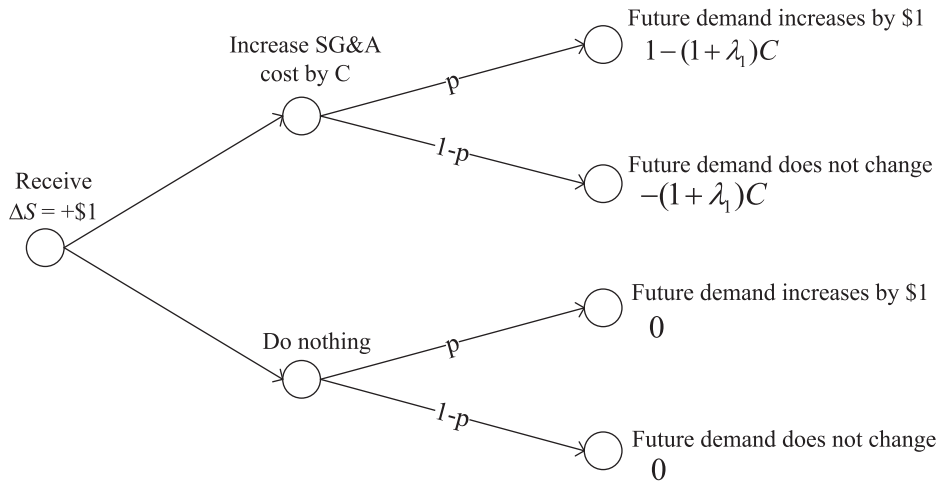

Fig. 1. Manager's decision and utility after receiving ΔS = +$1 without shared auditors.

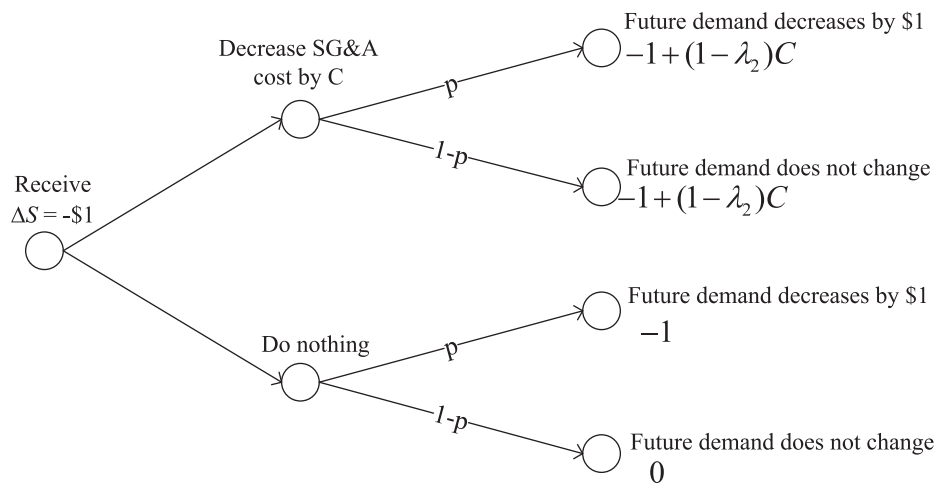

Fig. 2. Manager's decision and utility after receiving ΔS = −$1 without shared auditors.

unchanged. As a result, the expected utility of doing nothing is 0. Only when the expected utility of increasing SG&A exceeds that of doing nothing, that is, $p - (1 + \lambda_1)C > 0$, would a manager choose to acquire additional committed resources.

Similarly, after receiving the signal of ΔS = −$1, the manager may decrease SG&A or do nothing if there is not a shared auditor, as shown in Fig. 2. If the manager chooses to decrease cost by C, the company's utility will be $-1 + (1 - \lambda_2)C$ when future demand decreases by one unit or stays unchanged. Therefore, the expected utility of decreasing SG&A is $-1 + (1 - \lambda_2)C$. If the manager chooses to do nothing, the company's utility will be −1 when future demand decreases by one unit and 0 if future demand does not change. As a result, the expected utility of doing nothing is -p. Only when the expected utility of decreasing SG&A exceeds that of doing nothing, that is, $-1 + (1 - \lambda_2)C > -p$, would a manager choose to decrease committed resources.

In summary, if a manager has optimistic expectations, he or she will increase resources if $p > (1 + \lambda_1)C$ after receiving signal ΔS = +$1 and do nothing if $p < 1 - (1 - \lambda_2)C$ after receiving signal ΔS = −$1. Therefore, without shared auditors, cost stickiness exists if $(1 + \lambda_1)C < p < 1 - (1 - \lambda_2)C$. However, if a manager has pessimistic expectations, he or she will do nothing if $p < (1 + \lambda_1)C$ after receiving signal ΔS = +$1 and decrease resources if $p > 1 - (1 - \lambda_2)C$ after receiving signal ΔS = −$1. Therefore, without shared auditors, cost anti-stickiness exists if $1 - (1 - \lambda_2)C < p < (1 + \lambda_1)C$.

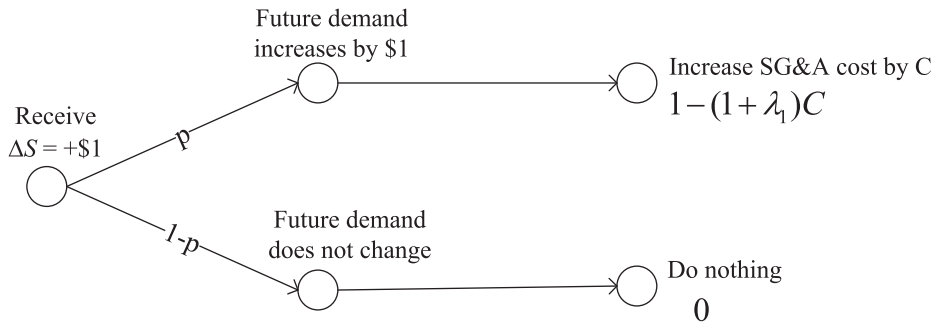

Fig. 3. Manager's decision and utility after receiving ΔS = +$1 with shared auditors.

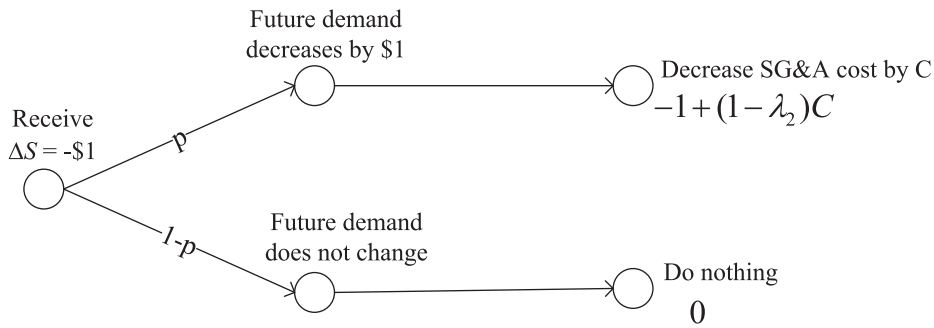

Fig. 4. Manager's decision and utility after receiving ΔS = −$1 with shared auditors.

When suppliers and customers share auditors (complete information), the shared auditors help ease information asymmetry by facilitating information flow. Managers acquiring more high-quality information know whether changes in demand are transitory and are able to make right decisions. According to Fig. 3, after receiving the signal of ΔS = +$1, the manager will increase cost by C if future demand will increase by one unit (the change is permanent) and do nothing if the change is transitory. Therefore, the expected cost to the enterprise will increase by pC after receiving the signal of ΔS = +$1. Similarly, after receiving the signal of ΔS = −$1 (as shown in Fig. 4), the manager may decrease cost by C if the change is permanent and do nothing if the change is transitory. Therefore, the expected cost to the enterprise will decrease by pC after receiving the signal of ΔS = −$1. Because the change in expected cost is pC for either signal, ΔS = +$1 or ΔS = −$1, cost asymmetry (including cost stickiness and cost anti-stickiness) does not exist with shared auditors.

We therefore hypothesize the following:

H1a: Sharing auditors with customers decreases suppliers' cost stickiness in the case of optimistic management expectations.

H1b: Sharing auditors with customers increases suppliers' cost stickiness in the case of pessimistic management expectations.[6]

[6] In the case of pessimistic management expectations, sharing an auditor with the customer reduces suppliers' cost anti-stickiness, or in other words, increases the cost stickiness of suppliers.

4. Sample selection, measures, and research design

4.1. Sample selection

We choose Chinese non-financial firms listed in the A-share market from 2009 to 2017[7] as our sample. We then delete (1) ST and *ST firms; (2) firms that do not disclose their top five customers in their annual report; (3) firms for which all of their top five customers are missing audit data to identify the audit firm; (4) firms in which the supplier and customer belong to a common business group and share auditors; (5) firms in which the sum of sales and administrative fees is greater than sales revenue; (6) observations missing necessary financial statement data or other data to compute the variables in the empirical tests. This leaves us with a sample of 938 firm-year observations, of which 85 observations share auditors with at least one of their top five customers. To mitigate the concern of outliers, all continuous variables are winsorized at 1% and 99%. We obtain top five customer data from Supply Chain Research Database of Chinese Companies (SCRD), GDP data from National Bureau of Statistics, and other financial statement data from the China Stock Market and Accounting Research (CSMAR) database.

4.2. Measures and research design

4.2.1. Measure of shared auditors

We measure shared auditors in two ways. First, because a firm can have multiple major customers in a fiscal year, we define *Shareaud* as a dummy variable that equals 1 if a firm shares its audit firm with at least one of its top five customers and 0 otherwise. Second, we define *Num* as the number of top five clients who uses the same audit firm as the supplier. For example, if a company shares its audit firm with three of its top five customers, *Num* equals 3.

4.2.2. Measure of cost stickiness

Consistent with the literature (Anderson et al., 2003), we use the following logarithmic model to measure cost stickiness:

$$\Delta\ln\text{Cost} = \beta_0 + \beta_1 \Delta\ln\text{Sales} + \beta_2 \text{Dec} * \Delta\ln\text{Sales} + \varepsilon \quad (1)$$

where ΔlnCost is the natural log of the change in total administrative and sales expenses, ΔlnSales is the natural log of the change in sales revenue, and Dec is a dummy variable with a value of 1 if sales decrease and 0 otherwise. Because the value of Dec is zero when revenue increases, the coefficient β_1 measures the percentage increase in cost with a 1% increase in sales revenue. That is, for every 1% increase in sales revenue, the cost changes by β_1%, indicating the relative importance of variable costs. Because the value of Dec is 1 when revenue decreases, the sum of the coefficients, $\beta_1 + \beta_2$, measures the percentage decrease in cost with a 1% decrease in sales revenue. If cost is sticky, then the variation in cost with revenue increases should be greater than the variation for revenue decreases. Thus, the empirical hypothesis for stickiness, conditional on $\beta_1 > 0$, is $\beta_2 < 0$.

4.2.3. Measure of managers' expectations

Consistent with the literature (Anderson et al., 2003; Banker et al., 2011, 2014; Liang, 2015), we measure managers' expectations by the change in sales in the prior period, whether the manager is overconfident, and economic growth. Managers are more likely to be optimistic about the future if sales increased in the prior period, economic growth is rapid, or the manager is overconfident; conversely, if sales declined in the prior period or economic growth is slow, managers are more likely to hold pessimistic expectations.

Specifically, we measure the change in sales in the prior period (ΔSales_{t-1}) as the difference between sales in year $t-1$ and those in year t-2. A positive (negative) value of ΔSales_{t-1} indicates that sales increased (decreased) in year $t-1$, so managers are more likely to hold optimistic (pessimistic) expectations.

[7] To avoid the impact of new accounting standards adopted in 2007, we use China's A-share listed companies from 2007 to 2017. For the calculation of prior sales changes (ΔSales_{t-1}), which needs data in year t-1 and t-2, our final sample is from 2009 to 2017.

Consistent with the literature (Ahmed and Duellman, 2013; Sun and Zhao, 2014), we measure management overconfidence (Overconf) using the change in management shareholding. If manager shareholdings increase in the current year and the increase is not due to equity incentives, share offerings, or share allotment, Overconf equals 1 and 0 otherwise.

Economic growth is measured as the GDP growth rate. Observations for which this variable is greater than or equal to the median value are classified in the ΔGDP > Median group, and those for which this variable is less than the median value are classified in the ΔGDP < Median group.

4.2.4. Research design

We estimate the following regression model to test H1a and H1b:

$$\begin{aligned}\Delta\text{lnCost} = {} & \beta_0+\beta_1\Delta\text{lnSales}+\beta_2\Delta\text{lnSales}*\text{D}+\beta_3\Delta\text{lnSales}*\text{D}*\text{Shareaud/Num}\\ & +\beta_4\text{Shareaud/Num}+\beta_5\Delta\text{lnSales}*\text{Shareaud/Num}+\beta_6\Delta\text{lnSales}*\text{D}*\text{AI}\\ & +\beta_7\Delta\text{lnSales}*\text{D}*\text{EI}+\beta_8\Delta\text{lnSales}*\text{D}*\Delta\text{GDP}+\text{Year}+\text{Industry}+\varepsilon\end{aligned} \quad (2)$$

where ΔlnCost is the natural log of the change in total administrative and sales expenses, ΔlnSales is the natural log of the change in sales revenue, and D is a dummy variable with a value of 1 if sales decrease and 0 otherwise. Shareaud indicates there is a shared auditor in the supply chain if the value equals 1, and Num identifies the number of customers sharing auditors with the supplier. A negative value of β_2 documents the asymmetry of cost behavior.

The research design for Hypotheses 1a and 1b estimates empirical models separately for firms with optimistic and pessimistic management expectations and tests the equality of β_3 between the two subsamples using a Chow (1960) test.[8] We anticipate that β_3 will be significantly positive if shared auditors reduce cost stickiness in the case of optimistic expectations (as indicated by a sales increase in the prior period, management overconfidence, and high economic growth), consistent with H1a. As H1b indicates, if managers hold pessimistic expectations (as indicated by a sales decrease in the prior period and low economic growth), β_3 should be significantly negative. Consistent with Banker and Byzalov (2014), we include the interaction terms of asset intensity (AI), employee intensity (EI), and economic growth (ΔGDP) with ΔlnSales*D separately as control variables. Detailed variable definitions are shown in Table 1.

Table 1
Variable definitions.

Variable	Definition
ΔlnCost	Natural logarithm of the sum of administrative and sales expenses in year t divided by that in year t − 1
Shareaud	A dummy variable that equals 1 if a firm shares its audit firm with at least one of its top five customers and 0 otherwise
Num	Number of top five customers who use the same audit firm as the supplier
ΔlnSales	Natural logarithm of revenue in year t divided by that in year t − 1
D	An indicator of revenue decrease in year t
ΔSales_{t-1}	Sales in year t − 1 minus sales in year t − 2
Overconf	Equals 1 if manager shareholdings increase in the current year and the increase is not due to equity incentives, share offerings, or share allotment and 0 otherwise
ΔGDP	GDP growth in year t multiplied by 100
AI	Ratio of total assets to sales
EI	Ratio of number of employees over sales (unit: million)

[8] We adopt this approach, instead of a pooled model with an interaction on our test variable, for two reasons: (1) having fewer interactions eases economic interpretation of the coefficients and (2) this approach imposes fewer assumptions on the model, as all coefficients are allowed to vary across the management optimistic/pessimistic expectation subsamples.

Table 2
Descriptive statistics.

Panel A: Descriptive statistics for the full sample

Variable	N	Mean	Std. dev	Min	Median	Max
ΔlnCost	938	0.143	0.311	−1.325	0.118	3.870
ΔlnSales	938	0.127	0.388	−2.374	0.114	3.798
D	938	0.298	0.458	0	0	1
Shareaud	938	0.091	0.287	0	0	1
Num	938	0.111	0.384	0	0	3
AI	938	2.245	1.884	0.194	1.768	26.730
EI	938	1.673	1.357	0.023	1.357	10.280
ΔGDP	938	8.235	1.256	6.700	7.900	10.600
Overconf	938	0.251	0.434	0	0	1
$\Delta Sales_{t-1}$	938	0.132	0.372	−1.449	0.111	3.798

Panel B: Descriptive statistics of the subsample and univariate tests

	Mean			Median		
Variable	Shareaud = 0 n = 853	Shareaud = 1 n = 85	t-statistics	Shareaud = 0 n = 853	Shareaud = 1 n = 85	z-statistics
ΔlnCost	0.145	0.128	0.464	0.120	0.097	1.651*
ΔlnSales	0.127	0.129	−0.049	0.116	0.095	0.439
D	0.301	0.271	0.589	0	0	0.590
AI	2.241	2.280	−0.183	1.783	1.595	0.501
EI	1.680	1.606	0.481	1.352	1.402	0.279
ΔGDP	8.227	8.307	−0.557	7.800	7.900	−0.375
Overconf	0.245	0.306	−1.235	0	0	−1.234
$\Delta Sales_{t-1}$	0.131	0.147	−0.382	0.112	0.095	−0.299

See Table 1 for variable definitions. All continuous variables are winsorized at the 1st and 99th percentiles of their annual distributions. The t- and z-statistics are obtained from the t- and Wilcoxon tests that compare the two-sample differences in the mean and median values, respectively. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively.

5. Empirical results

5.1. Descriptive statistics

Panel A of Table 2 reports the descriptive statistics for the full sample. As shown in Panel A, the mean values of ΔlnCost and ΔlnSales are 0.143 and 0.127, respectively, suggesting that the operational expenses (sum of sales and administrative expenses) and revenue of Chinese listed companies are increasing year by year and that the increase in expenses is higher than that in revenue. The mean value of D was 0.298, indicating that 29.8% of the observations experienced a revenue decrease. The mean value of Shareaud is 0.091, indicating that 9.1% of firms in the sample share auditors with at least one of their top five customers. The mean value of Num is 0.111, the minimum value is 0, and the maximum value is 3. Panel B of Table 2 presents the univariate tests and all of the previously described variables between the shared auditor and non-shared auditor groups. As shown in Panel B, there is no significant difference between the groups.

5.2. Multivariate tests

Tables 3–5 present the estimates for H1a and H1b. In Table 3, we estimate the regression specification given in Eq. (2) to separately examine the relation between shared auditors and cost stickiness based on the subsamples of sales increase in the prior period and sales decrease in the prior period. For the subsample of sales increase in the prior period ($\Delta Sales_{t-1} > 0$[9]), the coefficient of ΔlnSales * D * Shareaud (ΔlnSales * D * Num) is 0.320 (0.297); for the subsample of sales decrease in the prior period ($\Delta Sales_{t-1} < 0$), the coefficient of ΔlnSa-

[9] Including $\Delta Sales_{t-1} = 0$.

Table 3
Regression analysis of the effect of a shared auditor on cost stickiness conditional on a sales change in the prior period.

Variable	(1) ΔlnCost $\Delta Sales_{t-1} > 0$	(2) ΔlnCost $\Delta Sales_{t-1} < 0$	(3) ΔlnCost $\Delta Sales_{t-1} > 0$	(4) ΔlnCost $\Delta Sales_{t-1} < 0$
ΔlnSales	0.715***	0.644***	0.715***	0.630***
	(5.95)	(7.97)	(5.97)	(7.42)
ΔlnSales * D	0.212	−0.235	0.213	−0.249
	(0.19)	(−0.29)	(0.20)	(−0.32)
ΔlnSales * D * Shareaud	**0.320**	**−0.829***		
	(0.98)	**(−1.88)**		
Shareaud	0.009	−0.128**		
	(0.24)	(−2.50)		
ΔlnSales * Shareaud	−0.153	0.401***		
	(−0.77)	(3.08)		
ΔlnSales * D * Num			**0.297**	**−0.479***
			(1.16)	**(−1.72)**
Num			0.007	−0.078*
			(0.24)	(−1.73)
ΔlnSales * Num			−0.134	0.243***
			(−1.12)	(4.75)
ΔlnSales * D * AI	−0.016	0.006	−0.016	0.006
	(−1.39)	(0.81)	(−1.39)	(0.80)
ΔlnSales * D * EI	−0.046	−0.014	−0.046	−0.015
	(−0.66)	(−0.57)	(−0.66)	(−0.61)
ΔlnSales * D * ΔGDP	−0.077	−0.026	−0.078	−0.022
	(−0.68)	(−0.23)	(−0.69)	(−0.21)
Year & Industry fixed effect	Yes	Yes	Yes	Yes
_Cons	0.057	−0.150*	0.058	−0.141*
	(0.52)	(−1.85)	(0.52)	(−1.76)
N	669	269	669	269
R-squared	0.535	0.683	0.536	0.690
Chow test	1.91		1.11	

All regressions are estimated by the model of ordinary least squares. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively.

les*D*Shareaud (ΔlnSales * D * Num) is −0.829 (−0.479) and is statistically significant at the 10% level. The Chow test shows that the difference between these subsamples is not statistically significant (F-statistics are 1.91 and 1.11 separately). The results in Table 3 imply that shared auditors decrease (increase) suppliers' cost stickiness in the case of a sales increase (decrease) in the prior period.

In Table 4, we conduct the regression in Model (2) with the overconfident and non-overconfident manager groups separately. For the subsample of overconfident managers (Overconf = 1), the coefficient of ΔlnSales * D * Shareaud (ΔlnSales * D * Num) is 1.173 (0.766); for the subsample of non-overconfident managers (Overconf = 0), the coefficient of ΔlnSales * D * Shareaud (ΔlnSales * D * Num) is −0.535 (−0.293). The Chow test shows that the difference between these subsamples is statistically significant (F-statistics are 13.74 and 6.07 separately). The results collectively suggest that shared auditors reduce suppliers' cost stickiness if the supplier's manager is overconfident.

Table 5 shows the results for Eq. (2) based on the subsamples of high and low economic growth. For the subsample of high economic growth (ΔGDP > Median), the coefficient of ΔlnSales * D * Shareaud (ΔlnSales * D * Num) is 0.011 (0.037); for the subsample of low economic growth (ΔGDP < Median), the coefficient of ΔlnSales * D * Shareaud (ΔlnSales * D * Num) is −1.491 (−1.246), which is statistically significant at the 1% level. The Chow test shows that the difference between these subsamples is statistically significant (F-statistics are 2.88 and 4.35 separately). The results in Table 5 indicate that when economic growth is rapid (slow), shared auditors reduce (increase) suppliers' cost stickiness.

In summary, the results in Tables 3–5 support H1a and H1b, which suggest that shared auditors reduce suppliers' cost stickiness in the case of optimistic management expectations (measured by sales increase in the prior period, management overconfidence, and high economic growth) and increase suppliers' cost stick-

Table 4
Regression analysis of the effect of shared auditor on cost stickiness conditional on manager overconfidence.

Variable	(1) ΔlnCost Overconf = 1	(2) ΔlnCost Overconf = 0	(3) ΔlnCost Overconf = 1	(4) ΔlnCost Overconf = 0
ΔlnSales	0.998***	0.615***	0.994***	0.609***
	(5.36)	(10.54)	(5.29)	(10.39)
ΔlnSales * D	−1.905	0.009	−2.255*	0.025
	(−1.48)	(0.01)	(−1.93)	(0.03)
ΔlnSales * D * Shareaud	**1.173****	**−0.535****		
	(2.48)	**(−2.16)**		
Shareaud	0.091	−0.096***		
	(1.62)	(−3.08)		
ΔlnSales * Shareaud	−0.533*	0.408***		
	(−1.86)	(3.31)		
ΔlnSales * D * Num			**0.766**	**−0.293**
			(1.59)	**(−1.49)**
Num			0.064	−0.068***
			(1.36)	(−3.02)
ΔlnSales * Num			−0.311	0.244***
			(−0.97)	(6.05)
ΔlnSales * D * AI	0.051	−0.010	0.055	−0.010
	(0.79)	(−1.46)	(0.85)	(−1.47)
ΔlnSales * D * EI	−0.021	−0.003	−0.032	−0.003
	(−0.21)	(−0.16)	(−0.31)	(−0.15)
ΔlnSales * D * ΔGDP	0.072	−0.048	0.120	−0.050
	(0.51)	(−0.51)	(1.01)	(−0.52)
Year & Industry fixed effects	Yes	Yes	Yes	Yes
_Cons	0.093	−0.044	0.108	−0.041
	(0.39)	(−1.23)	(0.45)	(−1.16)
N	235	703	235	703
R-squared	0.642	0.567	0.639	0.573
Chow test	13.74***		6.07**	

All regressions are estimated by the model of ordinary least squares. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively.

iness in the case of pessimistic management expectations (measured by sales decrease in the prior period and low economic growth).

6. Additional tests and robustness tests

6.1. Additional tests

As mentioned above, shared auditors in the supply chain facilitate information flow, ease information asymmetry between suppliers and customers, and weaken management's optimistic or pessimistic expectations, thus decreasing or increasing the cost stickiness of suppliers. Next, we use economic growth[10] to proxy for management expectations and examine whether the association between shared auditors and cost stickiness differs depending on customer importance, demand uncertainty, and auditor size.

6.1.1. The effect of customer importance

Sharing an auditor with different customers results in different shared auditor effects. Transactions with the customer that account for the greatest share of the supplier firm's revenue, its most important customer, have

[10] Managers hold optimistic expectations if GDP growth is greater than or equal to median and hold pessimistic expectations otherwise. Compared with sales change in the prior period and management overconfidence, using economic growth to measure management expectations makes the number of subsamples equal; thus, the conclusion will be more reliable.

Table 5
Regression analysis of the effect of a shared auditor on cost stickiness conditional on economic growth.

Variable	(1) ΔlnCost ΔGDP > Median	(2) ΔlnCost ΔGDP < Median	(3) ΔlnCost ΔGDP > Median	(4) ΔlnCost ΔGDP < Median
ΔlnSales	0.561***	0.765***	0.562***	0.755***
	(9.56)	(6.23)	(9.60)	(6.11)
ΔlnSales * D	1.048	5.230**	0.970	5.248**
	(1.20)	(2.38)	(1.10)	(2.39)
ΔlnSales * D * Shareaud	**0.011**	**−1.491*** **		
	(0.03)	**(−3.45)**		
Shareaud	−0.047	−0.070*		
	(−1.07)	(−1.86)		
ΔlnSales * Shareaud	0.096	0.259		
	(0.53)	(1.59)		
ΔlnSales * D * Num			**0.037**	**−1.246*** **
			(0.14)	**(−3.53)**
Num			−0.029	−0.053*
			(−0.93)	(−1.94)
ΔlnSales * Num			0.062	0.170**
			(0.56)	(2.48)
ΔlnSales * D * AI	0.002	−0.009	0.002	−0.009
	(0.44)	(−1.15)	(0.40)	(−1.16)
ΔlnSales * D * EI	−0.004	−0.024	−0.005	−0.025
	(−0.29)	(−0.45)	(−0.31)	(−0.46)
ΔlnSales * D * ΔGDP	−0.152	−0.807***	−0.143	−0.808***
	(−1.59)	(−2.68)	(−1.49)	(−2.68)
Year & Industry fixed effects	Yes	Yes	Yes	Yes
_Cons	−0.014	−0.009	−0.012	−0.005
	(−0.51)	(−0.06)	(−0.45)	(−0.04)
N	470	468	470	468
R-squared	0.469	0.645	0.469	0.649
Chow test	2.88*		4.35**	

All regressions are estimated by the model of ordinary least squares. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively.

the strongest influence on the supplier. The importance of customers decreases gradually from the top 1 to 5. Sharing an auditor with customers of higher importance enables the shared auditor to acquire information more relevant to the supplier, especially information about the customer's demand for enterprise products, thus mitigating optimistic (pessimistic) management expectations and decreasing (increasing) the suppliers' cost stickiness.

We use a customer's rank to measure the importance of that customer.[11] The higher the rank, the more important the customer is. Observations for customers that rank higher than or equal to the median value are classified in the customer importance > median group and those with a rank less than the median value are classified in the customer importance < median group. We regress these two groups separately, using Model (2) to examine the effect of customer importance.

Table 6 presents the estimates. When managers hold optimistic expectations, the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in the customer importance > median group are both significantly positive, while the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in the customer importance < median group are both significantly negative. The Chow test shows that the difference between these subsamples is statistically significant (F-statistics are 49.66 and 28.78 separately). These results collectively suggest that the relationship between shared auditors in the supply chain and suppliers' cost stickiness will be more pronounced in firms sharing auditors with customers of higher importance when suppliers' man-

[11] If a supplier shares an auditor with more than one customer, we choose the customer of highest rank to calculate customer importance.

Table 6
Regression analysis of shared auditors' information role conditional on customer importance.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Management optimistic expectations				Management pessimistic expectations			
	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost
	customer importance >median	customer importance <median	customer importance >median	customer importance <median	customer importance >median	customer importance <median	customer importance >median	customer importance <median
ΔlnSales	0.583***	0.576***	0.578***	0.576***	0.721***	0.792***	0.718***	0.792***
	(7.10)	(8.80)	(7.16)	(8.79)	(4.46)	(6.92)	(4.44)	(6.91)
ΔlnSales * D	0.236	0.621	−0.065	0.648	4.417	4.844***	4.443	4.842***
	(0.16)	(0.55)	(−0.04)	(0.57)	(1.44)	(2.95)	(1.45)	(2.95)
ΔlnSales * D * Shareaud	**0.858*** **	**−2.390*** **			**0.210**	**−0.099**		
	(2.78)	**(−5.34)**			**(0.04)**	**(−0.20)**		
Shareaud	−0.010	−0.275***			−0.056	0.037		
	(−0.20)	(−4.92)			(−0.97)	(0.80)		
ΔlnSales * Shareaud	−0.053	1.618***			0.411***	−0.361		
	(−0.30)	(5.12)			(2.66)	(−1.55)		
ΔlnSales * D * Num			**0.640****	**−1.989*** **			**0.816**	**−0.120**
			(2.29)	**(−5.28)**			**(0.17)**	**(−0.24)**
Num			0.009	−0.246***			−0.043	0.034
			(0.27)	(−4.24)			(−0.88)	(0.79)
ΔlnSales * Num			−0.062	1.277***			0.218***	−0.357
			(−0.61)	(5.80)			(2.80)	(−1.53)
ΔlnSales * D * AI	0.027	0.006	0.025	0.005	0.003	−0.117**	0.003	−0.116**
	(0.53)	(0.37)	(0.48)	(0.31)	(0.36)	(−2.46)	(0.35)	(−2.46)
ΔlnSales * D * EI	0.031	−0.047	0.026	−0.044	0.053	0.039	0.052	0.038
	(1.21)	(−1.00)	(0.97)	(−0.94)	(0.57)	(0.43)	(0.55)	(0.42)
ΔlnSales * D * ΔGDP	−0.124	−0.082	−0.085	−0.085	−0.723*	−0.714***	−0.726*	−0.714***
	(−0.85)	(−0.68)	(−0.56)	(−0.70)	(−1.69)	(−3.11)	(−1.69)	(−3.12)
Year & Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	−0.028	0.043	−0.024	0.043	−0.030	0.092	−0.030	0.093
	(−0.71)	(0.92)	(−0.62)	(0.92)	(−1.37)	(0.47)	(−1.35)	(0.47)
N	236	234	236	234	208	260	208	260
R-squared	0.420	0.617	0.416	0.616	0.733	0.589	0.734	0.589
Chow test		49.66***		28.78***		0.01		0.00

All regressions are estimated by the model of ordinary least squares. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively.

agers hold optimistic expectations. However, if the suppliers' manager is pessimistic about the future, the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in both groups are insignificant. The Chow test suggests that the difference between the subsamples is statistically insignificant. Therefore, the evidence does not support that sharing auditors with customers of high importance increases suppliers' cost stickiness when the supplier's managers hold pessimistic expectations.

6.1.2. The effect of demand uncertainty

If demand is hard to predict (high demand uncertainty), the bias of management expectation is more likely to exist. Shared auditors' information role should be more pronounced in cases of high demand uncertainty. We use the standard deviation of sales revenue in the most recent 3 years (sdSales) to measure demand uncertainty. Observations with demand uncertainty higher than or equal to the median value are classified in sdSales > median group and those with demand uncertainty less than the median value are classified in sdSales < median group. We regress the two groups separately using Model (2) to examine the effect of demand uncertainty.

Table 7 shows the results. When a suppliers' managers hold optimistic expectations, the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in sdSales < median group are both insignificantly negative, while the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in sdSales > median group are both

Table 7
Regression analysis of shared auditors' information role conditional on demand uncertainty.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Management optimistic expectations				Management pessimistic expectations			
Variable	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost
	sdSales >median	sdSales <median	sdSales >median	sdSales <median	sdSales >median	sdSales <median	sdSales >median	sdSales <median
ΔlnSales	0.541***	0.639***	0.538***	0.641***	0.830***	0.396***	0.827***	0.396***
	(6.71)	(8.14)	(6.59)	(8.20)	(5.43)	(4.61)	(5.41)	(4.61)
ΔlnSales * D	0.575	1.949	0.521	1.909	7.547***	2.240	7.563***	2.218
	(0.42)	(1.55)	(0.38)	(1.51)	(3.76)	(0.87)	(3.78)	(0.86)
ΔlnSales * D * Shareaud	**0.382**	**−0.036**			**−1.365*** **	**−0.294**		
	(0.88)	**(−0.09)**			**(−3.85)**	**(−0.17)**		
Shareaud	0.0409	−0.134***			−0.086	−0.001		
	(0.59)	(−2.73)			(−1.50)	(−0.02)		
ΔlnSales * Shareaud	−0.104	0.179			0.294*	−0.175		
	(−0.44)	(0.91)			(1.89)	(−1.40)		
ΔlnSales * D * Num			**0.205**	**−0.021**			**−1.012*** **	**−0.372**
			(0.57)	**(−0.07)**			**(−3.62)**	**(−0.22)**
Num			0.012	−0.115***			−0.050	−0.005
			(0.27)	(−2.63)			(−1.29)	(−0.13)
ΔlnSales * Num			0.024	0.228**			0.159**	−0.173
			(0.13)	(2.04)			(2.02)	(−1.40)
ΔlnSales * D * AI	−0.027	−0.153	−0.027	−0.152	−0.080	−0.007	−0.080	−0.007
	(−0.99)	(−1.25)	(−0.98)	(−1.25)	(−1.55)	(−0.65)	(−1.55)	(−0.66)
ΔlnSales * D * EI	0.077	0.082	0.075	0.082	0.073	0.039	0.073	0.039
	(0.95)	(1.44)	(0.95)	(1.43)	(1.06)	(0.36)	(1.05)	(0.36)
ΔlnSales * D * ΔGDP	−0.102	−0.263*	−0.096	−0.259*	−1.133***	−0.341	−1.135***	−0.337
	(−0.71)	(−1.73)	(−0.66)	(−1.70)	(−3.84)	(−0.99)	(−3.85)	(−0.98)
Year & Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	−0.021	−0.035	−0.025	−0.033	−0.580*	0.200**	−0.574*	0.200**
	(−0.23)	(−1.01)	(−0.26)	(−0.93)	(−1.84)	(1.96)	(−1.82)	(1.96)
N	247	223	247	223	205	263	205	263
R-squared	0.529	0.425	0.530	0.423	0.789	0.239	0.790	0.239
Chow test	1.36		2.19		3.96**		3.53**	

All regressions are estimated by the model of ordinary least squares. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively

insignificantly positive. The Chow test shows that the difference between the subsamples is statistically insignificant. Therefore, the evidence does not support that shared auditors are more likely to decrease suppliers' cost stickiness for high demand uncertainty firms when suppliers' managers hold optimistic expectations. However, if suppliers' managers are pessimistic about the future, the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in sdSales > median group are both significantly negative, while the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in sdSales < median group are both insignificantly negative. In addition, the Chow test suggests that the difference between the subsamples is statistically significant (F-statistics are 3.96 and 3.53 separately). These results collectively indicate that the relationship between shared auditors in the supply chain and suppliers' cost stickiness is stronger in firms of high demand uncertainty when the suppliers' managers hold pessimistic expectations.

6.1.3. The effect of auditor size

Larger audit firms have greater resources to both generate and collect incrementally valuable information (Bae et al., 2017). Therefore, we anticipate that larger audit firms weaken management's optimistic (pessimistic) expectations to a greater extent, resulting in lower (higher) cost stickiness. Because the Chinese audit market is much more dispersed in contrast to the oligopolistic market structure in the US (Guan et al., 2016) and the market share of the big 4 is very low, we measure auditor size using big 10 and non-big 10 firms. We anticipate that shared auditors' informational role should be more pronounced for big 10 auditors.

Table 8
Regression analysis of shared auditors' information role conditional on auditor size.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Management optimistic expectations				Management pessimistic expectations			
Variable	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost	ΔlnCost
	Big10 = 1	Big10 = 0	Big10 = 1	Big10 = 0	Big10 = 1	Big10 = 0	Big10 = 1	Big10 = 0
ΔlnSales	0.635***	0.573***	0.626***	0.573***	0.751***	0.774***	0.736***	0.774***
	(6.87)	(8.11)	(6.90)	(8.11)	(4.59)	(6.17)	(4.47)	(6.17)
ΔlnSales * D	0.488	−0.471	0.444	−0.471	7.371***	0.538	7.431***	0.538
	(0.68)	(−0.29)	(0.60)	(−0.29)	(3.15)	(0.19)	(3.20)	(0.19)
ΔlnSales * D * Shareaud	**0.288**	**−0.630**			**−1.644*** **	**1.172***		
	(0.84)	**(−0.91)**			**(−3.32)**	**(1.83)**		
Shareaud	−0.055	−0.087			−0.075	0.012		
	(−1.06)	(−0.99)			(−1.59)	(0.35)		
ΔlnSales * Shareaud	−0.068	0.672			0.281	−0.429		
	(−0.33)	(1.27)			(1.42)	(−1.17)		
ΔlnSales * D * Num			**0.224**	**−0.630**			**−1.340*** **	**1.172***
			(0.95)	**(−0.91)**			**(−3.12)**	**(1.83)**
Num			−0.026	−0.087			−0.054	0.012
			(−0.81)	(−0.99)			(−1.59)	(0.35)
ΔlnSales * Num			−0.027	0.672			0.185**	−0.429
			(−0.23)	(1.27)			(2.09)	(−1.17)
ΔlnSales * D * AI	−0.038***	0.046*	−0.038***	0.046*	−0.005	0.011	−0.005	0.011
	(−2.87)	(1.75)	(−2.79)	(1.75)	(−0.63)	(0.10)	(−0.64)	(0.10)
ΔlnSales * D * EI	0.141***	−0.044***	0.139***	−0.044***	−0.026	0.114	−0.027	0.114
	(3.45)	(−2.76)	(3.36)	(−2.76)	(−0.42)	(1.16)	(−0.44)	(1.16)
ΔlnSales * D * ΔGDP	−0.143*	0.021	−0.137*	0.021	−1.107***	−0.191	−1.112***	−0.191
	(−1.89)	(0.12)	(−1.75)	(0.12)	(−3.38)	(−0.50)	(−3.41)	(−0.50)
Year & Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_Cons	−0.046	0.276***	−0.045	0.276***	0.068	0.011	0.070	0.011
	(−1.36)	(4.94)	(−1.30)	(4.94)	(0.48)	(0.37)	(0.52)	(0.37)
N	220	250	220	250	254	214	254	214
R-squared	0.427	0.537	0.426	0.537	0.707	0.558	0.713	0.558
Chow test	0.46		0.39		9.14***		7.67***	

All regressions are estimated by the model of ordinary least squares. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9
Change Analysis.

Variable	(1) ΔSticky	(2) ΔSticky
ΔShareaud	**−0.069***	
	(−1.65)	
ΔNum		**−0.046****
		(−2.24)
ΔAI	0.018	0.019
	(0.40)	(0.44)
ΔEI	−0.103**	−0.104**
	(−2.09)	(−2.10)
Δ^2GDP	0.019	0.018
	(0.81)	(0.77)
ΔD	−0.070	−0.070
	(−1.19)	(−1.20)
Year & Industry fixed effects	Yes	Yes
_Cons	0.525	0.526
	(1.31)	(1.32)
N	324	324
R-squared	0.094	0.094

All variables are yearly change variables. The superscripts ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8 presents the estimates. When suppliers' managers hold optimistic expectations, the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in the big 10 group are both insignificantly positive, while the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in the non-big 10 group are both insignificantly negative. The Chow test shows that the difference between these subsamples is statistically insignificant. Therefore, the evidence does not support that shared auditors are more likely to decrease suppliers' cost stickiness for big 10 auditors when suppliers' managers hold optimistic expectations. However, if suppliers' managers are pessimistic about the future, the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in the big 10 group are both significantly negative, while the coefficients of ΔlnSales * D * Shareaud and ΔlnSales * D * Num in the non-big 10 group are both significantly positive. In addition, the Chow test suggests that the difference between the subsamples is statistically significant (F-statistics are 9.14 and 7.67 separately). These results collectively suggest that the relationship between shared auditors in the supply chain and suppliers' cost stickiness will be more pronounced for big 10 auditors if suppliers' managers hold pessimistic expectations.

6.2. Robustness tests

First, supplier companies audited by shared auditors may have some innate characteristics that are associated with cost stickiness, and those characteristics may not be controlled in our regression models, which may cause omitted variable problems. Consistent with Weiss (2010) and using quarterly data, we estimate firm-year level cost stickiness (Sticky) based on firms that experienced a sales increase in the prior period and conduct a change analysis to address this concern. The results in Table 9 show that the coefficients of ΔShareaud and ΔNum are both significantly negative, suggesting that shared auditors reduce suppliers' cost stickiness if managers hold optimistic expectations.

Second, we include firm fixed effects in Model (2). The untabulated results[12] are consistent with those reported earlier, so our main conclusions remain unchanged using this alternative model specification.

[12] Readers can contact the authors for the table if necessary.

7. Conclusion

Supply chain relationships between suppliers and their major customers are of strategic importance in the modern economy, and prior research has investigated the effects of these relationships on partners within the supply chain (Johnstone et al., 2014). However, little is known about how other constituents in capital markets, such as auditors, might be affected by or have effects on supply chain relationships. Based on the data of Chinese A-share listed companies from 2009 to 2017, we explore the association between shared auditors and cost stickiness conditional on management expectations. The results show that sharing auditors with customers helps reduce suppliers' cost stickiness significantly in the case of optimistic management expectations, as indicated by a sales increase in the prior period, management overconfidence, and high economic growth and increase suppliers' cost stickiness in the case of pessimistic expectations, as indicated by a sales decrease in the prior period and low economic growth. Further, the greater the number of shared auditors, the stronger the effect. Additional tests suggest that such effects will be more pronounced for firms that share auditors with important customers, have higher demand uncertainty, and share big 10 auditors.

This study provides direct empirical evidence that supply chain auditors affect suppliers' cost stickiness, enriches research on supply chain audits, and sheds light on the improvement of supply chain audit and corporate cost management. In addition, this study reveals that the auditor is an integral part of the management information set and indicates the auditor's information role, thus helping investors, academic researchers, and regulators to develop an overall understanding of the auditor's role in corporate governance.

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China Journal of Accounting Research 12 (2019) 357–377

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China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Voluntary CSR disclosure, institutional environment, and independent audit demand

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ARTICLE INFO

Article history:
Received 15 October 2018
Accepted 10 October 2019
Available online 23 November 2019

Keywords:
Voluntary disclosure of corporate social responsibility information
Auditor selection
Auditing fees
Institutional environment

ABSTRACT

Using a sample of A-share listed companies on the Shanghai and Shenzhen Stock Exchanges, this study examines the impact of voluntary corporate social responsibility (CSR) disclosure on independent audit demand in different institutional environments. The sample covers the 2008–2016 period and excludes firms that are required to disclose CSR information. The findings show that compared with companies that choose to not disclose such information, companies that voluntarily disclose CSR information prefer to employ "small" accounting firms for auditing services, although the auditing fees are much higher. However, as the institutional environment improves, this preference is weakened. Further analyses show that this preference is stronger in enterprises where CSR disclosure is driven by strong political motivations and managerial self-interest motivations. Legitimate motivations and economic motivations do not significantly impact the preference for "small" audit firms. Furthermore, this preference is more obvious in enterprises with poor operational performance and low information disclosure quality, and it increases as CSR disclosure level decreases. The study enriches our understanding of the economic consequences of voluntary CSR disclosure and the factors that influence independent audit demand. The results also have implications for the construction and regulation of China's system for supervising CSR information disclosure in the transitional phase.

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https://doi.org/10.1016/j.cjar.2019.10.002
1755-3091/

1. Introduction

Stakeholders have diverse information needs, and as financial information cannot meet all of their decision-making needs, non-financial information has become increasingly important. Since 2009, the China Securities Regulatory Commission (CSRC) has required that some listed companies to disclose their social responsibility reports together with their annual reports, while other listed companies can independently decide whether to disclose their social responsibility reports. According to the Rankins CSR Ratings, the number of listed companies issuing CSR reports increased from 471 in 2009 to 795 in 2016, and the proportion of firms voluntarily issuing CSR reports increased from 28.03% (132) to 47.55% (378) over the same period. Thus, both the number of listed companies disclosing their CSR activities and the proportion of firms voluntarily disclosing CSR activities are increasing. However, CSR disclosure is not uniform, and the content and form of the reports are largely arbitrary and inconsistent (Shen and Jin, 2006; Quan et al., 2015).

Non-financial information is more difficult to manipulate than financial information, so it is useful for evaluating financial information (Dhaliwa et al., 2011). As important participants in the capital market, the Public Company Accounting Oversight Board (PCAOB) believes that CPAs can use non-financial information as an independent and effective benchmark for evaluating financial reporting data and can use non-financial data to improve the detection of fraud. Therefore, non-financial information such as CSR reports has become an important component of audit risk assessment and risk response (Zhu et al., 2015). Although CSR disclosure has a ‘‘communication effect’’, thus reducing information asymmetry (Li et al., 2013; Zhou et al., 2016), empirical evidence shows that CSR disclosure also has a ‘‘cover-up effect’’, and can become a managerial tool for concealing immoral behaviors such as inadequate profitability or other bad news (Koehn and Ueng, 2010; Quan et al., 2015). In practice, once corporate immoral behavior is discovered or exposed, it will cause serious adverse consequences, as in the cases of the Sanlu ‘‘poisoned milk powder’’ incident in 2008, the ‘‘zombie meat’’ incident in 2015, the fake Nike ‘‘best basketball shoes’’ incident in 2017, and so on.

Accordingly, it is important to ask the following questions: how do companies’ CSR disclosure decisions affect their independent audit demand decisions? when selecting auditors, do they prefer ‘‘big’’ or ‘‘small’’ firms? In addition, due to regional differences in resource endowment, geographical location, and national policies, there are obvious differences in the institutional environments of Chinese listed companies in China’s transitional economy (Fan et al., 2011). As a result, companies’ motivation to disclose information and their capacity to misrepresent their activities are heterogeneous due to different institutional constraints (Cheng et al., 2011). Therefore, when examining the relationship between voluntary CSR disclosure and audit behaviors, enterprises’ institutional environments should be taken into account.

Regulatory factors can obscure companies’ motivation to issue CSR reports; that is, CSR reports that are part of a company’s mandatory disclosure are not entirely the product of managerial autonomy (Wang et al., 2014). Therefore, this study uses a sample from the 2008 to 2016 period of A-share listed companies on the Shanghai and Shenzhen Stock Exchanges that are not required to issue CSR reports. This allows the study to investigate the relationship between the voluntary disclosure of CSR information and independent auditing needs. It asks the following questions: (1) do enterprises that voluntarily disclose CSR reports prefer ‘‘big’’ or ‘‘small’’ audit firms, and how much do they pay for auditing services?; and (2) does the institutional environment affect the demand for independent audits among enterprises that voluntarily disclose CSR information?

The results indicate that enterprises that voluntarily disclose CSR information prefer ‘‘small’’ audit firms, which have a higher audit risk and charge higher auditing fees, but a good institutional environment can effectively suppress this preference. Further tests show that the impact of voluntary CSR disclosure on independent auditing needs varies with disclosure motivations, and that corporate performance and the quality of enterprises’ information disclosure influence this relationship. The lower the quality of information disclosure, the stronger the preference for ‘‘small’’ firms.

This study contributes to the literature in several ways. First, few studies of the factors that influence the demand for independent audits have explored the effect of voluntary CSR disclosure. As government supervision on CSR is in an important period of system construction and regulation, the study of the relationship between voluntary CSR disclosure and independent audit demand provides important empirical evidence for the effects of government supervision in a transition economy. Second, using independent audit needs as an

example, this study enriches our understanding of the consequences of disclosing non-financial information, and provides a new perspective for understanding how the institutional environment in China affects the micro-path of audit demand. Third, most studies of CSR disclosure do not distinguish between voluntary and mandatory disclosure. In fact, these two types of disclosure have quite different motivations. This study uses a sample that contains only enterprises that can choose whether to make CSR disclosures, which improves the reliability and pertinence of the research conclusions and provides better guidelines for improving relevant policies.

The rest of the paper is organized as follows. Section 2 reviews the literature and develops our hypotheses. Section 3 introduces the research design. Section 4 reports the empirical results and analyses. Section 5 presents further analyses. Section 6 gives our robustness test. Section 7 concludes the paper.

2. Literature and hypotheses development

Previous studies of the economic consequences of CSR disclosure focus on earnings management (Hemingway and Maclagan, 2004; Chen et al., 2018), capital cost (Dhaliwal et al., 2011; Li et al., 2013), tax avoidance (Hoi et al., 2013; Zou, 2018), and so on. Their conclusions are inconsistent. Most studies of the impact of CSR disclosure on audit behavior consider its effect on audit fees (Zhu et al., 2015; Peter et al., 2017), and very few consider its relationship with independent audit needs. In fact, auditors have a number of reasons for paying attention to clients' CSR disclosures. First, because auditors have a deep understanding of their customer's business environment and financial situation, they are able to evaluate non-financial information disclosed by the customer. As CSR is an important type of non-financial information, auditors can obtain additional information through its disclosure, which in turn provides favorable conditions for audit risk assessment. Second, CSR disclosure tends to attract the attention of external stakeholders (Kong et al., 2013; Wang et al., 2014), thus creating a kind of supervisory pressure on auditors' behaviors, so auditors need to consider CSR disclosure in risk assessment procedures. Third, some studies indicate that CSR is used by managers to pursue their self-interest (Hemingway and Maclagan, 2004; Quan et al., 2015), which can influence business operation risk and consequently affect the evaluation of audit risk. Based on the above analysis, this study argues that it is necessary and important to examine the impact of voluntary CSR disclosure on independent audit needs.

According to principal-agent theory, managers use CSR to enhance their professional reputation and personal interests, and that this is at the expense of shareholders' interests. In other words, CSR disclosure has "cover-up effect." Hemingway and Maclagan (2004) argue that CSR is used to cover up managers' earnings manipulation and other misconduct. Kim et al. (2012) believe that the purpose of CSR disclosure is to create an apparently transparent social image for enterprises, which allows them to conduct earnings management behind the screen. Gao et al. (2012) finds that Chinese private enterprises are more likely to make charitable donations in the hope of covering up or diverting the public's attention from other improper behaviors such as the internal lack of social responsibility or the declining reputation of the enterprises. That is to say, the charitable donations of Chinese private enterprises are more "instrumental" and are "green scarf" rather than "red scarf."

In addition, in the context of China's special transition economy, the content and language of voluntary CSR disclosure are often selected to convey positive information about the company's active fulfillment of its responsibilities, for very obvious public relations purposes (Song and Gong, 2006). To some extent, CSR disclosure has become a tool for enterprises to seek rent from the government; that is, it can help enterprises obtain rent. Zou (2018) finds that CSR disclosure is negatively related to actual tax burden, and the relationship is more obvious among enterprises that disclose CSR information voluntarily, suggesting that enterprises proactively disclose CSR information, while secretly engaging in tax avoidance behaviors. Li et al. (2016) find that the tendency to make donations and the amount of donations of Chinese private listed companies are positively related to tax avoidance, which means that there is a phenomenon of "apparent donation, but secret tax avoidance" among these companies. As audits are external governance mechanisms, higher quality audits provide more supervision and more restriction on tax avoidance (Jin and Lei, 2011). The size of accounting firms is a basic guarantee of high audit quality (De Angelo, 1981). As large accounting firms have higher professional competence than smaller firms and are more concerned about reputation, litigation

risk, and audit failure penalties, firm size is usually used as a proxy for high-quality audits (Pan, 2010; Chen et al., 2013). Auditors can determine whether an enterprise's operation risk is increased by negative CSR performance (Koh and Tong, 2013). When auditing a client with high operation risk, big audit firms have the motivation and ability to increase the number of audit procedures applied to the client's accounting information, thus reducing the audit risk to an acceptable level. However, small audit firms may not have the professional competence or resources needed to detect false information. In reality, audit committees' choice of auditor is usually directed by managers, even directly decided by them (Zhang et al., 2010). Therefore, the managers of enterprises that have voluntarily disclosed CSR may select small audit firms to avoid unfavorable auditor supervision, which sends a negative signal to stakeholders. Based on the above analysis, we propose the following research hypothesis.

Hypothesis 1. Other factors being equal, companies that make voluntarily CSR disclosures are more likely to select "small" accounting firms as auditors than companies that do not disclose CSR.

What is the effect of selecting "small" audit firms on audit fees? Generally, there are three determinants of audit pricing: normal cost, risk premium, and reputation premium. Compared with "big" audit firms, "small" audit firms do not have a reputation premium. Therefore, assuming that normal audit cost is controlled, audit risk is the main factor in determining the audit fees of "small" audit firms. Confucian culture, which occupies a dominant position in Chinese culture, emphasizes "wise self-preservation, the doctrine of the mean," which creates a universal mentality of "the less trouble the better" in listed companies, and this leads them to restrict the disclosure of information. According to Rankins CSR Ratings (RKS), "reporting before management" is a common problem among Chinese listed companies. Although the number of enterprises voluntarily disclosing CSR information is increasing, most of the CSR reports have low scores, well below the RKS passing grade. Furthermore, the content of most CSR reports are merely "gratifying" summaries, and there are "clone" CSR reports (Quan et al., 2015). The number of CSR reports assured by third-party authorities is very small, they are insufficiently independent, and the assurance practice standards are not uniform (Shen et al., 2011). In practice, enterprises labeled socially responsible have frequently engaged in activities that damaged social interests and their corporate reputations, for example, Vanke's "poisonous floor" case and Tsingtao Beer's "quality gate" case. Thus, the general public lacks confidence in the quality of CSR reports, and questions the motivations of enterprises that voluntarily disclose CSR information. Zhu et al. (2015) argue that as an important type of non-financial information, CSR reports can provide auditors with information that is important for the audit process, and is an important component of audit risk assessment and risk response. Specifically, when determining audit pricing, auditors may tend to think that voluntary CSR disclosure enhances audit risk and increases audit efforts, causing an increase in audit costs; thus, they will charge these audit clients higher audit fees. Based on the above analysis, we propose the following research hypothesis.

Hypothesis 2. Other factors being equal, companies that make voluntary CSR disclosures pay higher audit fees to employ "small" accounting firms than with companies that do not disclose CSR information.

Institutional environment is a basic determinant of the behaviors of economic subjects, and enterprise behaviors are often endogenous within a specific institutional environment. As China's capital market is a new and transitional market, there are significant differences in the institutional environments of different regions, which can cause differences in the motivations for information disclosure, the ability to make false statements (Cheng et al., 2011), and the corporate governance role of independent auditing. Hence, it can be reasonably inferred that the preference for "small" audit firms among enterprises that voluntarily disclose CSR information may be affected by the local institutional environment. First, as the level of marketization and legalization is relatively high in areas with good institutional environments, enterprises in these areas are motivated to provide more transparent and higher quality accounting information to alleviate the agency problem and strengthen the role of signal transmission (Liu and Wang, 2014); thus, the demand for high-quality auditing is strong. In contrast, in a bad institutional environment, investors have insufficient legal protection, and enterprises lack the need for high-quality auditing (Zhang et al., 2012). Second, in an area with strong legal protections and developed market intermediaries, enterprises' illegal or immoral behaviors are more likely to be investigated and exposed, and the subsequent losses are more serious. That is, the costs and risks of actively disclosing CSR information are greater, which makes the fulfillment of CSR more signif-

icant, and thus enterprises seek high quality auditing. Lastly, according to the reputation mechanism theory and "deep pocket" theory, reputation and legal punishment mechanisms are more likely to play a role in good institutional environments; thus, in these environments, auditors' concerns for self-reputation and litigation risk will lead to high audit quality (Chen et al., 2010; Liu and Wang, 2014). Based on the above analysis, we propose the following research hypothesis.

Hypothesis 3. Other factors being equal, improving the regional institutional environment can effectively restrain the preference of enterprises that voluntarily disclose CSR information for "small" accounting firms.

3. Research design

3.1. Sample selection and data source

We select all of the A-share companies listed on the Shanghai and Shenzhen Stock Exchanges between 2008 and 2016 as our initial sample. China began to implement a policy that is a mixture of mandatory and voluntary CSR disclosure in 2009, but as companies disclose their last year's CSR reports during this year, 2008 is the initial year. Then, we exclude the following observations from the sample: (1) financial companies, because these companies have special operational characteristics and accounting systems; (2) companies with abnormal operations such as ST and *ST companies; (3) companies issuing B-shares, H-shares, and other foreign shares, because the market price, accounting standards, and regulatory environment of such stocks are different than those of A-share companies; (4) companies that are required to disclose CSR activities, because this study examines the differences in independent audit demand between companies that choose to disclose CSR activities and those that choose not to disclose CSR activities; and (5) any observation with missing data. The final sample has 13,340 observations, including 1622 observations of voluntary disclosure, and 11,718 observations with no disclosure. The financial data are mainly from the CSMAR database and the CSR report data are from the RKS database. In addition, to eliminate the interference of outliers on our regression tests, all of the continuous variables are winsorized at the 1% and 99% levels.

3.2. Models and variable definitions

We construct Model (1) to test Hypothesis 1 as follows:

$$\begin{aligned} A\text{uditor}_{i,t} = {} & \alpha_0 + \alpha_1 CSR_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 Growth_{i,t} + \alpha_5 Rev_{i,t} + \alpha_6 Inv_{i,t} + \alpha_7 \text{Curr}_{i,t} + \alpha_8 Roa_{i,t} \\ & + \alpha_9 Loss_{i,t} + \alpha_{10} Age_{i,t} + \alpha_{11} Top1_{i,t} + \alpha_{12} Seo_{i,t} + \alpha_{13} Soe_{i,t} + Year + Industry + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where i indexes the firm and t indexes the year. The dependent variable, $\text{Auditor}_{i,t}$, is a dummy variable for the enterprise's independent audit demand. Following previous studies, this study defines "big" accounting firms as firms that are ranked in the top 10 in the "Information about the Top 100 Ranked Firms in the Comprehensive Evaluation of Certified Public Accountants Firms" issued by the Chinese Association of Certified Public Accountants (CACPA). If an accounting firm employed by company i in year t is ranked in the top 10, Auditor is equal to 0, and otherwise 1. The independent variable $\text{CSR}_{i,t}$ indicates whether company i voluntarily discloses its CSR report in year t; if yes, the variable is equal to 1, and otherwise 0. Hypothesis 1 predicts that the regression coefficient a1 of variable $\text{CSR}_{i,t}$ will be significantly positive.

We construct Model (2) to test Hypothesis 2 as follows:

$$\begin{aligned} Infee_{i,t} = {} & \alpha_0 + \alpha_1 CSR_{i,t} + \alpha_2 Auditor_{i,t} + \alpha_3 CSR_{i,t} \times A\text{uditor}_{i,t} + \alpha_4 Size_{i,t} + \alpha_5 Lev_{i,t} + \alpha_6 Growth_{i,t} \\ & + \alpha_7 Rev_{i,t} + \alpha_8 Inv_{i,t} + \alpha_9 \text{Curr}_{i,t} + \alpha_{10} Roa_{i,t} + \alpha_{11} Loss_{i,t} + \alpha_{12} Age_{i,t} + \alpha_{13} Top1_{i,t} + \alpha_{14} Seo_{i,t} \\ & + \alpha_{15} Soe_{i,t} + \alpha_{16} Auditop_{i,t} + \alpha_{17} Sqsub_{i,t} + Year + Industry + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Model (2) is an OLS regression model that examines the effect of voluntary CSR disclosure on auditor selection and audit fees. The independent variable $Infee_{i,t}$ represents audit fee, which is equal to the natural logarithm of the domestic audit fees paid by enterprise i in year t. Hypothesis 2 predicts that the regression coefficient a_3 of the interaction term $CSR_{i,t} \times Auditor_{i,t}$ will be significantly positive.

We construct Model (3) to test Hypothesis 3 as follows:

$$\begin{aligned} Auditor_{i,t} = {} & \alpha_0 + \alpha_1 CSR_{i,t} + \alpha_2 Hmkt_{i,t} + \alpha_3 CSR_{i,t} \times Hmkt_{i,t} + \alpha_4 Size_{i,t} + \alpha_5 Lev_{i,t} + \alpha_6 Growth_{i,t} \\ & + \alpha_7 Rev_{i,t} + \alpha_8 Inv_{i,t} + \alpha_9 Curr_{i,t} + \alpha_{10} Roa_{i,t} + \alpha_{11} Loss_{i,t} + \alpha_{12} Age_{i,t} + \alpha_{13} Top1_{i,t} + \alpha_{14} Seo_{i,t} \\ & + \alpha_{15} Soe_{i,t} + Year + Industry + \varepsilon_{i,t} \end{aligned} \quad (3)$$

Model (3) is a logit regression model, which is used to test whether the relationship between voluntary CSR disclosure and independent audit demand is affected by differences in regional institutional environments. The variable $Hmkt_{i,t}$, a dummy variable representing institutional environment, is derived from the "Marketization Index" published by Fan et al. in 2011. As this index only includes data up to 2010, we draw on Yang et al. (2014) to develop an index for 2011 and later years: for example, the index for 2011 is equal to the index of 2010 plus the average value added of 2008, 2009, and 2010 (the three previous years). The marketization indexes for each year in the 2012–2016 period are calculated in an analogous fashion. If the marketization index of the area where the enterprise is located is larger than the sample median, then $Hmkt_{i,t}$ equals 1, and otherwise 0. Hypothesis 3 predicts that the regression coefficient of the interaction term $CSR_{i,t}$ - $\times Hmkt_{i,t}$ will be significantly negative.

Table 1
Variable definitions.

Variable name	Variable symbol	Variable definitions
Audit fees	Infee	Natural logarithm of the domestic audit fees paid by the enterprise
Independent audit demand	Auditor	Equal to 1 if a company employs a "non-top10" accounting firms for auditing, and otherwise 0
CSR information voluntary disclosing	CSR	Equal to 1 if a company discloses its CSR report voluntarily, and otherwise 0
Institutional environment	Hmkt	Equal to 1 if the marketization index is larger than the sample median, and otherwise 0.
Firm size	Size	Natural logarithm of total assets at the end of the year
Debt level	Lev	Ratio of total liabilities to the total assets at end of the year
Enterprise growth ability	Growth	Annual percentage revenue growth of the firm
Receivable items	Rev	Ratio of accounts receivable to the total assets at the end of the year
Inventory items	Inv	Ratio of inventories to the total assets at the end of the year
Liquidity ratio	Curr	Ratio of current assets to the current assets at the end of the year
Profitability	Roa	Ratio of annual net profit to the total assets at the end of the year
Operation loss	Loss	A dummy variable that equals 1 if the business operates at a loss in the current year, and otherwise 0.
Years of listing	Age	Natural logarithm of one plus the number of years a company has been listed
Ownership concentration	Top1	Shareholding ratio of the largest shareholder at the end of the year
Motivation of equity financing	Seo	An indicator variable that equals 1 if the firm has the demand of additional shares or rights issue in the current year, and otherwise 0.
Nature of property rights	Soe	An indicator variable that equals 1 if the firm is ultimately controlled by the government, and otherwise 0.
Audit opinions	Auditop	Equal to 1 if the firm obtains the standard unqualified audit opinion in that year, and otherwise 0.
Number of subsidiaries	Aqsub	Square roots of the number of subsidiaries included in the consolidated statements at the end of the year
Year variable	Year	Dummy variable, controlling the time effect
Industry variable	Industry	Dummy variable, controlling the industry effect. According to the industry classification standard of the Securities Regulatory Commission in 2012, the manufacturing industry is classified as a second-level industry, and all of the other industries are classified as first-level.

Following previous studies (Simunic, 1980; Wang et al., 2008; Yang et al., 2017), the following variables are controlled in the models: firm size, debt level, enterprise growth ability, receivable items, inventory items, liquidity ratio, profitability, operation loss, years of listing, ownership concentration, motivation of equity financing, nature of property rights, audit opinions, and number of subsidiaries.

The definitions of all of the variables are presented in Table 1.

4. Empirical results and analysis

4.1. Descriptive statistics

Table 2 reports the summary statistics, including the means, medians, minimum, maximum, and standard deviations of the variables. The mean, minimum, and maximum of Infee are 13.343, 12.206, and 14.845 respectively, indicating that the companies paid a range of audit fees. The mean of Auditor is 0.470, suggesting that more than half of the sample companies employ "Top 10" accounting firms. The mean of CSR is 0.122, showing that only 12.2% of the sample companies voluntarily disclose their CSR reports, indicating that Chinese enterprises are generally unwilling to voluntarily engage in CSR disclosure. In Table 3, the variables are grouped into subsamples of companies that voluntarily disclose their CSR reports and companies that do not disclose their CSR reports. The means are calculated for each subsample. The results show that the means of Infee and Auditor for companies that voluntarily disclose their social responsibility reports are significantly higher than those of companies that do not disclose their social responsibility reports, indicating that companies that practice voluntarily CSR disclosure are more willing to hire non-top 10 accounting firms to conduct audits and are willing to pay higher audit fees. The means of most of the control variables are significantly different between the subsamples.

4.2. Correlation analysis

Table 4 lists the Pearson correlation coefficients of the variables. The correlation coefficient between Auditor and CSR is 0.042, which is significantly positive at the 1% level, suggesting that companies that voluntarily disclose their CSR reports are more willing to employ "small" accounting firms than companies that do not disclose their CSR reports; thus Hypothesis 1 is preliminarily supported. The correlation coefficient between Infee and CSR is 0.125, which is also significantly positively correlated at the 1% level, indicating that companies that voluntarily disclose their CSR reports may pay higher audit fees than companies that do

Table 2
Descriptive statistics of the variables.

Variable	Obs	Mean	Median	Minimum	Maximum	Sd
Infee	13,340	13.343	13.305	12.206	14.845	0.506
Auditor	13,340	0.470	0	0	1	0.499
CSR	13,340	0.122	0	0	1	0.327
Size	13,340	21.678	21.605	19.436	24.477	1.017
Lev	13,340	0.425	0.416	0.046	0.896	0.213
Growth	13,340	0.223	0.111	−0.575	4.679	0.629
Rev	13,340	0.113	0.091	0	0.446	0.100
Inv	13,340	0.159	0.122	0	0.755	0.148
Curr	13,340	2.592	1.646	0.301	20.136	2.996
Roa	13,340	0.038	0.035	−0.160	0.191	0.051
Loss	13,340	0.091	0	0	1	0.288
Age	13,340	2.037	2.197	0	3.296	0.773
Top1	13,340	0.346	0.325	0.090	0.751	0.149
Seo	13,340	0.226	0	0	1	0.418
Soe	13,340	0.366	0	0	1	0.482
Sqsub	13,340	2.427	2.236	0	20.149	1.991
Auditop	13,340	0.972	1	0	1	0.164

Table 3
Mean difference tests of the variables.

Variable	Mean		Mean difference test
	CSR = 0	CSR = 1	
Infee	13.320	13.540	−0.194***
Auditor	0.462	0.526	−0.064***
Size	21.614	22.146	−0.532***
Lev	0.422	0.446	−0.024***
Growth	0.226	0.200	0.026*
Rev	0.115	0.098	0.017***
Inv	0.156	0.182	−0.026***
Curr	2.608	2.480	0.128*
Roa	0.038	0.043	−0.005***
Loss	0.094	0.070	0.024***
Age	2.025	2.125	−0.100***
Top1	0.345	0.358	−0.013***
Seo	0.226	0.224	0.002
Soe	0.360	0.412	−0.052***
Auditop	0.970	0.991	−0.021**
Sqsub	2.387	2.721	−0.334***

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

not disclose their CSR reports. In addition, the absolute value of the correlation coefficients between variables is generally less than 0.5, which shows that there is no serious multi-collinearity problem in the model.

4.3. Multivariate regression analysis

Table 5 reports the results of the analyses of the relationships between voluntary CSR disclosure, institutional environment, and independent audit needs. The regression coefficient of CSR, shown in column (1), is 0.415 and is significantly positive at the 1% level, showing that companies that voluntarily disclose their CSR reports are more willing to employ "small" accounting firms than companies that do not disclose their CSR reports. Thus, Hypothesis 1 is supported. The regression coefficient of the interaction term CSR × Auditor, shown in column (2), is 0.044 and is significantly positive at the 5% level, suggesting that small accounting firms employed by the companies that voluntarily disclose their CSR reports charge higher audit fees, perhaps because small accounting firms believe that auditors' efforts and audit risk are increased by voluntary CSR disclosure. The regression results for CSR are given in columns (3) and (4). The former is significantly positive at the 1% level, and the latter is negative and insignificant. The total regression results given in columns (2) to (4) support Hypothesis 2. The regression coefficient of CSR is significantly positive at the level of 1%, and the regression coefficient of the interaction term CSR × Hmkt is significantly negative at the 1% level, indicating that the preference for small accounting firms expressed by companies that voluntarily disclose their CSR reports decreases as the regional institutional environment improves. Thus, Hypothesis 3 is supported.

5. Further analysis

5.1. Motivations for CSR disclosure

Since 2009, China has had a policy that combines voluntary CSR disclosure with mandatory CSR disclosure. Scholars have conducted a series of studies on the motivations for CSR disclosure, including legitimacy motivation, economic motivation, political motivation, and managers' self-interest motivation, which suggest the economic consequences of disclosing CSR reports driven by different motivations are different (Branco and Rodrigues, 2008; Dhaliwal et al., 2011; He et al., 2012; Zhang et al., 2014; Zou, 2018; Heminway and Maclagan, 2004). Therefore, it is necessary to examine whether the influence of voluntary CSR disclosure

Table 4
Pearson correlation coefficient.

	Infee	Auditor	CSR	Size	Lev	Growth	Rev	Inv	Curr	Roa	Loss	Age	Top1	Seo	Soe	Sqsub	Auditop
Infee	1																
Auditor	−0.164***	1															
CSR	0.125***	0.042***	1														
Size	0.647***	−0.086***	0.171***	1													
Lev	0.249***	0.046***	0.037***	0.449***	1												
Growth	0.080***	0.007**	−0.014**	0.086***	0.060***	1											
Rev	−0.012**	−0.038***	−0.057***	−0.142***	−0.038***	0.028***	1										
Inv	0.063***	0.019**	0.057***	0.166***	0.343***	0.038***	−0.120***	1									
Curr	−0.208***	−0.026***	−0.014**	−0.280***	−0.621***	−0.043***	−0.008**	−0.134***	1								
Roa	−0.009**	−0.037***	0.036***	−0.028***	−0.381***	0.179***	0.046***	−0.117***	0.237***	1							
Loss	−0.022**	0.021**	−0.027***	−0.058***	0.190***	−0.128***	−0.059***	0.005	−0.109***	−0.620***	1						
Age	0.143***	0.066***	0.042***	0.302***	0.423***	0.024***	−0.260***	0.165***	−0.350***	−0.218***	0.120***	1					
Top1	0.089***	−0.036***	0.028***	0.197***	0.044***	0.036***	−0.071***	0.070***	−0.016**	0.107***	−0.063***	−0.108***	1				
Seo	0.160***	−0.042***	−0.001	0.125***	0.074***	0.179***	0.084***	−0.011**	−0.100***	−0.011**	−0.024***	0.042***	−0.041***	1			
Soe	−0.012**	0.052***	0.036***	0.230***	0.297***	−0.045***	−0.178***	0.025***	−0.223***	−0.147***	0.079***	0.417***	0.151***	−0.094***	1		
Sqsub	0.253***	−0.023***	0.055***	0.278***	0.241***	0.003	−0.065***	0.120***	−0.183***	−0.034***	0.008**	0.197***	0.023***	−0.005	0.128***	1	
Auditop	0.038***	−0.023***	0.043***	0.106***	−0.114***	−0.002	0.045***	0.033***	0.057***	0.180***	−0.190***	−0.085***	0.060***	0.022**	−0.028***	0.033***	1

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

Table 5
Regression results for relationships between voluntary CSR disclosure, institutional environment, and independent audit demand.

Variable	Dependent variable				
	Auditor	Infee			Auditor
	Full sample		Auditor = 1	Auditor = 0	Full sample
	(1)	(2)	(3)	(4)	(5)
CSR	0.415***	0.005	0.058***	−0.003	0.641***
	(7.398)	(0.315)	(4.282)	(−0.193)	(8.292)
Auditor		−0.080***			
		(−11.903)			
CSR*Auditor		0.044**			
		(2.241)			
Hmkt					−0.501***
					(−11.940)
CSR*Hmkt					−0.588***
					(−5.137)
Size	−0.162***	0.284***	0.264***	0.306***	−0.151***
	(−7.041)	(61.683)	(40.927)	(46.435)	(−6.473)
Lev	0.131	−0.070***	−0.054*	−0.104***	0.028
	(0.950)	(−2.853)	(−1.663)	(−2.829)	(0.201)
Growth	0.049	0.016***	0.012	0.020**	0.039
	(1.595)	(2.824)	(1.498)	(2.456)	(1.262)
Rev	0.238	0.212***	0.152***	0.268***	0.492**
	(1.107)	(5.867)	(2.841)	(5.417)	(2.282)
Inv	0.224	−0.078***	−0.017	−0.133***	0.262
	(1.307)	(−2.772)	(−0.458)	(−3.050)	(1.513)
Curr	0.010	−0.011***	−0.013***	−0.010***	0.010
	(1.301)	(−8.982)	(−7.191)	(−5.698)	(1.206)
Roa	−1.586***	−0.023	0.041	−0.104	−1.457***
	(−3.195)	(−0.257)	(0.346)	(−0.822)	(−2.907)
Loss	−0.154*	0.061***	0.060***	0.057***	−0.157*
	(−1.911)	(4.459)	(3.124)	(2.957)	(−1.931)
Age	0.236***	−0.022***	−0.021***	−0.022***	0.214***
	(7.655)	(−4.294)	(−2.859)	(−2.994)	(6.893)
Top1	−0.198	0.032	0.018	0.047	−0.138
	(−1.512)	(1.435)	(0.553)	(1.459)	(−1.041)
Seo	−0.016	0.019**	0.013	0.022**	−0.032
	(−0.353)	(2.279)	(1.091)	(2.033)	(−0.671)
Soe	−0.097**	−0.127***	−0.114***	−0.148***	−0.184***
	(−2.141)	(−16.475)	(−11.007)	(−12.707)	(−3.970)
Auditop		−0.126***	−0.190***	−0.052*	
		(−6.140)	(−6.802)	(−1.837)	
Sqsub		0.066***	0.064***	0.066***	
		(25.612)	(17.505)	(18.427)	
Constant	4.266***	7.181***	7.520***	6.789***	4.041***
	(8.774)	(77.758)	(58.147)	(51.436)	(8.242)
Year	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
N	13,340	13,340	6265	7075	13,340
Wald Chi^2/F value	919.89	304.7	134.6	178.9	1113.40
Pseudo R^2 /Adjusted R^2	0.056	0.522	0.503	0.520	0.069

on auditor selection varies with the motivation for engaging in CSR disclosure. First, following Zhang et al. (2014), the legitimacy motivation is explored by using the Senind variable, which represents industry sensitivity to social responsibility concerns. Companies in safe production sensitive industries, product quality sensitive industries and environmental protection-sensitive industries are classified as having high industry sensitivity. According to the Securities Regulatory Commission's 2012 industry classifications, Senind is equal

Table 6
Regression results for the different disclosure motivations.

Variable	Dependent variable: Auditor									
	Senind = 1 (1)	Senind = 0 (2)	CP = 1 (3)	CP = 0 (4)	Fseo = 1 (5)	Fseo = 0 (6)	Soe = 0 (7)	Soe = 1 (8)	Adm = 1 (9)	Adm = 0 (10)
CSR	0.373***	0.503***	0.653***	0.383***	0.470***	0.399***	0.490***	0.283***	0.652***	0.208***
	(5.563)	(4.790)	(4.199)	(6.328)	(4.071)	(6.206)	(6.642)	(3.231)	(7.862)	(2.696)
Size	−0.168***	−0.150***	−0.305***	−0.139***	−0.153***	−0.165***	−0.135***	−0.207***	−0.230***	−0.113***
	(−6.021)	(−3.572)	(−4.809)	(−5.563)	(−3.321)	(−6.138)	(−4.401)	(−5.686)	(−6.788)	(−3.284)
Lev	0.205	0.017	1.044***	0.012	−0.266	0.242	0.155	0.217	0.338*	−0.156
	(1.229)	(0.069)	(2.877)	(0.078)	(−0.940)	(1.498)	(0.840)	(0.965)	(1.743)	(−0.736)
Growth	0.040	0.068	0.050	0.046	−0.014	0.071*	0.043	0.064	0.066	0.028
	(1.002)	(1.421)	(0.480)	(1.428)	(−0.231)	(1.955)	(1.076)	(1.320)	(1.403)	(0.700)
Rev	0.180	0.348	0.099	0.240	−0.411	0.440*	0.953***	−1.018***	0.534	0.018
	(0.685)	(0.921)	(0.119)	(1.075)	(−0.999)	(1.735)	(3.612)	(−2.684)	(1.621)	(0.061)
Inv	0.188	0.373	0.347	0.199	0.406	0.143	−0.334	1.019***	0.240	−0.042
	(0.758)	(1.483)	(0.694)	(1.087)	(1.181)	(0.718)	(−1.488)	(3.642)	(0.902)	(−0.179)
Curr	0.020**	−0.014	0.048***	0.003	−0.012	0.016*	0.013	0.016	0.018**	0.011
	(2.145)	(−0.947)	(2.628)	(0.384)	(−0.600)	(1.828)	(1.423)	(0.820)	(1.973)	(0.685)
Roa	−2.199***	0.100	−2.984***	−1.305**	0.021	−2.007***	−1.865***	−1.669*	−0.917	−2.551***
	(−3.803)	(0.100)	(−2.583)	(−2.327)	(0.020)	(−3.537)	(−3.013)	(−1.936)	(−1.365)	(−3.316)
Loss	−0.240**	0.084	−0.576***	−0.087	−0.114	−0.158*	−0.129	−0.207*	0.011	−0.349***
	(−2.539)	(0.538)	(−2.588)	(−1.005)	(−0.695)	(−1.691)	(−1.190)	(−1.683)	(0.101)	(−2.901)
Age	0.248***	0.218***	0.204**	0.247***	0.201***	0.250***	0.258***	0.153**	0.244***	0.238***
	(6.764)	(3.726)	(2.473)	(7.335)	(3.269)	(6.943)	(6.974)	(2.521)	(5.407)	(5.495)
Top1	0.111	−0.888***	0.695*	−0.308**	−0.273	−0.161	0.097	−0.585***	−0.093	−0.376**
	(0.707)	(−3.775)	(1.867)	(−2.188)	(−0.998)	(−1.080)	(0.567)	(−2.797)	(−0.476)	(−2.087)
Seo	0.013	−0.088	0.075	−0.028	−0.014	−0.027	−0.080	0.093	−0.026	−0.005
	(0.235)	(−1.007)	(0.567)	(−0.557)	(−0.145)	(−0.491)	(−1.397)	(1.123)	(−0.391)	(−0.079)
Soe	−0.116**	−0.048	0.045	−0.127***	0.120	−0.157***			−0.003	−0.192***
	(−2.068)	(−0.612)	(0.364)	(−2.580)	(1.251)	(−3.022)			(−0.041)	(−3.075)
Constant	1.864***	2.175***	7.004***	3.805***	4.150***	4.298***	2.318***	1.881***	2.165***	2.091***
	(6.854)	(5.933)	(5.322)	(7.290)	(4.266)	(7.589)	(7.356)	(5.311)	(6.497)	(6.395)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	9379	3961	1910	11,430	3304	10,035	8452	4875	6670	6660
Wald Chi^2	553.65	371.74	220.15	740.60	202.04	740.77	584.25	365.62	482.11	497.81
Pseudo R^2	0.047	0.080	0.098	0.053	0.048	0.060	0.059	0.061	0.059	0.060
coefficient difference test of CSR		P = 0.295		P = 0.106		P = 0.589		P = 0.071		P = 0.000

to 1 if a company belongs to a sensitive industry such as mining, manufacturing, power, heat, gas, and water production and supply, and otherwise 0. Second, following Zhang et al. (2014), we adopt two variables—customer distance (CP) and refinancing demand (Fseo)—to investigate the economic motivation. If a company belongs to the textile, clothing, fur, food, beverage, or pharmaceutical industry, then the variable CP is equal to 1, and otherwise 0. For refinancing demand, if the company has additional issuance or allotment in the following year, Fseo is 1, and otherwise 0. Third, due to their close relationship with the government, state-owned enterprises are more likely to get preferential policies (Li and Zheng, 2016), whereas it is more difficult for non-state-owned enterprises to obtain government resources. Thus, the motivation of rent-seeking from the government through voluntary disclosure of CSR information is stronger for non-state-owned enterprises (Godfrey, 2005; Zou, 2018). Therefore, non-state-owned enterprises are more inclined than state-owned enterprises to voluntarily disclose their CSR reports. Finally, the principal-agent theory suggests that the disclosure of CSR information may be a tool to "whitewash" managerial misconduct. As the agent cost of managers is one of the necessary conditions for the existence of this "cover-up effect" (Tian and Wang, 2017), we use the variable of agency cost (Adm) to test the existence of managers' self-interest motivation; the higher the agency cost, the stronger the self-interest motivation of managers. Following Li (2014), agency cost is measured as the

Table 7
Regression results for firm performance and information disclosure quality.

Variable	Dependent variable: Auditor							
	Profit and loss		Return on equity		Institutional ownership		Evaluation rating	
	loss	Profit	decline	not decline	low	high	pass/fail	good/ excellent
CSR	0.764***	0.388***	0.478***	0.333**	0.728**	0.349**	0.605***	0.286**
	(2.971)	(3.414)	(4.046)	(2.563)	(2.490)	(2.487)	(4.094)	(2.058)
Size	−0.353***	−0.144***	−0.184***	−0.155***	−0.208*	−0.130*	−0.204***	−0.130**
	(−3.773)	(−3.119)	(−3.809)	(−3.068)	(−1.880)	(−1.953)	(−3.529)	(−2.238)
Lev	0.251	0.240	0.230	0.250	0.208	−0.325	0.259	0.055
	(0.489)	(0.930)	(0.877)	(0.897)	(0.345)	(−0.948)	(0.832)	(0.159)
Growth	−0.058	0.039	0.097*	0.032	−0.132	0.114*	0.057	0.042
	(−0.336)	(1.258)	(1.656)	(0.857)	(−1.027)	(1.951)	(1.279)	(0.980)
Roa					−1.677	−1.641*	−2.247***	0.007
					(−1.132)	(−1.691)	(−2.813)	(0.008)
Rev	0.770	0.197	0.283	0.178	−0.502	0.408	0.513	−0.036
	(0.781)	(0.479)	(0.634)	(0.382)	(−0.494)	(0.805)	(0.994)	(−0.065)
Inv	−0.285	0.291	0.028	0.490	0.583	0.724	0.007	0.471
	(−0.441)	(0.880)	(0.081)	(1.351)	(0.773)	(1.567)	(0.016)	(1.116)
Curr	−0.015	0.012	0.007	0.015	−0.002	0.002	0.007	0.019
	(−0.312)	(0.941)	(0.463)	(0.945)	(−0.053)	(0.111)	(0.451)	(1.049)
Age	0.435***	0.217***	0.248***	0.238***	0.286*	0.166**	0.228***	0.283***
	(2.683)	(3.714)	(4.041)	(3.354)	(1.870)	(2.205)	(3.332)	(3.446)
Top1	−0.568	−0.201	0.025	−0.507*	0.363	0.137	0.385	−0.806**
	(−0.934)	(−0.754)	(0.088)	(−1.697)	(0.580)	(0.403)	(1.180)	(−2.289)
Seo	−0.444**	0.020	0.009	−0.047	−0.129	0.047	−0.160**	0.111*
	(−2.565)	(0.419)	(0.143)	(−0.696)	(−0.841)	(0.805)	(−2.480)	(1.780)
Soe	−0.162	−0.076	−0.124	−0.057	−0.069	−0.042	−0.138	−0.050
	(−0.874)	(−0.788)	(−1.214)	(−0.547)	(−0.301)	(−0.327)	(−1.083)	(−0.435)
Constant	7.767***	3.856***	4.555***	4.009***	5.244**	4.289***	5.323***	3.071**
	(4.012)	(3.984)	(4.520)	(3.761)	(2.300)	(3.095)	(4.380)	(2.544)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1210	12,127	7118	6218	1123	7655	6598	6733
Wald Chi^2	108.83	434.53	361.17	282.41	126.50	261.94	346.89	220.12
Pseudo R^2	0.114	0.052	0.061	0.055	0.116	0.051	0.072	0.048
Coefficient difference test of CSR		P = 0.02		P = 0.07		P = 0.00		P = 0.05

ratio of management expenses to revenue. If the ratio is larger than the median of the sample, Adm is equal to 1, and otherwise 0.

Based on the above analysis, Table 6 reports the regression results for the disclosure motivations subsamples discussed above. The regression coefficients of CSR in column (1) are smaller than that in column (2), but there is no significant difference, suggesting that when voluntary CSR disclosure is driven by the legitimacy motivation, its effect on the demand for high-quality auditing is limited, perhaps because the legitimacy motivation cannot guarantee the disclosure level of CSR information. To reduce the risk of auditors' delivering negative signals to stakeholders, these enterprises may have a weak demand for high quality audits. There are no significant differences in the regression coefficients of CSR between columns (3) and (4), or between columns (5) and (6), indicating that economic motivations do not significantly affect the relationship between voluntary CSR disclosure and independent auditing demand, perhaps because Chinese listed companies can't make scientific decisions when they determine the disclosure level of CSR information in practice, the significant impact of customer proximity on CSR remains at the decision-making level of whether to disclose CSR reports, but not at the actual disclosure level of CSR information (Zhang et al., 2014). The supervision mechanism proposed by China's regulatory authorities, that "the refinancing of listed companies will be linked to the fulfillment of social responsibility", has not worked effectively, thus listed companies do not feel the need

Table 8
Regression results for the disclosure level of CSR information.

Variable	Dependent variable: Auditor		
Score	−0.030***		
	(−4.328)		
Med_score		0.494***	
		(4.090)	
Mea_score			0.583***
			(4.778)
Size	−0.404***	−0.441***	−0.429***
	(−4.958)	(−5.529)	(−5.360)
Lev	0.394	0.466	0.480
	(0.790)	(0.933)	(0.961)
Growth	−0.015	−0.013	−0.026
	(−0.123)	(−0.104)	(−0.213)
Rev	−1.028	−0.934	−0.954
	(−1.429)	(−1.308)	(−1.334)
Inv	−0.003	0.004	0.007
	(−0.005)	(0.007)	(0.013)
Curr	0.036	0.040	0.039
	(1.426)	(1.600)	(1.558)
Roa	−0.426	−0.177	0.029
	(−0.275)	(−0.114)	(0.019)
Loss	0.033	0.050	0.087
	(0.129)	(0.195)	(0.333)
Age	0.280***	0.303***	0.297***
	(2.910)	(3.135)	(3.090)
Top1	0.206	0.164	0.146
	(0.547)	(0.436)	(0.387)
Seo	−0.195	−0.188	−0.189
	(−1.411)	(−1.363)	(−1.371)
Soe	−0.256*	−0.259*	−0.252*
	(−1.903)	(−1.919)	(−1.857)
Constant	11.960***	11.351***	11.005***
	(6.793)	(6.375)	(6.152)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	1580	1580	1580
Wald Chi^2	161.05	158.29	164.69
Pseudo R^2	0.094	0.093	0.096

to improve the disclosure level of CSR information when they have refinancing motivation (Zhang et al., 2012). Generally, high-quality auditing is more likely to discover the true "information content" of CSR reports. Therefore, to reduce the risk of conveying bad signals to stakeholders, companies in close contact with customers and companies with refinancing needs tend to choose low-quality audits when they voluntarily disclose CSR reports.

Comparisons of the regression coefficients of CSR between columns (7) and (8) and between columns (9) and (10) shows that (7) and (9) are significantly larger than (8) and (10) correspondingly, which means the relationship between voluntary CSR disclosure and independent audit demands is significantly influenced by political motivations and managerial self-interest motivation. Specifically, the disclosure of CSR information may allow managers to conceal misconduct (Hemingway and Maclagan, 2004; Zou, 2018). For managers, voluntary CSR disclosure can reduce the demand for high-quality audits and thus reduce the possibility that auditors will convey to stakeholders bad signals that could damage the enterprises' or their own reputation. As a resource of great value, political connections can be exploited by managers conducting rent-seeking activities, and the transactions that can help obtain various benefits from government officials are often in a "grey zone" of activities forbidden by the formal system (Tang et al., 2011). Obviously, managers do not want sensitive information related to rent-seeking activities to be made public and become the focus of attention from external investors and regulators. As auditing is an external supervision mechanism, political connections will weaken the demand for high-quality audits (Du and Zhou, 2010).

5.2. Firm performance and information disclosure quality

As CSR disclosure can allow managers to cover up inadequate profitability or other bad news, it can be expected that firm performance and information disclosure quality may have different effects on the relationship between CSR disclosure and audit demand. Therefore, we further divide the sample into subsamples based on firm performance and information disclosure quality. Specifically, to examine firm performance, the sample is divided into subsamples of enterprises with and without operational losses and into subsamples of enterprises with declining or not declining business operations. If the net profit of an enterprise is less than 0, it is classified as operating at a loss; if the rate of return on common stockholders' equity is lower than in the previous year, the firm is classified as having performance declines. Columns 2–5 of Table 7 show that compared with companies that do not disclose CSR information, companies that make voluntary CSR disclosures are more inclined to select "small" accounting firms for auditing when their business is operating at a loss or firm performance is declining. To examine information disclosure quality, we create subsamples based on institutional ownership and on the evaluation of information disclosure. Previous studies indicate that enterprises with high institutional ownership have relatively high quality information disclosure (Velury and Jenkins, 2006; Gao and Zhang, 2008). In this sample, if the percentage of institutional ownership of an enterprise is higher than the sample median, we assume that the quality of information disclosure is high. The Shenzhen Stock Exchange grades the information disclosure quality of enterprises as excellent, good, pass, or fail. Following Yi et al. (2010), this study treats grades of "good" or "excellent" as indicators of high quality of information disclosure. As shown in columns 6–9 of Table 7, the preference of enterprises that voluntarily disclose CSR information for "small" audit firms is stronger in enterprises with low quality information disclosure.

5.3. Disclosure level of CSR information

The previous section examines the influence of voluntary CSR disclosure on audit demand; however, as China does not yet have clear provisions for the format and content of CSR disclosure reports, the level of disclosure in CSR reports is uneven. Hence, we restrict the sample to enterprises that voluntarily disclose CSR information to further test the effect of disclosure level on audit demand. Drawing on Huang and Zhou (2017) and Chen et al. (2018), the RKS rating scores are used to measure the disclosure level of CSR information. The higher the rating score, the higher the disclosure level. Specifically, we use two measures of disclosure level. The first directly uses the rating scores (Score). The second is a dummy variable Med_score (Mea_score) calculated from the sample median (mean) of the rating scores; if the score is less than the sample

Table 9
Regression results of models after PSM.

Variable	Dependent variables		
	Auditor (1)	Infee (2)	Auditor (3)
CSR	0.345***	−0.008	0.621***
	(4.484)	(−0.413)	(5.627)
Auditor		−0.107***	
		(−5.539)	
CSR*Auditor		0.080***	
		(2.975)	
Hmkt			−0.503***
			(−4.393)
CSR*Hmkt			−0.617***
			(−3.960)
Size	−0.297***	0.328***	−0.271***
	(−5.682)	(29.781)	(−5.110)
Lev	−0.068	−0.194***	−0.230
	(−0.208)	(−3.170)	(−0.688)
Growth	−0.052	0.028***	−0.064
	(−0.876)	(2.937)	(−1.075)
Rev	−0.321	0.353***	0.004
	(−0.662)	(4.001)	(0.009)
Inv	0.167	0.105	0.147
	(0.448)	(1.618)	(0.389)
Curr	0.005	−0.016***	0.010
	(0.293)	(−5.164)	(0.542)
Roa	−1.499	−0.256	−0.966
	(−1.367)	(−1.265)	(−0.856)
Loss	−0.177	0.079**	−0.161
	(−0.979)	(2.373)	(−0.866)
Age	0.290***	−0.031**	0.268***
	(4.359)	(−2.561)	(3.962)
Top1	0.032	−0.014	0.109
	(0.121)	(−0.291)	(0.410)
Seo	−0.031	0.023	−0.066
	(−0.310)	(1.288)	(−0.659)
Soe	−0.077	−0.143***	−0.191**
	(−0.828)	(−8.460)	(−1.984)
Auditop		−0.039	
		(−0.744)	
Sqsub		0.056***	
		(10.141)	
Constant	6.552***	6.497***	6.611***
	(5.550)	(25.882)	(5.468)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	3106	3106	3106
Wald Chi^2/F value	233.53	81.39	322.06
PseudoR^2 /adjusted R^2	0.064	0.539	0.090

median (mean), Med_score (Mea_score) is equal to 1, and otherwise 0. The regression results, given in Table 8, show that the regression coefficient of Score is significantly negative at the 1% level, and the regression coefficients of Med_score (Mea_score) are significantly positive at the 1% level, indicating that among companies that voluntarily disclose their CSR reports, lower disclosure levels increase the likelihood of "small" accounting firms being employed to conduct audits, perhaps because the disclosure of CSR information has a "cover-up" effect. Compared with small accounting firms, big accounting firms devote more auditing resources to CSR information because of their professional competence and their concerns for reputation loss, litigation

Table 10
Two stage least square regression with an instrumental variable.

variable	Dependent variables			
	CSR (1)	Auditor (2)	Infee (3)	Auditor (4)
Mean_pro	3.113***			
	(31.011)			
P_CSR		0.915***	0.160***	0.598***
		(9.615)	(2.866)	(6.092)
Auditor			−0.126***	
			(−14.420)	
P_CSR*Auditor			0.209***	
			(3.558)	
Hmkt				−0.289***
				(−7.213)
P_CSR* Hmkt				−1.222***
				(−3.888)
Size	0.362***	−0.237***	0.326***	−0.163***
	(19.801)	(−16.230)	(69.618)	(−9.789)
Lev	−0.437***	0.507***	−0.165***	0.307***
	(−3.766)	(6.071)	(−6.689)	(3.618)
Growth	−0.099***	0.063***	0.015**	0.042**
	(−3.455)	(3.371)	(2.512)	(2.227)
Rev	−0.545***	−0.251*	0.363***	−0.089
	(−3.263)	(−1.930)	(9.797)	(−0.680)
Inv	0.389***	0.191*	−0.122***	0.279***
	(3.862)	(1.843)	(−4.231)	(2.650)
Curr	0.003	0.005	−0.013***	0.005
	(0.354)	(1.013)	(−10.250)	(0.976)
Roa	1.957***	−0.499	−0.227**	−0.264
	(4.573)	(−1.638)	(−2.497)	(−0.850)
Loss	0.065	−0.075	0.046***	−0.062
	(0.995)	(−1.520)	(3.224)	(−1.252)
Age	−0.044*	0.092***	0.002	0.081***
	(−1.800)	(5.007)	(0.332)	(4.383)
Top1	−0.254**	−0.051	−0.014	−0.057
	(−2.331)	(−0.634)	(−0.620)	(−0.704)
Seo	−0.061	−0.082***	0.058***	−0.085***
	(−1.612)	(−2.971)	(7.155)	(−3.049)
Soe	0.073**	0.067**	−0.163***	−0.006
	(1.983)	(2.502)	(−20.877)	(−0.216)
Auditop			−0.131***	
			(−6.052)	
Sqsub			0.022***	
			(12.223)	
Constant	−9.256***	4.554***	6.564***	3.197***
	(−24.220)	(14.888)	(69.428)	(9.134)
Year	No	No	No	No
Industry	No	Yes	Yes	Yes
N	13,340	13,340	13,340	13,340
Wald Chi^2/ F value	1342.79	491.51	341.1	791.53
Pseudo R^2/ adjusted R^2	0.158	0.027	0.495	0.044

risk and audit failure penalties, and thus big firms are more likely to discover the disclosure aims and true information content of CSR reports.

6. Robustness tests

To ensure the reliability of the main conclusions, this study carries out several robustness tests.

6.1. Propensity score matching (PSM)

Our sample of firms that voluntarily disclose CSR information may raise the problem of self-selection; that is, companies may decide to disclose a CSR report only when the demand for a high-quality audit is not strong. To mitigate the influence of the self-selection problem on our findings, the PSM method is adopted. First, following Zhang et al. (2014), and Huang and Zhou (2017), we establish Model (4), which includes some factors that are known to affect voluntary CSR disclosure. Second, we use a logit regression to compute tendentiousness scores and then match them 1:1 to get two groups called "enterprises disclosing CSR reports voluntarily" and "enterprises not disclosing CSR reports". Finally, we regress the matched samples using the previous main models.

$$CSR_{i,t} = \alpha_0 + \alpha_1 \mathrm{Size}_{i,t} + \alpha_2 Lev_{i,t} + \alpha_3 Roa_{i,t} + \alpha_4 Top1_{i,t} + \alpha_5 Dual_{i,t} + \alpha_6 Bsize_{i,t} + \alpha_7 Mcgb_{i,t} + \alpha_8 Soe_{i,t} + \alpha_9 Seo_{i,t} + \alpha_{10} HHI_{i,t} + \alpha_{11} CP_{i,t} + \alpha_{12} Listplace_{i,t} + \alpha_{13} Senind_{i,t} + Year + \varepsilon_{i,t} \quad (4)$$

where the definitions of CSR, Size, Lev, Roa, Top1, Seo, and Soe are the same as in Table 1. Dual is a variable indicating whether the chairman and CEO are the same person; if so, it takes 1, and otherwise 0. Bsize, an indicator of the size of the board of directors, equals the number of directors. Mcgb indicates managers' ownership at the end of year. HHI is the product market competition, which is based on the H. Findall index. CP is the customer proximity, such that if the enterprise belongs to the textile, clothing, fur, food, beverage, or pharmaceutical industry, it takes 1, and otherwise 0. Listplace is the dummy variable representing listing location, such that if a company is listed on the Shanghai Stock Exchange, Listplace equals 1, and otherwise 0. Senind is a dummy variable representing the industry's sensitivity to social responsibility issues, such that if the enterprise belongs to mining, manufacturing, power, heat, gas, or water production and supply, it is 1, and otherwise 0.

Table 9 reports the regression results for the matched samples. The regression coefficient of CSR is significantly positive at the 1% level (column (1)), and the interaction term CSR × Auditor is also significantly positive at the 1% level (column (2)). These results indicate that companies that voluntarily disclose CSR tend to select small accounting firms for audits and pay them higher audit fees than companies that do not disclose their CSR reports. The regression coefficient of the interaction term CSR × Hmkt is signficantly negative at the 1% level (column (3)), which suggests that a good institutional environment can effectively weaken the positive correlation between voluntary CSR disclosure and the tendency to choose "small" accounting firms. The above regression results are consistent with our main findings, which further verifies all three hypotheses.

6.2. Instrumental variable (IV)

To avoid any potential endogeneity problems in the above findings, this study uses an instrumental variable to control. Following Feng et al. (2016), the mean of the voluntary CSR disclosure of enterprises in the same region in the same year (Mean_pro) is taken as the instrumental variable indicating whether enterprises will voluntarily disclose CSR activities in the current period. We argue that the companies in the same region (the same province where a company is registered) share an external environment, so their CSRs are to some extent correlated. However, the disclosure decisions of other companies in the same region should not affect the focal company's independent audit requirements; therefore, the variable Mean_pro satisfies the exogenous principle of an instrumental variable. Table 10 shows the test results of a two stage least square (2SLS) test using the instrumental variable. The regression coefficient of Mean_pro (column (1)) is significantly positive. The regression coefficient of P_CSR, which is represented whether or not enterprises voluntarily disclose their CSR reports, equals the expected value. The P_CSR value is obtained from the first-stage regression. The regression coefficient of the interaction term P_CSR × Auditor (column (3)) is significantly positive, and the regression coefficient of the interaction term P_CSR × Hmkt (column (4)) is significantly negative. Overall, the results support the main findings.

Table 11
Regression results of the robustness tests.

Variable	Dependent variables				
	Auditor			Infee	Auditor
	(1)	(2)	(3)	(4)	(5)
CSR	1.254***	0.650***	0.942***	0.040	1.604***
	(4.459)	(8.501)	(8.350)	(1.591)	(7.604)
Mkt	−0.048***				
	(−5.736)				
CSR*Mkt	−0.081***				
	(−3.086)				
Hmkt		−0.463***			−0.481***
		(−11.221)			(−8.477)
CSR*Hmkt		−0.589***			−1.034***
		(−5.178)			(−4.025)
Auditor				−0.085***	
				(−9.244)	
CSR*Auditor				0.075**	
				(2.272)	
Size	−0.155***	−0.149***	−0.144***	0.275***	−0.138***
	(−6.729)	(−6.419)	(−4.807)	(46.551)	(−4.586)
Lev	0.076	−0.008	0.319	−0.076**	0.236
	(0.546)	(−0.056)	(1.608)	(−2.259)	(1.177)
Growth	0.040	0.040	0.058**	0.003	0.050*
	(1.315)	(1.286)	(1.991)	(0.614)	(1.750)
Rev	0.373*	0.496**	0.519	0.184***	0.794**
	(1.733)	(2.302)	(1.612)	(3.391)	(2.463)
Inv	0.276	0.249	−0.022	−0.162***	0.090
	(1.604)	(1.437)	(−0.099)	(−4.748)	(0.408)
Curr	0.008	0.009	0.024	−0.014***	0.022
	(1.041)	(1.195)	(1.036)	(−4.194)	(0.968)
Roa	−1.530***	−1.405***	−1.698**	0.037	−1.731**
	(−3.081)	(−2.807)	(−2.531)	(0.324)	(−2.551)
loss	−0.157*	−0.151*	−0.085	0.045***	−0.105
	(−1.940)	(−1.859)	(−0.808)	(2.610)	(−0.985)
Age	0.219***	0.214***	0.351***	−0.014	0.285***
	(7.079)	(6.876)	(5.678)	(−1.461)	(4.544)
Top1	−0.180	−0.146	−0.202	0.013	−0.198
	(−1.374)	(−1.105)	(−1.064)	(0.399)	(−1.033)
Seo	−0.023	−0.029	0.017	0.014	0.006
	(−0.486)	(−0.618)	(0.260)	(1.157)	(0.083)
Soe	−0.141***	−0.185***	−0.089	−0.136***	−0.172***
	(−3.078)	(−3.994)	(−1.565)	(−14.283)	(−2.943)
Auditop				−0.112***	
				(−4.753)	
Sqsub				0.063***	
				(18.153)	
Constant	4.503***	4.116***	3.637***	7.457***	3.773***
	(9.193)	(8.397)	(5.687)	(62.564)	(5.841)
Year	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
N	13,340	13,340	6816	6816	6816
Wald Chi^2/F value	963.51	. 1101.87	597.93	169.7	671.12
Pseudo R^2/adjusted R^2	0.060	0.068	0.073	0.521	0.084

6.3. Additional robustness tests

We also examine how using an alternate measure of institutional environment affects Hypothesis 3. Specifically, we directly use the annual marketization index (Mkt) to measure institutional environment; a higher index number indicates a better institutional environment. We rerun the regression, and the results are listed in column (1) of Table 11. We also create a third measure of institutional environment: we make the marketization index in 2011 and subsequent years directly equal to the previous year's value, and then construct a dummy variable of institutional environment (Hmkt), where if the index is larger than the sample median, Hmkt is equal to 1, and otherwise 0. We rerun the regression using this alternate measurement and the results are reported in column (2) of Table 11.

In another robustness test, we use different regression samples. To further examine the influence of voluntary CSR disclosure on independent audit demand, we limit our sample to enterprises that either voluntarily disclosed their CSR activities in every year of the nine-year sample period or did not disclose their CSR activities in any of the nine years. The regression results are listed in columns (3)–(5) of Table 11. Consistent with the results reported above, we find that enterprises that voluntarily disclose their CSR activities prefer "small" accounting firms for audits and are willing to pay higher audit fees, but a good institutional environment can effectively restrain this preference. These robustness tests further support our hypotheses.

7. Conclusions and implications

In recent years, due to crises that have exposed a lack of food safety, environmental pollution, and safety production accidents, the public has begun to demand that enterprises recognize their social responsibilities. Since China issued policies related to social responsibility, enterprises have gradually realized the importance of social responsibility for business development. Since 2008, the number of enterprises disclosing CSR reports has increased each year, as has the number of voluntary disclosures. CSR reports provide important nonfinancial information, which can play a supplementary role in audits. This study uses a sample of listed companies from the 2008 to 2016 period to examine the relationship between voluntary CSR disclosure and independent audit demand, and the effects of institutional environment on this relationship. Our conclusions can be summarized as follows. (1) The demand for high-quality auditing is weaker in enterprises that voluntarily disclose their CSR reports; that is, such enterprises are more inclined to employ small accounting firms for auditing services and to pay them higher audit fees. (2) As the regional institutional environment improves, the preference for small accounting firms is effectively restrained. (3) The relationship between voluntary CSR disclosure and independent audit demand is influenced by the disclosure motivations. Specifically, political motivation and managers' self-interest motivation strengthen the preference for "small" firms, but legitimate motivations and economic motivations have no significant impact on the focal relationship. (4) The business performance and information disclosure quality of enterprises also have an impact on the focal relationship. Specifically, the preference for "small" accounting firms is stronger in enterprises with poor performance or low quality of information disclosure. (5) Among enterprises that voluntarily disclose their CSR reports, lower levels of disclosure are associated with stronger preferences for "small" accounting firms. The main conclusions of this study are unchanged by a series of robustness tests.

China currently has a transition economy, and a system for supervising CSR is currently being constructed by the relevant government departments. Therefore, this study's findings make important contributions to the understanding of the economic consequences of voluntary CSR disclosure, its influence on independent audit demand, and how institutional environment affects micro-enterprise decision-making. The study also provides empirical evidence that will help government regulatory authorities to formulate targeted normative policies related to CSR. One aspect of supervision that government regulators should strengthen is the supervision of the performance and disclosure of CSR. In particular, they should severely crack down on pseudo-social responsibility behaviors, improve the information quality of voluntary CSR disclosure, and promote CSR that truly serves stakeholders. In addition, as a good institutional environment can play a positive role in helping enterprises to make audit selection decisions, government departments should actively and steadily improve the external institutional environment and focus on fostering and enhancing an environment that promotes high-quality audits. This study also helps managers to realize the importance of the economic consequences

of social responsibility activities. To fully exploiting the usefulness of CSR information, they need to strengthen the motivation and content of CSR reports and promote the overall improvement of CSR disclosure quality.

Acknowledgments

We are indebted to the editor and anonymous reviewers for their excellent suggestions and positive feedback throughout the review process. We also appreciate the detailed and constructive comments of Xingqiang Du (our discussant) and participants at the 10th anniversary and 2018 annual symposium of China Journal of Accounting Research (CJAR).We thank the National Natural Science Foundation of China (71902038) and the Institute of Capital Market and Audit Governance Studies for the Great Bay Area (Guangdong, Hong-Kong, Macau) of GDUFE of China (2019yb03). We also appreciate the valuable writing guidance on our English version from the English editors. All errors are ours.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cjar.2019.10.002.

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China Journal of Accounting Research 12 (2019) 379–394

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Short-sale refinancing and price adjustment speed to bad news: Evidence from a quasi-natural experiment in China

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ARTICLE INFO

Article history:
Received 15 October 2018
Accepted 7 November 2019
Available online 5 December 2019

ABSTRACT

Short selling may accelerate stock price adjustment to negative news. However, the literature provides mixed evidence for this prediction. Using short-sale refinancing and a staggered difference-in-differences (DID) model, this paper explores the effect of short selling on stock price adjustment. Our results show that (1) short-sale refinancing improves the speed of stock price adjustment to negative news. This result holds after we control for endogeneity. (2) The positive relationship between short-sale refinancing and stock price adjustment speed is significant in subsamples of stocks with higher earnings management or lower accuracy of analyst forecasts, indicating that firms with more opaque information are more likely to be targeted by short sellers. In subsamples of stocks with a higher ownership concentration or lower ownership by institutional investors, short selling is more likely to increase the speed of stock price adjustment, indicating that ownership structure may influence negative news mining. (3) As short-sale refinancing exacerbates the absorption of bad news by stock prices, it increases crash risk. This study enriches the research on the economic consequences of short selling and provides empirical evidence supporting regulations on short selling in China.

1. Introduction

Capital markets use efficient pricing of assets to achieve an optimal allocation of resources. In an effective capital market, the stock price guides the flow of resources to the most promising projects, and managers use

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https://doi.org/10.1016/j.cjar.2019.11.001
1755-3091/

the stock price to make decisions (Durnev et al., 2004). However, these rules rely on efficient asset pricing. As an important financial innovation product, short selling may improve price discovery in a capital market by facilitating the absorption of negative news into stock prices (Miller, 1977). Short selling has existed in countries with developed capital markets for a long time. The Chinese capital market has a rather short history. Its regulations and rationality of its investors need improvement, and its conditions for short selling are immature. However, after more than 20 years of development, the Chinese capital market has developed considerably. On March 31, 2010, China officially piloted a short-sale trading mechanism, hoping that it would help stock prices better integrate investor information and better reflect intrinsic value.

Previous studies have examined the effect of short selling on the efficiency of stock pricing. Most studies using global data indicate that short selling promotes stock price absorption of negative information and improves market efficiency (Diamond and Verrecchia, 1987; Hong and Stein, 2003; Bris et al., 2007; Boehmer and Wu, 2013). Bris et al. (2007) suggest that removing short-sale restrictions makes stock prices more sensitive to negative news. Although Bris et al. (2007) control for country-specific characteristics using cross-listing and event studies, the selection of cross-listing and policy implementation is not random. The approach in Bris et al. (2007) does not completely resolve the endogeneity problem by only comparing before and after a shock. It is noteworthy that the conclusion in Bris et al. (2007) is based on evidence from a specific country and therefore may not be applicable to other countries with different institutional environments.

China has the largest emerging capital market. Previous studies on whether short selling affects pricing efficiency have shown mixed results. Chang et al. (2014), Xiao and Kong (2014), and Li et al. (2015) find that short selling can improve market efficiency. Xu and Chen (2012) provide evidence that short selling does not improve the speed of price adjustment to negative news using one-year data. However, Tang et al. (2016) extend the sample from 2007 to 2012 and suggest that short selling does indeed improve the speed of stock price adjustment to negative news by investigating the relationship between margin trading and short selling.

We propose that opposite conclusions with the same institutional background may be related to the measures of efficiency and samples used. First, previous studies are mainly based on the information content and volatility or liquidity of stock prices (Chang et al., 2014; Xiao and Kong, 2014; Li et al., 2015). However, short selling in China is different from that in other countries (Gao and Lin, 2018). The China Securities Regulatory Commission permits both short selling and margin trading of only 950 pilot firms. Short selling delivers negative information, whereas margin trading delivers positive information. Therefore, the effect of short selling may be compounded by that of margin trading. Second, regulators often take liquidity, volatility, turnover and other indicators as criteria[1] for choosing pilot firms for short selling and margin trading. As a result, pilot firms may be different from control firms (Su and Ni, 2018). Third, due to the lack of shortable securities, short selling in China is rare. Therefore, it is reasonable to draw the conclusion that short selling does not facilitate more efficient price discovery in this specific capital market.

In February 2013, a pilot program called refinancing was officially launched in China. In the refinancing project, China Securities Finance Corporation Limited (CSFC) borrows stocks from listed companies' shareholders and other lenders and makes them available to securities companies, which make them available to investors for short selling. The introduction of this trading mechanism has facilitated short selling by expanding the number of stocks that securities companies can lend to their clients. Fig. 1 shows the time trend of short-sale refinancing volume as well as short selling from 2010 to 2019. As can be seen in Fig. 1, after short-sale refinancing was officially allowed in 2013, the volume of short selling increased exponentially. This

[1] The standard for a short selling target is defined in the "detailed rules for implementation," sorted from large to small according to weighted evaluation value, and comprehensively considers the conditions of the individual stock and market including the following factors. (1) The stock has been on the exchange for over 3 months. (2) The firm has no less than 100 million shares or no less than 500 million yuan of market value for stocks purchased through margin trading, and no less than 200 million shares or no less than 800 million yuan of market value for stocks sold through short selling. (3) The number of shareholders shall not be less than 4,000. (4) None of the following situations have occurred in the past three months: (i) the average daily turnover was less than 15% of the average daily turnover of the benchmark index, and the average daily turnover amount was less than RMB50 million; (ii) the deviation value between the average daily change and the average daily change of the benchmark index was more than 4%; or (iii) the fluctuation range was more than 5 times that of the benchmark index. (5) Stock issuing companies have completed the reform of non-tradable shares. (6) Stock transactions are not subject to special treatment by the exchange. (7) Other conditions as prescribed in the "detailed rules for implementation."

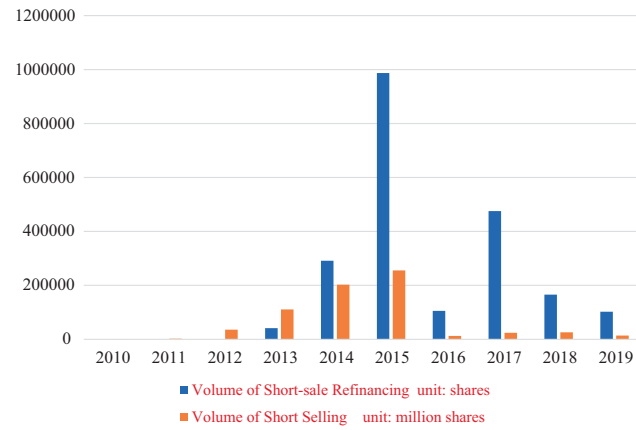

Fig. 1. Time trend of short-sale refinancing and short selling volume.

indicates that the launch of the short-sale refinancing program indeed boosted the growth of short selling. During the early period after the launch of the program, securities companies only selected some shortable securities as pilot securities, so the pilot shortable securities and other shortable securities are the treatment group and control group, respectively. As a result, the differences between the treatment and control groups in liquidity, volatility and turnover are small. Accordingly, this allows us to examine the real economic consequences of short selling. Additionally, after refinancing transactions started on August 27, 2012, margin trading has been allowed for both the control and treatment groups. However, only the treatment group is available for short-sale refinancing from February 28, 2013. Therefore, our sample, to a certain extent, may remove the confounding effect of margin trading.

Using a staggered difference-in-differences (DID) model and short-sale refinancing in China, this paper explores whether short selling affects the speed of stock price adjustment to negative information. The results show that short-sale refinancing improves price adjustment to negative news. The result holds after controlling for endogeneity, indicating that short selling improves the speed of price adjustment to negative information. We also find that the positive relationship between short-sale refinancing and the speed of price adjustment to negative information is significant in a subsample of stocks with higher earnings management or lower accuracy of analyst forecasts, indicating that firms with more opaque information are more likely to be followed by short sellers. In firms with higher ownership concentrations or lower percentages of institutional investors, short selling is more likely to increase the speed of price adjustment to negative information, indicating that ownership structure may influence negative news mining of short selling. In the end, we find that as short-sale refinancing exacerbates the absorption of bad news into stock prices, stock price crash risk increases. Investor structure may explain this result. Short selling in China has only been permitted and practiced recently; in addition, most investors are individuals and institutional investors, which exhibit herd behavior (Xu et al., 2013). These factors may cause excessive short selling due to overconfidence in private information or due to an excessively pessimistic mood. Such short selling behavior can cause negative emotions in the market to increase (Scheinkman and Xiong, 2003), trigger share prices falling and increase stock price crash risk.

Our paper contributes to the literature in several ways. First, using an exogenous event, we find that short selling in the Chinese capital market improves the speed of price adjustment to negative news. Although Bris et al. (2007) use national level data and suggest that relaxing the restriction on short selling makes the pilot firms' stock prices more sensitive to negative news; however, results based on data from one country may not be applicable to countries with different institutional environments. In addition, prior research on this topic in the Chinese context has not reached a consistent conclusion (Chang et al., 2014; Xu and Chen, 2012; Tang et al., 2016).

Second, we discover the influence of the information environment and ownership structure on the economic consequences of short selling, which enriches the literature on short sellers' bad news mining based on the characteristics of listed companies.

Third, we find that short selling in China increases stock price crash risk. Whereas this conclusion is consistent with Callen and Fang's (2015) study on US-listed companies, it is inconsistent with another study using a Chinese sample (Chu and Fang, 2016). Using short selling volume in China, Chu and Fang (2016) find that although margin trading increases stock price crash risk, short selling reduces stock price crash risk to some extent. We propose that short sellers choose companies with more accumulated negative news to short sell, so the findings based on short selling volumes may have endogeneity issues. This paper solves this problem by using whether a firm is subject to short-sale refinancing to study the effect of short selling on stock price crash risk.

Fourth, our conclusions have implications for regulators. Short selling in China helps accelerate price adjustment to negative news, but it can also increase stock price crash risk due to share price stimulation. China's policymakers should be careful in regulating short selling activities, make rigid market operational rules, make full and effective use of short selling's advantages and avoid excessive volatility caused by short selling.

The remainder of this paper is organized as follows. In Section 2, we review the literature and give research hypotheses. Section 3 reports the data sources, model interpretation, variable analysis and summary statistics of the sample. Section 4 reports and discusses the empirical results and handling of the endogeneity problem. In Section 5, we further analyze the effect of information transparency and ownership structure on the short selling effect and explore the economic consequences of short-sale refinancing on crash risk. Section 6 presents the conclusion.

2. Institutional background, literature review and hypotheses

Margin trading and short selling refer to brokers lending money to investors to buy securities or lending securities to investors to sell in anticipation of a price drop, respectively; the borrowers must deposit collateral. On March 31, 2010, a pilot program to allow margin trading and short selling was officially launched in China, allowing investors to borrow funds and securities from brokers for margin trading and short selling and ending the "unilateral market" in which short selling had been prohibited for more than 20 years. The short selling mechanism has become an important reform of the Chinese stock market; it has attracted extensive attention and brought new opportunities for investors' trading methods. The development of short selling in China is different from that in a mature capital market. The pilot has been expanded, step by step, from 90 firms available for short selling at the beginning to 950 firms on December 12, 2016. Although short selling may bring significant stock price discovery and market efficiency, its scale was restricted in the early stages due to insufficient security sources, limited capital and a high entry threshold. In addition, due to high transaction costs, transaction time and place constraints and other short selling constraints, margin trading has the dominant market role. Basically, the uneven scale of the two types of trading means that they have an asymmetric effect on market efficiency, so there is still room for development of the short selling mechanism.

To improve the margin trading and short selling mechanisms and broaden the sources of funds and securities available for margin trading and short selling, CSFC implemented a refinancing mechanism on August 27, 2012, allowing securities trading through refinancing. On February 28, 2013, CSFC officially implemented short-sale refinancing. Short-sale refinancing means that a securities finance company lends its securities to another securities company for that company's securities lending business. Fig. 2 shows the time trend of the number of pilot securities and the transaction volume of short-sale refinancing. As of December 12, 2016, when the number of pilot securities expanded to 950, equal to the number available for margin trading, the volume of short-sale refinancing achieved rapid growth. The large increase in short-sale refinancing after 2014 was due to the state council publishing "Opinions of the State Council on Further Promoting the Sound Development of Capital Markets" in May 2014. Securities lending and short selling have achieved leapfrog development through the perfecting of the capital market system and optimized short selling mechanism. Short-sale refinancing is conducive to improving securities market efficiency, meeting investor requirements for diversified investments and risk management, establishing and strengthening the investment concept of the securities market and improving securities companies' ability to manage income, innovation and risk. The gradual expansion of the number of pilot firms not only shortens the gap between the treatment and control groups in this study but also avoids the possibility of margin trading affecting the results and thus provides an ideal natural experiment to explore the economic consequences of short selling.

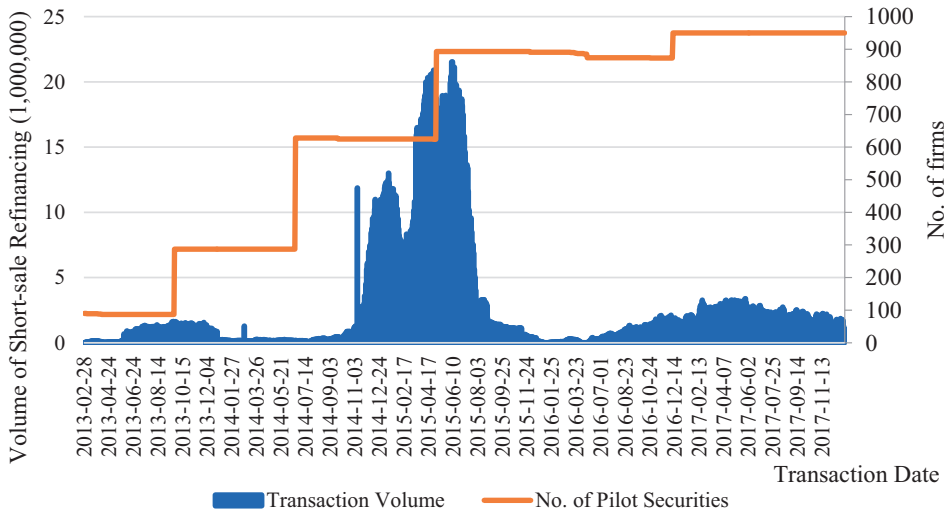

Fig. 2. Time trend for short-sale refinancing transaction volume and number of firms.

The short-sale refinancing program has important practical significance. First, the pilot program increased short selling by Chinese investors and provided them with more profit opportunities, which is conducive to investors implementing diversified investment strategies through refinancing to disperse risk. Second, the pilot program changed investment behavior and reduced risk in the Chinese securities market. When short selling is restricted due to capital market immaturity and various system shortcomings, insider trading and stock manipulation lead to continuous stock price increases. When that happens, a large number of investors often follow the trend to seek excess profits. However, the introduction of short-sale refinancing has focused short sellers' attention on overvalued stocks and optimized investment behavior in the market. Finally, the refinancing pilot has promoted the return of securities to their intrinsic value and reduced the price bubble in the market. Stocks with high share prices are more likely to attract short sellers for securities lending. Short sellers deliver relevant information to the stock market by shorting securities, thus inhibiting the price bubble and causing stock prices to return to their fundamental value, which has also been explained by prior research (Su and Ni, 2018). In practice, "black swan" events, such as Shuanghui clenbuterol and Yili melamine, have a significant effect on stock price. Black swan events may increase short-sale refinancing, which will enhance the price discovery function of the stock market. Fig. 3 shows the trend of short-sale refinancing trading in Hebei Iron and Steel from 2014 to 2017. After 2014, there was excess capacity and negative growth at Hebei. A large number of employees were laid off, and bribery occurred in 2017. This black swan event had a significant negative effect on Hebei, leading to a sharp increase in its short selling trading volume in 2015 and 2017. This example shows that a black swan event can indeed increase short selling trading volume.

Previous studies on short selling have focused on the effect of short selling on stock pricing efficiency but have not reached a consistent conclusion. Miller (1977) was the first to propose that under short selling restrictions, stock prices only reflect the attitude of optimistic investors and are overvalued because pessimistic investors cannot short sell the stock. Diamond and Verrecchia (1987) suggest that short selling restrictions reduce the efficiency of stock pricing, especially when bad news cannot be reflected timely in stock prices. However, Diamond and Verrecchia (1987) also point out that investors adjust stock price expectations in consideration of short selling restrictions, so the restrictions do not result in overvalued stock prices. This view was supported by Xu and Chen (2012) using margin trading and short selling data in China. They found that the price of target firms makes no difference to the content of negative private information or to the speed of adjustment to market downswings. The influence on pricing efficiency is still limited mainly because the mechanism is limited by factors during the pilot that led to low trading volume. After the implementation of short selling, research on short selling gradually increased. Previous studies have used empirical data to prove that short selling restrictions lead to the overvaluation of stock prices (Chang et al., 2007; Figlewski, 1981) and verified

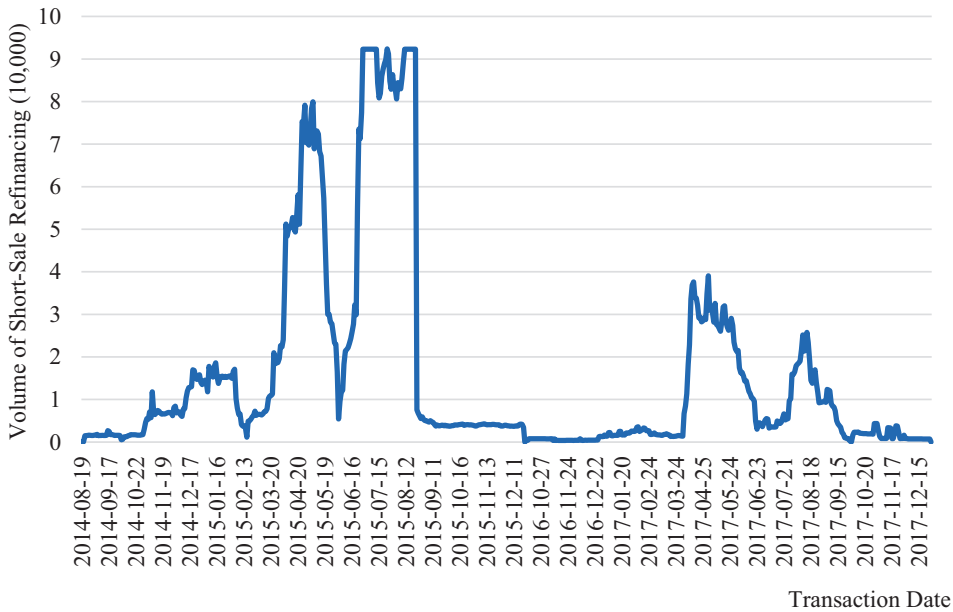

Fig. 3. Time trend of short-sale refinancing volume for Hebei iron and steel.

the hypothesis of stock price overvaluation proposed by Miller (1977). Aitken et al. (1998), using the event research method, suggest that stock prices would fall after short sales in the Australian market. Diether et al. (2009) also found that stock returns decrease after short sales. Desai et al. (2002) confirm the decline of stock prices after short sales using NASDAQ data from 1988 to 1994 and propose that the more short selling transactions, the lower the stock's return. Chang et al. (2014) find that when listed companies became pilot firms, their stock return became negative, indicating that short selling restrictions led to the overvaluation of stock. The Chinese capital market is not yet mature, and the introduction of the short selling mechanism was late, so relevant research has only recently developed. Gu and Hao (2011) find that short selling constraints lead to pricing deviation using a stochastic valuation model and panel data. Li et al. (2014) find that compared with stocks available to short, stocks restricted from short sales showed higher yields after the shock. Li et al. (2015) propose that margin trading could improve pricing efficiency by improving stock liquidity, reducing information asymmetry and increasing shareholding width. Some research proposes that short selling may reduce stock price volatility (Hong and Stein, 2003; Xiao and Kong, 2014). Chu and Fang (2016) propose that short selling improves pricing efficiency but that the possibility of reducing volatility is small while the underlying stock has little risk of crashing. Su and Ni (2018) study the relationship between short selling constraints and stock price changes from the perspective of short-sale refinancing and find that a reduction in short selling constraints can not only reduce market asymmetry and volatility but also reduce market stability and aggravate market slump.

Some papers distinguish positive news from negative news by focusing on short selling and stock pricing efficiency and study the adjustment speed of stock price to different kinds of news. Diamond and Verrecchia (1987) theoretically propose that short-selling constraints prevent negative news from being reflected in the stock price in a timely manner, thus reducing the rate of information absorption by the stock price. Bris et al. (2007) use global data to compute cross-autocorrelations between lagged one-week market returns and individual stock returns and confirm that relaxing short-selling constraints is conducive to improving the speed of adjustment to bad news. However, conclusions drawn at a national level may not apply in a different institutional environment. Saffi and Sigurdsson (2011) use the correlation coefficient of market returns on lagged stock returns, the delay of stock price reaction to market information, and the distribution of stock returns as measures of stock pricing efficiency. They show that short selling can accelerate the

speed of stock price adjustment to information, but they do not distinguish between good and bad news, which would affect short selling differently. However, Xu and Chen (2012) use one-year data to put forward that short sales do not improve the speed of stock price adjustment to negative news, which can be explained by the short sample period. Additionally, in 2011, when short selling was in its initial period, it could not play its significant role in such a short period. The positive relationship between short selling and speed of stock price adjustment to negative news could not be obtained due to the restrictions on underlying stock type and quantity, transaction costs and barriers to entry. Tang et al. (2016) use an enlarged sample range, 2007–2012, and find that short selling can indeed improve the speed of stock price adjustment to negative news. Despite using a PSM + DID method for a robustness test, the particularities of securities and the influence of margin trading could not be removed, so endogeneity problems remain. Therefore, it is necessary to consider endogeneity and explore the effect of short selling on the speed of stock price adjustment to negative news.

Short selling can affect the speed at which stock prices adjust to negative news. In short selling trading, investors who hold negative news expect a stock price to fall in the future, so they pay a margin to a broker to borrow the stock and sell it. When the stock price falls, the investor buys the stock and repays it to the broker they borrowed it from, earning money from the stock price falling. Short selling restrictions result in pessimistic investors who cannot short sell leaving the stock market (Miller, 1977); therefore, negative news is not reflected timely in stock prices. Fama (1965) proposed that in an efficient market, stock prices reflect historical and current information about a company's value, good or bad, and stock prices adjust according to market information timely and comprehensively. When short selling is restricted, short sellers cannot react to negative information through trading, resulting in asymmetric price adjustments to positive and negative information and delayed price adjustments to negative news. The ban on short selling also reduces the efficiency of information transmission and expression in the market (Diamond and Verrecchia, 1987), leading to a decrease in the propagation speed of bad news, whereas the introduction of short selling accelerates the speed of adjustment to negative information through trading. Thus, allowing short selling accelerates investors' search for negative news and the rate at which stock prices absorb it.

Based on that, we propose the following hypothesis:

Short selling accelerates the speed of stock price adjustment to negative news.

3. Research design

3.1. Sample construction and data sources

We choose the pilot firms for short selling from 2010 to 2017 as the sample. The research data mainly come from the CSMAR database. Table 1 provides the annual adjustments in margin and short selling pilot firms and the expansion and adjustments for short-sale refinancing. On December 5, 2011; January 31, 2013; September 16, 2013; September 22, 2014; and December 12, 2016, the firms available for margin and short selling securities were expanded, ultimately reaching 950. On February 28, 2013; September 16, 2013; June 20, 2014; April 30, 2015; and December 12, 2016, the number of short-sale refinancing pilot firms increased, starting at 287 and ending at 950.

Table 1
Timetable of adjustments to short selling and short-sale refinancing firms.

Year	Short selling in	Short selling out	Total short selling	Refinancing in	Refinancing out	Total refinancing
2010	96	6	90	0	0	0
2011	190	2	278	0	0	0
2012	0	0	278	0	0	0
2013	482	60	700	299	12	287
2014	218	19	899	356	18	625
2015	0	8	891	269	3	891
2016	77	18	950	77	18	950

3.2. Model and variables

We use the method in Bris et al. (2007) to measure the speed of stock price adjustment to negative news:

$$\rho diff_i = \rho 0_i - \rho 1_i, \tag{1}$$

in which $\rho 0_i$ and $\rho 1_i$ are the cross-autocorrelations between market weekly returns lagged one week and individual stock weekly returns, respectively, when the market return falls or rises, reflecting different price delays when the market moves in different directions, namely the speed of stock price adjustment to negative news. Bris et al. (2007) point out that downside cross-autocorrelation ($\rho 0_i$) is high when there is a short-selling restriction, as stock prices cannot quickly respond to the market's downward fluctuation. In contrast, upside cross-autocorrelation ($\rho 1_i$) is low if stock prices can adjust quickly to good news when the market fluctuates upward. When short selling is allowed and market friction is removed, the asymmetric restriction between margin trading and short selling disappears, resulting in a significant drop in $\rho diff_i$. Thus, the difference in cross-autocorrelation $\rho diff_i$ can be used to measure the speed of stock price adjustment to positive and negative news.

From the short selling firms used as the sample, the short-sale refinancing firms are the treatment group and the rest are the control group. After a treatment firm can be traded through short-sale refinancing, *Shock* is 1; otherwise *Shock* is 0. We exclude the following from the sample: (1) financial companies; (2) companies with negative equity; (3) companies with annual stock trading days under six months; and (4) companies with missing variables.

Xu and Chen (2012) suggest that the P/E ratio is related to stock pricing efficiency from the perspective of a pricing bubble. With reference to Tang et al. (2016), company size (natural logarithm of total assets at the end of the year) and market-to-book value are significantly correlated with the speed of stock price adjustment to news and are selected as control variables. Hou and Moskowitz (2005) decompose the factors related to price delay into traditional liquidity indicators (trading days, etc.) and investor recognition or attention (number of shareholders, etc.) and believe that investor attention may explain stock price delays better than traditional liquidity indicators. In addition, we refer to Hou and Moskowitz (2005) to select our control variables, such as the number of employees, market beta coefficient, financial leverage and other variables related to the speed of stock price adjustment to news. Li and Zhang (2015) believe that earnings forecasts issued by firms not subject to the short selling restriction were more ambiguous and that the market reaction to their profit forecasts was greater, so the quality of information disclosure may affect the speed of stock price adjustment to news. On that basis, we refer to Li and Xiao (2015) and, based on a listed company's earnings forecast, divide its content into four types of information to use as good news: continuing profitability, profitability in advance, slight profitability and return to profitability. We count the number of good news items disclosed in quarterly earnings forecasts each year and name this variable *News*, which we use to control management earnings forecast information for the effects of price discovery. In addition, we use earnings management to control for information transparency and shareholding ratio of the largest shareholder and proportion of independent directors to control for the influence of ownership structure and governance level.

To measure the influence of short selling on the speed of stock price adjustment to news, we use firm fixed and year fixed effects models to control for company and time variants in the DID analysis (Bertrand and Mullainathan, 2003). Armstrong et al. (2012) use this model when studying corporate governance and information environments. Specific to the field of short selling, Jin et al. (2015) also use this method in their research on short selling and investment efficiency.

The basic model is as follows:

$$\rho \mathrm{diff}_{i,t} = \alpha_i + \alpha_t + \alpha_1 Shock_{i,t} + Control_{i,t} + \varepsilon_{i,t} \tag{2}$$

in which $\rho diff_{i,t}$ is the price adjustment speed for stock i in period t, α_i is the firm fixed effect, α_t is the year fixed effect. The short-sale refinancing variable (*Shock*) measures whether a stock is allowed to be traded in short-sale refinancing. When a stock is allowed to be traded in short-sale refinancing, *Shock* is 1; before a security is allowed to be traded in short-sale refinancing and for all other control firms, *Shock* is 0. α_1 measures the speed of stock price adjustment to negative news. When the coefficient of α_1 is significantly negative, it indicates that short selling accelerates the speed of stock price adjustment to negative news. Otherwise, the opposite is true.

Table 2
Variable definitions.

Variable type	Variable definition	
Dependent variables	*ρdiff*	*ρ0*-*ρ1*, the difference between the speed of stock price adjustment to good or bad news
	ρ0	The downside cross-autocorrelation between market weekly returns lagged one week and individual stock weekly returns, representing the speed of stock price adjustment to good news
	ρ1	The upside cross-autocorrelation between market weekly returns lagged one week and individual stock weekly returns, representing the speed of stock price adjustment to bad news
Independent variable	*Shock*	For treatment group firms that are allowed to be traded in short-sale refinancing, *Shock* is 1, otherwise 0.
Control variables	*Size*	Company size, natural logarithm of total assets at the end of the year
	Leverage	Financial leverage, the ratio of total liabilities to total assets
	Sholders	The natural logarithm of the number of shareholders of a company
	Employees	The natural logarithm of the number of employees of a company
	MB	Market-to-book value
	Trading days	The natural logarithm of the number of trading days of an individual stock
	BETA	Market beta coefficient, regression coefficient between stock current return and market current return
	PE	P/E ratio divided by 100
	News	Earnings forecast news, a measure of the amount of good news a company discloses during the year
	EarningMgt	The absolute level of earnings management, measuring the transparency of corporate information[1]
	First	The largest shareholder shareholding ratio
	Independence	Ratio of independent directors

[1] Refer to the measure of earnings management mentioned in Kothari et al. (2005).

Table 2 provides the variable definitions. Finally, to avoid the possible influence of outliers, the continuous variables are winsorized at 1%.

3.3. Descriptive statistics

Table 3 reports the descriptive statistics of the variables. It shows that the mean value of *Shock* is 0.735, indicating that 73.5% of all firms in the sample are allowed to be traded in short-sale refinancing. The quartile of *ρdiff* is –0.063, its maximum value is 0.590, and its mean value is 0.255, indicating the price delay in market adjustment to good news. The results are consistent with those of Xu and Chen (2012).

The mean value of *Size* is 23.273, and its standard deviation is 1.327. The mean value of financial leverage is 0.488, which is consistent with the data in relevant literature (Chen and Ma, 2017). The quartile coefficient of market beta is 0.753, the third quartile is 1.339, and the mean value is 1.040, which is consistent with Hou and

Table 3
Descriptive statistics.

Variables	Mean	Standard deviation	25th	Median	75th
pdiff	0.255	0.561	−0.063	0.257	0.590
Shock	0.735	0.442	0.000	1.000	1.000
Size	23.273	1.327	22.289	23.118	24.063
Leverage	0.488	0.200	0.338	0.495	0.645
Sholders	11.090	0.891	10.474	11.026	11.644
Employees	8.534	1.370	7.610	8.510	9.384
MB	3.291	2.552	1.590	2.531	4.143
Trading days	5.439	0.126	5.460	5.485	5.497
BETA	1.040	0.421	0.753	1.067	1.339
PE	72.160	161.147	0.153	0.288	0.610
News	1.244	1.625	0.000	0.000	3.000
EarningMgt	0.060	0.063	0.019	0.041	0.076
First	0.371	0.163	0.239	0.357	0.499
Independence	0.377	0.058	0.333	0.364	0.429

Moskowitz (2005). The mean value and standard deviation of earnings management level are 0.060 and 0.063, respectively, and are consistent with those reported by Xin et al. (2014).

4. Empirical analysis

4.1. Short-sale refinancing and the speed of price adjustment to news

Table 4 reports the regression results of DID analysis on the sample. Column (1) reports the influence of short-sale refinancing on *Short* (the proportion of short selling, securities that are sold divided by the number of trading shares), the coefficient of *Shock* is positive and significant at the 1% level and shows that short-sale refinancing is significantly and positively related to short selling. This result indicates that short-sale refinancing promotes short selling.

Column (2) reports the effect of short-sale refinancing on price adjustment speed. The result shows that the coefficient of *Shock* is negative and significant at the 5% level, indicating that short-sale refinancing accelerates the speed of price adjustment to negative news. Hypothesis 1 is proven. From the perspective of the control variables, the larger the company, the smaller the financial leverage, the larger the market-to-book ratio, and the more trading days, the slower the speed of price adjustment to negative news.

The in and out of firms in the short-sale refinancing program during the sample period may affect the regression results. To ensure robustness of the results, a robustness test is carried out and the results are reported in columns (3) and (4) of Table 4. In column (3), the portion of the treatment group that have changed status within 6 months are moved to the control group. In column (4), the portion of the treatment group

Table 4
Analysis of short-sale refinancing and speed of price adjustment to news.

Variables	(1) *Short*	(2) *ρdiff*	(3) *ρdiff*	(4) *ρdiff*
Shock	0.007***	−0.073**	−0.156***	−0.228***
	(19.77)	(−2.12)	(−4.13)	(−4.79)
Size		0.102**	0.110**	0.094**
		(2.32)	(2.49)	(2.00)
Leverage		−0.330**	−0.343**	−0.296**
		(−2.37)	(−2.47)	(−2.01)
Sholders		−0.098***	−0.094***	−0.067**
		(−3.59)	(−3.42)	(−2.27)
Employees		−0.005	−0.005	−0.011
		(−0.16)	(−0.17)	(−0.35)
MB		0.032***	0.033***	0.034***
		(4.31)	(4.40)	(4.40)
Trading days		0.212***	0.207***	0.242***
		(2.68)	(2.63)	(2.96)
BETA		0.077***	0.091***	0.081***
		(2.81)	(3.30)	(2.66)
PE		0.005	0.005	0.005
		(0.67)	(0.68)	(0.72)
News		−0.019***	−0.021***	−0.023***
		(−2.64)	(−2.83)	(−2.93)
EarningMgt		−0.102	−0.100	−0.096
		(−0.60)	(−0.59)	(−0.55)
First		−0.276	−0.280	−0.370
		(−1.27)	(−1.29)	(−1.61)
Independence		−0.06	−0.043	0.023
		(−0.22)	(−0.15)	(0.08)
Firm	Control	Control	Control	Control
Year	Control	Control	Control	Control
R^2	0.412	0.040	0.043	0.052
Observations	4475	4475	4475	3876

that have changed status within 6 months are removed from the sample. Then, the DID analysis is repeated. The results show that after adjusting the sample, the coefficient of *Shock* is still negative and significant in each column, consistent with the previous DID analysis results and ensuring the robustness of the conclusion.

4.2. Endogenous problem processing: PSM-DID

As for the selection rules of the refinancing pilot, according to the refinancing business rules of China Securities Finance Co., Ltd. (trial) published as early as August 2012, CSFC can adjust the firms included in the refinancing securities pilot program under some circumstances, such as price fluctuation, change of operations or management status, and merger or acquisition.[2] On February 28, 2013, when refinancing was officially announced, the characteristics of the 90 pilot firms were not mentioned, but the underlying stocks were of higher market value and good liquidity. On June 20, 2014, the pilot expansion announcement clearly pointed out that current market value and turnover were the main factors for selection. Therefore, to avoid the possible influence of biased securities on our conclusion, we conduct propensity score matching (PSM) between the treatment and control groups and conduct further DID analysis.

First, we select variables, such as turnover and the logarithm of the circulation market value of securities, that would affect stocks in the short-sale refinancing pilot and other stocks in the industry at the same time. We run a probit model during each sample year to test whether a firm is in the treatment or control group. Then, the treatment and control groups are matched using calipers of 0.05 and 0.01 according to the propensity score neighbor matching method with replacement. Finally, the matched samples are analyzed to test the balance panel data hypothesis and the common supporting hypothesis. Panel A of Table 5 shows the difference between the control and experimental groups after PSM. After matching with calipers of 0.01 and 0.05, the mean difference of the paired variables between the control and experimental groups is not significant, indicating that PSM corrected the distribution deviation of the two groups' sample values, and the values of the paired variable of the two groups were close to the same.

Columns (1) and (2) of Panel B in Table 5 report the regression results of the DID analysis on the matched sample. Column (1) reports a 1:1 match with a matched caliper of 0.05, and column (2) reports a 1:1 match with a matched caliper of 0.01. The coefficient of *Shock* is still negative and significant in columns (1) and (2), which is consistent with the regression results with the full sample. In conclusion, the results of PSM-DID analysis show that short selling can improve the speed of price adjustment to negative information. By accelerating the price sensitivity to bad news in the market, negative news can be timely reflected in stock prices, which is conducive to improving the pricing efficiency of the capital market. Therefore, the hypothesis is valid.

4.3. Parallel trend test

That the treatment and control groups have a parallel trend before short selling is an important prerequisite for using the DID model. Only when there is no significant difference between the treatment and control groups before the experiment can the treatment effect of short selling with the DID model be true. To ensure the robustness of the DID regression results, we refer to the studies of Chen and Ma (2017), Ni and Zhu (2017), the following regression model for a parallel trend test:

$$\rho diff_{i,t} = a + bPOST(-2) + cPOST(-1) + dPOST(0,1) + ePOST(2,3) + control_{i,t} + \varepsilon_{i,t} \quad (3)$$

The dummy variables are set according to the periods in which short-sale refinancing is allowed. Two years before short-sale refinancing is allowed for a security, *POST(-2)* is 1; otherwise, it is 0. The year before

[2] Article 18 of the refinancing business rules of China Securities Finance Co., Ltd. (trial) states, "The company shall, according to the relevant management rules and market conditions of the underlying securities, reasonably determine the list of the underlying securities and publish it before the opening of each trading day." Article 19 states, "The company may adjust the list of underlying securities in the following circumstances: (1) abnormal fluctuation of price of the underlying securities happens; (2) there are major changes in the operation and management of the listed company corresponding to the underlying securities; (3) merger, acquisition or material assets reorganization of the listed company corresponding to the underlying securities happens; (4) the underlying securities of margin lending and short selling are temporarily adjusted by the stock exchange; (v) other circumstances that the company needs to be adjusted necessarily."

Table 5
Analysis of PSM-DID and parallel trend test.

Panel A: T-test of matched variables

Caliper	Paired variable	Control group number	Mean	Treatment group number	Mean	Difference of mean
0.01	Circulation Market Value	63	16.347	63	16.342	0.005
	Turnover		18.187		19.212	−1.026
0.05	Circulation Market Value	71	16.443	71	16.394	0.049
	Turnover		16.737		19.148	−2.411

Panel B:Analysis of PSM+DID and parallel trend test

Variable	(1) Caliper is 0.05 *ρdiff*	(2) Caliper is 0.01 *ρdiff*	(3) Parallel Trend Test *ρdiff*
Post(-2)			0.034
			(1.28)
Post(-1)			−0.024
			(−0.56)
Post(0,1)			−0.091**
			(−2.35)
Post(2,3)			−0.086**
			(−2.28)
Shock	−0.207**	−0.193*	
	(−2.11)	(−1.81)	
Control Variables	Control	Control	Control
Year	Control	Control	Control
Firm	Control	Control	Control
R^2	0.098	0.082	0.041
Observations	431	380	4475

refinancing is allowed, *POST(-1)* is 1, otherwise 0. The year a stock becomes eligible for refinancing and the year after, *POST(0,1)* takes 1, otherwise 0. *POST(2,3)* is 1 when a pilot security is within two to three years after refinancing is allowed, otherwise 0. The coefficients of *b*, *c*, *d* and *e* in the model are the main regression coefficients. The regression results of the parallel trend test are listed in column (3) of Panel B in Table 5. The results show that the coefficients *b* and *c* are not significant, indicating that the parallel trend hypothesis of the DID method is valid. Compared with the control group, the price sensitivity to bad news of firms in the treatment group did not improve before they became a pilot firm for short selling. However, *d* and *e* are negative and significant, indicating that, compared with the control group, price sensitivity to bad news improved after firms in the experimental group became pilot firms for short-sale refinancing and their stock prices could absorb negative news more effectively and reduce the degree of information asymmetry.

5. Additional analysis

5.1. The influence of information transparency on the short-sale refinancing effect

We find that short selling accelerates the speed of stock price adjustment to negative news, indicating that short sellers may mine the negative news of listed companies, thus accelerating the transmission of such news. If this is true, then for firms in the sample with low information transparency, short sellers are more likely to mine negative news, leading to faster stock price adjustment to negative news. Based on this, we refer to the study of Xin et al. (2014) and measure the information transparency of enterprises using the absolute level of earnings management and accuracy of analyst earnings forecasts (Wang et al., 2015) and then explore the role of information transparency in the effect of short-sale refinancing. Higher levels of earnings management may indicate that companies want to hide negative news, leading to less transparency. Higher earnings forecasting accuracy alleviates the degree of information opacity.

Table 6 reports the main analysis results. Columns (1) and (2) report the results after dividing the sample according to the median of absolute value of earnings management. The coefficient of *Shock* is negative and

Table 6
The influence of information transparency on the short-sale refinancing effect.

Variables	(1) *ρdiff*	(2) *ρdiff*	(3) *ρdiff*	(4) *ρdiff*
	Earnings management		Accuracy of analyst earnings forecast	
	LOW	HIGH	HIGH	LOW
Shock	−0.066	−0.090*	0.002	−0.178***
	(−1.21)	(−1.65)	(0.04)	(−2.83)
Control Variables	Control	Control	Control	Control
Year	Control	Control	Control	Control
Firm	Control	Control	Control	Control
R^2	0.038	0.053	0.079	0.076
Observations	2226	2249	1797	17,96[1]

[1] Table 6 (3) and (4) show a difference in the number of observations from the main regression sample due to the exclusion of samples with missing accuracy of analyst earnings forecast.

significant at the 10% level when earnings management is higher, indicating that the greater the earnings management, the greater the information opacity, so price discovery is faster. Columns (3) and (4) report the results after dividing the sample according to the median of analyst forecast accuracy. The coefficient of *Shock* is negative and significant at the 1% level when analyst earnings forecast accuracy is poor, which shows that the worse the analyst earnings forecast accuracy, the greater the information opacity, so price discovery is faster. In conclusion, the results in Table 6 show that the greater the information opacity, the more likely short sellers are to dig for negative news and thus accelerate the speed of price adjustment to negative news.

5.2. The influence of ownership structure on the short-sale refinancing effect

Under different ownership structures, the severity of the agency problem and hiding of negative news by managers may differ, which may affect the short-sale refinancing effect. Based on this, we explore the influence of short-sale refinancing on the speed of stock price adjustment to negative news from the perspective of ownership structure. The shareholding structure of listed companies in China is relatively concentrated, and companies are at risk of being invaded by controlling shareholders (Stulz, 2005). Major shareholders may grab resources from listed companies by hiding negative news, which will lead to short sellers digging for negative news and a stronger short selling effect. In addition, the higher the ratio of institutional shareholders, the more supervision management receives from institutional investors, and the smaller the agency problem with shareholders will be (Du and Xiu, 2009). Management may have little motivation to hide bad news, so the effect of short-sale refinancing will be smaller. Therefore, the shareholding ratio of the largest shareholder is used to measure the degree of ownership concentration and the shareholding ratio of institutional investors is used to measure the degree of supervision of firm management to explore the influence of short-sale refinancing on the speed of stock price adjustment to negative news under different ownership structures.

Table 7
The Influence of ownership structure on the short-sale refinancing effect.

Variable	(1) *ρdiff*	(2) *ρdiff*	(3) *ρdiff*	(4) *ρdiff*
	Largest shareholder		Institutional investors	
	LOW	HIGH	LOW	HIGH
Shock	−0.062	−0.082*	−0.115**	−0.039
	(−1.20)	(−1.72)	(−2.12)	(−0.73)
Control variable	Control	Control	Control	Control
Year	Control	Control	Control	Control
Firm	Control	Control	Control	Control
R^2	0.037	0.058	0.053	0.061
Observations	2236	2239	2234	2241

Table 7, columns (1) and (2) report the results after grouping by the largest shareholder ratio as a measurement of ownership concentration, and it shows that in the group with higher ownership concentration, the coefficient of *Shock* is negative and significant at the 10% level, indicating that the higher the ownership concentration, the greater the information opacity. Therefore, short-sale refinancing is likely to accelerate the speed of stock price adjustment to negative news. Columns (3) and (4) report the results of the groups divided by the median shareholding ratio of institutional investors, and show that short-sale refinancing has a more obvious effect on the speed of stock price adjustment to negative news in companies with a low shareholding ratio of institutional investors. The results show that short-sale refinancing's effect varies across ownership structures. When ownership concentration is high or the proportion of institutional investors is low, the corporate governance mechanism is poor and short-sale refinancing's effect appears to be concentrated, reducing noise trading and increasing the speed of stock price adjustment to negative news.

5.3. Economic consequences: Short-sale refinancing and crash risk

Short sellers' search for bad news accelerates the rate at which stock prices adjust to negative news, potentially leading to a higher crash risk. Therefore, we introduce crash risk to explore the economic consequences of short selling. We use Chen et al. (2001) as a reference to measure the crash risk with two indicators, namely, the negative skew of stock returns of (NCSKEW) and the difference between the volatility of rising and falling stock prices (DUVOL). Following Chen et al. (2001), Chu and Fang (2016) and Jiang et al. (2015), the control variables are *RET*, annual stock return rate; *SIGMA*, the standard deviation of a stock's weekly return; *Size*, the natural logarithm of total assets; *Leverage*, the ratio of total liabilities to total assets; *MB*, market-to-book value; *ROA*, ratio of net profit to total assets; *EarningMgt*, earnings management level and *MHOLD*, management shareholding ratio. Table 8 shows the regression results of short selling on stock price crash risk. It shows that the coefficient of *Shock* is significantly positive at the 1% and 5% levels, indicating that stock price crash risk significantly increases due to short selling transactions.

Table 8
Short-sale refinancing and crash risk.

Variable	(1) NCSKEW	(2) DUVOL
Shock	0.111***	0.064**
	(2.82)	(2.10)
RET	−12.566***	−10.102***
	(−6.52)	(−6.77)
SIGMA	−1.106	−0.572
	(−1.27)	(−0.85)
Size	−0.075*	−0.073**
	(−1.65)	(−2.08)
Leverage	0.109	0.076
	(0.63)	(0.57)
MB	0.035***	0.016*
	(3.26)	(1.92)
EarningMgt	0.177	0.018
	(0.92)	(0.12)
ROA	0.057	−0.080
	(0.15)	(−0.26)
MHOLD	3.231*	2.764*
	(1.75)	(1.94)
Year	Control	Control
Firm	Control	Control
R^2	0.073	0.083
Observations	42,70[1]	4270

[1] The decrease in sample size is caused by the absence of the stock price crash variable.

Chu and Fang (2016) use short selling volume to measure short selling and show that short selling can reduce stock price crash risk to a certain extent. However, short sellers choose companies with more concentrated bad news to trade, so there may be some sample selection bias in this conclusion. Bris et al. (2007) find that the market's negative bias rate increases after the deregulation of short selling, which indicates that stock price crash risk may increase after deregulation of short selling. Callen and Fang (2015) reach similar conclusions. We also find that the relaxation of short selling restrictions in China leads to crash risk. China allowed short selling late and as a result, investors are mainly individuals, and among institutional investors herd behavior is significant (Xu et al., 2013). Immature investors may engage in excessive short selling with overconfidence in private information or engage in short selling due to an excessively pessimistic mood, eventually leading to share prices falling and increasing crashes (Scheinkman and Xiong, 2003).

6. Conclusion

Short selling allows investors holding negative news to trade in a timely manner, thus accelerating the speed of stock price adjustment to negative news (Bris et al., 2007). However, inconsistent conclusions have been drawn regarding this effect in China. Short-sale refinancing, launched in February 2013, expanded the sources of securities available for borrowing and facilitated short selling. In the early pilot period, securities financial companies selected only some stocks as pilots. The pilot and non-pilot short selling firms are our treatment and control groups, respectively. To a certain extent, this minimizes the differences between the treatment and control groups in terms of liquidity, volatility and turnover, and provides an opportunity to investigate the economic consequences of short selling.

Based on this, we use the DID method to explore the influence of Chinese short selling on the speed of price adjustment to negative information. We find that short selling is conducive to the timely and effective reflection of negative news in stock prices. Through short selling, stock prices can quickly adjust and react to negative news in the market to accelerate the speed of price adjustment to negative information, reduce stock price delay and improve pricing efficiency. In addition, investors are more likely to conduct short selling by mining bad news in an environment with less information transparency. Short-sale refinancing has different effects under different firm ownership structures. In addition, short selling is more likely to encourage short sellers to dig for negative news, ultimately raising crash risk. The results will help short sellers play their market role and improve pricing efficiency.

Acknowledgement

Kaijuan Gao acknowledges the financial support from the National Natural Science Foundation of China (No. 71802078) and the Fundamental Funds for the Central Universities (No. 531107051035).

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China Journal of Accounting Research 12 (2019) 395–409

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China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Unconditional conservatism under the Chinese version of IFRS

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ARTICLE INFO

Article history:
Received 31 March 2019
Accepted 7 November 2019
Available online 28 November 2019

JEL Classification:
M48
M41
M42

Keywords:
Convergence with IFRS
Unconditional conservatism
China, non-financial sector

ABSTRACT

This study explores the level of unconditional conservatism (UNCC) in accounting after China's convergence with International Financial Reporting Standards (IFRS). Using the intercept of the Basu (1997) model, an overall reduction is found in UNCC under the Chinese version of IFRS. This study is the first attempt to conduct a comprehensive theoretical comparison between old and new Chinese accounting standards (CAS) in terms of UNCC. Additionally, it is the first study on the impact of convergence with IFRS, not the full adoption of IFRS, on UNCC. Finally, the study covers a relatively more extended period than most previous studies, from 1996 to 2017.

1. Introduction

Since 2001, more than 120 countries have required or allowed the use of International Financial Reporting Standards (IFRS) (Ball, 2016). In line with this international trend, China conducted four main sets of accounting reforms, in 1992, 1998, 2001, and 2006, with each replacing the preceding reform. The goals of these reforms have been to converge with IFRS (Peng et al., 2008) and attract foreign direct investments as a means of achieving high levels of economic growth (Wu et al., 2007).

The new Chinese accounting standards (CAS) have covered all aspects of IFRS, with great care taken to substantially align with IFRS. However, due to the uniqueness of China's environment, the country has

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https://doi.org/10.1016/j.cjar.2019.11.002
1755-3091/

modified its adoption of IFRS in some respects (Hou et al., 2014). Wu et al. (2014) argue that the economic consequences of convergence with IFRS should differ from those related to the full adoption of IFRS. Indeed, there are many key differences between the Chinese version of IFRS and the standard version. One important difference between them is their position concerning accounting conservatism (AC). In 2010, the International Accounting Standards Board (IASB) removed the term "prudence" (or AC) from its conceptual framework. In contrast, the Ministry of Finance (MOF), which determines the CAS, has adopted the prudence principle as a basic standard in the 2006 accounting reform, stating in article 18 that "an enterprise shall exercise prudence in recognition, measurement, and reporting of transactions or events. It shall not overstate assets or income nor understate liabilities or expenses." Moreover, IAS 16 and IAS 38 allow both the revaluation model and the cost model, whereas Accounting Standards for Business Enterprises No. 4 – Fixed Assets (ASBE 4) adopts only the cost model, which is in line with AC. More importantly, ASBE 4 prohibits the reversal of impairment losses for most long-term assets, but IAS 36 prohibits this practice only for goodwill. In effect, the prohibition on the reversal of impairment losses works against the recognition of good news, which aligns with conditional conservatism (CC).[1]

This study examines the impact of China's convergence with IFRS, not mandatory IFRS adoption, on UNCC. This study has four main motivations. First, research on IFRS and AC is still limited, and the findings remain unclear (André et al., 2015). In the Chinese context, Hou et al. (2014) confirm that there is still no direct evidence on the impact of China's convergence with IFRS on AC. Therefore, the impact of convergence with IFRS in China is relatively under-investigated (Li et al., 2018). Second, most studies concerning IFRS and AC largely focus on the impact of mandatory IFRS adoption, not convergence with IFRS. In effect, the impact of convergence with IFRS should differ from the full adoption of IFRS (Wu et al., 2014). However, convergence with IFRS has been considered by relatively few studies (Liu et al., 2016). Third, most studies on IFRS and AC focus on developed countries, and relatively few studies focus on developing countries (Liu et al., 2011). In this respect, Hou et al. (2014) state that developed markets differ from other markets in many significant ways. Fourth, UNCC is not investigated in the literature as much as CC, and UNCC is considered by relatively few studies (Qiang, 2007).

A comprehensive comparison is conducted between old and new CAS, taking account of all the new practices that may affect UNCC. The theoretical comparison suggests that the negative impact of convergence with IFRS is expected to overcome its positive impact on UNCC. As predicted, the findings show that the Chinese capital market has experienced a significant decline in UNCC following convergence with IFRS.

One very recent study that explores the association between mandatory IFRS adoption and UNCC is that of Fullana et al. (2018), which differs from this study in many ways. First, this study deals with the impact that convergence with IFRS has on UNCC, whereas Fullana, González, and Toscano deal with the economic consequences of the full adoption of IFRS on UNCC. Second this study focuses on China, a developing country, whereas Fullana, González, and Toscano focus on Spain, a developed country. Third, this study covers an extended period, from 1996 to 2017, whereas Fullana, González, and Toscano investigate only the period from 2000 to 2009. In this regard, the study addresses serious concerns about the potential effect of the global financial crisis on the results of Fullana, González, and Toscano. Their measure, the MTB ratio, maybe reduced after the adoption of IFRS as a result of a reduction in the market values of firms during the global financial crisis, and not as a result of increases in the book values of firms caused by a reduction in UNCC owing to mandatory IFRS adoption. To isolate the potential effects of the global financial crisis, this study excludes 2008 from the sample period, as 2008 is the year when the impact of the global financial crisis was the strongest in China (Hou et al., 2014). Fourth, this study analyses new practices resulting from convergence with IFRS that might increase or decrease UNCC, whereas Fullana, González, and Toscano consider only some of the key differences between old Spanish GAAP and IFRS. Fifth, to measure UNCC this study uses the intercept of the Basu (1997) model and the cumulative negative accruals measure. whereas Fullana, González, and Toscano use the MTB ratio as a proxy of UNCC. In effect, variations in the MTB ratio can be driven by many factors other than IFRS, such as growth options, financial crises, and inflation. Therefore, the MTB ratio may fail to capture UNCC (Lara and Mora, 2004).

[1] For more detail on the differences between China's new accounting standards and IFRS, please see Deloitte (2006).

This study covers several gaps in the literature. First, UNCC is seldom investigated in the accounting literature (Lara and Mora, 2004). Moreover, prior studies mainly focus on exploring the economic consequences of mandatory IFRS adoption rather than the economic consequences of convergence with IFRS. Therefore, this study enriches the literature concerning the relationship between convergence with IFRS and UNCC. Second, previous studies on this topic focus on developed countries. Therefore, investigating this issue in China provides the literature with useful sights from the perspective of a major developing country. Policymakers, accounting standards setters, the IFRS Foundation, and IFRS adopters in other countries can all greatly benefit from understanding the Chinese experience.

2. The potential impact of convergence with IFRS on UNCC

The theory of AC suggested by Watts (2003) assumes that accounting regulation can play a role in determining the level of AC. The following two sections discuss the positive and negative effects of China's convergence with IFRS on UNCC.

2.1. The positive impact of convergence with IFRS on UNCC

The new CAS is analyzed, considering 14 cases that are related to 10 new Chinese standards that may lead to an increase in UNCC. These cases concern ASBE 2—Long-Term Equity Investments, ASBE 4—Fixed Assets, ASBE 6—Intangible Assets, ASBE 9—Employee Compensation, ASBE 11—Share-Based Payments, ASBE 13_Contingencies, ASBE 16—Government Subsidies, ASBE 18—Income Taxes, ASBE 20—Business Combinations, and ASBE 27—Exploitation of Petroleum and Natural Gas.

In addition, seven new accounting practices that might increase UNCC are captured, namely increasing expenses and/or liabilities, accelerated depreciation methods, recording accruals for expenses, using the cost method, applying the pooling of interests method, using the output method to compute the depletion of mineral interests, and using balance sheet method for taxation.

The most frequent practice is the wide recognition of liabilities and/or expenses (see, ASBE 4, §8, 13; ASBE 6, §12; ASBE 9, §2, 6; ASBE 11, §4–6, 8, 10–12; ASBE 13, §4,8,10; ASBE 16, §6–8). As is well known, UNCC understates the book value of stockholders' equity (André et al., 2015). This bias can be introduced by overstating expenses and/or liabilities. However, liabilities and/or expenses can be recognized more quickly by using the accrual basis instead of the cash basis. In this respect, the new ASBE 9—Employee Compensation recognizes compensation payable as a liability according to the accrual basis, and not the cash basis (ASBE 9 §4). Accelerated depreciation methods inflate depreciation expenses in early periods (Qiang, 2007), and thus these methods increase UNCC. In this regard, the new ASBE 6—Intangible Assets opens the door to the use of accelerated depreciation methods (ASBE 6 §17). Similarly, the new ASBE 27—Exploitation of Petroleum and Natural Gas allows the use of the output method and the straight-line method, and it allows the computation of mineral interest depletion in proved properties (ASBE 27 §21). The output method probably reports larger depletion expenses than the straight-line method, which is regarded as income-increasing (Scott, 2009). Alternatively, bias resulting from UNCC practice can be introduced by understating assets and/or revenues. Concerning this issue, the new ASBE 13_Contingencies require that obligations related to a contingency must be recognized as estimated liabilities when they are likely to cause economic benefit to flow out (ASBE 13 §4,8,10). However, expected compensation must be recognized as an asset when the inflows are virtually certain, rather than likely (ASBE 13 §7). In this respect, the practice of not recognizing expected assets until the inflows are virtually certain is considered a bias that enhances UNCC. Historical cost accounting supports UNCC. Unlike fair value accounting, historical cost accounting does not allow changes to the book value of assets, even if the real value of such assets changes through time. As a result, historical cost accounting understates the net value of assets. The cost method is an example of historical cost accounting. In this respect, the new ASBE 2—Long-Term Equity Investments requires that a long-term equity investment of an investing enterprise that is able to control the invested enterprise shall be measured by using the cost method (ASBE 2 §5). The pooling of interests method also aligns with historical cost accounting, as this method, when applied during an acquisition or merger, allows the balance sheets of two enterprises to be added together, using their book values rather than their fair values, which results in no goodwill. However,

the non-recognition of goodwill understates the net value of assets, which reflects UNCC. In this regard, the new ASBE 20—Business Combinations adopts the pooling of interests method for evaluating business combinations involving entities that are controlled by the same entities (ASBE 20 §6). Unlike the tax payable method, the balance sheet method recognizes deferred income taxes in the balance sheets as either assets or liabilities. Given the phenomena of tax avoidance and the tendency of firms to pay no more than the tax payable, the majority of deferred income taxes are expected to represent deferred income tax liabilities rather than deferred income tax assets. If this is the case, then the application of the balance sheet method eliminates the non-recognition of deferred income tax liability, and thus enhances UNCC.

2.2. The negative impact of convergence with IFRS on UNCC

In analyzing the new CAS, 26 cases related to 13 new standards that may reduce UNCC are considered, namely ASBE 1—Inventories, ASBE 2—Long-Term Equity Investments, ASBE 3—Investment Real Estates, ASBE 6—Intangible Assets, ASBE 7—Exchange of Non-Monetary Assets, ASBE 10—Enterprise Annuity Fund, ASBE 12—Debt Restructuring, ASBE 14—Revenues, ASBE 16—Government Subsidies, ASBE 17—Borrowing Costs, ASBE 20—Business Combinations, ASBE 21—Leases, ASBE 22—Recognition and Measurement of Financial Instruments.

Eight newly adopted practices that might reduce UNCC are observed, namely fair value accounting, reducing amortization/depreciation, capitalization, and liabilities, increasing gains, using the accrual basis for income, and canceling the Last In First Out (LIFO) method.

The most frequent practice is fair value accounting, which is used in all 13 of the standards investigated (see ASBE 2, §9; ASBE 3, §10–11; ASBE 6, §14; ASBE 7, §3; ASBE 10, §6; ASBE 12, §5–7; ASBE 14, §5, 13; ASBE 20, §13–15; ASBE 21, §11, 32; and ASBE 22, §30). In this regard, KPMG (2014) documents that the new CAS introduces more requirements for fair value accounting at the expense of historical cost accounting. Unlike historical cost accounting, fair value accounting does not understate the net value of assets. Furthermore, it does not ignore the recognition of day one gains or losses. Thus, fair value accounting mitigates UNCC. Regarding the reporting of gains, the new CAS increase the recognition of gains in many cases (see, ASBE 2, §9; ASBE 12, §5–7; ASBE 14, §5; ASBE 16, §7; ASBE 20, §13; ASBE 21, §32). However, the initial recognition of an account as a gain is closed in earnings, instead of being recognized as a liability, or closed in capital reserves. This practice increases earnings and thus reduces UNCC. In terms of reducing amortization/depreciation, the new CAS directly reduce the amount of amortization/depreciation, either directly (see, ASBE 2, §5; ASBE 3, §11; ASBE 6, §17, 19) or indirectly (see, ASBE 6, §18). Specifically, the new ASBE 6—Intangible Assets requires that the expected residual value shall be taken into account in computing the amortization amount of intangible assets (ASBE 6 §18). This new policy reduces the amount of amortization expense, as the deduction of residual value from the cost reduces the amortization expense, and UNCC as a result. Capitalization is adopted in five cases (see, ASBE 6, §9, 17; ASBE 17, §4, 6; ASBE 21, §11, 18). This practice decreases expenses at the initial recognition, as it recognizes expenditures as assets rather than expenses. Therefore, this capitalization policy does not align with UNCC. Liabilities are negatively affected by the new ASBE 21—Leases, as this case states that if a sale and leaseback transaction that results in an operating lease is based on the fair value, then the difference between the sales proceeds and the carrying amount of the asset shall be closed in earnings (ASBE 21 §32), rather than deferred as a liability. Indeed, recognizing an item as a gain instead of treating it as a liability at initial recognition has a positive (negative) effect on both earnings and net assets (UNCC). The new ASBE 16—Government Subsidies adopts the accrual basis in recognizing government grants related to income (ASBE 16 §5), but not on a cash basis. In this matter, accrual basis accounting recognizes government grants quicker than cash basis accounting. Thus, UNCC is negatively affected. Finally, the new ASBE1—Inventories does not adopt the LIFO method (ASBE 1, §14) which overstates the cost of sales, and thus this case increases UNCC.

3. Literature review

Several studies document an adverse effect of IFRS application on CC. In the European Union context, Chen et al. (2010) consider whether changes in accounting quality can be attributed principally to IFRS

application. They find that CC is significantly reduced after the full adoption of IFRS. Piot et al. (2010) explore the effect of mandatory IFRS adoption on AC in Europe. They report a decrease in CC (but not in UNCC) in the presence of a Big 4 auditor under mandatory IFRS adoption. Ahmed et al. (2013) test the impact of mandatory adoption of IFRS on accounting quality. They observe that CC declines significantly under IFRS in countries with strong enforcement, but countries with weak enforcement experience insignificant declines of CC. André et al. (2015) find an overall reduction in CC after mandatory IFRS adoption in 16 European countries. They document that this decline is less pronounced in countries where compliance with IFRS is strictly enforced.

Some studies suggest an opposite trend. Gassen and Sellhorn (2006) document that CC is significantly higher for IFRS-compliant firms than for German firms applying domestic GAAP. Barth et al. (2008) demonstrate that CC is improved among voluntary adopters relative to non-IAS firms. They note that their results may be not attributable to the application of IAS rather than to the effects of economic environment and firms' incentives. Günther et al. (2009) capture improvements in CC among German firms that adopted IFRS on either a voluntary or a mandatory basis. In comparing the quality of accounting measures used under the United Kingdom GAAP and those used in IFRS, Iatridis (2010) find that IFRS are associated with more timely loss recognition. Dimitropoulos et al. (2013) document that in Greece, CC increased after mandatory IFRS adoption, relative to use of the local GAAP. Chan et al. (2015) find that CC is improved only among IFRS firms that have higher costs of debt, and in European countries that are less dependent on bank financing or private debt.

In China, Chen et al. (1999) find that earnings under the old Chinese GAAP are higher than those reported under IAS, suggesting that IAS are more conservative. In examining the period from 1992 to 1998, Ball et al. (2000b) detect a weak level of CC among Chinese firms, whether they report under the old Chinese GAAP or IAS (although international auditors certify those reporting under IAS). In comparing profits before and after the 1998 accounting reform, Chen et al. (2002) confirm that profits under the old Chinese GAAP are higher than those reported under IAS. Peng et al. (2008) also determine that profits under the 2001 accounting reform are higher than those under IAS. Notably, they point out that the 2001 accounting reform decreased the gap in profits. Hou et al. (2014) find that the positive impact that China's convergence with IFRS has on the use of accounting performance in determining executive compensation is significantly affected by a reduction in AC, as a result of China's convergence with IFRS. However, Liu et al. (2016) concur that Chinese firms recognized losses in a timely manner after 2007. They observe that before 2007, Chinese firms following IFRS were more conditionally conservative than those operating under the old Chinese GAAP. In addition, Liu, Skerratt, and Li note that after 2007, the CC of Chinese firms following the new Chinese GAAP was similar to the CC practiced under the IFRS prior to 2007. Bradford et al. (2017) demonstrate that the governance role that AC plays in the dividend policies of Chinese firms is reduced, because convergence with IFRS tends to reduce CC. In a more recent study, Li et al. (2018) document that the 2001 accounting reform enhances CC significantly. In contrast, the 2006 accounting reform is found to have a negative effect on CC. Notably, Li et al. document that CC has increased since 2011, following the global financial crisis (2007–2009).

Research on IFRS and UNCC is very limited with conflict findings reported by few papers (Lara and Mora, 2004). Some studies suggest a negative relationship between IAS/IFRS and UNCC. In Germany, Hung and Subramanyam (2007) explore the effects of the voluntary adoption of IAS on financial statements. They provide strong evidence that balance sheets (UNCC) under German GAAP are more conservative than IAS. In a very recent study, Fullana et al. (2018) find that the full adoption of IFRS in Spain leads to significant reductions in UNCC.

Other studies find positive associations between IAS/IFRS and UNCC. Ball et al. (2000b) use the Basu model to observe that the net income reported under IAS has lower intercepts than the net income reported under domestic Chinese GAAP, indicating that IAS income is more unconditionally conservative than Chinese-standard income. Callao et al. (2007) find that the gap between book and market values has been wider since IFRS compliance became mandatory in Spain, suggesting that UNCC has increased after the adoption of IFRS. Piot et al. (2010) find that in the European Union, UNCC(but not CC) is higher after mandatory IFRS adoption in the presence of a Big 4 auditor. Gastón et al. (2010) document that market value is significantly higher than book value following the application of IFRS in Spain and the UK, concluding that UNCC is enhanced under the adoption of IFRS.

In addition, a number of studies support the notion that accounting quality is unlikely to be determined by accounting standards alone. Ball et al. (2000b) find no evidence that Chinese accounting income is conditionally conservative, under either domestic standards or IAS, although the latter was audited by international accounting firms. They suggest that accounting standards per se do not have the main role in determining the timeliness of loss recognition. Ball et al. (2000a) detect that common-law countries are substantially more conditionally conservative than code-law countries. They propose that differences in legal and institutional environments have a dominant influence on the levels of CC across countries. Ball et al. (2003) find that the interactions between accounting standards and preparer incentives generally produce CC. They suggest that the properties of earnings are ultimately determined by the institutional factors that influence the incentives of managers and auditors. Bushman and Piotroski (2006) find that countries with high-quality judicial systems, and countries with strong public enforcement of securities laws, tend to experience high levels of CC. They document that civil law countries with greater state involvement tend to exhibit lesser CC than common law countries with low state involvement. Further, they find that companies in countries with high levels of state involvement in the economy tend to experience lower CC than companies in countries with less state involvement. Moreover, they note that firms in countries with weak investor protections and low-quality judicial systems reflect less CC in their accounting numbers than firms in countries with strong investor protections and high-quality judicial systems. Hung and Subramanyam (2007) find that German firms experience an increase in CC under both IAS and German GAAP, highlighting the significant role of institutional factors in explaining the variation in firms' CC rather than accounting standards. Lara et al. (2008) document that CC is more pronounced in common-law-based developed economies, where enforcement is high. Further, their results reveal that the use of IASB standards does reflect CC in emerging countries with weak enforcement and low investor protection. Concerning Greece, Karampinis and Hevas (2011) fail to find a substantial increase in CC after mandatory IFRS adoption. Accordingly, they recommend that simultaneous infrastructure changes are essential to provide superior financial reporting. He et al. (2012) observe several unintended effects of convergence with IFRS, concluding that incentives and institutional factors play key roles in determining the level of accounting quality. Christensen et al. (2015) capture mixed results concerning CC in Germany. First, they find that CC increased after German firms voluntarily adopted IFRS (prior to the mandatory IFRS adoption). Second, CC is decreased after the adoption of IFRS became mandatory. They conclude that incentives play a main role in determining the relation between IFRS and CC.

4. Hypotheses development

Based on the theoretical analysis of the expected impacts that convergence with IFRS has on UNCC in China, as summarized in Sections 2.1 and 2.2, the negative impact of convergence with IFRS on UNCC (see Section 2.2) is expected (for many reasons) to overcome the positive impact of that convergence (see Section 2.1).

First, Chinese capital market rules provide Chinese firms with incentives to inflate their earnings, which contradicts the concept of AC. For instance, the rules state that a firm will be delisted if it reports losses in three consecutive years. Such rules create strong incentives for Chinese companies to manage earnings in order to maintain their listing status (He et al., 2012). Another example is that Chinese firms commonly inflate their earnings by engaging in abnormal related party transactions before their initial public offering periods (Aharony et al., 2010). Apparently, it is expected that managers will prefer new Chinese standards that have a negative impact on UNCC, at the expense of new Chinese standards that have a positive impact on UNCC.

Second, some cases that have a positive impact on UNCC (see Section 2.1) apply only under certain conditions, which do not occur permanently. For example, a delayed payment for purchasing fixed or intangible assets is subject to being expensed if the payment is delayed (ASBE 4, §8; ASBE 6, §12). In addition, a recognition of compensation for the cancelation of a labor relationship with employees can be applied under certain conditions (ASBE 9 §6).

Third, some cases having a positive impact on UNCC (see Section 2.1) apply due to specific choices, and therefore do not occur permanently. For example, accelerated depreciation methods or the straight-line method can be used to compute the amortization of intangible assets with limited service (ASBE 6 §17).

However, to compute the depletion of mineral interests in proved properties (ASBE 27 §21), either the straight-line or the output method can be used.

Fourth, some cases that have a positive impact on UNCC (see Section 2.1) are associated with abnormal situations. For example, for the recognition of obligations related to a contingency (ASBE 13 §4,8,10) in a case involving government subsidies, they generally arise due to distress. To give another example, cases involving business combinations are relevant only to a limited number of companies.

Fifth, only about half of the cases that have a negative impact on UNCC (see Section 2.2) occur permanently, or under normal situations. Such cases include prohibiting the LIFO method (ASBE 1 §14); cancelling the amortization of "equity investment differences" (ASBE 2 §5), the non-amortization of indefinite life intangible assets (ASBE 6 §19); computing the expected residual value in amortization of intangible assets (ASBE 6 §18); capitalizing development costs (ASBE 6 §9); recognizing financial assets with good liquidity according to fair value (ASBE 10 §6); canceling amortization for positive goodwill (ASBE 6 §19); and recognizing all financial assets and financial liabilities, including derivatives, according to their fair values at initial recognition (ASBE 22 §30).

In summary, China's convergence with IFRS is predicted to have a negative impact on UNCC, and the following hypothesis is proposed in the alternative form with a negative direction:

H1: The level of UNCC is significantly reduced under the Chinese version of IFRS.

5. Research design

Consistent with Basu (1997) and Giner and Rees (2001), Basu (2005) documents that the intercept coefficient, β_0, of the Basu (1997) model can be used to measure UNCC, indicating that the lower the intercept, the greater the UNCC. The model proposed by Basu (1997) is conducted as follows:

$$E_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 R_{it} + \beta_3 R_{it} D_{it} + e_{it} \quad (1)$$

where E_{it} represents net profit after extraordinary items of firm_i in year_t, scaled by the market value of firm_i in year_{t-1}. R_{it} represents the adjusted stock return of firm_i over a year ended April 30. D_{it} is a dummy variable that takes the value of 1 if R_{it} is negative, and 0 otherwise. e_{it} is the error term.

To measure the change in UNCC after convergence with IFRS, the Basu model is transformed by adding another variable, $IFRS_{it}$, as a dummy variable and its interaction effects with stock returns. The transformed model is constructed as follows:

$$E_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 R_{it} + \beta_3 R_{it} D_{it} + \beta_4 IFRS_{it} + \beta_5 IFRS_{it} D_{it} + \beta_6 IFRS_{it} R_{it} + \beta_7 IFRS_{it} D_{it} R_{it} + e_{it} \quad (2)$$

where $IFRS_{it}$ is a dummy variable that equals 1 for years after 2006, and 0 otherwise.

The coefficient β_4 represents the change in the intercept coefficient, β_0, of the Basu model. A significantly positive (negative) value of β_4 reveals that UNCC is decreased (increased) after convergence with IFRS.

6. Data

6.1. Data selection

Compared with past research, this study covers a relatively more extended period, from 1996 to 2017. Brüggemann et al. (2013) believe that using short periods is one weakness of contemporary IFRS studies and thus call for a re-examination of probable IFRS effects by using longer time series. In this context, Liu et al. (2011) argue that a more comprehensive view of the changes in accounting quality in China could be provided by a longitudinal study of accounting quality over a longer period. In addition, financial regulation changes may need sufficient time to be appropriately practiced in firms. In turn, it is important to update the sample (Liu et al., 2016). Therefore, this study extends the sample period to include the years between 1996 and 2017.

Table 1
Data selection.

Item	Firms	Observations
Firms on CSMAR from 1996 to 2017	3704	40,769
Drop B-listed firms	(114)	(2353)
Drop financial sector firms	(82)	(966)
Drop firms with non-normal status	(316)	(3849)
Drop observations with negative equity or negative total assets	0	(413)
Drop 2006 data	0	(1203)
Drop 2008 data	0	(1359)
Drop observations with incomplete data	(487)	(4818)
Final sample	2705	25,808

Table 1 reports the data collection process. The initial data come from the China Stock Market and Accounting Research (CSMAR) database, consisting of 3704 firms listed on the Shanghai Stock Exchange or the Shenzhen Stock Exchange from 1996 to 2017. As only A-listed firms are heavily influenced by the 2006 accounting reform, all B-listed firms (114 firms) are removed. All firms related to the financial sector (82 firms) are also dropped, as they follow different reporting regulations. Only listed firms with normal status are considered, and firms with other statuses (316 firms) are ignored. Additionally, all observations with

Table 2
Data description.

Panel A. Data description before convergence with IFRS

Variables	*N*	Mean	Std. Dev.	Min.	*p*25%	Median	*p*75%	Max.
E	7456	0.0245	0.0307	−0.0357	0.0078	0.0216	0.0398	0.1060
D	7456	0.6882	0.4633	0	0	1	1	1
R	7456	−0.1379	0.2840	−0.7341	−0.3187	−0.1340	0.0450	0.4530
D_R	7456	−0.1944	0.2128	−0.7341	−0.3187	−0.1340	0	0
IFRS	7456	0	0	0	0	0	0	0
IFRS_D	7456	0	0	0	0	0	0	0
IFRS_R	7456	0	0	0	0	0	0	0
IFRS_D_R	7456	0	0	0	0	0	0	0
UNCC_NONACC	4750	−0.0228	0.1440	−0.3686	−0.1063	−0.0127	0.0740	0.2279
UNCC_TACC	4750	−0.0033	0.0424	−0.0967	−0.0299	−0.0017	0.0244	0.0761

Panel B. Data description after convergence with IFRS

Variables	*N*	Mean	Std. Dev.	Min.	*p*25%	Median	*p*75%	Max.
E	18,462	0.0289	0.0323	−0.0389	0.0092	0.0233	0.0447	0.1030
D	18,462	0.6032	0.4892	0	0	1	1	1
R	18,462	−0.0935	0.3198	−0.7265	−0.2974	−0.0812	0.1296	0.4681
D_R	18,462	−0.1799	0.2248	−0.7265	−0.2974	−0.0812	0	0
IFRS	18,462	1	0	1	1	1	1	1
IFRS_D	18,462	0.6032	0.4892	0	0	1	1	1
IFRS_R	18,462	−0.0935	0.3198	−0.7265	−0.2974	−0.0812	0.1296	0.4681
IFRS_D_R	18,462	−0.1799	0.2248	−0.7265	−0.2974	−0.0812	0	0
UNCC_NONACC	17,132	−0.0543	0.1513	−0.3686	−0.1454	−0.044	0.0463	0.2279
UNCC_TACC	17,132	−0.0086	0.0444	−0.0967	−0.0368	−0.0076	0.0205	0.0761

Notes: E_{it} represents net profit after extraordinary items of $firm_i$ in $year_t$, scaled by the market value of $firm_i$ in $year_{t-1}$. R_{it} is the stock return of $firm_i$ over a year ended April 30. UNCC_TACC is a proxy of UNCC, based on cumulative total accruals over the past three years, divided by average total assets, and multiplied by negative 1, where total accruals equal earnings before extraordinary items, less cash flows from operations plus depreciation expense. UNCC_NONACC is another proxy of UNCC, based on cumulative nonoperating accruals over the past three years, deflated by beginning total assets, and multiplied by negative 1, where nonoperating accruals = (earnings + depreciation − cash flows from operations) − (Δ Accounts Receivable + Δ Inventories + Δ Prepaid Expenses − Δ Accounts Payable − Δ Taxes Payable). All continuous variables are winsorized at 5%.

negative equity (413 observations) are dropped. Following He et al. (2012) and Li et al. (2018), 2006, the year immediately prior to the 2006 accounting reform, is excluded. Although the 2006 accounting reform took effect in 2007, firm managers may have had incentives to manipulate earnings in 2006, because they were required to disclose earnings for that year (in their 2007 financial statements) based on the new accounting standards (He et al., 2012, Li et al., 2018). In this regard, Zhang et al. (2010) document that Chinese listed firms recognized lower impairment losses during the transition period (after the announcement of the new standard and before the effective date) than in pre-announcement periods. Furthermore, Zhang, Lu, and Ye find that firms with considerably high previous impairment losses tend to reverse more impairment losses in the transition period, in order to achieve certain earnings thresholds. According to Hou et al. (2014), 2008 was the year when the impact of the global financial crisis was strongest in China. To isolate the potential effects of the global financial crisis, 2008 is excluded from the sample (1359 observations). Finally, all observations with incomplete data are also removed (4818 observations). The final sample includes 2705 listed firms (25,808 firm-year observations). To mitigate the possible effect of outliers on inferences, all of the continuous variables are winsorized at 5%.

During the sample period, the Chinese capital market was affected by many significant events. In 1992, the MOF issued the first set of Western-oriented accounting standards for domestic companies. In 1998, the MOF issued a reform to eliminate the differences between the 1992 accounting reform and IAS principles (Chen et al., 2002). Starting from January 1, 2001, all joint stock limited entities were required to follow the 2001 accounting reform (Deloitte, 2005). In 2006, China issued a reform to achieve greater convergence with IFRS, with an effective date starting on January 1, 2007. In 2008, financial markets around the world were affected by the global financial crisis. According to Hou et al. (2014), 2008 was the year when the global financial crisis had the strongest impact on China. In May 2008, China issued the first Basic Standards of Enterprise Internal Control, which were similar those enacted in the US with the Sarbanes–Oxley Act (SOX). In addition, a series of internal control guidelines was issued in April 2010. Since January 1, 2012, all listed firms have been required to adopt Chinese SOX (C-SOX) (Liu et al., 2017).

6.2. Data description

Table 2 reports some of the descriptive statistics from before and after the 2006 accounting reform. As can be noted, the two samples are materially imbalanced. The number of observations is 7456 (18,462) observations in the main model before (after) convergence with IFRS, which reflects the process of development in China. The primary comparison between the two samples shows an increase in the mean (median) value of earnings, *E*, from 0.0245 to 0.0289 (0.0216 to 0.0233). Specifically, the mean (median) value of the accrual component of earnings (as measured by UNCC_NONACC) increases from 0.0228 (0.0127) to 0.0543 (0.044). In addition, the mean (median) value of the accrual component of earnings (as measured by UNCC_TACC) increases from 0.0033 (0.0017) to 0.0086 (0.0075).[2] Furthermore, the dependent variable, *E*, varies from −0.0357 (−0.0389) to 0.1060 (0.1030), with a standard deviation of 0.0307 (0.0323), before (after) the 2006 accounting reform. Table 2 also shows that returns, R, range between −0.7341 (−0.7265) and 0.4530 (0.4681), with an average of −0.1379 (−0.0935), a median of −0.1340 (−0.0812), and a standard deviation of 0.2840 (0.3198), before (after) the 2006 accounting reform. The mean (median) value of returns becomes less negative after the 2006 accounting reform, changing from −0.1379 to −0.0935 (−0.1340 to −0.0812), suggesting that Chinese firms experienced an increase in their market value after convergence with IFRS, again reflecting the process of development in China. The increase in the standard deviation, from 0.2906 to 0.3198 after the 2006 accounting reform, suggests an increase in the volatility and uncertainty in Chinese capital market after the 2006 accounting reform, perhaps as a result of significant events such as the global financial crisis in 2008. However, the comparatively high volatility of returns is characteristic of emerging markets (Ball et al., 2000b). Not surprisingly, the minimum value of D in both samples is 0, and its maximum value is 1. The mean value of D, 0.6882 (0.6032), indicates that 68.82% (60.32%) of the D variable takes the

[2] The original sign in Table 2, the mean value of UNCC_NONACC (UNCC_TACC), is positive, but the stated value is multiplied by the negative value for easy interpretation of UNCC.

value of one before (after) the 2006 accounting reform, meaning that the frequency of bad news is greater than the frequency of good news in China. Nevertheless, the frequency of bad news is reduced after the 2006 accounting reform, declining from 0.6882 to 0.6032, in favor of more frequent good news. This statistical description aligns with the notion that the Chinese capital market has experienced a positive development in value after convergence with IFRS. The mean (median) value of D_R is increased from −0.1944 (−0.1340) to −0.1799 (−0.0812), which may reflect an improvement in CC after the 2006 accounting reform. Not surprisingly, the maximum value of D_R (in both samples) equals 0, as the maximum value of R is to be multiplied by a D value that equals 0 when R is positive. Not surprisingly, all of the statistics for IFRS variable before 2007 take the value of 0. Further, the interactions between IFRS and the other variables (IFRS_D, IFRS_R, and IFRS_D_R) before the 2006 accounting reform also take the value of 0, because IFRS variable equals 0 before 2007. However, the IFRS variable takes the value of 1 after 2006. Therefore, except for the standard deviation, the statistics for this variable equals 1 after the 2006 accounting reform. In effect, the 0 value of standard deviation indicates that each observation of the IFRS variable equals the mean value, which is 1. As the IFRS variable takes the value of 1 after 2006, all of the statistics in panel B for the other variables multiplied by IFRS (IFRS_D, IFRS_R, and IFRS_D_R), equal the statistics for D, R, and D_R, respectively, in the same period. For example, IFRS_D equals 1 times D, which equals D, and so on.

7. Results

Prior to the analysis of multiple regression, several assumptions related to the classical linear regression model are tested. To mitigate homoscedasticity and autocorrelation, standard errors are clustered at the firm level.

7.1. Results of the main model

Table 3 shows the estimated results for the main model, to test the impact of convergence with IFRS on UNCC in China. As can be seen, the model is significant, as the *p*-value of the computed *F*-statistic, 140.26, is almost 0, and as a result, the R-squared, 0.0426, is significantly different from 0. The results show that the Chinese non-financial sector experienced a significant reduction in UNCC after convergence with

Table 3
Results of the main model.

Variables *E*	Expected signs	Coefficients	Standard errors	*p*-values
D	?	−0.0016	0.0012	0.1710
R	?	0.0401***	0.0048	0.000
D_R	?	−0.0317***	0.0055	0.000
IFRS	+	0.0091***	0.0014	0.000
IFRS_D	?	−0.0008	0.0015	0.575
IFRS_R	?	−0.0223***	0.0057	0.000
IFRS_D_R	?	0.0277***	0.0065	0.000
Constant	?	0.0250***	0.0012	0.000
Observations	25,808			
Number of clusters	2705			
R-squared	0.0426			
F-statistic	140.26***			
Prob > F	0.000			

Notes: This table shows the estimated results of OLS regressions, to test the impact of convergence with IFRS on UNCC in China. The sample period spans 1996–2017, excluding 2006 and 2008. The dependent variable, E, represents net profit after extraordinary items of $firm_i$ in $year_t$, scaled by the market value of $firm_i$ in $year_{t-1}$. R represents the adjusted stock return of $firm_i$ over a year ended April 30. D is a dummy variable that takes the value of 1 if R is negative, and 0 otherwise. IFRS is a dummy variable that equals 1 for years after 2006, and 0 otherwise. All continuous variables falling in the top or bottom 5% are winsorized. Standard errors are adjusted for clustering at the firm level. The reported *p*-values are based on two-tailed significance levels, and on one-tailed levels when the prediction is directional. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

IFRS (estimated coefficient IFRS = 0.0091, significant at less than 1%, one-tailed). Specifically, the intercept of the Basu model is significantly increased, by about 0.0091, and it becomes approximately 0.0341 (0.0250 + 0.0091) after 2006, which suggests that UNCC is significantly reduced under the Chinese version of IFRS.

The above results also suggest an increase in CC after China's convergence with IFRS. The coefficient of IFRS_D_R (0.0277) is significantly positive, suggesting that CC increased after 2006. However, this result aligns with the notion that UNCC and CC are negatively related. Accordingly, the amounts of bad prudence in Chinese accounting numbers (resulting from UNCC) are expected to decline. However, the good prudence in Chinese accounting numbers (resulting from CC) is expected to increase.[3] In other words, the overall economic efficiency and social welfare can be expected to increase in China after convergence with IFRS.

7.2. Robustness tests

7.2.1. Results excluding the transition year (2007)

This study includes the transition year in its analysis. However, some scholars exclude the transition year in such investigations. To address this concern, the main model is rerun omitting the transition year (2007). The untabulated results show similar findings.

7.2.2. Results using unadjusted returns instead of adjusted returns

This study uses adjusted returns to overcome the effect of macroeconomic news and to capture firm-specific news. As a robustness check, unadjusted instead of adjusted returns are used, and the results are similar.

7.2.3. Results excluding dividends

This study includes dividends in the calculation of returns. However, some researchers, such as Giner and Rees (2001), exclude dividends from the calculation of returns. As predicted, the exclusion of dividends does not affect the inferences of the main model.

7.2.4. Results using earnings before extraordinary items

Earnings after extraordinary items are used in the main model. However, some studies use earnings before extraordinary items in such investigations. Hence the analysis is redone using earnings before extraordinary items, and the results remain the same.

7.2.5. Results using narrower time windows

To reduce the likelihood of other factors confounding the results, prior studies rely on shorter periods. In IFRS studies, short analysis periods generally cover two to three post-adoption years (Brüggemann et al., 2013). Accordingly, the main model is rerun to cover two to three post-adoption years (2005–2007 and 2004–2009). Again, the obtained results remain similar to those derived from the main model.

7.2.6. Results considering only firms with complete data in both periods

Most studies of this kind do not consider the potential influence of sample firm differences across different periods. To mitigate this effect, Liu et al. (2011) recommend considering only firms with complete data in both periods. As a robustness test, this suggestion is taken into consideration but the results remain the same.

7.2.7. Results including the first accounting reform (1992–1997)

The first accounting reform (1992–1997) is not entirely included in the analysis. As a robustness test, the main model is rerun including the period from 1992 to 1997. As expected, the inclusion of the first accounting reform (1992–1997) does not disturb the initial conclusion.

[3] André, Filip, and Paugam (2015) explain in detail that UNCC can be considered as a form of bad prudence, and CC can be considered a form of good prudence.

7.2.8. Results comparing the 2001 reform with the convergence with IFRS

To conduct a comparison between the effects of the 2001 and 2006 accounting reforms on UNCC, the main model is rerun over the period from 2001 to 2017. The inferences remain identical to those reported in the main model.

7.2.9. Results using fixed and random effects models

Most previous studies on the Basu regression estimator of CC have used the OLS model. Ball et al. (2013) recommend using the fixed effect model (FEM), as this model might reduce the bias in the standard Basu regression estimator. However, using the FEM and the REM both lend support to the initial conclusion derived from the main model.

7.2.10. Results with consideration for possible delays in earnings announcements

Some scholars have taken account of potential delays in earnings announcements, as a way to ensure that the accounting information is in the public domain. Returns are thus recalculated over a year from June 30 of $year_t$ to June 30 of $year_{t+1}$. The results of this check confirm the main results.

7.2.11. Results using different definitions of returns

This study computes the returns as the natural logarithm of the ratio of the share price. The main model is rerun using two differing definitions of returns (simple returns and cumulative returns), but these alternative definitions yield similar inferences.

7.2.12. Results using different levels of winsorization

In the main model, all continuous variables used in the regressions are winsorized at 5%. As a robustness test, winsorizations are conducted at the 1%, 2%, 3%, 4%, and even 10% levels, and the results are qualitatively similar to those reported in the main model.

7.2.13. Results using alternative specification of the Basu model

The Basu model is used to measure UNCC, with share returns used as a proxy for the flow of value-relevant information over each fiscal year. To retest the study hypothesis based on another specification of the model, changes in income from the previous year (rather than changes in stock returns) are used as a proxy for good news and bad news (Basu, 1997). The results of this alternative specification of the Basu model align with the primary inferences.

7.2.14. Results excluding the effect of the C-SOX

To isolate the influence of the C-SOX on the relationship between convergence with IFRS and UNCC, the main model is repeated excluding all years after adoption of the C-SOX in 2012, and all coefficients of this check are nearly identical to those shown in Table 3.

7.3. Additional test – the negative accruals measure

Givoly and Hayn (2000) claim that AC leads to persistently negative accruals, unlike the expected pattern of accrual reversals. This suggests that the average of accruals over a reasonably extended period can be used as a firm-specific proxy for AC (Ahmedet al., 2002). Following Givoly and Hayn (2000), this study uses cumulative nonoperating accruals (UNCC_NONACC) over the past three years, deflated by beginning-point total assets, multiplied by negative 1, where nonoperating accruals = (earnings + depreciation − cash flows from operations) − (Δ Accounts Receivable + Δ Inventories + Δ Prepaid Expenses − Δ Accounts Payable − Δ Taxes Payable). Chen et al. (2014), among others, use this measure as a proxy for UNCC. In addition, following Ahmad and Duellman (2013) UNCC is measured by defining UNCC (UNCC_TACC) as earnings before extraordinary items, less cash flows from operations, plus depreciation expense, divided by average total assets and averaged over the previous three years, then multiplied by negative 1 for ease of interpretation. A higher value of UNCC_NONACC (UNCC_TACC) suggests a greater degree of UNCC. If convergence with IFRS is

Table 4
Additional tests – the negative accruals measure.

Variables	Observations	Before 2007	After 2007	Differences	*t*-statistics
UNCC_NONACC	20,621	−0.0204	−0.0554	−0.0350***	(−13.67)
UNCC_TACC	20,770	−0.0053	−0.0090	−0.0037***	(−4.77)

Notes: This table shows the mean values of UNCC_NONACC and UNCC_TACC before and after convergence with IFRS, and compares them using the two-sample *t*-test. The sample period spans 1996–2017, excluding 2006 and 2008. UNCC_NONACC = cumulative nonoperating accruals over the past three years, deflated by beginning total assets, and multiplied by negative 1, where nonoperating accruals = (earnings + depreciation − cash flows from operations) − (Δ Accounts Receivable + Δ Inventories + Δ Prepaid Expenses − Δ Accounts Payable − Δ Taxes Payable). UNCC_TACC = earnings before extraordinary items, less cash flows from operations, plus depreciation expense, divided by average total assets, averaged over the previous three years, and multiplied by negative 1. Following Bradford et al. (2017), 2007 and 2008 are excluded as they mix old and new standards in the computed variables (UNCC_NONACC, UNCC_TACC). The variables are winsorized at 5% to eliminate the influence of abnormal values. *t*-statistics are in parentheses. *p*-values are based on one-tailed levels, as the prediction is directional. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels respectively.

associated with a lower mean of UNCC than that associated with the previous Chinese GAAP, then it can be concluded that UNCC was reduced after China's convergence with IFRS.

As shown in Table 4, UNCC_NONACC (UNCC_TACC) is reduced from −0.0204 to −0.0554 (−0.0053 to −0.0090), resulting in a significant reduction, −0.0350 (−0.0037), at less than 1% significance, indicating that UNCC significantly decreased after 2006. These results further confirm the main results.

8. Conclusion

This study tests the effect that convergence with IFRS has had on UNCC in China. A sample of 25,808 firm-year observations is considered over the period from 1996 to 2017. Using the intercept of the Basu model, the study finds a significant reduction in UNCC after 2006 in China. Robustness tests are conducted, and yield similar results.

This study fills several gaps in the literature. First, UNCC has not been adequately investigated in the previous accounting literature (Qiang, 2007). Moreover, prior studies mainly examine mandatory IFRS adoption, rather than convergence with IFRS. Therefore, this study enriches the literature by clarifying the relation between convergence with IFRS and UNCC. Second, previous research mainly focuses on developed countries. By exploring the issue in relation to China, this study provides useful sights from the perspective of a developing country.

Nevertheless, this study has some limitations, which are suggestive of future research directions. First, this study examines the impact that China's convergence with IFRS has had on UNCC, but not on CC. Second, the study focuses on only one country, namely China. Hence, its inferences may not fit other countries. Accordingly, future research should investigate this topic in other countries, such as pre-emerging countries. Third, the study is limited to the non-financial sector. Future research should consider the impact of convergence with IFRS on UNCC within the financial sector.

Acknowledgments

I would like to thank all others who have participated in one way or another in my research success. It is hard to mention them all, but a special word of thanks goes to my university, the Palestine Technical University –Kadoorie for its support and encouragement.

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China Journal of Accounting Research 12 (2019) 411–430

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Contents lists available at ScienceDirect

China Journal of Accounting Research

journal homepage: www.elsevier.com/locate/cjar

Non-CEO top managers' monitoring power and CEO pay-performance sensitivity in state-owned enterprises: Evidence from Chinese state-owned listed firms

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ARTICLE INFO

Article history:
Received 9 May 2017
Accepted 8 October 2019
Available online 13 November 2019

Keywords:
Inside directors
State-owned enterprises
Non-CEO top managers
Pay-performance sensitivity

ABSTRACT

Few studies have focused on the role of non-CEO top manager inside directors in corporate governance, especially in the context of emerging countries. Despite their tendency to be subject to CEOs, non-CEO top manager inside directors can counterbalance CEOs in specific situations. Using panel data on state-owned listed companies in China, we conduct an empirical study of how non-CEO top manager inside directors influence CEO pay-performance sensitivity under serious agency conflicts. We find that the proportion of non-CEO top manager inside directors is significantly negatively correlated with CEO pay-performance sensitivity in state-owned enterprises, whereas the shareholding proportion of the controlling shareholders weakens this relationship. Furthermore, we find that non-CEO top manager inside directors significantly increase executives' on-the-job consumption. Our conclusions are robust to endogeneity testing and alternative specifications.

1. Introduction

Although boards of directors serve as a critical corporate governance mechanism, our knowledge of what makes boards effective is limited (Masulis and Mobbs, 2011). Studies have investigated the impacts of various governance subjects on board decision making and corporate behavior from the perspective of controlling shareholders, the CEO, independent directors, and institutional investors. However, few studies have focused

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https://doi.org/10.1016/j.cjar.2019.10.001
1755-3091/

on the impact of inside directors, and most of these do not distinguish between CEO inside directors and non-CEO inside directors or examine the monitoring role of non-CEO inside directors. Most of the literature considers top managers as a whole and does not discuss the diverse roles of different top manager positions. Some studies have discussed the compensation gap between CEOs and VPs (Main et al., 1993; Bognanno, 2001; Li et al., 2012) and the compensation contracts for VPs (Ederhof, 2011). However, these studies do not indicate whether non-CEO top managers can reduce CEOs' agency problems.

We address whether non-CEO top managers monitor CEOs when the former are also directors. The conclusions about the governance effect of inside directors remain controversial in the literature. For example, Weisbach (1988) finds that firm performance is more related to CEO turnover for firms with boards of directors dominated by outside directors than for firms with boards dominated by inside directors. Bozec (2005) argues that firms must be exposed to a competitive environment for inside directors to be effective. Raheja (2005), Adams and Ferreira (2007), and Harris and Raviv (2008) show that inside directors are valuable in enhancing a board's advisory and monitoring functions.

Non-CEO top managers have more information advantages than outside directors. Although they can conduct more timely and effective supervision of CEOs' agency behavior, they are not independent from the CEO. Some recent studies explore the roles of inside directors. Acharya et al. (2011) point out that inside directors can improve efficiency when CEOs are less inclined to harm firm interests. Masulis and Mobbs (2011) find that firms with inside directors holding outside directorship demonstrate better operating performance and market-to-book ratios, especially when monitoring is more difficult. These firms make better acquisition decisions, have greater cash holdings, and overstate earnings less often. Mobbs (2013) finds that talented inside operating officers, as indicated by their holding of an outside board seat, are associated with increased CEO turnover sensitivity to firm accounting performance and greater sensitivity of CEO compensation to stock performance and that they are more likely to become a CEO than are other non-CEO inside directors. All of the above studies show that inside directors can increase pressure on current CEOs to perform rather than entrench CEOs. However, these studies are based on the United States' capital market, which has strong legal protection for investors. We focus on the role of non-CEO top manager inside directors in China's capital market, which has weak legal protection for investors.

In firms with manager-shareholder agency problems, CEOs may use their managerial power to gain private benefits (Jensen and Meckling, 1976; Murphy, 1999), such as on-the-job consumption (Burrough and Helyar, 1990), over-investment for more resources, or higher compensation (Jensen, 1986); to entrench themselves by making manager-specific investments that make it costly for shareholders to replace them (Shleifer and Vishny, 1989); to alter their compensation contracts (Core et al., 1999; Grinstein and Hribar, 2004; Cheng and Indjejikian, 2009); or to benefit from completed mergers and acquisitions (Hartzell et al., 2004).

Performance-based pay can reduce manager-shareholder agency costs (Jensen and Murphy, 1990). Managers in China's state-owned enterprises (SOEs) receive direct incentives for economic performance through the use of performance-based compensation, which has been both encouraged and enforced through government regulation. China's SOEs demonstrate serious manager-shareholder agency problems (Lei et al., 2013), providing a good setting for us to study the role of non-CEO inside directors in monitoring CEOs through pay-performance sensitivity. China is a transition economy with weak investor protection and ownership concentration and SOEs remain a vital part of the Chinese economy. By definition, SOEs are owned by "the whole people", which is an abstract concept and not a legal entity. This ownership structure can be perceived as the root cause of SOEs' agency problems. Agency problems exist as long as investors and managers are not the same people. They are especially worse among SOEs, as the ability of the principal—all citizens—to monitor the agent is extremely weak. This inability creates greater opportunities for SOE managers (relative to their private counterparts) to pursue wasteful projects for managerial interests, such as empire building at the cost of investors.

Agency theory and stewardship theory facilitate our understanding of the role of inside directors in corporate governance (Nicholson and Kiel, 2007). Agency theory concerns aligning the interests of owners and managers (Jensen and Meckling, 1976). It is based on the premise that an inherent conflict exists between the interests of a firm's owners and its management. Agency theory suggests that a greater proportion of non-CEO inside directors is unable to monitor any self-interested CEO actions. As a result, the CEO has more opportunity to pursue self-interest at the expense of the owners, such that the shareholders enjoy fewer

returns. In contrast to agency theory, stewardship theory posits that inside directors are essentially trustworthy individuals and that superior corporate performance is linked to a majority of inside directors, as they naturally work to maximize shareholder profit. Stewardship theory suggests that a greater proportion of non-CEO inside directors can monitor any self-interested CEO actions. This monitoring decreases the opportunity for CEOs to pursue self-interest at the expense of the owners, such that the shareholders enjoy more returns. Nisbett and Ross (1980) find that people's behavior is susceptible to their environment. Thus, we argue that the behavior of non-CEO inside directors is influenced by CEO behavior. If the CEO's interests are aligned with the firm's, the non-CEO inside directors facilitate higher-quality decision making and better corporate performance. Otherwise, if the CEO is entrenched for private benefit, the non-CEO inside directors become his conspirators. Large shareholders can monitor managers (Vishny and Shleifer, 1986) and affect the role of non-CEO inside directors.

Using a sample of Chinese listed SOEs from 2007 to 2017, we find that SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity. Furthermore, the negative effect of non-CEO top manager inside directors on CEO pay-performance sensitivity is less pronounced in SOEs with more large shareholders' shareholding. Our conclusions are robust to endogeneity testing. Additional testing shows that non-CEO top managers can increase managers' on-the-job consumption. We also find that VP inside directors and CFO inside directors can significantly reduce CEO pay-performance sensitivity, but the influence of board secretary inside directors on CEO pay-performance sensitivity is not significant.

We contribute to the literature in the following ways. We conduct the first study to show a significant negative relationship between non-CEO top manager inside directors and CEO pay-performance sensitivity in SOEs. We extend the emerging literature on inside directors and CEO compensation, which has received a great deal of research attention. We provide new evidence that in firms with serious manager-shareholder agency problems, non-CEO top manager inside directors can reduce CEO pay-performance sensitivity and increase agency costs above other influencing factors identified by previous research. We also lend further empirical support to the agency theory on inside directors. Overall, this paper has important practical significance for understanding the agency problems of SOEs and the role of non-CEO inside directors.

The remainder of this paper is structured as follows. Section 2 analyzes China's institutional background, reviews the related literature, and presents our hypotheses. Section 3 describes our sample and research design. Section 4 discusses our empirical results. Section 5 presents the endogeneity test. Section 6 outlines the additional tests. Finally, Section 7 concludes the paper.

2. Institutional background, related literature, and hypotheses

Boards of directors serve as a critical corporate governance mechanism that can monitor managers, reduce agency costs, and improve firm performance. According to the Chinese Company Law, directors are appointed by shareholders. In China, directors are appointed by large shareholders. Furthermore, SOEs' boards of directors are mainly appointed by state-owned shareholders. Arranging the board of directors reasonably is of great significance to the efficiency of the corporate governance of SOEs.

In China, under the system of ownership by all people, property rights belong to everyone and to no one in particular, and state ownership property rights are intrinsically ambiguous. SOEs in China are affiliated with the county, city, province, or central government. In 1993, the Corporate Law system was introduced and the internal governance system of SOEs was restructured along the pattern of a modern corporation. The Corporate Law system requires SOEs to establish a governance structure that includes shareholders and a board of directors. The reform of traditional SOEs significantly reduced the role of government intervention in the management of SOEs. However, the rights and responsibilities of SOE stakeholders and management were ill-defined and the boards of directors in SOEs were given weak incentives to monitor CEOs and protect investor benefits. Thus, when non-CEO top managers are also board members, they may have incentives to collude with the CEO for private benefit, which increases SOEs' manager-shareholder agency costs.

In addition, SOE boards of directors and CEOs are often appointed and dismissed by the government and treated as government officials. This greatly limits the power of appointment and removal of personnel of SOEs' boards of directors, which correspondingly weakens the supervisory ability of boards of directors over management.

Weakening board supervision increases manager-shareholder agency problems, which are serious in Chinese SOEs. Jensen (1986) and Hanson and Song (2000) argue that management shareholding helps reduce agency costs and increase firm value, but management shareholding in SOEs is rather low. At the same time, soft budget constraints are present, and SOEs can easily borrow from state-owned banks (Brandt and Li, 2003; Cull and Xu, 2005). Such systemic features of SOEs (e.g., soft budget constraints) undermine the incentives and disciplinary mechanisms essential to corporate governance. Most board members and managers in SOEs also still have a corresponding status of civil service, and their remuneration promotions still rely on the assessments of their superiors in the political and administrative hierarchy rather than on market performance. Company managers need not worry that poor management may cause their company to be taken over. Public shareholders cannot "vote with their feet," and managers are not concerned about their rights, giving SOE managers a strong incentive to entrench themselves for private benefit.

The Chinese culture embodies the characteristics of strong power distance, and the bureaucratic system of SOEs makes CEOs rather authoritative. This authoritativeness exerts great pressure on non-CEO managers, who have a weak incentive to monitor CEOs.

According to managers, the missing link between executive pay and firm performance is the power imbalance between executives and shareholders. CEOs can use their power to pursue self-interests, such as increased pay and decreased pay-performance sensitivity (Bertrand and Mullainathan, 2001; Bebchuk and Fried, 2003; Grinstein and Hribar, 2004; Otten and Heugens, 2007; Weisbach, 2007). CEOs can also influence the pay decisions made by the board of directors or the remuneration committee due to the inefficiency of outside and inside directors. Main et al. (1995) find that independent boards of directors may not safeguard shareholders' interests and minimize opportunism on the behalf of management. Social influence may be responsible for significant increments in CEO compensation beyond what economic theories predict. Core et al. (1999) find that firms with weaker governance structures have greater agency problems and that the CEOs of firms with greater agency problems receive greater compensation. Furthermore, Grinstein and Hribar (2004) find that CEOs with more power to influence board decisions receive significantly larger bonuses. Overall, CEOs may have great incentives to increase their pay and decrease pay-performance sensitivity to entrench themselves. Furthermore, non-CEO top managers may increase CEOs' agency costs and salary-manipulating behavior.

First, the systemic features of SOEs include soft budget constraints, ill-defined rights and responsibilities of SOE stakeholders and management, and ambiguous property rights, which undermine the incentives and disciplinary mechanism essential to corporate governance. As manager-shareholder agency problems are more serious in SOEs than in non-SOEs (Lei et al., 2013), non-CEO top managers have little incentive to monitor CEOs or improve firm performance. Second, the CEO power in SOEs is strong, and CEOs can exert great pressure on non-CEO top managers. As such, non-CEO top managers in Chinese SOEs may collude with CEOs, increasing agency problems between managers and outside shareholders. In SOEs with more non-CEO top managers, CEO agency problems are presumably greater and pay-performance sensitivity may be lower than those in SOEs with fewer non-CEO top managers.

Considering the above discussion, we propose the following hypothesis in the alternative form:

H1. All else being equal, SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity.

La Porta et al. (1999) find that with the exception of economies with very good shareholder protection, relatively few firms are widely held, and they are typically controlled by families or the state. Firms with centralized ownership structures may have fewer manager-shareholder agency problems than firms with decentralized ownership structures. Controlling shareholders monitor managers effectively and reduce manager-shareholder agency costs (Lei et al., 2013). Berle and Means (1932) point out that over-decentralized ownership structures may increase the cost of shareholders' decision making, thereby reducing the welfare of owners. The free rider problem is an issue in economics. It is considered an example of a market failure. This is a situation where individuals are able to consume a good without paying. Grossman and Hart (1980) argue that shareholders can free ride on raiders' improvement of the corporation, thereby seriously limiting the raiders' profit. Gorton and Schmid (1999) study corporate governance efficiency using Austrian cooperative banking, an organizational form in which the ownership structure is exogenous. They show that firm performance

decreases as the number of cooperative members increases, corresponding to a greater separation of ownership and control. That is, more centralized ownership structures may monitor managers efficiently and improve firm performance.

Large shareholders can have an important impact on corporate behavior. Studies have found that large shareholders can significantly influence capital structure (Cao et al., 2004; Zhao and Zhu, 2006; Xiao and Zou, 2008), investment (Wang and Hu, 2005; Yang et al., 2010; Luo et al., 2014), and dividend policy (Liu and Hu, 2003; Deng and Zeng, 2005; Yang, 2008). Large shareholders also have strong incentives to monitor managers and reduce manager-shareholder agency problems (Huang and Zhou, 2012; Wang et al., 2015), thereby increasing firm value (Holderness, 2003).

Despite the ambiguous property rights of SOEs and the ill-defined rights and responsibilities of SOE stakeholders and management, the government pays more attention to SOEs and gains more incentive to monitor managers as the proportion of the first largest SOE shareholder increases. In this context, non-CEO top managers have less opportunity and incentive to collude with CEOs.

Considering the above discussion, we propose our second hypothesis:

H2. All else being equal, the negative effect of non-CEO top manager inside directors on CEO pay-performance sensitivity is less pronounced in SOEs with more large shareholders' shareholding.

3. Sample and research design

3.1. Sample and data source

The sample includes all of the A-share companies in the Shanghai and Shenzhen stock markets from 2007 to 2017. We start our sample period in 2007, as this is the year in which the new Chinese accounting standards came into effect. Thus, all of the financial variables are comparable across our samples. We remove financial listed firms, non-SOE firms, and firms with missing variables from the regression models. We obtain a final sample of 8894 firm-year observations from 2007 to 2017.

All of the non-dummy variables are winsorized at the 1% and 99% levels to alleviate the potential effects of outliers. We obtain each firm's financial accounting information from the China Stock Market & Accounting Research (CSMAR) database.

We mainly focus on collusion or mutual monitoring with top managers. In China, the annual report of a listed firm must disclose the names and basic information of its board of directors, board of supervisors, and top managers. According to the Chinese Company Law, the top managers in listed firms include general managers (or the CEO), the VP, the CFO, the secretaries of the board of directors, and other top managers in the articles of association. The other top managers are different in different listed firms, but nearly all listed firms disclose the basic information of general managers (or the CEO), the VP, the CFO, and the secretaries of the board of directors, such that we have two alternatives for the quantities of non-CEO top managers. The first alternative refers only to the VP, CFO, and secretaries of the board of directors. The second alternative refers to the VP, CFO, secretaries of the board of directors, and other top managers disclosed in annual reports.

We obtain the top manager information of listed firms from the CSMAR database and manually collate the data on the non-CEO top manager inside directors.

3.2. Research design

We use model (1) to test H1 as follows:

$$\begin{aligned} LnCEO\_salary = {} & \beta_0 + \beta_1 * ROA + \beta_2 * ID + \beta_3 * ROA * ID + \beta_4 * Asset + \beta_5 * Debt \\ & + \beta 6 * Growth + \beta 7 * Ind\_Dir + \beta 8 * Boardsize + \beta 9 * First + \beta 10 * Dual \\ & + \beta 11 * Boardsal\_dum + \beta 12 * Separation + \beta_{13} * Age + \beta_{14} * CEO\_Age \\ & + \beta_{15} * CEO\_Age^2 + Year + Industry + \varepsilon \end{aligned} \tag{1}$$

We use model (2) to test H2 as follows:

$$\begin{aligned} LnCEO\_salary = {} & \beta_0 + \beta_1 * ROA + \beta_2 * ID + \beta_3 * First + \beta_4 * ROA * ID + \beta_5 * ROA * First \\ & + \beta_6 * First * ID + \beta_7 * ROA * ID * First + \beta_8 * Asset + \beta_9 * Debt + \beta_{10} * Growth \\ & + \beta_{11} * Ind\_Dir + \beta_{12} * Boardsize + \beta 13 * Dual + \beta 14 * Boardsal\_dum + \beta 15 * Separation \\ & + \beta_{16} * Age + \beta_{17} * CEO\_Age + \beta_{18} * CEO\_Age^2 + Year + Industry + \varepsilon \end{aligned} \quad (2)$$

where LnCEO_salary is the natural logarithm of total CEO salary, ROA is the net profit divided by total assets, and ID is the number of non-CEO top manager inside directors. We have two alternatives for the number of non-CEO top managers. The first alternative refers only to the VP, CFO, and secretaries of the board of directors. The second alternative refers to the VP, CFO, secretaries of the board of directors, and other top managers disclosed in annual reports. Thus, we have six alternatives (ID1_dir, ID1_exe, ID1_dum, ID2_dir, ID2_exe, and ID2_dum) for the number of non-CEO top manager inside directors. ID1_dir is the number of first alternatives for the non-CEO top manager inside directors divided by the number of board members. ID1_exe is the number of first alternatives for the non-CEO top manager inside directors divided by the number of first alternatives for the non-CEO top managers. ID1_dum is an indicator variable that equals 1 if the first alternatives for the non-CEO top managers include inside directors and 0 otherwise. ID1_dir is the number of second alternatives for the non-CEO top manager inside directors divided by the number of board members. ID2_exe is the number of second alternatives for the non-CEO top manager inside directors divided by the number of second alternatives for the non-CEO top managers. ID2_dum is an indicator variable that equals 1 if the second alternatives for the non-CEO top managers include inside directors and 0 otherwise.

The control variables are Asset, Debt, Growth, Ind_dir, Boardsize, First, Dual, Boardsal_dum, Separation, Age, CEO_Age, CEO_Age^2, Year, and Industry. Asset is the natural logarithm of total assets. Debt is the total liabilities divided by total assets. Growth is the growth of firm sales. Ind_dir is the percentage of independent directors, which equals the number of independent directors divided by the total number of board members. Boardsize is the total number of board members. First is the percentage of shares held by the largest shareholder of the listed firm. Dual is an indicator variable that equals 1 if the chairman and CEO of the listed firm are the same person and 0 otherwise. Boardsal_dum is an indicator variable that equals 1 if the listed firm pays the chairman and 0 otherwise. Separation is the separation of ownership and control, which equals the control rights minus the cash flow rights of the firms' ultimate controllers. Age is the firm age, which is the number of years since listing. CEO_Age is the CEO age. CEO_Age^2 is the square of CEO age. Year is the year-fixed effects and Industry is the industry-fixed effects.

All of the variable definitions are provided in Table 1.

4. Empirical results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics for all of the variables used in the regression analyses. The mean of ROA is 0.0298. ROA demonstrates a broad range, from a minimum value of −0.2106 to a maximum value of 0.1844, which suggests that ROA varies widely among listed SOEs. The mean of ID1_dir is 0.0878, which suggests that 8.78% of the board members in listed SOEs are non-CEO top managers (including the VP, CFO, and secretaries of the board of directors). The mean of ID1_exe is 0.1799, which suggests that 17.99% of the non-CEO top managers (including the VP, CFO, and secretaries of the board of directors) are inside directors in listed SOEs. The mean of ID1_dum is 0.5664, which suggests that 56.64% of the listed SOEs have non-CEO top manager inside directors (including the VP, CFO, and secretaries of the board of directors). The mean of Boardsize is 9.3295, which suggests that Chinese listed SOEs have nine board members on average. The mean of First is 39.0651, which suggests that the average shareholding of the largest shareholder in SOEs is 39% and is relatively concentrated.

4.2. Multivariate tests of H1 and H2

H1 predicts that SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity. We conduct multivariate regression analyses to test H1 with the full set of control

Table 1
Variable definitions.

Dependent variables	Description
CEO_salary	The total CEO salary
LnCEO_salary	The natural logarithm of the total CEO salary
Independent variables	**Description**
ROA	The net profit divided by the total assets
ID1_dir	The number of first alternatives for the non-CEO top manager inside directors divided by the number of board members
ID1_exe	The number of first alternatives for the non-CEO top manager inside directors divided by the number of first alternatives for the non-CEO top managers
ID1_dum	An indicator variable that equals 1 if the first alternatives for the non-CEO top managers include inside directors and 0 otherwise
ID2_dir	The number of second alternatives for the non-CEO top manager inside directors divided by the number of board members
ID2_exe	The number of second alternatives for the non-CEO top manager inside directors divided by the number of second alternatives for the non-CEO top managers
ID2_dum	An indicator variable that equals 1 if the second alternatives for the non-CEO top managers include inside directors and 0 otherwise
Control variables	Description
Asset	The natural logarithm of the total assets
Debt	The total liabilities divided by the total assets
Growth	The growth of firm sales
Ind_Dir	The percentage of independent directors, which equals the number of independent directors divided by the total board members
Boardsize	The total board members
First	The percentage of shares held by the largest shareholder of the listed firm, multiplied by 100
Dual	An indicator variable that equals 1 if the chairman and CEO of the listed firm are the same person and 0 otherwise
Boardsal_dum	An indicator variable that equals 1 if the listed firm pays the chairman and 0 otherwise
Separation	The separation of ownership and control, which equals the control rights minus the cash flow rights of the firms' ultimate controllers
Age	The firm age, which is the number of years since listing
CEO_Age	The CEO age
CEO_Age^2	The square of CEO age
Year	The year-fixed effects
Industry	The industry-fixed effects

variables. To alleviate concerns about potential standard errors in the data, we report t-values on an adjusted basis using robust standard errors.

As shown in columns (1), (2), (3), and (4) of Table 3, all else being equal, the coefficients of ROA*ID1_dir (-3.1575, $t = -2.16$), ROA*ID2_dir (-2.3633, $t = -1.79$), ROA*ID1_exe (-1.9497, $t = -2.85$), and ROA*ID2_exe (2.1964, $t = -2.84$) are all significant and display the expected signs. This means that SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity. Furthermore, CEO pay-performance sensitivity decreases as the number of non-CEO top manager inside directors increases, which is consistent with H1.

As the proportion of the first largest SOE shareholder increases, the government pays more attention to SOEs and has more incentive to monitor managers. In this context, non-CEO top managers have less opportunity and incentive to collude with CEOs. Therefore, H2 predicts that the negative effect of non-CEO top manager inside directors on CEO pay-performance sensitivity is less pronounced in SOEs with more controlling shareholders' shareholding. To test H2, we choose the largest shareholders' shareholding (First) as the moderator and investigate how it moderates the correlation between the number of non-CEO top manager inside directors and pay-performance sensitivity. The regression results are presented in Table 4, where the coefficients of ROA*First*ID1_dir (0.2070, $t = 2.14$), ROA*First*ID1_exe (0.1233, $t = 2.75$),

Table 2
Descriptive statistics.

Variables	Obs.	Mean	Median	Std. Dev.	Min.	Max.
CEO_sal	8894	578,368	456,750	505,344	24,000	3,105,000
LnCEO_sal	8894	12.9459	13.0319	0.8494	10.3450	14.9485
ROA	8894	0.0298	0.0283	0.0552	−0.2106	0.1844
ID1_dir	8894	0.0878	0.0833	0.0971	0.0000	0.3750
ID2_dir	8894	0.1057	0.0909	0.1063	0.0000	0.4000
ID1_exe	8894	0.1799	0.1429	0.2112	0.0000	1.0000
ID2_exe	8894	0.1786	0.1429	0.1880	0.0000	0.7500
ID1_dum	8894	0.5664	1.0000	0.4956	0.0000	1.0000
ID2_dum	8894	0.6248	1.0000	0.4842	0.0000	1.0000
Asset	8894	22.3840	22.2088	1.3615	19.6883	26.4656
Debt	8894	0.5222	0.5322	0.2033	0.0857	0.9994
Growth	8894	0.1726	0.0973	0.4654	−0.5725	3.0990
Ind_Dir	8894	0.3660	0.3333	0.0518	0.3000	0.5714
Boardsize	8894	9.3295	9.0000	1.8272	5.0000	15.0000
First	8894	39.0651	38.4600	15.2820	11.2970	77.0200
Dual	8894	0.0914	0.0000	0.2882	0.0000	1.0000
Boardsal_dum	8894	0.5381	1.0000	0.4986	0.0000	1.0000
Separation	8894	4.2888	0.0000	7.5910	0.0000	27.9277
Age	8894	13.4366	14.0000	5.5792	2.0000	24.0000
CEO_Age	8894	49.2651	49.0000	5.4286	37.0000	62.0000
CEO_Age2	8894	2457	2401	537	1369	3844

ROA*First*ID2_exe (0.1172, t = 2.33), ROA*First*ID1_dum (0.0509, t = 2.58), and ROA*First*ID2_dum (0.0448 with t = 2.27) are all significant and display the expected signs. This means that the negative effect of non-CEO top manager inside directors on CEO pay-performance sensitivity weakens in SOEs as the number of largest shareholders' shareholding increases, which is consistent with H2.

5. Robustness checks

5.1. Endogeneity analysis

As discussed above, many of the managerial positions in SOEs are directly appointed by the government, bypassing shareholders' meetings and the board of directors. The government may appoint more non-CEO top manager inside directors to alleviate information asymmetry in firms with low CEO pay-performance sensitivity, which leads to endogeneity bias. We introduce instrumental variables and use two-stage regression method to alleviate the endogeneity problems mentioned above.

Beyond the targeted company itself, we introduce the mean of the quantity of non-CEO top manager inside directors of all other listed SOEs in the same year, city, and industry as the target company (ID_mean) as an instrumental variable. Different cities and industries have different laws and financial institutions, which are very important for the appointment of non-CEO top managers. Therefore, this instrument variable is reasonable. We use the provincial legal environment (Legal-envir) as another instrumental variable for the quantity of non-CEO top manager inside directors. The legal environment in different regions affects agency costs and the companies' decisions regarding whether to increase the quantity of non-CEO top manager inside directors.

Table 5 shows the second-stage results of the two-stage regressions. All else being equal, the coefficients of ROA*ID1_dir (3.770, t = −2.23), ROA*ID2_dir (−2.7992, t = −1.83), ROA*ID1_exe (−1.8440, t = −2.41), and ROA*ID2_exe (−1.9080, t = −2.11) are all significant and display the expected signs. This means that our conclusion that SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity does not change after controlling for the endogeneity problem.

Table 3
The impact of non-CEO top manager inside directors on CEO pay-performance sensitivity.

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
ROA	3.7817***	3.7618***	3.8685***	3.9079***	3.7312***	3.6377***
	(16.29)	(15.71)	(17.41)	(16.84)	(14.66)	(13.55)
ID1_dir	−0.3642***					
	(−4.14)					
ROA*ID1_dir	−3.1575**					
	(−2.16)					
ID2_dir		−0.2174***				
		(−2.70)				
ROA*ID2_dir		−2.3633*				
		(−1.79)				
ID1_exe			−0.2157***			
			(−5.20)			
ROA*ID1_exe			−1.9497***			
			(−2.85)			
ID2_exe				−0.2057***		
				(−4.50)		
ROA*ID2_exe				−2.1964***		
				(−2.84)		
ID1_dum					−0.0716***	
					(−3.91)	
ROA*ID1_dum					−0.3888	
					(−1.27)	
ID2_dum						−0.0276
						(−1.47)
ROA*ID2_dum						−0.1972
						(−0.63)
Asset	0.2314***	0.2323***	0.2269***	0.2276***	0.2307***	0.2316***
	(30.24)	(30.34)	(29.58)	(29.65)	(30.21)	(30.26)
Debt	−0.2682***	−0.2700***	−0.2702***	−0.2714***	−0.2697***	−0.2707***
	(−5.27)	(−5.30)	(−5.32)	(−5.34)	(−5.31)	(−5.31)
Growth	−0.0592***	−0.0594***	−0.0575***	−0.0574***	−0.0574***	−0.0584***
	(−2.91)	(−2.92)	(−2.82)	(−2.82)	(−2.84)	(−2.87)
Ind_Dir	−0.4560***	−0.4319***	−0.4667***	−0.4520***	−0.4401***	−0.4109**
	(−2.82)	(−2.67)	(−2.89)	(−2.80)	(−2.72)	(−2.54)
Boardsize	0.0174***	0.0172***	0.0200***	0.0201***	0.0188***	0.0172***
	(3.81)	(3.76)	(4.36)	(4.36)	(4.10)	(3.74)
First	−0.0044***	−0.0045***	−0.0043***	−0.0044***	−0.0044***	−0.0044***
	(−7.96)	(−8.04)	(−7.77)	(−7.91)	(−8.03)	(−7.96)
Dual	0.1327***	0.1237***	0.1360***	0.1334***	0.1237***	0.1144***
	(4.62)	(4.32)	(4.73)	(4.64)	(4.35)	(4.03)
Boardsal_dum	0.0104	0.0082	0.0108	0.0122	0.0093	0.0029
	(0.64)	(0.51)	(0.67)	(0.76)	(0.57)	(0.18)
Separation	0.0076***	0.0076***	0.0076***	0.0075***	0.0077***	0.0078***
	(7.08)	(7.06)	(7.13)	(7.02)	(7.13)	(7.20)
Age	−0.0013	−0.0011	−0.0008	−0.0008	−0.0012	−0.0012
	(−0.83)	(−0.72)	(−0.51)	(−0.48)	(−0.78)	(−0.78)
CEO_Age	0.0846***	0.0848***	0.0847***	0.0841***	0.0853***	0.0852***
	(3.79)	(3.79)	(3.81)	(3.77)	(3.82)	(3.81)
CEO_Age^2	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***
	(−3.45)	(−3.45)	(−3.48)	(−3.44)	(−3.48)	(−3.47)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Constant	5.0054***	4.9744***	5.0791***	5.0745***	4.9989***	4.9756***
	(8.82)	(8.74)	(8.97)	(8.95)	(8.80)	(8.74)

(*continued on next page*)

Table 3 (*continued*)

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
Obs.	8894	8894	8894	8894	8894	8894
Adjusted R^2	0.3196	0.3182	0.3215	0.3205	0.3191	0.3172
F	61.67	61.16	62.14	61.74	61.60	61.02

Notes: Robust t-statistics are in parentheses.
*** $p < 0.01$.
** $p < 0.05$, and
* $p < 0.1$.

Table 4
The impact of non-CEO top manager inside directors on CEO pay-performance sensitivity: The effects of the largest shareholders' shareholding.

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
ROA	4.6784***	4.3781***	4.9521***	4.9370***	5.0442***	4.8594***
	(7.83)	(7.34)	(8.78)	(8.30)	(7.45)	(6.95)
First	−0.0041***	−0.0042***	−0.0040***	−0.0042***	−0.0037***	−0.0036***
	(−4.94)	(−4.91)	(−4.92)	(−5.00)	(−4.07)	(−3.79)
ROA*First	−0.0226*	−0.0159	−0.0270**	−0.0257*	−0.0330**	−0.0309**
	(−1.65)	(−1.15)	(−2.07)	(−1.88)	(−2.19)	(−2.01)
ID1_dir	−0.3418					
	(−1.50)					
ROA*ID1_dir	−11.3116***					
	(−2.82)					
First*ID1_dir	−0.0010					
	(−0.19)					
ROA*First *ID1_dir	0.2070**					
	(2.14)					
ID2_dir		−0.1865				
		(−0.92)				
ROA*ID2_dir		−6.6928*				
		(−1.93)				
First*ID2_dir		−0.0011				
		(−0.22)				
ROA*First *ID2_dir		0.1120				
		(1.31)				
ID1_exe			−0.2229**			
			(−2.06)			
ROA*ID1_exe			−6.8460***			
			(−3.62)			
First*ID1_exe			−0.0002			
			(−0.06)			
ROA*First *ID1_exe			0.1233***			
			(2.75)			
ID2_exe				−0.2317*		
				(−1.96)		
ROA*ID2_exe				−6.8625***		
				(−3.21)		
First*ID2_exe				0.0004		
				(0.13)		

Table 4 (*continued*)

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
ROA*First *ID2_exe				0.1172**		
				(2.33)		
ID1_dum					−0.0386	
					(−0.79)	
ROA*ID1_dum					−2.3656***	
					(−2.82)	
First*ID1_dum					−0.0010	
					(−0.84)	
ROA*First *ID1_dum					0.0509***	
					(2.58)	
ID2_dum						0.0111
						(0.22)
ROA*ID2_dum						−1.9337**
						(−2.27)
First*ID2_dum						−0.0011
						(−0.94)
ROA*First *ID2_dum						0.0448**
						(2.27)
Asset	0.2312***	0.2321***	0.2265***	0.2276***	0.2304***	0.2313***
	(30.19)	(30.28)	(29.47)	(29.53)	(30.13)	(30.14)
Debt	−0.2681***	−0.2705***	−0.2693***	−0.2710***	−0.2664***	−0.2689***
	(−5.26)	(−5.30)	(−5.30)	(−5.33)	(−5.24)	(−5.27)
Growth	−0.0590***	−0.0592***	−0.0571***	−0.0572***	−0.0572***	−0.0580***
	(−2.91)	(−2.91)	(−2.81)	(−2.81)	(−2.84)	(−2.86)
Ind_Dir	−0.4476***	−0.4243***	−0.4581***	−0.4447***	−0.4368***	−0.4075**
	(−2.77)	(−2.63)	(−2.85)	(−2.76)	(−2.70)	(−2.52)
Boardsize	0.0173***	0.0173***	0.0200***	0.0201***	0.0185***	0.0171***
	(3.77)	(3.78)	(4.37)	(4.38)	(4.02)	(3.71)
Dual	0.1323***	0.1231***	0.1355***	0.1325***	0.1234***	0.1138***
	(4.60)	(4.29)	(4.71)	(4.60)	(4.34)	(4.00)
Boardsal_dum	0.0103	0.0082	0.0099	0.0115	0.0090	0.0028
	(0.64)	(0.51)	(0.62)	(0.71)	(0.55)	(0.17)
Separation	0.0076***	0.0076***	0.0076***	0.0075***	0.0077***	0.0078***
	(7.07)	(7.06)	(7.12)	(6.99)	(7.14)	(7.21)
Age	−0.0011	−0.0010	−0.0006	−0.0005	−0.0011	−0.0012
	(−0.71)	(−0.65)	(−0.37)	(−0.33)	(−0.72)	(−0.73)
CEO_Age	0.0861***	0.0860***	0.0865***	0.0860***	0.0875***	0.0869***
	(3.85)	(3.83)	(3.87)	(3.85)	(3.90)	(3.87)
CEO_Age^2	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***
	(−3.51)	(−3.49)	(−3.55)	(−3.51)	(−3.57)	(−3.53)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Constant	4.9581***	4.9361***	5.0302***	5.0180***	4.9247***	4.9105***
	(8.70)	(8.65)	(8.86)	(8.82)	(8.61)	(8.58)
Obs.	8894	8894	8894	8894	8894	8894
Adjusted R^2	0.3198	0.3181	0.3222	0.3210	0.3196	0.3174
F	59.29	58.62	59.50	59.14	59.14	58.58

Notes: Robust t-statistics are in parentheses.
*** $p < 0.01$.
** $p < 0.05$, and
* $p < 0.1$.

Table 5
The impact of non-CEO top manager inside directors on CEO pay-performance sensitivity controlling for endogeneity: The Second-stage results.

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
ROA	3.8500***	3.8260***	3.8574***	3.8608***	3.7613***	3.6547***
	(15.52)	(14.88)	(16.36)	(15.40)	(13.37)	(12.23)
ID1_dir	−0.4185***					
	(−4.06)					
ROA*ID1_dir	−3.7708**					
	(**−2.23**)					
ID2_dir		−0.2208**				
		(−2.31)				
ROA*ID2_dir		−2.7992*				
		(−1.83)				
ID1_exe			−0.2592***			
			(−5.42)			
ROA*ID1_exe			−1.8440**			
			(−2.41)			
ID2_exe				−0.2688***		
				(−4.97)		
ROA*ID2_exe				−1.9080**		
				(−2.11)		
ID1_dum					−0.0935***	
					(−4.28)	
ROA*ID1_dum					−0.4146	
					(−1.16)	
ID2_dum						−0.0404*
						(−1.82)
ROA*ID2_dum						−0.1947
						(−0.53)
Asset	0.2311***	0.2320***	0.2261***	0.2265***	0.2303***	0.2313***
	(29.77)	(29.84)	(29.07)	(29.10)	(29.73)	(29.77)
Debt	−0.2644***	−0.2664***	−0.2668***	−0.2677***	−0.2661***	−0.2667***
	(−5.09)	(−5.12)	(−5.15)	(−5.17)	(−5.14)	(−5.12)
Growth	−0.0582***	−0.0585***	−0.0561***	−0.0560***	−0.0559***	−0.0574***
	(−2.80)	(−2.81)	(−2.69)	(−2.69)	(−2.71)	(−2.76)
Ind_Dir	−0.4650***	−0.4323***	−0.4768***	−0.4625***	−0.4518***	−0.4155**
	(−2.85)	(−2.64)	(−2.93)	(−2.84)	(−2.77)	(−2.54)
Boardsize	0.0171***	0.0168***	0.0200***	0.0203***	0.0190***	0.0171***
	(3.72)	(3.65)	(4.34)	(4.38)	(4.12)	(3.69)
First	−0.0045***	−0.0045***	−0.0044***	−0.0045***	−0.0046***	−0.0045***
	(−8.04)	(−8.10)	(−7.84)	(−8.00)	(−8.14)	(−8.05)
Dual	0.1444***	0.1327***	0.1478***	0.1461***	0.1355***	0.1243***
	(5.00)	(4.59)	(5.12)	(5.05)	(4.76)	(4.35)
Boardsal_dum	0.0109	0.0071	0.0116	0.0137	0.0109	0.0030
	(0.67)	(0.43)	(0.71)	(0.84)	(0.66)	(0.18)
Separation	0.0073***	0.0073***	0.0073***	0.0072***	0.0073***	0.0074***
	(6.65)	(6.65)	(6.72)	(6.57)	(6.68)	(6.76)
Age	−0.0014	−0.0012	−0.0008	−0.0007	−0.0013	−0.0013
	(−0.87)	(−0.77)	(−0.50)	(−0.45)	(−0.81)	(−0.81)
CEO_Age	0.0830***	0.0831***	0.0827***	0.0819***	0.0835***	0.0832***
	(3.67)	(3.66)	(3.66)	(3.62)	(3.69)	(3.67)
CEO_Age^2	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***
	(−3.36)	(−3.35)	(−3.37)	(−3.32)	(−3.39)	(−3.36)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control

Table 5 (*continued*)

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
Constant	5.0647***	5.0337***	5.1612***	5.1648***	5.0713***	5.0463***
	(8.80)	(8.72)	(8.99)	(8.99)	(8.81)	(8.74)
Obs.	8732	8732	8732	8732	8732	8732
Adjusted R^2	0.3199	0.3182	0.3219	0.3206	0.3193	0.3170
F	62.57	62.00	63.24	62.71	62.55	61.82

Notes: Robust t-statistics are in parentheses.
*** $p < 0.01$.
** $p < 0.05$, and
* $p < 0.1$.

5.2. Alternative measures of firm performance

In this section, we use three alternative measures of firm performance to test the robustness of our conclusion that SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity: opeROA (the operating profit divided by total assets), ROE (the net profit divided by total equity), and opeROE (the operating profit divided by total equity).

Table 6 shows the results of the impact of non-CEO top manager inside directors on CEO pay-performance sensitivity using opeROA as the dependent variable. As shown in columns (1), (3), and (4) of Table 6, all else

Table 6
The impact of non-CEO top manager inside directors on CEO pay-performance sensitivity: opeROA as the dependent variable.

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
opeROA	3.3888***	3.3508***	3.3995***	3.4108***	3.2356***	3.1732***
	(17.06)	(16.39)	(17.68)	(17.14)	(14.68)	(13.80)
ID1_dir	−0.3876***					
	(−4.51)					
opeROA *ID1_dir	−2.3029*					
	(−1.93)					
ID2_dir		−0.2391***				
		(−3.03)				
opeROA *ID2_dir		−1.5263				
		(−1.39)				
ID1_exe			−0.2365***			
			(−5.81)			
opeROA *ID1_exe			−1.1746**			
			(−2.08)			
ID2_exe				−0.2288***		
				(−5.11)		
opeROA *ID2_exe				−1.2728**		
				(−1.98)		
ID1_dum					−0.0828***	
					(−4.63)	
opeROA *ID1_dum					−0.0876	
					(−0.34)	
ID2_dum						−0.0374**
						(−2.04)
opeROA *ID2_dum						0.0251
						(0.09)
Asset	0.2217***	0.2224***	0.2171***	0.2178***	0.2208***	0.2216***
	(28.94)	(29.02)	(28.21)	(28.33)	(28.85)	(28.92)

(*continued on next page*)

Table 6 (*continued*)

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
Debt	−0.2140***	−0.2153***	−0.2162***	−0.2177***	−0.2142***	−0.2149***
	(−4.23)	(−4.26)	(−4.27)	(−4.31)	(−4.24)	(−4.25)
Growth	−0.0639***	−0.0641***	−0.0621***	−0.0619***	−0.0621***	−0.0631***
	(−3.16)	(−3.16)	(−3.06)	(−3.05)	(−3.08)	(−3.12)
Ind_Dir	−0.4387***	−0.4150**	−0.4480***	−0.4343***	−0.4234***	−0.3946**
	(−2.72)	(−2.57)	(−2.78)	(−2.69)	(−2.63)	(−2.44)
Boardsize	0.0179***	0.0177***	0.0205***	0.0204***	0.0193***	0.0177***
	(3.88)	(3.83)	(4.42)	(4.40)	(4.17)	(3.81)
First	−0.0045***	−0.0046***	−0.0044***	−0.0045***	−0.0046***	−0.0045***
	(−8.16)	(−8.24)	(−7.99)	(−8.13)	(−8.24)	(−8.18)
Dual	0.1369***	0.1279***	0.1397***	0.1370***	0.1279***	0.1187***
	(4.81)	(4.51)	(4.90)	(4.82)	(4.54)	(4.21)
Boardsal_dum	0.0067	0.0045	0.0071	0.0083	0.0060	−0.0003
	(0.41)	(0.27)	(0.44)	(0.52)	(0.37)	(−0.02)
Separation	0.0077***	0.0078***	0.0078***	0.0077***	0.0078***	0.0079***
	(7.21)	(7.21)	(7.27)	(7.18)	(7.26)	(7.33)
Age	−0.0009	−0.0007	−0.0004	−0.0003	−0.0008	−0.0008
	(−0.56)	(−0.46)	(−0.24)	(−0.22)	(−0.52)	(−0.51)
CEO_Age	0.0897***	0.0903***	0.0893***	0.0889***	0.0908***	0.0911***
	(4.04)	(4.05)	(4.03)	(4.00)	(4.08)	(4.09)
CEO_Age^2	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***
	(−3.70)	(−3.71)	(−3.71)	(−3.67)	(−3.75)	(−3.75)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Constant	5.1060***	5.0697***	5.1959***	5.1897***	5.0976***	5.0666***
	(9.03)	(8.94)	(9.21)	(9.19)	(9.01)	(8.94)
Obs.	8894	8894	8894	8894	8894	8894
Adjusted R^2	0.3208	0.3193	0.3224	0.3214	0.3203	0.3185
F	62.58	62.03	63.01	62.62	62.59	61.79

Notes: Robust t-statistics are in parentheses.
*** $p < 0.01$.
** $p < 0.05$, and
* $p < 0.1$.

being equal, the coefficients of opeROA*ID1_dir (−2.3029, t = −1.93), opeROA*ID1_exe (−1.1746, t = −2.08), and opeROA*ID2_exe (−1.2728, t = −1.98) are all significant and display the expected signs. This means that our conclusion that SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity is robust.

Using ROE as the dependent variable (Zhang et al., 2014), Table 7 shows the results of the impact of non-CEO top manager inside directors on CEO pay-performance sensitivity. As shown in columns (1), (2), (3), (4), and (5) of Table 7, all else being equal, the coefficients of ROE*ID1_dir (−1.3688, t = −2.54), ROE*ID2_dir (−1.1146, t = −2.43), ROE*ID1_exe (−0.8484, t = −4.01), ROE*ID2_exe (−0.8666, t = −3.62), and ROE*ID1_dum (−0.1805, t = −1.66) are all significant and display the expected signs. This means that our conclusion that SOEs with more non-CEO top manager inside directors demonstrate lower CEO pay-performance sensitivity is robust.

Table 8 shows the results of the impact of non-CEO top manager inside directors on CEO pay-performance sensitivity using opeROE as the dependent variable. As shown in columns (1), (2), (3), (4), and (5) of Table 8, all else being equal, the coefficients of opeROE*ID1_dir (−1.2938, t = −3.00), opeROE*ID2_dir (−0.9034, t = −2.41), opeROE*ID1_exe (−0.8040, t = −4.68), opeROE*ID2_exe (−0.7959, t = −3.89), and opeROE*ID1_dum (−0.1697, t = −1.84) are all significant and display the expected signs, which is consistent with H1.

Table 7
The impact of non-CEO top manager inside directors on CEO pay-performance sensitivity: ROE as the dependent variable.

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
ROE	0.9374***	0.9368***	0.9852***	0.9816***	0.9131***	0.9091***
	(11.80)	(11.60)	(12.78)	(12.38)	(10.19)	(9.67)
ID1_dir	−0.3886***					
	(−4.60)					
ROE*ID1_dir	−1.3688**					
	(−2.54)					
ID2_dir		−0.2241***				
		(−2.90)				
ROE*ID2_dir		−1.1146**				
		(−2.43)				
ID1_exe			−0.2264***			
			(−5.78)			
ROE*ID1_exe			−0.8484***			
			(−4.01)			
ID2_exe				−0.2221***		
				(−5.11)		
ROE*ID2_exe				**−0.8666*** **		
				(−3.62)		
ID1_dum					−0.0714***	
					(−4.16)	
ROE*ID1_dum					**−0.1805***	
					(−1.66)	
ID2_dum						−0.0218
						(−1.25)
ROE*ID2_dum						−0.1531
						(−1.37)
Asset	0.2500***	0.2510***	0.2453***	0.2461***	0.2497***	0.2507***
	(33.38)	(33.49)	(32.64)	(32.72)	(33.34)	(33.42)
Debt	−0.5662***	−0.5687***	−0.5691***	−0.5708***	−0.5704***	−0.5712***
	(−11.97)	(−12.00)	(−12.04)	(−12.07)	(−12.05)	(−12.03)
Growth	−0.0296	−0.0299	−0.0284	−0.0283	−0.0272	−0.0285
	(−1.43)	(−1.45)	(−1.37)	(−1.37)	(−1.32)	(−1.38)
Ind_Dir	−0.5519***	−0.5269***	−0.5602***	−0.5480***	−0.5311***	−0.5025***
	(−3.38)	(−3.22)	(−3.44)	(−3.37)	(−3.26)	(−3.08)
Boardsize	0.0179***	0.0177***	0.0205***	0.0204***	0.0193***	0.0177***
	(3.88)	(3.83)	(4.42)	(4.40)	(4.16)	(3.80)
First	−0.0041***	−0.0041***	−0.0040***	−0.0041***	−0.0041***	−0.0041***
	(−7.29)	(−7.36)	(−7.13)	(−7.26)	(−7.35)	(−7.28)
Dual	0.1320***	0.1226***	0.1344***	0.1319***	0.1226***	0.1133***
	(4.55)	(4.24)	(4.64)	(4.55)	(4.27)	(3.95)
Boardsal_dum	0.0133	0.0107	0.0132	0.0145	0.0118	0.0052
	(0.81)	(0.65)	(0.81)	(0.89)	(0.72)	(0.31)
Separation	0.0078***	0.0078***	0.0078***	0.0077***	0.0079***	0.0080***
	(7.23)	(7.22)	(7.24)	(7.13)	(7.29)	(7.38)
Age	−0.0019	−0.0017	−0.0014	−0.0013	−0.0018	−0.0018
	(−1.17)	(−1.07)	(−0.85)	(−0.81)	(−1.12)	(−1.14)
CEO_Age	0.0867***	0.0870***	0.0867***	0.0861***	0.0869***	0.0869***
	(3.87)	(3.87)	(3.88)	(3.85)	(3.87)	(3.86)
CEO_Age^2	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***
	(−3.52)	(−3.52)	(−3.54)	(−3.50)	(−3.53)	(−3.52)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control

(*continued on next page*)

Table 7 (*continued*)

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
Constant	4.7679***	4.7365***	4.8514***	4.8457***	4.7691***	4.7376***
	(8.37)	(8.29)	(8.54)	(8.52)	(8.36)	(8.28)
Obs.	8893	8893	8893	8893	8893	8893
Adjusted R^2	0.3070	0.3055	0.3092	0.3079	0.3062	0.3043
F	57.12	56.76	57.52	57.20	57.11	56.63

Notes: Robust t-statistics are in parentheses.
*** $p < 0.01$.
** $p < 0.05$, and
* $p < 0.1$.

Table 8
The impact of non-CEO top manager inside directors on CEO pay-performance sensitivity: opeROE as the dependent variable.

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
opeROE	0.8935***	0.8732***	0.9437***	0.9317***	0.8673***	0.8445***
	(13.14)	(12.63)	(14.38)	(13.73)	(11.42)	(10.73)
ID1_dir	−0.36***91					
	(−4.51)					
opeROE*ID1_dir	−1.2938***					
	(−3.00)					
ID2_dir		−0.2169***				
		(−2.88)				
opeROE*ID2_dir		−0.9034**				
		(−2.41)				
ID1_exe			−0.2193***			
			(−5.70)			
opeROE*ID1_exe			−0.8040***			
			(−4.68)			
ID2_exe				−0.2179***		
				(−5.07)		
opeROE*ID2_exe				−0.7959***		
				(−3.89)		
ID1_dum					−0.0692***	
					(−4.12)	
opeROE*ID1_dum					−0.1697*	
					(−1.84)	
ID2_dum						−0.0227
						(−1.33)
opeROE*ID2_dum						−0.1172
						(−1.25)
Asset	0.2424***	0.2431***	0.2379***	0.2385***	0.2420***	0.2428***
	(32.01)	(32.07)	(31.37)	(31.42)	(31.95)	(32.00)
Debt	−0.5247***	−0.5252***	−0.5286***	−0.5282***	−0.5266***	−0.5260***
	(−10.94)	(−10.93)	(−11.04)	(−11.03)	(−10.97)	(−10.93)
Growth	−0.0339	−0.0342	−0.0322	−0.0322	−0.0317	−0.0331
	(−1.63)	(−1.64)	(−1.54)	(−1.54)	(−1.53)	(−1.59)
Ind_Dir	−0.5191***	−0.4943***	−0.5328***	−0.5184***	−0.5000***	−0.4715***
	(−3.22)	(−3.06)	(−3.32)	(−3.23)	(−3.11)	(−2.92)
Boardsize	0.0184***	0.0182***	0.0207***	0.0208***	0.0198***	0.0182***
	(3.98)	(3.92)	(4.45)	(4.46)	(4.25)	(3.89)
First	−0.0041***	−0.0042***	−0.0041***	−0.0041***	−0.0041***	−0.0041***
	(−7.37)	(−7.43)	(−7.29)	(−7.39)	(−7.41)	(−7.34)

Table 8 (*continued*)

Variables	(1) LnCEO_sal	(2) LnCEO_sal	(3) LnCEO_sal	(4) LnCEO_sal	(5) LnCEO_sal	(6) LnCEO_sal
Dual	0.1353***	0.1260***	0.1381***	0.1358***	0.1266***	0.1176***
	(4.71)	(4.40)	(4.80)	(4.72)	(4.45)	(4.14)
Boardsal_dum	0.0125	0.0101	0.0120	0.0138	0.0115	0.0052
	(0.76)	(0.62)	(0.74)	(0.85)	(0.71)	(0.31)
Separation	0.0075***	0.0076***	0.0075***	0.0074***	0.0076***	0.0077***
	(6.98)	(6.98)	(7.00)	(6.89)	(7.04)	(7.12)
Age	−0.0014	−0.0013	−0.0010	−0.0009	−0.0014	−0.0014
	(−0.90)	(−0.80)	(−0.62)	(−0.57)	(−0.86)	(−0.86)
CEO_Age	0.0901***	0.0903***	0.0903***	0.0892***	0.0907***	0.0906***
	(4.04)	(4.04)	(4.07)	(4.01)	(4.06)	(4.05)
CEO_Age^2	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***
	(−3.69)	(−3.68)	(−3.72)	(−3.65)	(−3.71)	(−3.70)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Constant	4.8300***	4.8040***	4.9110***	4.9187***	4.8198***	4.7951***
	(8.52)	(8.45)	(8.70)	(8.70)	(8.49)	(8.42)
Obs.	8893	8893	8893	8893	8893	8893
Adjusted R^2	0.3096	0.3080	0.3120	0.3106	0.3088	0.3070
F	57.44	57.04	57.99	57.60	57.31	56.90

Notes: Robust t-statistics are in parentheses.
*** $p < 0.01$.
** $p < 0.05$, and
* $p < 0.1$.

6. Additional tests

6.1. Additional tests of the agent role of non-CEO top manager inside directors

Agency theory concerns aligning the interests of owners and managers (Jensen and Meckling, 1976). It is based on the premise that an inherent conflict exists between the interests of a firm's owners and its management. Agency theory suggests that a greater proportion of non-CEO inside directors is unable to monitor any self-interested CEO actions. Our empirical results are consistent with agency theory. We further test the agent role of non-CEO top manager inside directors through the perspective of the impact of non-CEO inside directors on managers' on-the-job consumption.

Table 9 shows the empirical results of the impact of non-CEO top manager inside directors on managers' on-the-job consumption. As shown in columns (4) and (6) of Table 9, all else being equal, the coefficients of ID2_exe (0.0032, $t = 2.25$) and ID2_dum (0.0011, $t = 2.09$) are both significant with a positive sign. The empirical results suggest that non-CEO top manager inside directors increase managers' on-the-job consumption, which is consistent with the agent role of non-CEO top manager inside directors.

6.2. Effects of different types of non-CEO top manager inside directors on CEO pay-performance sensitivity

According to the Chinese Company Law, the non-CEO top managers in listed firms are mainly the VP, CFO, and secretaries of the board of directors. Thus, we test the impact of VP inside directors, CFO inside directors, and board secretary inside directors on CEO pay-performance sensitivity. We find that VP inside directors and CFO inside directors have significant impacts on CEO pay-performance sensitivity. However, the influence of board secretary inside directors on CEO pay-performance sensitivity is not significant. The corresponding regression results are not shown here due to space constraints.

Table 9
The impact of non-CEO top manager inside directors on CEO managers' on-the-job consumption.

Variables	(1) Perks	(2) Perks	(3) Perks	(4) Perks	(5) Perks	(6) Perks
ROA	0.0252***	0.0253***	0.0254***	0.0255***	0.0253***	0.0252***
	(4.31)	(4.33)	(4.34)	(4.37)	(4.33)	(4.32)
ID1_dir	−0.0005					
	(−0.21)					
ID2_dir		0.0023				
		(0.98)				
ID1_exe			0.0018			
			(1.49)			
ID2_exe				0.0032**		
				(2.25)		
ID1_dum					0.0007	
					(1.45)	
ID2_dum						0.0011**
						(2.09)
Asset	−0.0045***	−0.0045***	−0.0044***	−0.0044***	−0.0045***	−0.0045***
	(−18.69)	(−18.71)	(−18.50)	(−18.38)	(−18.66)	(−18.68)
Debt	−0.0031**	−0.0031**	−0.0031**	−0.0031**	−0.0031**	−0.0031**
	(−2.02)	(−2.04)	(−2.04)	(−2.04)	(−2.04)	(−2.06)
Growth	−0.0007	−0.0007	−0.0007	−0.0007	−0.0007	−0.0007
	(−0.95)	(−0.95)	(−0.96)	(−0.97)	(−0.97)	(−0.97)
Ind_Dir	−0.0025	−0.0021	−0.0020	−0.0018	−0.0021	−0.0020
	(−0.49)	(−0.42)	(−0.39)	(−0.35)	(−0.40)	(−0.39)
Boardsize	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000
	(0.51)	(0.44)	(0.32)	(0.20)	(0.34)	(0.27)
First	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
	(5.93)	(5.97)	(5.90)	(5.95)	(5.97)	(6.02)
Dual	−0.0003	−0.0004	−0.0005	−0.0006	−0.0004	−0.0005
	(−0.30)	(−0.46)	(−0.52)	(−0.63)	(−0.47)	(−0.50)
Boardsal_dum	0.0004	0.0003	0.0003	0.0002	0.0003	0.0002
	(0.72)	(0.53)	(0.52)	(0.37)	(0.49)	(0.39)
Separation	0.0001**	0.0001**	0.0001**	0.0001**	0.0001**	0.0001**
	(1.99)	(2.07)	(2.06)	(2.13)	(2.07)	(2.14)
Age	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***
	(6.49)	(6.45)	(6.43)	(6.35)	(6.48)	(6.43)
CEO_Age	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.03)	(0.04)	(0.05)	(0.07)	(0.03)	(0.03)
CEO_Age^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.28)	(0.27)	(0.26)	(0.24)	(0.27)	(0.27)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Constant	0.0874***	0.0871***	0.0863***	0.0856***	0.0869***	0.0870***
	(5.23)	(5.21)	(5.16)	(5.11)	(5.20)	(5.21)
Obs.	8772	8772	8772	8772	8772	8772
Adjusted R^2	0.0617	0.0618	0.0620	0.0623	0.0620	0.0622
F	9.879	9.893	9.915	9.967	9.913	9.950

Notes: Robust t-statistics are in parentheses.
*** $p < 0.01$.
** $p < 0.05$, and *$p < 0.1$.

6.3. Effects of non-CEO top manager inside directors on CEO pay-performance sensitivity in different types of SOE

We divide SOEs into central SOEs, provincial SOEs, and municipal SOEs. We then test the relationship between non-CEO top manager inside directors and CEO pay-performance sensitivity in SOEs. We find that non-CEO top manager inside directors have a significant impact on CEO pay-performance sensitivity in

central SOEs and municipal SOEs but not in provincial SOEs, possibly because central SOEs are very important to the national economy and municipal SOEs also play an important role in regional economic development. Therefore, the managers in central SOEs and municipal SOEs are subject to greater supervision than those in provincial SOEs and have fewer agency problems.

7. Conclusions

Agency theory and stewardship theory help us understand the role of inside directors in corporate governance (Nicholson and Kiel, 2007). Agency theory suggests that a greater proportion of non-CEO inside directors is unable to monitor any self-interested CEO actions. As a result, the CEO has more opportunity to pursue self-interest at the expense of owners. In contrast to agency theory, stewardship theory suggests that a greater proportion of non-CEO inside directors can monitor any self-interested CEO actions. Using listed SOEs as our sample, our empirical results are consistent with agency theory. We find that the proportion of non-CEO top manager inside directors has a significant negative correlation with CEO pay-performance sensitivity in SOEs, whereas the shareholding proportion of the controlling shareholders can weaken this relationship. Our conclusions are robust to endogeneity testing and alternative specifications. Furthermore, we find that non-CEO top manager inside directors significantly increase executives' on-the-job consumption. Overall, we contribute to the literature on inside directors.

The results of this paper also have practical implications. Specifically, the government should strengthen the supervision of SOE managers' behavior and decrease manager-shareholder agency problems. This would stimulate the stewardship role of non-CEO top manager inside directors and protect investor interests.

Acknowledgments

The authors acknowledge the financial support of the National Natural Science Foundation of China (Project 71602059, 71872192, 71602039); the Natural Science Foundation of Guangdong Province, China (Project 2015A030310223, 2016A030313482); the Humanities and Social Science Fund of Ministry of Education of China (Project 15YJC630051). All authors contribute equally.

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