Does audit quality reduce stock price synchronicity? Evidence from China.

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Abstract

In this paper we investigate the effect of auditor quality on stock price synchronicity. Based on the analysis of a large sample of Chinese listed firms over the period 2003 to 2019, we find that stocks of firms that are audited by high quality auditors have lower synchronicity, suggesting that more firm-specific information has been incorporated into stock price. Furthermore, results on mediation test show that high quality auditing improves the information transparency of their auditees and reduces the herding behavior of institutional investors, both of which contribute to lower stock price synchronicity. Our findings, which are robust to a battery of sensitivity check, have implication for policymakers and investor.

Keywords: stock price synchronicity; audit quality; information transparency; herding

1. Introduction

One of the important functions of the capital market is to improve the efficiency of resource allocation through the signalling of stock price. Prior literature suggests that stock prices reflect both market-wide and company-specific information (Roll, 1998; Fox, Morck, Yeung, & Durnev, 2003). Stock price synchronicity, which has been proposed by Roll (1988), captures the extent to which company-specific information has been impounded into stock prices. A lower synchronicity implies that market and industry returns can explain a smaller proportion of individual stock returns, suggesting that more firm-specific information has been capitalized into stock price (Roll, 1988). Previous studies show that capital budgeting[1] (Durnev et al., 2004) and corporate governance[2] (Defond & Hung, 2004) can have markedly influence on synchronicity.

The benefits of high-quality auditing have been discussed extensively in the literature. Early studies document that high-quality auditors could improve the financial report quality through constraining earnings management (Ahmad, Suhara, & Ilyas, 2016; Alhadab, 2016; Orazalin & Akhmetzhanov, 2019; Swastika, 2013), lowering the possibility of accounting fraud (Jiang, Habib, & Zhou, 2015; Kadous, 2000; Skinner & Srinivasan, 2012), and reporting errors (Francis, 2011; Rodríguez & Alegría, 2012).

[1] Durnev, Morck, and Yeung (2004) used the deviation of Tobin's Q's marginal ratio from the industrial optimal level as the measurement of investment efficiency to analyse the relationship between stock price synchronicity and capital budgeting efficiency. It has been found that there is a negative correlation between a company's stock price synchronicity and capital budgeting efficiency. They pointed out that a higher level of stock price synchronicity will reduce the efficiency of capital budgeting and cannot effectively inhibit management from investing blindly and ineffectively, thus deviating capital budgeting from the corporate goal of value maximization.

[2] Defond and Hung (2004) conducted an empirical analysis of CEO changes of listed companies from 33 countries and found that in countries where investor protection is executed less effectively, for companies with lower stock price synchronicity, their CEOs are less likely to be changed because of poor performance. Overly high stock price synchronicity reduces the likelihood of identifying and changing poor-performing CEO, thus affecting the effectiveness of corporate governance.

In this paper we investigate the relationship between audit quality and stock price synchronicity. The majority of the extant research focuses on the impact of the internal mechanisms as determinants of synchronicity, such as equity structure of management (Gul et al., 2010; Kim & Shi, 2009), quality of accounting information (Dasgupta, Gan, & Gao, 2010; Ding et al., 2018; Gul et al., 2010), complexity of operation (Fox, Morck, Yeung, & Durnev, 2003), and ownership structure (Chin et al., 2014; Ding et al., 2013; Gul et al., 2010). Studies focusing on the association between audit quality and stock price synchronicity are primarily based on the US market (Hsin & Tseng, 2012; Kumar & Dhankar, 2010; Lee & Liu, 2011; Shiller, 1980, 1989), with relatively limited evidence in emerging markets[3].

We argue that audit quality could serve an important external monitoring mechanism in helping improve the information transparency and credibility of firms' financial statements. External auditing can affect stock price synchronicity in several ways. First, high-quality auditors are expected to carefully scrutinise the auditees' operation and internal documents, thereby strengthening the credibility of financial statements, which reduces the information acquisition cost of investors (Kadous, 2000; Teoh & Wong, 1993). Second, high-quality auditors are able to restrain the opportunistic behaviours of the management, which can further enhance the reliability of corporate disclosure (Bhattacharya, Daouk, & Welker, 2003; Teoh & Wong, 1993). As a result, high-quality auditing enables the flow of more company-specific information to the market and subsequently being incorporated into stock prices, leading to lower stock price synchronicity.

We further analyse whether the association between audit quality and stock price synchronicity is meditated by information transparency and the institutional investors' herding. First, higher information transparency lowers the information acquisition cost for

[3] An exception is Gul et al. (2010), which use Big-4 as the audit quality proxy to measure audit quality and examine the relation between audit quality and synchronicity in China. However, this study did not explore the mechanism through which audit quality can impact synchronicity.

investors, which enables the stock price to impound more firm-specific information, thus decreasing synchronicity. Prior research concludes that high quality auditing helps companies enhance the quality of disclosure, which contributes to improved information transparency (Jin & Myers, 2006). Second, high quality disclosure boosts the confidence of professional investors, mitigating their concerns about the future operation of the firm. This motivates investors to trade on information instead of speculation, which results in more firm-specific information being incorporated into stock price.

In this paper, we follow Roll (1988) to measure stock price synchronicity with adjusted R^2 from the market model regression to capture the extent to which stock price movement can be explained by both market and industry-wide information. After a log-transformation, a lower synchronicity measure implies that market and industry returns can explain a smaller proportion of individual stock returns, suggesting that more firm-specific information has been capitalized into stock price. We measure audit quality with auditor industry specialization, the issuance of modified auditor opinion (MAO) and auditor reputation and scale. Our sample consists of 24,199 firm-year observations of Chinese listed firms over the period 2003 and 2019. We find that high-quality auditing is negatively associated with stock price synchronicity. Furthermore, mediation tests show that high quality auditing improve the information transparency of their auditees and strengthens the herding behavior of institutional investors, both of which contribute to lower stock price synchronicity. We conduct a battery of robustness tests to corroborate our findings. Our results are insensitive to alternative audit quality measures and auditor switch. To address the endogeneity issue, we use 1) the two-stage Heckman regression; 2) the introduction of New Audit Reporting standards in 2016; 3) propensity-matching (PMS). Our inference remains unchanged.

This paper contributes to the literature in several ways. In particular, the findings that high-quality auditors reduce stock price synchronicity point to the externality of auditing that has

received limited attention in prior literature. Furthermore, our results indicating that high quality auditing improves the information transparency of their auditees and reduce the herding behavior of institutional investors provide fresh insights on the mechanism through which auditing can make a difference in stock price synchronicity. Second, this paper is of interest to regulators and policy makers. Our results suggest that the new audit reporting standards introduced by the Chinese government in 2016 (MoF, 2016) are able to promote stock price efficiency by incorporating more firm-specific information into stock price. Finally, this paper contributes to the research on the external determinants of stock price synchronicity.

The rest of the paper is organized as follows: the next section reviews the literature and develops the hypotheses, which is followed by a discussion of data and research design. The following two sections present the empirical results and robustness checks. The final section concludes.

2 Literature review and hypothesis development

2.1 Literature on synchoronicity

According to Roll (1988), stock price synchronicity reflects the extent to which firm-specific information has been impounded into the stock price. Morck et al. (2000) indicate the low synchronicity is mainly caused by the fact that more company's specific information (less market and industry-wide information) has been captured by the stock price. Later research such as Durnev et al. (2004) suggest that the difference in stock price synchronicity across countries can be attributed to the different level of protection of property rights between countries. According to Chen, Goldstein, and Jiang (2007), developed countries have better investor protection and stringent disclosure regulation, so stock price movement can be explained by the company's fundamental information. In contrast, in developing countries

such as China, stock prices contain limited information about corporate fundamentals. As a result, market factors and industry factors may explain a large proportion of stock price fluctuation, leading to higher synchronicity of stock price fluctuations (Dasgupta et al., 2010). Based on an equilibrium model of rational expectations for multi-period trading, Lee and Liu (2011) decompose the fluctuation in stock price into two components: those caused by information related to a company's underlying value, and those caused by noise trading. When more company-specific information has been incorporated into the stock price, synchronicity gradually decreases.

To summarize, information is the primary determinant of stock price fluctuation in the stock market, and the quality of information affects the capital flow and the optimization of capital allocation structure (Chen et al., 2007; Ding et al., 2013; Gul et al., 2010; Lee and Liu, 2011; Shiller, 1989; Zhou and Peng, 2007). Noise trading is another factor influencing stock price fluctuation. In a market with more noise, firm-specific information exerts less influence on stock price, and noise assumes a greater influence on stock price. By boosting investors' confidence and alleviating their concerns about the company's prospects, improved corporate transparency is expected to decrease the impact of noise trading on stock prices fluctuation (Zhou & Peng, 2007).

2.2 Audit quality and stock price synchonicity

As a crucial external monitoring mechanism to protect the rights and interests of investors, independent auditing ensures the reliability of corporate information disclosure, and serves as a major institutional arrangement to alleviate the conflicts between internal and external agents (Chang et al., 2008; Jiang et al., 2015; Kim & Song, 2011). Previous studies have documented that qualified auditors are more capable of performing the external audits to constrain management opportunism (Chang et al., 2008; Choi, Kim, Kim, & Zang, 2010;

DeAngelo, 1981; Jiang et al., 2015; Karjalainen, 2011; Kim & Song, 2011). In what follows the mechanism through which audit quality can make a difference in stock price synchronicity is discussed:

Firstly, high quality auditing can enhance the credibility of company-specific information disclosed in the financial reports by effectively identifying reporting errors and irregularities (Ding & Jia, 2012). At the same time, high quality auditors usually have a higher standard of evaluating and selecting their clients to avoid audit failure.[4] High quality auditors are also motivated to increase the investment including the human resource, technical equipment etc, to maintain high-quality audit services. Consequently, the improvement of information disclosure resulting from high quality auditing allows the capitalisation of reliable company-specific information into the stock price, thus reducing stock price synchronicity.

Second, according to the theory of supply of audit service (Chow & Lim, 2000), external audit is a transfer of information risk, and its insurance value depends on the auditor's legal liability and the ability to compensate. High quality auditors (usually large auditors) are more concerned about their reputation and potential litigation risk because of their “deep pocket” to compensate and therefore higher potential liability in case of audit failure (DeAngelo, 1981;). High quality auditors have economic incentive to restrict the opportunistic behaviours such as the management hiding negative information and earnings manipulating, which can further enhance the reliability of corporate disclosure (Bhattacharya, Daouk, & Welker, 2003; Teoh & Wong, 1993). In sum, high quality auditors ensure the quality of company information disclosure, which enables the incorporation of more company-specific information into the stock price. Based on the discussion, we propose the first hypothesis as follows:

[4] In robustness check (section 5) we design tests to rule out the reverse causality that firms with lower stock price synchronicity select high quality auditors.

H1: High quality auditing is associated with reduced stock price synchronicity.

2.3 Audit quality, information transparenct and stock price synchonicity

As defined by the Basel Committee on Banking Supervision (BSBC, 1998), high information transparency means that investors can “see through the appearance to perceive the essence”. Bhattacharya et al. (2003) defines earnings opacity, an important aspect of information transparency, as “the extent to which the accounting statements fails to provide information about the real earnings of a company”. Low transparency allows the corporate insiders to conceal negative news, increases the firm-specific risks, and prevents the external investors from fully assessing the corporate fundamentals, which leads to the stock price incorporating less firm-specific information and a higher stock price synchronicity. For example, Hutton et al. (2009) report that among different stocks in the market, the lower the information transparency of a company, the lower the information content of its stock price, and the higher the stock price synchronicity.

High-quality auditors can effectively enhance corporate transparency. Krishnan and Visvanathan (2007) argue that external audit is an integral part of corporate governance, and the quality of audit determines the quality of a firm's accounting information. In particular, auditors with industry expertise have a better understanding of company fundamental and are more capable of obtaining accurate operating information, thereby effectively decreasing information asymmetry between firm insiders and external stakeholders. For example, Blankley, Hurtt, and MacGregor (2012) assert that auditors’ industry expertise can significantly relieve information asymmetry between firms and external stakeholders, and create a strong supervision mechanism over a firm's operation and management, thereby effectively increasing the transparency of accounting information. The theoretical model developed by O'Hara (2003) predicts that the information environment of a company

influences how investors evaluate its value and hence influence the fluctuation of its stock price. Chan and Hameed (2006) show that in emerging markets, low information transparency of listed companies and the resultant high information collection cost are the main reasons of high stock price synchronicity. To summarise, when high quality auditing promotes information transparency, the cost of acquiring information is lower and investors may find it easy to access and subsequently trade on firm-specific information, leading to more firm specific information being impounded into stock price. H2 is formulated as follows:

H2: The negative relationship between audit quality and stock price synchronicity is mediated by information transparency.

2.3 Audit quality, institutinoal herding and stock price synchonicity

Kraus and Stoll (1972) propose the idea “parallel trading” by the institutional traders (later labelled as “herding”), which refers to the scenario where massive institutional investors buy or sell the same stock at the same time. Different theories have been developed to explain the herding behaviour, and the most widely used is the information flow model. According to the information flow model, all decision-makers observe the decisions made by previous decision-makers, aiming to gain additional private information exclusive to the former decision-makers. Bikhchandani, Hirshleifer, and Welch (1992) indicate that the investors estimate the private information of others from their investment decisions and market reaction, then make their decisions. Financial statements certified by high-quality auditors contain more credible information, increasing the “pertinence” and “creditability” of the information therein. The higher the audit quality, the more reliable the information acquired by external investors who are more likely to trade on such information. As a result, investors, in particular institutional investors, are less likely to herd. Instead, they would trade on the information disclosed by the firm, resulting in more firm-specific information being

impounded into stock price. This lowers the stock price synchronicity. Based on the discussion we propose H3:

H3: The negative relationship between audit quality and stock price synchronicity is mediated by herding of institutional investors.

3.Data and research design

3.1 Sample

The data used in this paper are collected from multiple sources. The stock return data are obtained from the WIND database, and the accounting data and auditor's characteristics are collected from the China Stock Market & Accounting Research Database (CSMAR). The sample starts with 61,009 firm-year observation between 2003 and 2019. Following prior studies (Ding et al., 2013; Gul et al., 2010; Robin & Zhang, 2015), we remove 1) firms in financial industry and utility; 2) firms with fewer than 180 days of trading in a year 3) ST and ST∗ firms; and 4) firms with missing control variables. Our final sample consists of 24,199 firm-year observations. To reduce the influence of outliers, we winsorise all continuous variables by the top and bottom one percentile. We use the industry classification standards released by the China Securities Regulatory Commission (CSRC) in 2012.

3.2 Measure of stock price synchronicity

Roll (1988) suggests that the amount of firm-specific information impounded into the stock price can be measured by stock price synchronicity (R^2)[5]. To construct the measure of stock

[5] In this paper, we also estimate the R^2 by two alternative models, the first one follows Roll (1988) and Morck et al. (2000):

$$RET_{i,t} = \beta_0 + \beta_1 r_{m,t} + \beta_2 r_{m,t-1} + \varepsilon_{i,t}$$

The Second one follows the prior research (Durnev et al., 2004; Fox et al., 2003), these studies added the return of a specific industry into the model:

$$RET_{i,t} = \beta_0 + \beta_1 r_{m,t} + \beta_2 r_{i,t} + \varepsilon_{i,t}$$

price synchronicity, we estimate the market model and decompose total return variations into two components: those tied to common (market wide and/or industry wide) factors and those tied to firm-specific factors. Specifically, the stock price synchronicity is estimated with the following model:

$$RET_{i,t} = \beta_0 + \beta_1 r_{m,t} + \beta_2 r_{m,t-1} + \beta_3 r_{i,t} + \beta_3 r_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where $r_{i,t}$ is the weekly return of stock i, $r_{m,t}$ is the weekly market return calculated on a value-weighted basis, and $r_{i,t}$ is the weekly industry return. We include the lagged market and industry returns to account for nonsynchronous trading. The industry-wide earnings is computed as:

$$RET_{j,m,t} = \frac{\sum_{k \in j} w_{k,w,t} * r_{k,w,t} - w_{k,w,t} * r_{k,w,t}}{I_{k,w,t} - 1} \quad (2)$$

where $w_{k,w,t}$ denotes Firm k's weight of market value in Week w of Year t in Industry j; and $I_{k,w,t}$ denotes the number of firms in Industry j (to which Firm i belongs) in Week w of Year t. The market earnings $r_{k,w,t}$ can be defined in a similar way.

Finally, we take a logarithm-transformation of adjusted R^2 of model (1) and define stock price synchronicity, SYNCH, as follows. A high SYNCH indicates that more (less) market- or industry-specific information (firm-specific information) has been impounded into stock price.

$$SYNCH = \log\left(\frac{R^2}{1 - R^2}\right) \quad (3)$$

3.3 Audit quality measure

We use three audit quality measures including auditor industry specialization, auditor reputation and MAO.

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where, $r_{i,t}$ is the weekly return of stock i, $r_{m,t}$ is the weekly market return calculated on a value-weighted basis, and $r_{i,t}$ is the weekly industry return.

All the results are consisted with the main findings in part 4, 5 and 6.

Auditor Industry Specialization. With a good comprehension of industry knowledge and a comprehensive understanding of industry-specific risks, auditors with industry expertise are able to exercise their full oversight in the audit assignment. From example, Krishnan (2003) found that auditors with industry expertise provide high quality financial reporting by limiting earnings management practices. According to Goodwin and Wu (2014), auditors with industry expertise improve the transparency of auditees' accounting information. Balsam, Krishnan, and Yang (2003) argue that an auditor with industry expertise reduces the auditor's tolerance for material misstatements in financial statements. Following prior research (Hogan & Jeter, 1999; Mayhew & Wilkins, 2003; Minutti-Meza, 2013; Robin & Zhang, 2015), the audit industry specialization is calculated as follows:

$$MSA_{i,t} = \sum_{j=1}^{J} \sqrt{ASSET_{i,k,j}} \Big/ \sum_{i=1}^{I} \sum_{j=1}^{J} \sqrt{ASSET_{i,k,j}} \qquad (4)$$

where $\sum_{j=1}^{J} \sqrt{ASSET_{i,k,j}}$ is the sum of the square roots of the total assets that are audited by auditor i in industry k. $\sum_{i=1}^{I} \sum_{j=1}^{J} \sqrt{ASSET_{i,k,j}}$ is the sum of the square roots of the total assets in industry k. $MSA_{i,t}$ is the market share for audit i in year t. The EXPERT is an indicator variable that equals 1 if the MSA for audit i is in the top 25% percent, and 0 otherwise. The auditor industry specialization variable is computed for each year.

Auditor reputation and scale. According to DeAngelo (1981), auditors of large size are exposed to higher risk in the case of audit failure, implying that larger auditors have higher audit quality. The "deep-pockets" theory offers an alternative explanation for the greater quality of the larger auditors such as the Big 4, as they attach greater importance to their brands and reputation to maintain their global standard of quality and higher market share (Lennox, 1999). According to Defond and Jiambalvo (1993), companies audited by the Big 4 reported fewer frauds and violations than those audited by non-Big_4. Francis and Yu (2009)

and Choi et al. (2010) show that larger firms were more likely to issue non-standard audit opinions to reduce earnings management. In accordance with prior studies, we measure audit quality by looking at whether the firm has been audited by one of the Big 4 auditors.

Modified Audit Opinions (MAOs). According to the *Auditing standards for Chinese Certified Public Accountants No. 1501: Audit Report*, there are four types of audit opinions, namely, unqualified opinion, qualified opinion, negative opinion, and disclaimer opinion. In the existing research, audit opinions are generally divided into two categories: standard unqualified opinion and modified audit opinion (MAOs) (Choi et al., 2010; Knechel & Vanstraelen, 2007). Generally, it is believed that when an auditor issues MAOs, the auditor can maintain a high degree of independence. Therefore, the higher the percentage of modified audit opinions issued by auditor, the higher their independence and the higher the audit quality is assumed to be (Choi et al., 2010; Knechel & Vanstraelen, 2007).

3.4 Research design

To test H1, we use the following model:

$$SYNCH_{i,t+1} = \beta_0 + \beta_1 * AQ_{i,t} + \beta_2 * SIZE_{i,t} + \beta_3 * STDROA_{i,t} + \beta_4 * STDROA_{i,t} + \beta_5 * TURNOVER_{i,t} + \beta_6 * VOL_{i,t} + \beta_7 * LEV_{i,t} + \beta_8 * MB_{i,t} + \beta_9 * ROE_{i,t} + \beta_{10} * TOP1_{i,t} + \beta_{11} * INSHOLD_{i,t} + \beta_{12} * SOE_{i,t} + \beta_{13} * INDNUM_{i,t} + \beta_{14} * INDSIZE_{i,t} + \beta_{14} * M2G_{i,t} + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t} \quad . \qquad (5)$$

We use the lead-lag approach by regressing $SYNCH_{it+1,}$ the stock price synchronicity f Firm i in year t+1, on one of the audit quality measures of firm i in year t ($AQ_{i,t}$), which includes auditor industrial specialization, MAO and auditor's reputation (big 4 *vs* non big 4).

Following prior research (Chan & Hameed, 2006; Gul et al., 2010; Knechel & Vanstraelen, 2007; Piotroski & Roulstone, 2004), we include a set of control variables that have been documented to influence synchronicity: $SIZE_{i,t}$. Natural logarithm of the firm i 's total assets in year t; $STDROA_{i,t:}$ the standard deviation of ROA for three consecutive years; $VOL_{i,t:}$ The

ratio of the trading volume in year to the amount of the outstanding shares in that year; $TURNOVER_{i,t}$: the difference between the monthly turnover rate in year t and that in year t-1; $LEV_{i,t}$: total debt scaled by total assets; $MB_{i,t}$: book-to-market ratio; $ROE_{i,t}$: Return on assets; $TOP1_{i;t}$: the shares (in percentage) owned by the largest shareholder; $INSHOLD_{i,t}$: the total shares (in percentage) owned by the institutional shareholders; SOE: a dummy variable that equals 1 the firm is owned by the state, 0 otherwise; $INSNUM_{i,t}$: the natural logarithm of the total firms in an industry. $INDSIZE_{i,t}$: the natural logarithm of the total assets in an industry; $M2G_{i,t}$: the rate of M2 growth in China market in year t. $\varepsilon_{i,t}$ is the residual of regression model. Both year and industry fixed effects are included. Appendix 1 presents the definition of all variables.

<< Insert Appendix 1 here >>

To test the mediation effect of information transparency, we follow prior research (Bhattacharya et al., 2003; Chang et al., 2008; DeAngelo, 1981; Francis & Yu, 2009; Kadous, 2000; Khajavi & Zare, 2016; Kim & Song, 2011; Orazalin & Akhmetzhanov, 2019) to calculate the absolute value of discretionary accruals (DA) and the transparency of accounting information (TRAN) as proxies of information transparency. The computation of DA and TRANS are explained in Appendix 2.

<< Insert Appendix 2 here >>

According to of Baron and Kenny (1986), the mediation effect can be statistically confirmed if the following three conditions are fulfilled. First, audit quality has a significant influence on information transparency (measured by absolute value of DA and TRANS); Second, the information transparency (measured by absolute value of DA and TRANS) has significant impact on stock price synchronicity. Third, the effect of audit quality on stock price synchronicity becomes insignificant when information transparency is added as explanatory variable to the baseline regression. The mediation effect can be statistically verified using the Sobel (1982) test.

We run the following three regressions:

$$Transparency_{i,t} = \beta_0 + \beta_1 * AQ_{i,t} + \sum\beta_n * Controls_{i,t} + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t,} \quad (6)$$

$$SYNCH_{i,t+1} = \beta_0 + \beta_1 * Transparency_{i,t} + \sum\beta_n * Controls_{i,t} + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t}\ , \quad (7)$$

$$SYNCH_{i,t+1} = \beta_0 + \beta_1 * AQ_{i,t} + \beta_2 * Transparency_{i,t} + \sum\beta_n * Controls_{i,t} + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t}. \quad (8)$$

where the dependent variable $SYNCH_{it+1}$ is stock price synchronicity for Firm i in year t+1. The independent variable $AQ_{i,t}$ is the audit quality measure in year t for firm i, including the auditor industrial specialization , auditor's reputation and audit opinion. The Transparency is eitehrh DA or TRANs for firm i in year t. All the control variables are defined as before. ∑INDUSTRY is the fixed industry effect. ∑YEAR is the fixed year effect. $\varepsilon_{i,t}$ is the residual of regression.

Commented [DR1]: Yaqiong, please explain how institutional herding is measured.

Then, in order to test the mediation effects of institutional investment behaviour, We recalculate the regressions (6), (7) and (8) by changing the parameters named Transparency to Institutional herding (Herd). According to Lakonishok, Shleifer, and Vishny (1992), the core concept is to judge whether there is institutional herd behaviour by measuring whether these funds have the same deal proneness towards specific stocks. They measure herd behaviour by the imbalance between the trading volumes of buyers and sellers. The computation of DA and TRANS are explained in Appendix 2.

<< Insert Appendix 2 here >>

4 Results

4.2 Descriptive statics

Table 1 presents the descriptive statistics. The mean (standard deviation) of SYNCH is-0.112 (0.765), which are consistent with the findings of Gul et al. (2010) based on an early period (1996-2003) in China. The mean of audit quality measures, EXPERT, BIG_4 and MAOs are 0.24, 0.064 and 0.026, respectively, indicating that about 7% of sample firms choose one of the Big-4 auditors, and approximately 3% of the sample firms received MAOs. Size has a mean of 21.996, while the mean of Lev and MB are 0.45 and 0.656, respectively. The average outstanding shares held by the largest shareholder is 36.3%, while the mean of institutional holding is 34.4%.

Table 2 presents the Pearson correlation matrix for the variables. The correlations among all the variables are less than 0.5. which implies multi-collinearity is less likely to be a concern. The EXPERT and BIG_4 negatively correlated with SYNCH, while MAOs is positively correlated with SYNCH.

Table 1 Descriptive Statistics

	OBS	MEAN	SD	P25	P50	P75
R^2	24199	0.477	0.168	0.356	0.483	0.603
SYNCH	24199	-0.112	0.765	-0.591	-0.067	0.417
EXPERT	24199	0.240	0.427	0.000	0.000	0.000
BIG_4	24199	0.064	0.244	0.000	0.000	0.000
MAOs	24199	0.026	0.160	0.000	0.000	0.000
SIZE	24199	21.996	1.262	21.074	21.815	22.708
STDROA	24199	0.025	0.030	0.007	0.015	0.030
TURNOVER	24199	-0.111	0.469	-0.280	-0.042	0.121
VOL	24199	5.890	4.579	2.709	4.673	7.761
LEV	24199	0.450	0.201	0.294	0.454	0.605
MB	24199	0.656	0.239	0.472	0.672	0.853
ROE	24199	0.069	0.125	0.030	0.072	0.122
TOP	24199	0.363	0.153	0.242	0.344	0.475
INSHOLD	24199	0.344	0.247	0.115	0.332	0.541
SOE	24199	0.479	0.500	0.000	0.000	1.000
INDNUM	24199	5.506	1.167	4.625	5.568	6.545

INDSIZE	24199	28.226	1.510	27.392	28.339	29.486

[*] *This table presents the descriptive statistics for the test sample with 24,199 observations from 2003 to 2019.*
SYNCH is stock price synchronicity measures, estimated using Eq. (3).
All other variables are as defined in Appendix 1.

	SYNCH	EXPERT	MAOs	BIG4	SIZE	STDROA	TURNOVER	VOL	LEV	MB	ROE	TOP	INSHOLD	SOE	INDNUM	INDSIZE
SYNCH	1.000															
EXPERT	-0.016**	1.000														
MAOs	-0.073***	-0.018***	1.000													
BIG_4	-0.036***	-0.064***	-0.021***	1.000												
SIZE	0.133***	0.135***	-0.064***	0.350***	1.000											
STDROA	-0.087***	-0.027***	0.255***	-0.040***	-0.148***	1.000										
TURNOVER	0.142***	-0.005	0.040***	0.023***	0.075***	0.035***	1.000									
VOL	0.058***	-0.041***	0.025***	-0.133***	-0.302***	0.111***	0.059***	1.000								
LEV	0.028***	0.012*	0.116***	0.083***	0.426***	-0.008	0.148***	-0.110***	1.000							
MB	0.032***	0.037***	-0.010	0.140***	0.410***	-0.128***	-0.022***	-0.161***	0.360***	1.000						
ROE	0.094***	0.044***	-0.338***	0.074***	0.151***	-0.378***	-0.064***	-0.111***	-0.155***	-0.130***	1.000					
TOP1	0.018***	0.086***	-0.050***	0.136***	0.184***	-0.068***	-0.017***	-0.128***	0.051***	0.184***	0.115***	1.000				
INSHOLD	-0.008	0.059***	-0.066***	0.180***	0.469***	-0.093***	-0.025***	-0.382***	0.107***	-0.170***	0.208***	0.214***	1.000			
SOE	0.124***	0.043***	-0.021***	0.115***	0.245***	-0.070***	0.158***	-0.167***	0.268***	0.231***	-0.028***	0.264***	0.168***	1.000		
INDNUM	-0.077***	-0.159***	-0.019***	-0.029***	0.027***	0.012*	-0.091***	0.063***	-0.118***	-0.105***	0.003	-0.083***	0.048***	-0.198***	1.000	
INDSIZE	-0.067***	-0.124***	-0.033***	0.037***	0.264***	-0.017***	-0.110***	0.036***	-0.019***	-0.047***	0.025***	-0.032***	0.226***	-0.135***	0.830***	1.000

Table 2 Pearson Correlation

[*] ***, **, * refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

[*] This table presents the Pearson Correlation coefficients for the test sample with 24,199 observations from 2003 to 2019.

SYNCH is stock price synchronicity measures, estimated using Eq. (3).

4.2 Results on H1

Results on H1 are presented in Table 3. We use three proxies of auditor quality, namely auditor industrial specialization (EXPERT), audit scale and reputation (Big-4), and audit opinions (MAOs). Consistent with our prediction in H1, the coefficients of EXPERT and the Big_4 are negative and significantly at 1% confidence level, and the coefficient of MAOs is positive and significant at 1% level when stock price synchronicity is the dependent variable. These results support the prediction in H1 that stock price synchronicity is lower for the firms with high audit quality, because firm-specific information has been incorporated into stock price to a greater extent among such firms.

With regard to the control variables, most of the coefficients have signs consistent with what has been reported in prior research (Gul et al., 2010). Stock price synchronicity is positively associated with SIZE, VOL, TURNOVER, MB, ROE and INDNUM, and negatively associated with LEV, INDSIZE and INSHOLD. In the next section we aim to identify the channels through which audit quality can affect stock price synchronicity.

Table 3 The effect of audit-quality on stock price synchronicity

	EXPERT Model	Big_4 Model	MAOs Model
AQ	**-0.0392*****	**-0.1136*****	**0.1248*****
	(-3.8054)	**(-5.8145)**	**(4.3154)**
SIZE	0.1244***	0.1211***	0.1213***
	(19.2429)	(18.9257)	(18.9712)
STDROA	-0.6052***	-0.5944***	-0.5048***
	(-4.0387)	(-3.9644)	(-3.3517)
TURNOVER	0.0443***	0.0457***	0.0460***
	(3.8790)	(4.0034)	(4.0337)
VOL	0.0064***	0.0063***	0.0063***
	(4.9071)	(4.8475)	(4.8251)
LEV	-0.4351***	-0.4321***	-0.4210***
	(-16.2452)	(-16.1321)	(-15.7011)

MB	0.2785***	0.2842***	0.2746***
	(8.8644)	(9.0573)	(8.7427)
ROE	0.3077***	0.3090***	0.2642***
	(7.6752)	(7.6940)	(6.3993)
TOP	-0.1730***	-0.1782***	-0.1783***
	(-5.5660)	(-5.7352)	(-5.7354)
INSHOLD	-0.1258***	-0.1242***	-0.1243***
	(-4.5861)	(-4.5258)	(-4.5315)
SOE	0.1019***	0.1028***	0.1010***
	(10.3681)	(10.4683)	(10.2854)
INDNUM	0.2464***	0.2425***	0.2416***
	(8.4389)	(8.2976)	(8.2734)
INDSIZE	-0.0515**	-0.0507**	-0.0503**
	(-2.4303)	(-2.3923)	(-2.3745)
M2g	0.0098*	0.0092	0.0093
	(1.6753)	(1.5704)	(1.5973)
_cons	-2.3326***	-2.2867***	-2.4200***
	(-3.8029)	(-3.7308)	(-3.9464)
INDUSTRY	Yes	Yes	Yes
YEAR	Yes	Yes	Yes
N	24199	24199	24199

* ***, **, * refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

This table presents the main regression results. The t-statistics and z-statistics are reported in parentheses. The t-statistics and z-statistics are based on standard errors clustered at both firm and year. All variables are as defined in Appendix 1.

4.3 Results on H2 and H3

4.3.1 The mediating effect of information transparency (H2)

We report the results on the mediating effect of information transparency in Table 4, Panel A and B. In the regression where synchronicity is the dependent variable, the coefficients of DA and TRANS are all positive and significant. Furthermore, the magnitude of coefficients of two audit quality measures (EXEPERT and MAO) decreases after TRANS is added as explanatory variable (Panel B). The Sobel z-statistics confirms the partial mediation effect of TRANS ($p< 0.05$). Overall we find partial support for H2.

Table 4 Mediation tests on information transparency

Panel A: Absolute value of discretionary accruals (DA) as the mediator

	EXPERT Model	Big_4 Model	MAOs Model
Model 1 (without the mediator)			
AQ	-0.0379***	-0.1136***	0.1263***
	(-3.6584)	(-5.8145)	(4.3752)
N	24199	24199	24199
adj. R^2	0.302	0.303	0.302
F	237.5037	238.0107	237.7037
All other control variables	Yes	Yes	Yes
Industry and year dummies	Yes	Yes	Yes
Model 2 （with the mediator）			
AQ	-0.0386***	-0.1151***	0.1343***
	(-3.7498)	(-5.8148)	(4.5632)
DA	0.2889***	0.2802***	0.3107***
	(3.9435)	(3.8213)	(4.2398)
N	24199	23871	23871
adj. R^2	0.302	0.303	0.303
F	234.4345	234.8758	234.7211
Sobel Z	**-0.0008****	**-0.0024****	**-0.0033****
P-value of Sobel Z	**0.0226**	**0.0032**	**0.0031**
All other control variables	Yes	Yes	Yes
Industry and year dummies	Yes	Yes	Yes

* ***, **, * refer significance at the 1 percent, 5 percent, and 10 percent levels, respectively.*

This table presents the main regression results.

The t-statistics and z-statistics are reported in parentheses.

The t-statistics and z-statistics are based on standard errors clustered at both firm and year.

All variables are as defined in the Appendix A.

Panel B: Index of Earnings aggressiveness and Earnings smoothness (TRAN) as the mediator

	EXPERT Model	Big_4 Model	MAOs Model
Model 1 (without the mediator)			
AQ	-0.0386***	-0.1136***	0.1263***
	(-3.7498)	(-5.8145)	(4.3752)
N	24199	24199	24199
adj. R^2	0.302	0.303	0.302
F	237.5037	238.0107	237.7037
All other control variables	Yes	Yes	Yes
Industry and year dummies	Yes	Yes	Yes
Model 2 （with the mediator）			
AQ	-0.0295**	-0.1215***	0.1214***
	(-2.4058)	(-5.4433)	(3.6072)
TRAN	0.0112***	0.0108***	0.0115***
	(4.4490)	-0.1215***	(4.5621)
N	16817	16817	16817
adj. R^2	0.308	0.309	0.308
F	163.7286	164.1947	163.6901
Sobel Z	**-0.0011****	**-0.0029****	**-0.0022***
P-value of Sobel Z	**0.0244**	**0.0028**	**0.0661**
All other control variables	Yes	Yes	Yes
Industry and year dummies	Yes	Yes	Yes

* ***, **, * refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.*

This table presents the mediation regression results.

The t-statistics and z-statistics are reported in parentheses.

The t-statistics and z-statistics are based on standard errors clustered at both firm and year.

All variables are as defined in Appendix 1 and Appendix 2.

4.3.2 The mediating effect of institutional herding (H3)

Panel 5 provides the results on the mediation role of institutional herding. In the regression where synchronicity is the dependent variable, the coefficient of Herd (the mediator) is negative and significant. The magnitude of the coefficients of two audit quality measures (Big_4 and MAOs), declines when Herd is add as explanatory variable to regression. The Sobel-Z statistics confirms a partial mediation effect of Herd. These results indicate that for firms with higher audit quality, reduced herding behavior of institutional investors contributes to lower synchronicity. Overall we find partial support for H3.

Table 5 Mediation tests on institutional herding

	EXPERT Model	Big_4 Model	MAOs Model
Model 1 （without the mediator）			
AQ	-0.005***	-0.1199***	0.1377***
	(-4.474)	(-4.7588)	(3.0688)
N	16694	16694	16694
adj. R^2	0.393	0.298	0.300
F	180.080	191.6037	190.1198
All other control variables	Yes	Yes	Yes
Industry and year dummies	Yes	Yes	Yes
Model 2 （with the mediator）			
AQ	-0.030**	-0.1132***	0.1342***
	(-2.356)	(-4.5009)	(2.9906)
Herd	-0.489***	-0.4682***	-0.5308***
	(-6.670)	(-6.3843)	(-6.9493)
N	16694	16694	16694
adj. R^2	0.299	0.299	0.302
F	189.026	189.4602	188.4602
Sobel Z	**0.0018****	**-0.0067*****	**0.0034**
P-value of Sobel Z	**0.0359**	**0.0000**	**0.1288**
All other control variables	Yes	Yes	Yes
Industry and year dummies	Yes	Yes	Yes

* ***, **, * refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

This table presents the mediation regression results.

The t-statistics and z-statistics are reported in parentheses.

The t-statistics and z-statistics are based on standard errors clustered at both firm and year.

All variables are as defined in Appendix 1 and Appendix 2.

5. Robustness check

In this section we perform a number of sensitivity check to verify the main findings.

First, we use substitute total assets with audit fee to re-calculate the auditor industry expertise (labelled as EXPERT_FEES). Following Huang et al., (2007), we use the following model:

$$IMS_{i,t} = \sum_{j=1}^{J}\sqrt{auditfee_{i,k,j}} \Big/ \sum_{i=1}^{I}\sum_{j=1}^{J}\sqrt{auditfee_{i,k,j}} \qquad (9)$$

where $\sum_{j=1}^{J}\sqrt{auditfee_{i,k,j}}$ is the sum of the square roots of the total audit fees that are charged by auditor i in industry k. $\sum_{i=1}^{I}\sum_{j=1}^{J}\sqrt{auditfee_{i,k,j}}$ is the sum of the square roots of the total audit fess in industry k. EXPERT_FEES is an indicator variable that equals 1 if the

$IMS_{i,t}$ for audit i is in the top 25% percent and 0 otherwise. The auditor industry specialization variable is computed for each year. Our results remain consistent.

Second we use the individual auditor specialization (labelled as individual EXPERT) as an alternative audit quality measure. Individual auditor specialization is computed as that the market share of an individual auditor in a specific industry (based on auditees' total assets as a proportion of all auditees' total assets):

$$Individual\ MSA_{i,t} = \Big/_{\sum_{i=1}^{I}\sum_{j=1}^{J}\sqrt{ASSET_{i,k,j}}}^{\sum_{j=1}^{J}\sqrt{ASSET_{i,k,j}}} \quad (10)$$

where, $\sum_{j=1}^{J}\sqrt{ASSET_{i,k,j}}$ is the sum of the square roots of the total assets that are audited by an individual auditor i in industry k. $\sum_{i=1}^{I}\sum_{j=1}^{J}\sqrt{ASSET_{i,k,j}}$ is the sum of the square roots of the total assets in industry k. $In\ dividual\ MSA_{i,t}$ is the market share for the specific audit i in year t. The individual EXPERT is an indicator variable that equals 1 if the Individual MSA for audit i is in the top 25%, and)otherwise equals to 0. Our inference remains robust to this alternative audit quallity measure.

Third, we take the advantage of auditor switch to investigate whether synchronicity changes after a firm has replaced a non-top 10 auditor with a top10 auditors (which is expected to result in higher audit quality). Consistent with the prediction in H1, our results show that synchronicity becomes lower after the an auditor upgrade. Table 6 presents the results.

Table 6 Robustness test of alternative the audit-quality proxy

	IMS model	Individual EXPERT model	Auditor Switch model
AQ	**-0.0384*** **	**-0.0382*** **	**-0.0561** **
	(-3.7599)	**(-3.4577)**	**(-2.1034)**
STDROA	-0.5995***	-1.3520***	-1.2563***
	(-4.0015)	(-7.0897)	(-4.6083)
TURNOVER	0.0442***	0.0535***	0.0708***
	(3.8641)	(3.8013)	(3.5465)
VOL	0.0064***	0.0117***	0.0102***
	(4.9026)	(7.8431)	(5.0107)
LEV	-0.4357***	-0.4655***	-0.3715***
	(-16.2638)	(-17.6033)	(-9.6661)
MB	0.2804***	0.2927***	0.5457***
	(8.9395)	(9.0785)	(11.7328)
ROE	0.3085***	0.4709***	0.3517***
	(7.6957)	(8.1604)	(4.4011)
TOP	-0.1751***	-0.1810***	-0.2174***
	(-5.6392)	(-5.7437)	(-5.0605)
INSHOLD	-0.1256***	-0.0822***	-0.2081***

	(-4.5794)	(-2.9998)	(-5.3147)
SOE	0.1015***	0.1123***	0.1735***
	(10.3319)	(11.8054)	(13.6042)
INDNUM	0.2457***	0.1743***	0.0099
	(8.4108)	(5.8333)	(0.2515)
INDSIZE	-0.0509**	-0.0502**	0.0799***
	(-2.4020)	(-2.3880)	(2.8983)
BIG4	-0.1129***	-0.0826***	-0.1141***
	(-5.7787)	(-4.4792)	(-4.4104)
_cons	-2.1305***	-2.1330***	-5.4230***
	(-4.1529)	(-4.0897)	(-8.0389)
INDUSTRY	Yes	Yes	Yes
YEAR	Yes	Yes	Yes
N	24199	24199	24199
adj. R^2	0.303	0.342	0.352
F	Yes	278.0022	240.5009

* ***, **, * *refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.*

This table presents the mediation regression results.

The t-statistics and z-statistics are reported in parentheses.

The t-statistics and z-statistics are based on standard errors clustered at both firm and year.

All variables are as defined in Appendix 1 and Appendix 2.

Next, to address the reverse causality that companies with low stock price synchronicity tend to choose high-quality auditors, we perform three additional tests: first, we use the two-stage Heckman (1979) regression; second, we exploit the introduction of New Audit Reporting Standard in 2016 as an exogenous shock. In December 2016, the Ministry of Finance (MoF) in China issued " New Standards on Auditing Reporting ", which requires that auditors add key audit items in the audit report by disclosing the personalized information of the audit items such as the key points and difficulties in the audit (Reid et al., 2015; Gutierrez, etc., 2018). The most critical change in the New Audit Reporting is to increase the disclosure of key audit items which are the most concerned items by the CPAs during the audit process. It also presents the specific reasons for the disclosure and how the auditor responds. It believes that the new standards increase the information in the audit report for decision-making and enhance investors' ability to analyse the company performance (PCAOB, 2017); third, we use the propensity score matching (PSM).

Commented [DR2]: More information about the New Audit Reporting Standard is needed. What is the incremental information released after the standard took effect?

In the first stage of Heckman regression, we employ a PROBIT model, where Pr (EXPERT) denotes the possibility of a firm choosing high-quality auditors (industry specialization is used to measure audit quality):

$$\Pr(EXPERT)_{i,t} = \delta_0 + \sum \delta_n * Controls_{i,t} + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t} \quad (10)$$

Where EXPERT equals to 1 if the selected auditing firm has industrial specialization, 0 otherwise. Controls refers to control variables, as defined in Appendix 1. ∑INDUSTRY is the fixed industry effect. ∑YEAR is the fixed year effect. $\varepsilon_{i,t}$ is the residual.

In stage I we calculate the Inverse Mills Ratio (IMR), which is added as explanatory variable in Stage II. Column 1 in Table 7 provides the regression results of Stage I; Column 2 reports

the Stage II regression results. The coefficient of EXPERT is significantly negative ($p < 0.01$). suggesting that our findings are robust to the Heckman two-stage approach.

Table 7 Robustness test: Heckman 2-stage regression

	PR(AQ-EXEPERT)	EXEPERT model
AQ		**-0.0551*****
		(-3.6864)
SIZE	0.5772***	0.2956***
	(38.7637)	(4.4335)
STDROA	-1.6480***	-0.5006**
	(-4.0245)	(-2.0041)
TURNOVER	-0.1176***	-0.0366*
	(-4.1483)	(-1.9319)
VOL	0.0111***	0.0222***
	(3.4792)	(10.7829)
LEV	-0.1217*	-0.4391***
	(-1.7917)	(-8.6984)
MB	-0.1281*	-0.0340
	(-1.7724)	(-0.7183)
ROE	-0.3867***	0.2790***
	(-3.7955)	(4.5278)
TOP	0.3541***	-0.0819
	(4.8274)	(-1.0031)
INSHOLD	0.0815	-0.0354
	(1.2732)	(-0.9160)
SOE	-0.0357	0.0295
	(-1.4738)	(1.0630)
INDNUM	-0.2523***	0.1175**
	(-3.4571)	(2.5089)
INDSIZE	-0.2103***	-0.1128***
	(-4.4441)	(-3.2915)
BIG4	0.2052***	0.0404
	(5.1585)	(0.8752)
IMR		**0.2364**
		(1.6173)
_cons	-4.8549***	-4.1018***
	(-4.3788)	(-3.5672)
INDUSTRY	Yes	Yes
YEAR	Yes	Yes
N	24199	24199
adj. R^2		0.307
F		338.3020

* ****, **, * refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.*

This table presents the mediation regression results.The t-statistics and z-statistics are reported in parentheses.

The t-statistics and z-statistics are based on standard errors clustered at both firm and year.

All variables are as defined in Appendix 1 and Appendix 2.

Listed firms trading on Shanghai and Shenzhen stock exchanges have to implement the new audit report from January 1, 2018. The new audit report standards are expected to have significant impact on listed firms because more information is available for investors. This means that the new audit report will contain more company-specific information, which is likely to lower synchronicity.

We create a dummy variable POST that equals 1 for observations from 2018 and 2019, and use big_4 as the audit quality measure. We interact big_4 with POST, and expect the coefficient of the interaction to be significant negative, in that audit reports issued after the new standard took effect are likely to provide more firm-specific information:

$$SYNCH_{i,t} = \beta_0 + \beta_1 * Big4_{i,t} + \beta_2 * Post_{i,t} + \beta_3 * Big4_{i,t} * post_{i,t} + \beta_4 * SIZE_{i,t} + \beta_5 * STDROA_{i,t} + \beta_6 * STDROA_{i,t} + \beta_7 * TURNOVER_{i,t} + \beta_8 * VOL_{i,t} + \beta_9 * LEV_{i,t} + \beta_{10} * MB_{i,t} + \beta_{11} * ROE_{i,t} + \beta_{12} * TOP1_{i,t} + \beta_{13} * INSHOLD_{i,t} + \beta_{14} * SOE_{i,t} + \beta_{15} * INDNUM_{i,t} + \beta_{16} * INDSIZE_{i,t} + \sum INDUSTRY + \sum YEAR + \varepsilon_{i,t}, \quad (11)$$

Other variables are as previously defined.

The results are reported in Table 8. The coefficient of Post is negative and significant at 1% level, suggesting that synchronicity becomes lower after the new standard on auditing report took effect. The coefficient of Post*Big4 are negative and significant at 1% level, which indicate that stock price synchronicity decreases more for firms audited by Big-4 after the new audit standard become effective, consistent with H1 that synchronicity is lower for firms with higher audit quality.

Table 8 The effect of new audit report on the relationship between stock price synchronicity and audit quality

	SYNCH_1
POST*BIG4	**-0.5627*****
	(-3.1333)
POST	-0.5306***

	(-4.1165)
BIG4	0.0364
	(0.5421)
Controls	Yes
Dummies	Yes
N	12179
pseudo R^2	0.061

[*] ***, **, * *refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.*

This table presents the mediation regression results.

The t-statistics and z-statistics are reported in parentheses.

The t-statistics and z-statistics are based on standard errors clustered at both firm and year.

All variables are as defined in Appendix 1 and Appendix 2.

Our final approach to address the concern of reverse causality is the propensity score matching (PSM). We use industry specialization (EXPERT) as the audit quality measure, and estimate the following logit model for each year: the dependent variable is coded 1 if a firm is audited by an auditor with industry specialization in a given year and zero otherwise; the independent variables include all firm-level control variables in model (5). Secondly, without replacement we match each "treatment firm" (a firm audited by an auditor with industry specialization in a given year *t*) with one matching firm from the same industry (firm that is not audited by an auditor with industry specialization in the same year) that have the closet propensity scores within a maximum distance of 1%. That is, we use a nearest-neighbour matching approach with common support and a caliper constraint of 0.05. We have 10,049 observations for this test. The matching appears successful as the standardized biases of variables are less than 5% after the matching. The results are reported in Table 9. The coefficient of EXPERT remains significantly ($p < 0.05$), which are in line with our main findings reported in section 3.

Table 9 Robustness test: Propensity score matching

	PSM
EXPERT	-0.029**
	(-2.151)

SIZE	0.131***
	(13.755)
STDROA	-0.859***
	(-3.329)
TURNOVER	0.042**
	(2.411)
VOL	0.006***
	(3.083)
LEV	-0.443***
	(-10.455)
MB	0.249***
	(5.218)
ROE	0.255***
	(3.836)
TOP	-0.199***
	(-4.172)
INSHOLD	-0.151***
	(-3.577)
SOE	0.104***
	(6.616)
INDNUM	0.271***
	(6.053)
INDSIZE	-0.030
	(-0.998)
_cons	-2.886***
	(-4.057)
INDUSTRY	Yes
YEAR	Yes
N	10049
adj. R^2	0.307
F	95.342

* ***, **, * refer to significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

This table presents the mediation regression results.

The t-statistics and z-statistics are reported in parentheses.

The t-statistics and z-statistics are based on standard errors clustered at both firm and year.

All variables are as defined in Appendix 1 and Appendix 2.

6. Conclusion

In this paper we examine the effect of auditor quality on stock price synchronicity and find that stocks of firms that are audited by high quality auditors have lower synchronicity, suggesting that more firm-specific information has been incorporated into stock price for these firms. Furthermore, results show that high quality auditing enhances the information transparency of their auditees and reduces the herding behavior of institutional investors, both of which lead to reduced stock price synchronicity.

This study contributes to the market micro-structure literature as well as the audit quality literature. In prior research such as Gul et al. (2010), it is found that audit quality can reduce the stock price synchronicity. However, they fail to identify the channels through which audit quality can shape stock price synchronicity. Based on a large sample of Chinese public firms between 2003 and 2019, our study fills the research gap by presenting fresh evidences that high quality auditing help to promote transparency of their auditees and discourage the institutional herding, which leads to decreased synchronicity and therefore more informative stock price.

Appendix 1

Variable definitions

Variables	Definitions
SYNCH	A log-transformation of R^2, as calculated by Eq. (4).
EXPERT	An indicator variable equal to 1 if the MSA for audit i in top 25% percent and 0 otherwise. MSA is calculated by Eq. (6)
Big_4	If the firm is audited by Big 4, Big_4 equals to 1, 0 otherwise.
MAOs	If the firm receive a MAO, MAOs is 1; 0 otherwise.
SIZE	Natural logarithm of the firm's total assets
STDROA	Standard deviation of the return rate on a firm's total assets for 3 consecutive years.
TURNOVER	The difference between the monthly turnover rate in year t and that in year t-1.
VOL	trading volume in year t scaled by the outstanding shares in the same year.
LEV	total debt divided by total assets.
MB	the book value divided by the market value
ROE	Return on net assets.
TOP	The shares owned by the largest shareholder
INSHOLD	The total shares owned by the institutional shareholders
SOE	If the firm is owned by the state, then SOE is 1; 0 otherwise.
INDNUM	The natural logarithm of the total number of firms in an industry
INDSIZE	The natural logarithm of the total assets in an industry.
M2G	The growth rate of M2 in the market each year
Audit switch	Equals to 1 if the listed firm i change the auditor from non top_10 to top_10 auditor in China market

Appendix 2

Discretionary Accruals (DA) is computed by using the cross-sectional industry variation of a performance-adjusted modified Jones model (Ding & Jia, 2012; Kothari, Leone, & Wasley, 2005). The performance-adjusted modified Jones model adds the ROA as an indicator to control the influence of firm's performance on total accruals. The absolute value of DA is calculated as follows:

$$TotalAccruals_{i,t} \Big/ Assets_{i,t,j} = \alpha_{1,t,j}\frac{1}{Assets_{i,t-1}} + \alpha_{2,t,j}\frac{\Delta Sales_{i,t} - \Delta Receivables_{i,t}}{Assets_{i,t-1}} + \alpha_{3j,t}\frac{PPE_{i,t,j}}{Assets_{i,t}} + \alpha_{4j,t}ROA_{i,j,t} + \varepsilon_{i,t,j} \quad (11)$$

where, i ,t, and j are the indexes of company, year, and industry, respectively. Total Accruals is the total accruals computed based on the net income from operations minus operating cash flows; Assets is the total assets. △SALES is the change in revenue. △Receivables is the change in trade receivables. PPE is the gross PP&E, ROA is the return on asset. α_1, α_2, α_3, and α_4 are firm-specific parameters. The residual term ε is DA. This model excludes the observations with fewer than 10 firms in the same industry (J. Jiang, Wang, & Wang, 2019; Kothari et al., 2005).

Transparency of accounting information (TRAN). Bhattacharya et al. (2003) hold that the transparency of accounting information is to what degree accounting earnings reported reflect actual earnings. They put forward three indicators to measure whether accounting information is transparent: earnings aggressiveness, loss aversion and earnings smoothness, among which loss aversion measures the overall situation of a country. This article adopts earnings aggressiveness (EA) and earnings smoothness (ES) as the proxy variables for accounting information transparency.

According to Bhattacharya et al. (2003), the EA is estimated as follows:

$$ACC_{i,t} = \Delta CA_{i,t} - \Delta CL_{i,t} - \Delta Cash_{i,t} + \Delta STD_{i,t} - DEP_{i,t} + \Delta TP_{i,t}$$

$$EA_{i,t} = ACC_{i,t}/TA_{i,t} \quad (12)$$

where, $ACC_{i,t}$ is the accruals for firm i in year t, $\Delta CA_{i,t}$ is the increase in current assets in year t, $\Delta CL_{i,t}$ is the increase in current liabilities in year t, $\Delta CASH_{i,t}$ is the increase in monetary capital in year t, $\Delta STD_{i,t}$ is the increase in long-term liabilities that mature within

one year in year t, $DEP_{i,t}$ is depreciation and amortization expenses , $\Delta TP_{i,t}$ is the increase in income tax payable in year t, and $TA_{i,t}$ is total assets at the beginning of year t. The higher the EA, stronger the motive of earnings aggressiveness for a company, and the lower the accounting information transparency.

Based on Bhattacharya et al. (2003), the ES is estimated as follows:

$$ES_{i,t} = Correl(\Delta ACC_{i,t}, \Delta CF_{i,t}) \quad (13)$$

where, Correl (*) is the correlation coefficient, $\Delta ACC_{i,t}$ is the increase in accruals in year t divided by total assets at the beginning of the year, and $\Delta CF_{i,t}$ is the increase in operating cash flow in year t divided by the total assets at the beginning of the year. This article takes the absolute value of the correlation coefficient between ΔACC and ΔCF in the period of year t-2 to year t as the substitute variable of earnings smoothness.

Overall, *information transparency (Tran).* Although the ES and EA can directly estimate the transparency of accounting information from a certain perspective, it is more comprehensive to take both into consideration. Based on this, EA and ES are given weighted equally in a more comprehensive index labelled of the transparency of accounting information, TRAN:

$$Tran_{i,t} = \left(\text{Deciles}\left(EA_{i,t}\right) + \text{Deciles}\left(ES_{i,t}\right)\right) * \frac{1}{2} \quad (14)$$

where, Tran is the information transparency of the listed company i in year t; Deciles (·) represents the deciles of the indicators within the brackets. Then $Tran_{i,t}$ are grouped and ranked, where a the higher the value indicates the less transparent earnings. Therefore, the higher the index, the lower the corporate accounting information transparency.

Herd of institutional investors (HERD). The level of herd behaviour is estimated as follows:

$$HM_{i,t} = \left|p_{i,t} - E(p_{i,t})\right| - AF_{i,t} \quad (15)$$

where, HM_{it} refers to the degree of herd behaviour for the stock i in the period t. $P_{i,t}$ is the ratio of buyers who have bought the stock i in the period t to all the traders of this stock (the sum of buyers and sellers), $P_{i,t}$ is estimated as follows:

$$p_{i,t} = \frac{Nbuy_{i,t}}{Nbuy_{i,t} + Nsell_{i,t}} \quad (16)$$

where, $Nbuy_{i,t}$ refers to the number of buyers who have bought the stock i in the period t; $Nsell_{i,t}$ signifies the number of sellers who have sold the stock i in the period t.

$E(P_{i,t})$ is the expectation of $P_{i,t}$, which is the proportion of funds that have bought stocks in the period t to all the funds that have traded stocks, $E(P_{i,t})$ is estimated as follows:

$$E(p_{i,t}) = \frac{\sum_{i=1}^{n_t} Nbuy_{i,t}}{\sum_{i=1}^{n_t} Nbuy_{i,t} + \sum_{i=1}^{n_t} Nsell_{i,t}} \qquad (17)$$

where, N_t refers to the number of stocks that have been traded in the period t. $E(P_{i,t})$ differs in different periods, and it can be deemed as the expected probability of "buying" by funds.

$Af_{i,t}$ is the adjustment factor. Under the assumption that the decisions made by investors are independent of each other, which means there is no herd behaviour, the number of funds that have bought a certain stock should follow the binomial distribution of $(N_{i,t}, E(P_{i,t}))$, where $N_{i,t}=Nbuy_{i,t}+Nsell_{i,t}$, which represents the number of funds that have traded the i-th stock in the t-th period. Therefore, according to Lakonishok et al. (1992), $AF_{i,t}=E|p_{i,t}-E(p_{i,t})|$ is used to signify the expected value of $p_{i,t}-E(p_{i,t})$ under the assumption that there is no herd behaviour. In their model, when $HM_{i,t}$ is significantly non-zero, it indicates that there is herd behaviour in the investment behaviour of securities investment funds, and the higher the $HM_{i,t}$, the more intense the herd behaviour.

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