Is Audit Behavior Contagious? Teamwork Experience and Audit Quality by Individual Auditors*

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Abstract

In this paper, we demonstrate that bad audit behavior is transmitted through the teamwork experience of individual auditors. We find that auditors who have previously worked in a team (team auditors) with those who are sanctioned by the regulators for audit failure (contagious auditors) are more likely to issue lenient audit opinions, and their audited accounting numbers are more likely to be downward restated in the future, compared to those who have no overlap with contagious auditors in their teamwork experience. This contagion effect is, however, absent among auditors who previously worked in the same audit firm but *not* in the same team (colleague auditors) as contagious auditors. Our findings highlight the importance of analyzing social learning via teamwork experience in understanding how audit quality at the individual level is shaped.

Key words: audit quality; contagion; teamwork; sanction.

JEL: M40; M42; M48; D83.

近朱者赤 近墨者黑
Proximity to cinnabar makes you red, to pitch makes you black.

— Old Chinese phrase

1. Introduction

Social influence theory suggests that individual preferences and decisions are affected by the actions of others (Jackson 2010). There is empirical evidence that individual behavior transmits through social networks and affects outcomes in a range of situations, from the investment decisions of individuals to various corporate decisions (e.g., Chiu et al. 2013; Hong et al. 2004; Rogers 2003). In this study, we examine the social influence of audit behavior. While previous theoretical research suggests that both error-prone and optimal outcomes can be reached via social influence (Bikhchandani et al. 1998), we focus on the influence of "bad" audit behavior for two reasons. First, regulators and firm stakeholders are more concerned with poor audit quality, as it can result in huge costs to the firms and auditors concerned, and to society.[1] Second, bad behavior and its effects are more salient and easier to observe and measure.[2]

In China, each audited annual financial report discloses the identities of the audit team, which consists of one field and one review auditor, so from this data we can study the learning and transmission of bad audit behavior via the teamwork experience. Chinese regulators sanction publicly listed firms for accounting fraud, and the auditors engaged for failing to detect and report the frauds (Firth et al. 2005). Using an epidemiological metaphor, we regard these auditors as a source of infection and refer to them as *contagious auditors*.[3] Following social network research (e.g., Hochberg et al. 2007; El-Khatib et al. 2015; Hochberg et al. 2015), we define a 5-year period ending

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[1] GAAP-violating earnings management and the accompanied earnings restatements are costly to a firm, as reflected in the increased likelihood of lawsuits (Brochet and Srinivasan 2014), reduced market value (Palmrose et al. 2004; Karpoff et al. 2008), and higher cost of capital (Hribar and Jenkins 2004). To auditors, it is costly in terms of auditor dismissal (Hennes et al. 2014) or damaged reputation (Swanquist and Whited 2015).

[2] This is consistent with the notion that it is easier to succumb to vice than to follow the path of virtue. People are naturally effort-averse and pursing virtue takes effort.

[3] Contagious can be defined as the capability of being transmitted from one person to another by contact or close proximity. (See http://www.cs.columbia.edu/digigov/LEXING/CDCEPI/gloss.html). We use the term sanctioned, contagious, or implicated auditors interchangeably throughout the paper.

at the year in which frauds occur as the *contact period*.[4] An auditor who works in the same audit firm as the contagious auditor during the contact period is a *colleague auditor*, and is exposed to the contagious auditors.[5] We refer to colleague auditors who co-signed audit reports with contagious auditors for any client during the contact period as *team auditors*. They are more directly exposed to the bad behavior of the contagious auditor via their teamwork and through the greater trust bred by familiarity, which facilitates learning. We therefore expect a stronger effect for team auditors. We measure audit quality by the propensity to issue more severe audit opinions and the likelihood that the audited accounting numbers are subsequently restated downward. We investigate whether audits by a colleague auditor are of worse quality in the audit failure period than those of control-group auditors who have not worked with the contagious auditor during the contact period. More importantly, we test whether audits by team auditors exhibit even worse quality than those by colleague auditors. Exhibit 1 shows the timeline illustrating the contact period and the test period.

A challenge in empirical social influence literature is that similarities or correlations of behavior are not definitive evidence of social interaction (Manski 1993). Individual choices may be correlated because individuals share common personal characteristics (referred to by Manski as the *correlated effect* and by us *selection*), or because individuals respond to common exogenous shocks (referred to by Manski as the *contextual effect*, and by us, following studies such as Hirshleifer and Teoh 2003, as *clustering*),[6] or because individuals are influenced through actual interactions (referred to by Manski as the *endogenous effect* and by us as *contagion*). It is intuitively more interesting to establish a *contagion* effect. We infer a distinct contagion effect by contrasting the audit quality of team auditors with colleague auditors. As the former is a subset of the latter, any incremental effect between the two is the difference in audit quality between just working in the same audit firm as the contagious auditor,

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[4] Contact means exposure to a source of an infection, or a person so exposed (see the above glossary).

[5] It is not possible to further differentiate the same-office colleagues and different-office colleagues because most of annual reports, from which we obtain the audit firm information, report their headquarters as the audit office. However, as Gul et al. (2013) demonstrate, audit-office effect, if any, adds very little to explain the audit outcomes in China.

[6] For example, past restatement studies report significant negative stock return spillover effects of restatement announcements to non-restating firms (Srinivasan 2005; Gleason et al. 2008; Kang 2008; Durnev and Mangen 2009). This evidence does not definitely support behavioral contagion of investors; rather, it is consistent with restatements reflecting industry common accounting practice (Gleason et al. 2008) or industry common poor future prospects (Durnev and Mangen 2009).

and working closely with them via co-signing audit reports. This design helps disentangle the contagion effect from the selection or clustering effects, as colleague auditors are subject to the same common external shocks (clustering effect), and are similar in characteristics, as they are hired by the same audit firm (selection effect). If team auditors exhibit incrementally worse audit quality than colleague auditors, we can ascribe this difference to a distinct contagion effect.

Using 51,486 auditor-client-year observations, we find that colleague auditors are not more likely to issue lenient audit opinions, nor to have their audited accounting numbers downward restated in the future, compared to sample average auditors. We do find that that team auditors have greater propensities to issue lenient audit opinions, and their audited accounting numbers are more likely to be downward restated in the future, compared to other colleagues or the sample average auditors. It therefore appears that the contagion effect works through individuals working in the same team but not through the audit firm, which is subject to clustering or selection effects. Consistent with Gul et al. (2015) and Li et al. (2016), we also find that the contagious auditors exhibit consistently poor audit quality not only in their failed audits but also in other engagements they handle in the fraudulent year; that is, there is self-contagion within contagious auditors' audits.

Our key findings are robust to the use of a covariate-balanced treatment and control sample and survive the placebo tests. The cross-sectional analyses reveal that the strength of contagion varies by factors such as the prestige and network centrality of the contagious auditor, the similarity between the team and the contagious auditors, and the severity of audit failures. In terms of economic consequences, we find that team auditors initially expand their clientele after learning the lax auditing style of their sanctioned peers but eventually pay for their learning behavior, with a decline in their clientele when the audit failures of their peers become known.

Our study makes the following contributions. First, we are the first to provide large-sample evidence that poor audit quality is contagious via audit team. Although experimental auditing research offers great insights into the audit team decision-making process such as audit planning, risk assessment, and group brainstorming (see e.g., Nelson et al. 2016), the archival research has remained silent on the audit-team effect, which is at least partly due to the data unavailability.[7] Our study

[7] Recent studies use data from China, Taiwan, Australia, U.K., wherein the identity of signing auditors are known, to examine the audit quality at individual level (Gul et al. 2013; Carcello and Li 2013; Goodwin and Wu 2014;

responds to the call for more research to understand audit team interaction (DeFond and Zhang 2014, p.304). The evidence is informative to audit firms when deploying audit teams in the interest of audit quality and to researchers in understanding how audit productions are shaped by interactions among individuals in the audit teamwork.

Second, previous studies document clustering of poor quality audits by audit offices (Francis and Michas 2013) or individual auditors (Gul et al. 2015; Li et al. 2016), and refer to this phenomenon as "contagion," but this is distinct from our finding that low quality audits spread via common teamwork experience. The divergence in the incidence of low quality audits has very different implications. Findings from Gul et al. (2015) and Li et al. (2016) suggest that audit failures are specific to a few individual auditors so mandatory partner rotations can preserve audit quality. Francis and Michas (2013) found systematic quality problems across engagements at the office level, implying that audit firm/office rotations would be effective in preventing audit failures. Our analysis suggests that audit teams are additional elements to consider in the rotation decisions.

Last, we provide new evidence of individual behavior contagion in the auditing context, which complements the social network and social influence literature. As previously mentioned, it is challenging to disentangle whether behavioral similarity within a network is caused by contagion, selection, or clustering. Econometrics and experimental approaches have been used to tackle this challenge (see e.g., the survey by Soetevent 2006). By directly observing the social interaction channel, i.e., the audit team, and showing that the audit behavior does not transmit through the entire audit firm but is confined to individuals working in a team, we provide evidence for a distinct contagion effect.

The rest of the paper is organized as follows. Section 2 discusses related literature and develops hypotheses. Section 3 describes the sample and research methods, followed by the report of empirical results in Section 4. The final section concludes the paper.

(Footnote continued.)

Aobdia et al. 2015). However, to our knowledge, only a few countries/economies, including China, Taiwan, and Germany, disclose the identities of multiple engagement auditors in the audit team. The PCAOB of the U.S. just passed new rules requiring disclosure of the engagement partner beginning in 2017.

2. Related literature and hypothesis development

2.1. Related literature on behavioral contagion in economic decisions

One important mechanism of social influence is contagion via observational learning, where influence takes the form of direct communication with others in the network, and direct observations of their actions and consequences (Bikhchandani et al. 1998). These influences can explain a range of economic activities, such as investors' decisions to participate in the stock market and stock picking (Hong et al. 2004; Hong et al. 2005; Brown et al. 2008; Ivkovich and Weisbenner 2007), and corporate managers' investment, financing, reporting, and disclosure decisions (Haunschild 1993; Kedia and Rajgopal 2008; also see the review by Hirshleifer and Teoh 2003).

A line of literature focuses on the behavior contagion through sharing common directors by different firms and investigates the effects on corporate decisions. Studies show behavioral similarity across firms with interlocked directors in poison-pill adoption (Davis 1991), merger and acquisitions (Haunschild 1993), option backdating (Bizjak et al. 2009), take-private transaction (Stuart and Yim 2010), and tax avoidance (Brown 2011). With respect to financial reporting and disclosure, firms with interlocked directors are found to share the common practices of stock option expensing (Reppenhagen 2010), earnings management (Chiu et al. 2013), and management earnings guidance (Cai et al. 2014).

The effect of learning at the corporate level is subject to other firm-specific characteristics and, as discussed, the empirical challenge of disentangling alternative explanations.[8] Unlike studies that examine this effect at the corporate level, we directly investigate the audit outcomes resulting from the behavioral learning of individual auditors working in the same audit firm. This strategy enhances the causal inference regarding the influence of behavior contagion.

Previous studies also show that when clients share the same audit firm, office, or partner, their accounting numbers exhibit common features. For example, Francis and Michas (2013) find systematically poor audit quality for clients at the same audit offices; Francis et al. (2014) report that clients with common Big 4 auditors exhibit comparable accruals and earnings; and in a Chinese

[8] One notable exception is Chiu et al. (2013), who control for the effect of endogenous matching between the firms and the directors by using time indicator variables that identify when interlocked directors are hired.

context, Li et al. (2016) find that individual auditors who have performed failed audits have lower quality audits in general, both over time and in other concurrent engagements they administer. In a similar vein, Gul et al. (2015) show that regulatory sanctions induce a significant stock price drop among clients that share a common auditor who is implicated in the sanction. None of these studies, however, examine the behavior contagion brought about by interactions between individual auditors.

2.2. Hypothesis development

In an audit engagement, the auditor proceeds with the assessment of the client's inherent and control risks by gaining an understanding of the client's business model, business environment, and internal control systems. Then, he/she trades off the expected audit effort and costs arising from audit planning (including staffing and working plan, and budgeting) and audit testing (including analytical and substantive testing) with the detection risk, which forms the residual risk after taking into consideration the inherent and control risks pertaining to the audit engagement and the overall audit risk the auditor is willing to accept. When the assessment of inherent and control risk is high, the auditor works harder to reduce the detection risk so that the total audit risk is at an acceptable level. Conversely, when the auditor believes the inherent and control risks of an engagement to be low, he/she can exert less effort, setting the detection risk at a relatively high level (Arens et al. 2012). This trade-off in turn determines the audit fee and quality.

Social influence literature suggests that observers may follow the behavior of others based on direct observation of an action, and the consequences of this action, or verbal communication about the preferred course of action (Bikhchandani et al. 1998). In an auditing context, by observing and communicating with a colleague who adopts lax practices, an auditor may develop substandard audit practices such as inappropriateness of staffing, premature sign-off of audit steps, and consequently poor audit quality. This is particularly true when he/she observes that poor audit quality does not backfire on the negligent auditor, as the economics of crime imitation suggests.[9] Sah (1991) argues

[9] This supports our choice of the 5-year contact period up to the fraudulent year, before the sanction is detected and publicly announced by the regulators. Once the sanctions are publicly announced, the deterrence effect inhibits auditors from learning the bad behavior. Similarly, the investigation by regulators during the time period between the fraudulent year and the sanction announcement year may also deter bad behavior and its transmission.

that individuals' perceptions concerning their probabilities of punishment are influenced by their exposure to crime and punishment in their social groups. These perceptions can then change their subjective estimate of the probability of being caught and the benefits of crime, encouraging imitation in committing crimes. More specifically, when working in the same audit firm, an individual auditor can observe the behavior of their colleagues and communicate with them to some extent, enabling them to assess colleagues' personal attributes, including their risk tolerance levels and ethical standards. Knowledge and actions such as when to challenge client managers' accounting choices and when not to, what the materiality cut-off points are, and the extent of sampling and substance testing conducted, appropriateness of staffing and interpretation of evidence, can be learned and shared as the auditors work in the same audit firm. The above arguments lead to the following hypothesis:

H1: Audit engagements of colleague auditors who were exposed to the contagious auditors have lower audit quality than other audit engagements.

Social learning depends on how strongly people identify with the social group (Louis et al. 2007). Social capital theory suggests that trust and perceived trustworthiness that are bred through a history of interactions facilitate the identity of social group and thus learning (Gultai 1995; Tsai and Ghoshal 1998). Communication among audit team members is critical for audit effectiveness (Solomon 1987). Through past team experience, auditors develop mutual trust, and the transfer of knowledge and the learning of actions can therefore be more easily completed among those working in a same audit team. Therefore, behavior learning is expected to be stronger in auditors working in the same audit team.

Another force for social learning derives from the conformity motive. Social psychology literature demonstrates that individuals in a social group tend to conform to others' behavior even when the consensus is clearly counter-factual or abusive (Asch 1951; Milgram 1963). Observing aggressive or dishonest behavior in peers changes an individual's understanding of the social norms governing this behavior and induces conformity to these norms (Bandura 1965; Bandura et al. 1961, 1963; Cialdini et al. 1990; Cialdini and Trost 1998). The contagious auditor's behavior is more directly observable by the team auditors, and as the social norm is more easily formed in a tight social group the conformity motive suggests that team auditors are more likely to conform to the behavior of their audit team partners. Our second hypothesis is stated as follows:

H2: Audit engagements of team auditors who were exposed to the contagious auditors have even lower audit quality than those of colleague auditors.

3. Sample and research methods

3.1. Sample and data sources

To test the above hypotheses, we take our sample from all publicly firms listed in the Shanghai or Shenzhen Stock Exchanges. Our sample covers the period of 1995-2013. The Chinese stock market was established in 1990, but we start from the fiscal year 1995 as we use a contact period of up to five years preceding and including the fraud occurrence. The financial statement and stock price data are retrieved from the China Stock Market and Accounting Research Database (CSMAR). In total, there are 26,838 firm-year observations between 1995 and 2013 in the CSMAR. We remove 333 observations from the financial industry due to the differences in the interpretation of financial ratios between financial and industrial firms. We further drop 80 observations that have missing values in accounting data, and 586 with missing values in the stock price data. This leaves us with 25,839 client-year observations. The signing auditor data are first downloaded from the CSMAR, and if missing, we search the companies' annual reports or the CICPA's online public accountant database at http://cmis.cicpa.org.cn to determine the signing auditors/CPAs.[10] We then have 368 observations, or 1.4% of the total sample, where we cannot determine the identities of signatory CPAs.[11] As noted, a client-year's audit reports should be signed by at least two CPAs. Merging the signatory CPA data with the client data yields a total of 51,486 CPA-client-year observations. This constitutes our primary sample. To determine the teamwork relationship among the CPAs, we use a larger sample (before requiring accounting/stock price data availability and removing financial industry clients) to trace the past team work experience of individual CPAs.

Our sanction data include sanctions imposed by the China Securities Regulatory Commission (CSRC) or the Ministry of Finance (MOF). Both regulators have the authority to sanction auditors.[12]

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[10] For easier exposition, we refer to individual auditors hereafter as CPAs. We do not use the term partner as in China non-partners can also sign off audit reports so long as they are professionally qualified.

[11] The identities of signatory auditors are missing as the clients did not print the names of signatory auditors in the published version of the audited financial reports. The original audit reports issued, which we cannot access, should bear the signatures and seals of responsible auditors.

[12] The MOF is in charge of all accounting affairs in China, while the CSRC is empowered to oversee accounting

We identify sanctions from the CSRC that are related to problematic audits from the announcements made on its website and cross-check them with *Who Audits China's Securities Market* (CSRC 2003). We collect data on the MOF sanctions against auditors of public firms by reviewing the "Accounting Inspection" bulletins released by the MOF and by searching related news reports. We include MOF sanctions as in some egregious cases, the MOF decisions had effectively superseded those of the CSRC, leading to a lack of sanction records from the CSRC.[13] Sanctions by the CSRC and MOF have similar legal implications. Under the *Private Securities Litigation Rules* enacted in 2003, a precondition for a Chinese court to accept securities litigation against auditors is that the defendants are sanctioned by a regulatory agency, such as the CSRC or MOF.

We identify a total of 94 sanctions against auditors that perform audit services to public companies. These sanctions were announced between September 1996 and November 2015, and include 81 and 13 cases enforced by the CSRC and MOF, respectively. Exhibit 2 displays the distribution of these cases by announcement time and regulatory agencies. We provide descriptive statistics of these sanctions in Table 1. Note that one sanction could be related to multiple fiscal years where auditors are found to be malfeasant. Row (1) of Table 1 shows that the number of fiscal years a sanctioned case can run for ranges from one to four, with a mean of 1.649. In Row (2) we show the time lag between the most recent fiscal year ends involved in the fraudulent reporting to the date when the sanctions are announced, which on average is 2.590 years. Row (3) presents the number of CPAs that are sanctioned because of signing audit reports in these deemed audit failures. Typically, two CPAs are punished in a case, but the maximum statistic suggests there could be as many as six CPAs involved. In Rows (4) and (5), we change the unit of analysis to fiscal years to reveal the attributes of audit firms. The total number of observations is 155 (= 94 cases × 1.649 years on average for each case). Around 4.5% of problematic audits are performed by the Big N firms, as shown in Row (4). As shown later in Table 2, about 6% of audits are performed by Big N firms across Chinese public firm

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(Footnote continued.)

and disclosure issues related to publicly traded companies. The form of sanctions includes warnings, monetary fines, bars from the securities market, suspension of practice, and disqualification.

[13] For example, in the case of YinGuangXia (stock code: 000557, dubbed the Chinese Enron. See Chen et al. 2010 for more details of this case), the MOF revoked the auditing license of its auditor, ZhongTianQin, soon after the scandal emerged. As the CSRC's jurisdiction is confined to licensing audits of public companies, the CSRC could not impose any sanction on ZhongTianQin after losing its general auditing license.

audits. It thus appears that Big N audit quality, in terms of the incidence of audit failures relative to all other audits, is slightly higher in China. Finally, we use audit firms' percentile rankings based on total assets audited (in millions RMB, taking the natural log) at the end of each year to reveal how sanctions are related to audit firm size.[14] As Row (5) shows, the mean percentile ranking for sanctioned audits is 0.634. Considering that the mean value of this variable is 0.721 for the full sample (also reported in Table 2), the incidence of audit failures tends to be lower among large audit firms.

3.2. Research methods

We denote *T* as the fiscal years involved in the sanction cases. To test the contagion effect of low quality audits, we need to first establish that audits performed by sanctioned CPAs are indeed of lower quality. We use the following two indicators for this: (a) *SCPA*, is equal to one for all observations audited by the sanctioned CPAs during *T*, and zero otherwise; and (b) *SCPAFAE,* is equal to one for failed audit engagements, i.e., those that are sanctioned by the regulators, and zero otherwise. Audits that result in regulatory sanctions are part of the sanctioned CPAs' total audits, so *SCPAFAE* is more restrictive than *SCPA*, and it turns on for a subset of audits within *SCPA*.

Following social network research (e.g., Hochberg et al. 2007; El-Khatib et al. 2015; Hochberg et al. 2015), we define the contact period as the window from *T* – 4 to *T*. During the contact period, non-sanctioned and sanctioned CPAs can interact as they work in the same accounting firm, and a closer relation is established if they work in the same team and co-sign audit reports. If the misbehavior of a sanctioned auditor is only present in the fraudulent year, by defining a contact period longer than the fraudulent year, the definition of team or colleague auditors can contain measurement errors and work against finding the results. We use two indicators to measure these relationships and test the contagion effect spread from contagious to exposed auditors: (a) *COLL_CPA*, equals one for all audit observations during *T* by CPAs who work in the same accounting firm as contagious CPAs during *T* – 4 to *T*, and zero otherwise; and (b) *CO_CPA*, equals one for all audit observations during *T* audited by those who co-sign with contagious CPAs during *T* – 4 to *T*, and zero otherwise. As CPAs

[14] We use the percentile rankings as audit firm size increases substantially during our sample period, rendering the raw firm size measures incomparable over time.

who co-sign with contagious CPAs must also be their colleagues, *CO_CPA* turns on for a subset of audits within *COLL_CPA*.

Exhibit 3 visually demonstrates the relationship among observations of interest. In the full set of the total sample, each subset represents a subsample denoted by the indicator variable. Our data are at the CPA-client-year level, so *COLL_CPA* and *SCPA* subsamples do not overlap. This design ensures that the effect captured by *COLL_CPA* or *CO_CPA* variables represents contagion due to the interaction between sanctioned CPAs and their colleagues or team auditors during the contact period, but not if they are the sanctioned CPAs. Finally, the full set exclusive of the four denoted subsamples serves as a control sample.

Based on the above sampling approach, our regression model is specified as:

$$y_{ijt} = \alpha_i + \lambda_t + \beta_1 SCPA_{ijt} + \beta_2 SCPAFAE_{ijt} + \beta_3 COLL\_CPA_{ijt} + \beta_4 CO\_CPA_{ijt} + \gamma \mathbf{X}^{\mathbf{C}}_{ijt} + \delta \mathbf{X}^{\mathbf{A}}_{ijt} + \varepsilon_{ijt}, \quad (1)$$

where i indexes clients, j indexes signatory CPAs, and t indexes time, y is audit quality proxies to be defined below, α_i is the client fixed effects, λ_t is year fixed effects, *SCPA*, *SCPAFAE*, *COLL_CPA*, and *CO_CPA* are defined as above, $\mathbf{X}^{\mathbf{C}}$ and $\mathbf{X}^{\mathbf{A}}$ are vectors of attributes for client firm and auditor, respectively, which may influence y, and ε denotes the regression residuals. Note that the model fully controls for the effects of time-constant client characteristics on y via the client fixed effects. The β coefficients can thus be interpreted as the effect of within-client, time-varying change in the covariates of interest on y.

As the audit failures take place in different years (see Exhibit 2) and the sample includes non-treated audits, i.e., those conducted by CPAs unrelated to the sanctioned CPAs (see Exhibit 3), we effectively apply the difference-in-differences (DiD) and triple DiD (DiDiD) methodology in model (1) to identify the contagion effect for the treatment groups of *COLL_CPA* and *CO_CPA*, respectively. With the fixed effects, the first difference compares audit quality y, separately for *COLL_CPA* group and its control, between T and other time periods. The second takes the difference between the above two differences, yielding an estimate of the effect of sanctioned CPAs' audits on the *COLL_CPA* group during T on y. This estimate is captured by the coefficient on *COLL_CPA*, β_3.[15] As CO_CPA is

[15] For example, for an audit failure occurred in 2000, the first difference for a colleague CPA when compared with

a subset of COLL_CPA, the coefficient on indicator *CO_CPA*, β_4, estimates the third difference, i.e., whether the contagion effect is incrementally stronger for CPAs that have previously co-signed with sanctioned CPAs than for colleague CPAs.[16] Analogously, the *SCPA* coefficient, β_1, estimates whether audits performed by sanctioned CPAs during *T* are different from others after considering the influence of contemporaneous factors over *y*, and the *SCPAFAE* coefficient, β_2, further assesses whether audits that eventually lead to regulatory sanctions are different from sanctioned CPAs' other audits.

As will be explained below, our dependent variables are discrete. In principle, a logistic or probit model is more appropriate for discrete dependent variables. However, such model may not adequately control for the clients' fixed effects on the discrete dependent variable, and the "fixed-effect" variant of the logistic (or probit) model may suffer from severe information loss.[17] The client fixed-effect model is essential to our DiDiD design, so we use the OLS-based linear probability model (LPM) as our primary regression model. A drawback of the LPM is that it can produce predicted probabilities that are less than zero or greater than one, but this is not a concern as we are interested in hypothesis testing rather than predicting the probability for individual observations. Importantly, for discrete dependent variables, LPM coefficient estimates remain unbiased, particularly in large samples, and can be interpreted in a usual sense (e.g., Wooldridge 2013, §17). We note that the use of LPM is also in line with the classic DiD study of Bertrand and Mullainathan (2003).

To enhance the robustness of our results, we also adopt a hybrid-type logistic model (Allison

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(Footnote continued.)

the pre-failure year of 1999 is: $E(y) = \lambda_{2000} - \lambda_{1999} + \beta_3$. Likewise, such a first difference for a non-colleague CPA for the same period is: $E(y) = \lambda_{2000} - \lambda_{1999}$. The DiD between them becomes: $(\lambda_{2000} - \lambda_{1999} + \beta_3) - (\lambda_{2000} - \lambda_{1999}) = \beta_3$.

[16] Following the previous example, for a co-signer: $E(y) = \lambda_{2000} - \lambda_{1999} + \beta_3 + \beta_4$. Differencing out colleague CPAs' $E(y)$, the DiDiD estimator is: $(\lambda_{2000} - \lambda_{1999} + \beta_3 + \beta_4) - (\lambda_{2000} - \lambda_{1999} + \beta_3) = \beta_4$.

[17] For longitudinal data, the conventional logistic or probit model tends to overestimate the regression coefficients after adding a large number of indicator variables (Allison 2005). One solution is to use the "conditional maximum likelihood" estimation, often viewed as the "fixed-effect" logistic or probit model. However, under this method, clients that are constant on *y* over the entire period of observation are effectively discarded from the analysis, leading to an unnecessary loss of information. Around 50% of our sample observations belong to clients that do not vary in *y* over time. For a CPA that audits such clients, meaningful "between-client" variation does exist as there are other clients (that have variation in *y* over time) in his/her portfolio. Information loss due to the use of "conditional maximum likelihood" estimation impairs the representativeness of the results, and is thus costly to us. Following Allison (2005), we apply a hybrid-type logistic model, elaborated later.

2005):

$$P(y_{ijt} = K) = G[\alpha + \lambda_t + \beta_1 d(SCPA_{ijt}) + \beta_2 d(SCPAFAE_{ijt}) + \beta_3 d(COLL\_CPA_{ijt}) + \beta_4 d(CO\_CPA_{ijt}) + \beta'_1 \mu(SCPA_{ij}) + \beta'_2 \mu(SCPAFAE_{ij}) + \beta'_3 \mu(COLL\_CPA_{ij}) + \beta'_4 \mu(CO\_CPA_{ij}) + \gamma d(\mathbf{X^C}_{ijt}) + \delta d(\mathbf{X^A}_{ijt}) + \gamma' \mu(\mathbf{X^C}_{ij}) + \delta' \mu(\mathbf{X^A}_{ij}) + \varepsilon_{ijt}], \quad (2)$$

where y is the ordered response taking on the values {0, 1,…, K}, α is the random effect intercept, d(•) denotes the deviations of explanatory variables from the client-specific means, μ(•) represents the means of explanatory variables for each client, G is the cumulative logistic function, and other variables are as previously defined. As per Allison (2005), the above model combines fixed effects and random effect estimates. The coefficients on the deviation terms, d(•), can be interpreted similarly to the fixed-effect estimates, although those on the mean variables, μ(•), do not have a causal interpretation. With the random effect intercept, the model absorbs all the differences in the measured client characteristics. However, different from the true fixed-effect model, this hybrid model does not control for unmeasured, time-constant client characteristics. We therefore provide the hybrid model results as supplementary evidence.

3.3. Audit quality proxies

We choose auditors' propensity to issue modified audit opinions (MAOs) and the likelihood of clients' earnings restatements as our proxies of audit quality. Both are very direct measures of actual audit quality and have low measurement errors (DeFond and Zhang 2014), and have been used to study variation in audit quality in various Chinese auditing studies.[18] Both proxies capture relatively more egregious audit failures and therefore fit our auditor sanction context well. Nevertheless, being discrete variables, the two measures do not reflect the subtle quality variation or fully capture the broad spectrum of audit quality, leading to weak statistical power. However, given our large sample size and our focus on audit failure, this is less of a concern. Finally, MAOs and restatements show different dimensions of audit outcomes: the former assesses whether auditors succumb to client pressure and issue clean opinions, and the latter captures whether audited financial statements contain

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[18] For MAOs, see DeFond et al. (2000), Chen et al. (2001), Chan et al. (2006), Wang et al. (2008), Chen et al. (2010), Chan and Wu (2011), and Firth et al. (2012). For earnings restatements, see Gul et al. (2013), He et al. (2015), Guan et al. (2016), and Li et al. (2016).

material misstatements. Consistent results across these two proxies enhance the validity of our findings.

China's Independent Auditing Standards (CIAS) identifies five types of audit opinions: clean, unqualified, qualified, disclaimer, and adverse. The CIAS also allows auditors to use unqualified opinions with explanatory notes to emphasize particular accounting, auditing, disclosure, or financial distress issues. Following previous China-related auditing research (e.g., DeFond et al., 2000; Chen et al., 2000; Chan et al., 2006), we treat unqualified opinions with explanatory notes as a form of MAOs, together with qualified, disclaimer, and adverse opinions. Different types of MAOs are likely associated with different levels of severity in accounting irregularities, so we define an ordered audit opinion variable *MAO* with a value from zero to four to represent clean opinions, unqualified opinions with explanatory notes, qualified opinions, disclaimed, and adverse opinions, respectively.[19] Firms are averse to MAOs and auditors face management pressure to issue favorable opinions, so a higher *MAO* value generally indicates higher audit quality, representing auditors' independence to withstand the pressure from managers.

Our restatement data are compiled as follows. From the "Material Accounting Errors" section of financial statement footnotes, we manually identify observations that correct prior financials. To focus on accounting irregularities, we exclude restatements triggered by changes in accounting standards or firms' mergers and acquisition transactions. Poor audit quality is typically associated with income-increasing earnings management (Barron et al., 2001; Kim et al. 2003), so we retain only downward restatement cases where accounting earning or shareholders' equity in the year concerned had been overstated. Thus, our restatement variable, *REST*, is an indicator of observations where earnings or shareholders' equity are subsequently restated downward.

Exhibit 4 shows the annual frequencies of *MAO* and *REST* during the sample period, and the legends to the figures give their relative percentages in the pooled sample. About 8.53% (= 5.18 + 2.44 + 0.89 + 0.02) of observations have received MAOs from their auditors, and 10.25% of have

[19] Compared with dichotomous measurement, the ordered MAO variable is more informative about the standard of auditors. Chinese regulators consider the appropriateness of audit report types. For example, the CSRC sanctioned the Shijiazhuang CPAs for its audits of ShiQuanYe Co. (stock code: 600892) during the 1997-1998 period, as the auditor only used explanatory notes for a severe accounting problem in the company. Our results are not sensitive to the use of a dichotomous variable, by coding all MAOs one and clean opinions zero.

their financials corrected in subsequent years. For both variables, there is a considerable fluctuation over time. In general, there are relatively more MAOs and restatements around the year 2000, coinciding with a rash of Chinese accounting frauds exposed between 2000 and 2001 (Chen et al. 2010). The incidence of MAOs and restatements declines sharply in the more recent period. Chen et al. (2001) argue that Chinese firms with a longer listing age are more susceptible to financial distress after they have exhausted capital raised from the IPOs. The reduced earnings management activities, and accordingly fewer MAOs, are in line with the increase in new firms floating their shares after the opening of the Small- and Medium-sized Enterprise and the ChiNext Boards in 2004 and 2009, respectively. As China's capital market develops, it may also be the case that Chinese listed firms generally improve their financial reporting quality. Either way, the time-series variation in the dependent variables requires the DiD methodology to untangle the contagion effects of poor quality audits from contemporaneous macro trends.

3.4. Control variables

Following previous studies, we consider the following set of client characteristics ($\mathbf{X^C}$) that may influence audit risk and/or audit complexity, and thus the issuance of MAOs or the occurrence of restatements:

CR = Current ratio, computed as current assets divided by current liabilities at the end of the year.

AR = Accounts receivable intensity, computed as the ending balances of accounts receivable divided by total assets at the end of the year.

INV = Inventory intensity, computed as the ending balances of inventories divided by total assets at the end of the year.

LEV = Leverage ratio, computed as total liabilities divided by total assets at the end of the year.

RPTLEND = Total lendings to related parties divided by total assets at the end of the year.

CROA = Core operating net income divided by the average of beginning and ending total assets.[20]

Loss = Indicator for bottom-line losses.

[20] China firms report financial expenses above the operating income in income statements. We therefore adjust operating income by adding financial expenses back to reported operating income so that the operating income variable is free from financing activities.

RET = Market-adjusted stock returns during the year.

Q = Year-end Tobin's *q* adjusted by the market median, where Tobin's *q* is computed as the sum of the book value of total debts and market value of shareholder equity, divided by the book value of total assets.

Ln(*TAST*) = Natural logarithm of year-end total assets (expressed in RMB at the beginning of 1995).

Age = Number of years a company has been listed.

FORESHR = Indicator for firms that have issued B- or H-shares to foreign investors.[21]

As for auditor attributes ($\mathbf{X^A}$) that may influence audit quality, we include the following covariates:

BigN = Indicator variable for observations that are audited by the international Big N auditors.

AFRANK = Annual percentile rankings of audit firm size, measured as the natural logarithm of the total audited assets (in millions of RMB) of the listed clientele.

NLOCAL = Indicator for firms headquartered in a province where the incumbent audit firm does not have a practice office.[22]

CI = Client importance at the CPA level, measured as client size, $\text{Ln}(TAST)_I$, divided by the annual client portfolio size of a CPA, $\sum \text{Ln}(TAST)_i$, where *i* is the number of public company clients audited by a particular CPA in a particular year.

Tenure = The number of continuous years that the CPA has audited the incumbent client.

MAO = Equals zero to four for clean opinions, unqualified opinions with explanatory notes, qualified opinions, disclaimers, and adverse opinions, respectively.[23]

Most of the above variables are common in the auditing literature, with the following China-specific variables: *RPTLEND* or related-party lendings are often used by Chinese firms to tunnel resources from listed firms to their parent firms or related parties, resulting in a higher audit risk associated with these lendings (Jiang et al. 2010); firms issuing foreign shares (*FORESHR*) are subject to stronger monitoring and are therefore associated with better financial reporting (Gul et al. 2010); auditors in China are more lenient toward client companies in the same region (Chan et al. 2006; Wang et al. 2008), and *NLOCAL* controls for this locality effect. Finally, as MAOs suggest

[21] The B-shares were originally issued to foreign investors and traded in domestic markets. Since 2001, domestic investors have been allowed to hold and trade B-shares. The H-shares are issued and traded in the Hong Kong stock markets.

[22] We determine the locations of practice offices according to the office addresses on the audit reports issued by the audit firm or its predecessors (in case the firm merged with other audit firms) in the current and all previous years.

[23] The *MAO* variable is included as a covariate only in the *REST* regression.

potential errors in the financial statements, they are positively correlated with the likelihood of subsequent restatements. Variable *MAO* is thus included in the *REST* regression model.

Table 2 reports the descriptive statistics of the independent variables. All continuous variables are Winsorized at the 1st and 99th percentiles of their respective annual distributions to reduce the influence of outliers. As the mean values for the test variables in Panel A show, the number of observations in the treatment groups is much smaller than those in the control group. In Panels B and C, both the client and auditor characteristic variables exhibit reasonable degrees of variation in the data.

4. Empirical results

4.1. Audit reporting analysis

The LPM regression results for the MAO analysis are reported in columns (1) of Table 3.[24] The underlying assumption of the contagion hypothesis is that the audit quality of sanctioned CPAs is lower. This is supported by the coefficient estimates for *SCPA* and *SCPAFAE*. Recall that in the fixed-effect regression framework, the regression coefficients represent time-varying effects of variables of interest. The negative coefficient on *SCPA*, significant at the 1% level, suggests that sanctioned CPAs tend to issue more lenient audit opinions to all their clients during period *T*. Of these clients, the probability of MAOs for failed audits that are sanctioned by regulators is even lower, as indicated by the significantly negative coefficient on *SCPAFAE*. The sum of the coefficients on *SCPA* and *SCPAFAE* estimates whether audits involved in sanctions are different from the whole sample. As reported at the bottom of the table, this coefficient sum is reliably different from zero in the F-test. Thus, failed audits identified by Chinese regulators are indeed of lower quality. Although our sample, audit quality measure, and research design differ from Li et al. (2016), our results corroborate their findings on the "self-contagion" effect. That is, implicated CPAs' low quality audits are not specific

[24] Cameron and Miller (2015) suggest that clustering standard errors by firm is not desirable in the firm fixed-effect models, given that the fixed effects have also absorbed the cross-correlation within firm. We therefore report t-statistics based on conventional standard errors. Nevertheless, our key findings continue to hold when we cluster the standard errors at the client firm level. We perform more rigorous analysis for the statistical properties of our data in Section 4.3.3.

to the sanctioned cases; rather, as reflected in the negative coefficient on *SCPA*, such CPAs' audit quality is systematically lower across all engagements during period *T*.

We are primarily interested in the indicators of *COLL_CPA* and *CO_CPA*, which assess how low-quality audits of implicated CPAs spread to others. The coefficient on *COLL_CPA* is positive but statistically insignificant. Thus, in general the MAO rates for audits performed by sanctioned CPAs' colleagues are not lower than the sample average. However, those previously collaborating with sanctioned CPAs are not immune. The *CO_CPA* indicator is loaded with a significantly negative coefficient ($p < 0.01$). As the *CO_CPA* group belongs to the *COLL_CPA* group, we further evaluate whether the former differs from the average sample CPAs by the F-test for the coefficient sum of *COLL_CPA* and *CO_CPA*. This F-test, reported at the bottom of the table, is also significantly negative at the 1% level. Therefore the contagion effect is specific to those exposed to the contagious CPAs' practices through teamwork experience. It is absent among the same-firm colleagues of sanctioned CPAs who do not co-sign with them and are thus less exposed to their deficient practices, suggesting that the contagion effect is driven by personal experience and cannot be simply ascribed to the selection or clustering effects at the audit firm level.

To reveal the economic significance of the contagion effect on co-signers, it is useful to benchmark the coefficient sum of *COLL_CPA* and *CO_CPA*, –0.034, which assesses the net difference between co-signers and the whole sample, against that of *SCPA*. The latter, at –0.049, gauges the "self-contagion" effect or quality of the audit engagements of malfeasant CPAs, other than those deemed to be failed audits by the regulators. The contagion spread to the co-signers is about 69.4% larger than the "self-contagion" effect within the implicated CPAs' engagements, which is highly significant from an economic point of view.

Column (2) of Table 3 reports the results from the hybrid logistic model.[25] Compared with the LPM, this hybrid model does not control for unmeasured, time-constant client characteristics and the regression coefficients can otherwise be interpreted in a similar way to the fixed-effect estimates. Under this approach, the coefficient on *SCPA* remains significantly negative though that of the *SCPAFAE* becomes insignificant. Thus with logistic estimation, we find no evidence suggesting

[25] For the hybrid model, the coefficients on the "mean" terms are not tabulated because they cannot be interpreted causally (Allison 2012).

opinions issued by sanctioned CPAs for failed audits are more favorable than their non-failed engagements. Most importantly, the coefficient on *COLL_CPA* is not statistically different from zero, suggesting the absence of the contagion effect on colleague CPAs that have not co-signed with sanctioned CPAs, and the coefficient on *CO_CPA* is significantly negative at the 1% level, confirming the contagion effect on co-signers, as we observe under the LPM approach. Compared to the coefficient on *SCPA*, the magnitude of the sum of coefficients on *COLL_CPA* and *CO_CPA* suggests that this contagion effect is economically significant.[26]

We further explore whether the above findings are caused by Type I or Type II errors in audit reporting. Here, the Type I error refers to the issuance of an MAO when a clean opinion is appropriate and the Type II error refers to the issuance of a clean opinion when an MAO is warranted. The error type analysis helps to demonstrate how low-quality audit contagion spreads. As Watts and Zimmerman (1986, §13) articulate, low-quality audits could be driven by a lack of competence or independence, where competence refers to a CPA's ability to discover a breach and independence is related to the CPA's incentives in reporting any discovered breach. Although competence affects both Type I and II error rates, independence should only affect Type II errors as faced with client pressures, a CPA likely compromises independence by issuing a clean opinion when a modified one is more appropriate. Competence reflects an individual's knowledge or expertise, so it cannot be easily transferred and shared among CPAs (Fama and Jensen 1983; Goodwin and Wu 2014). A CPA's independence is instead determined by the trade-off between audit effort and risk level derived from his/her incentive. A CPA's attitude toward independence can therefore be learnt and imitated by his/her peers and disseminated. We therefore expect the contagion effect will only manifest itself in cases where auditors commit a Type II error.

Following Guan et al. (2016), we partition the sample using the Z_{China}Score of Altman et al. (2010). This predicts the likelihood of Chinese public firms assuming ST status,[27] regarded as a

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[26] We also fit the MAO regression by the conditional maximum likelihood method, or the "fixed-effect" logistic model. As previously noted, this approach leads to serious information loss with around 50% of observations dropped from the data due to the lack of within-client variation in the *MAO* variable. Our key results do, however, survive: the coefficient on *COLL_CPA* is still insignificant while that on *CO_CPA* is significantly negative (coefficient = –0.331, p = 0.019).

[27] According to Chinese Company Law and related regulations, the stocks of a listed firm that incurred losses in the previous three years should be delisted by the stock exchange. To warn investors of the delisting risk, stock

financial distress measure (Jiang et al. 2010).[28] Based on the recommendation of Altman et al. (2010), we classify observations with a Z_{China}Score value above 0.9 (below 0.5) as financially healthy (distressed).

Table 4 displays the MAO regressions estimated by LPM separately for the subsamples partitioned by the Z_{China}Score. Consistent with our expectations, none of the four treatment indicators is significant at the 10% level in column (1), where the observations are financially healthy according to their Z_{China}Score value. Thus, there is no symptom of a Type I error for sanctioned CPAs when auditing financially sound clients, and not surprisingly, there is also no contagion. Column (2) gives the analysis of Type II errors based on the financially distressed auditees, and similar to Table 3, there is evidence that by delivering a clean opinion or less-serious MAOs to troubled clients, sanctioned CPAs systematically perform low-quality audits, which are also observed among their teammates, but not for their other colleagues in the accounting firm.[29] Jointly, the Type I/II error analysis results support the argument that attitudes toward independence can be spread among CPAs, rather than their competence.

4.2. Accounting restatement analysis

We next examine how poor-quality audits leave a trail of material misstatements in audited financial statements, which are subsequently corrected. The regressions of *REST*, or accounting restatements, are reported in Table 5. Here, the results for the LPM [column (1)] and the hybrid logistic model [column (2)] are generally in line with each other. For both regressions, the significantly positive coefficients on *SCPA* suggest that accounting numbers audited by sanctioned CPAs during *T* are generally more likely to be restated downwards in the future, and those on

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(Footnote continued.)

exchanges assign the Special-Treatment (ST) mark to a firm that has had two consecutive annual losses or a negative book value of equity. The trading of ST stocks is subject to a daily price up/down limit of 5%.

[28] Following Altman et al. (2010), we compute the Z_{China}Score as: $0.517 - 0.460x_6 + 9.320*x_7 + 0.388*x_8 + 1.158x_9$, where x_6 is the asset liability ratio (total liabilities/total assets), x_7 is the rate of return on total assets (net profit/average total assets), x_8 is the ratio of working capital to total assets (working capital/total assets), and x_9 is the ratio of retained earnings to total assets (retained earnings/total assets).

[29] We also test the "grey area" subsample with Z_{China}Score falling in the range of [0.5, 0.9]. The untabulated results are similar to those presented in column (1) of Table 4 except that the coefficient on *SCPAFAE* is significantly negative at the 1% level.

SCPAFAE, also significantly positive, suggest that this probability is incrementally higher for audit failures sanctioned by the regulators, relative to the base group designated by *SCPA*. CPAs involved in audit failure cases do indeed have more frequent restatements, validating *REST* as an audit quality measure. We find no effect of cross-CPA contagion on CPAs who are only colleagues of those implicated in sanction cases, as indicated by the statistically insignificant coefficient on *COLL_CPA*. However, a contagion effect is evident among CPAs who have co-signed audit reports with sanctioned CPAs, as shown by the significantly positive coefficients on *CO_CPA* and the F-statistics for the coefficient sums of *COLL_CPA* and *CO_CPA*.[30]

The contagion effect in misstatements is also economically meaningful. The LPM regression is an example. The sum of the coefficients on *COLL_CPA* and *CO_CPA*, estimated at 0.026, suggests that the probability of misstatements for audits conducted by co-signers relatively increases by about 25.4% when compared with the restatement percentage of 10.25% for the whole sample (Panel B of Exhibit 4). With reference to the coefficient on *SCPA* (i.e., 0.038), the increase is about 68% greater than the self-contagion effect, which is the spread of low quality from discovered audit failures to other engagements within the clientele of implicated CPAs.

Poor audit quality is normally associated with overstated earnings or shareholders equity, so we focus on downward restatements in the above analysis. To better identify the mechanism of contagion, we also examine upward restatements, i.e., corrections of previously understated earnings or equity. A CPA could be inherently less competent and make more mistakes in his/her audits, resulting in more restatements, including upward restatements. As previously argued, competence cannot be easily transferred and shared. We therefore do not also expect exposed CPAs to be more likely to have downward misstatements. Conversely, it can be argued that incompetent auditors pair together. The homophily theory in sociology predicts that that individuals tend to associate and bond with similar others (i.e., "birds of a feather flock together"), and if this is the case, the contagion we observe is actually driven by selection between CPAs rather than an *ex post* spread of bad behavior from sanctioned CPAs to their peers. Similar contagion should then also be evident in upward restatements.

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[30] Our results are robust to the use of the conditional maximum likelihood method though significant information loss is a concern. Under this method, the coefficient on *COLL_CPA* is statistically insignificant and that on *CO_CPA* is positive and significant (coefficient = 0.213, $p = 0.049$).

The results reported in Table 6 do not bear this out. In both the LPM and the hybrid logistic model, the coefficients on *SCPAFAE* are positive and coefficient sum of *SCPA* and *SCPAFAE* are significantly positive, implying that failed audits are also associated with more understatements of earnings or equity.[31] However, there is no "self-contagion" for this form of low-quality audit within the implicated CPAs' client portfolios, nor does any contagion spread to their co-signers, as both *SCPA* and *CO_CPA* are loaded with insignificant coefficients. Results from upward restatements support that the spread of poor quality is more likely due to the CPA's incentive than to selection.

4.3. Additional tests on research design issues

4.3.1. Possible confounding effects

In our main analysis, we control for clients' unobservable attributes with client fixed effects but do not include CPA fixed effects. Our data includes 5,949 unique CPAs. Including a large number of CPA fixed effects reduces the level of freedom and the regression estimation precision (Wooldridge 2013, §3). Gul et al. (2013) find that client fixed effects explain far more variation in audit outcomes than those for individual auditors, but one concern is that the results could be confounded by the clustering of team auditors with common unobservable attributes at the local office level. Following Bertrand and Mullainathan (2003) we address this by adding the mean value of the dependent variables for each CPA-year combination (excluding the observation of *ijt* itself in computing the mean, to avoid a mechanical relationship between dependent and independent variables) to the regressions. This variable absorbs clustering when the audits of team CPAs during a specific year are systematically different from others. We instead include a mean variable of the dependent variables for each CPA over the entire sample period in the regressions to control for the time-constant effects of CPAs. Under either approach, the results for both audit reporting and accounting restatement tests

[31] Significantly more upward restatements for failed audit engagements may first appear to be at odd with the expectation that poor-quality audits typically result in overstatement in earnings or shareholders equity. In our data, there are a total of six failed audit engagements where prior earnings or equity are understated. Among these cases, two are driven by restatement of prior overstated income tax expenses, consistent with Erickson et al.'s (2004) observation that firms may overpay income taxes due to upward earnings manipulation. In another two cases, the firms report net losses in the restated years, suggesting that these firms may deliberately understate earnings when taking a big bath. Thus over 50% of such seemingly unusual cases are still driven by earnings manipulation activities, supporting the inferior audit quality in these cases.

survive: the coefficients of *CO_CPA* are significant with expected signs at 5% or better levels (untabulated).

We use the CPA-client-year level data as at this level audits performed by each CPA type of can be categorized with no overlap, which facilitates the data analysis and interpretation of the results (see Exhibit 3). In China, each audit engagement must be signed off by two CPAs, so an audit during *T* can be jointly conducted by a sanctioned CPA and a team CPA. The quality of these audits can reflect the effects of a sanctioned CPA, a team CPA, or both. We conduct two tests to further identify the effects of joint audits. First, we dummy out these cases by using two additional indicator variables; one is turned on within the SCPA group if the engagement is also co-signed by a CO_CPA, and the other turned on within the CO_CPA group when an SCPA co-signs the report. In other unreported results, these two additional indicator variables are not loaded significantly in either the *MAO* or *REST* regression of model (1). Importantly, inferences for the four key experimental variables are qualitatively the same as previously reported. Second, we collapse the CPA-client-year data to client-year data and take the mean values of the four indicator variables, *SCPA*, *SCPAAFE*, *CO_COLL*, and *CO_CPA*, by client-year combination. The joint audit problem no longer exists under this approach as each client-year appears only once in the data. In untabulated regressions, we find that the tenor of the results for the variables of interest remains the same.

4.3.2. Covariate balanced sample

For causal inference, subjects should ideally be randomly assigned to the treatment and control groups, to ensure that treated and control firms are similar in every aspect so they would have evolved similarly had the shock (audit failure in our case) not occurred. Although such a condition rarely exists in social science research contexts, a DiD-type design helps to improve identification by controlling for observable time-variant characteristics and unobservable fixed attributes. As Atanasov and Black (2015 and 2016) stress, it is nevertheless a sound practice to keep a covariate balance between treated and controls to mimic the as-if-random condition. Following this, we use the propensity score matching procedure to create a covariate balanced sample as follows. First, we estimate the following logistic model:

$$Prob(CO\_CPA_{ijt} = 1) = G(\alpha + \delta \mathbf{X}_{ijt} + \kappa_k + \lambda_t + \varepsilon_{ijt}), \quad (3)$$

where *CO_CPA* is defined as before, *G* is the logistic function, and vector **X** includes all time-varying covariates except *MAO*, and κ_k and λ_t represent the industry and time fixed effects. We fit model (3) and obtain the estimated probability, denoted as *P-Score*, for each observation. The number of observations in the potential control pool is far larger that of the treated group, so we use a 1:3 matching without replacement, i.e., for each treated observation, we identify three control observations with the closest *P-Score*. To further ensure the similarity between the treated and controls, we set the caliper value at 0.01, i.e., the absolute difference between the treated and its controls in *P-Score* should not exceed 0.01.[32]

The above procedure successfully aligns the distributions of covariates within the matched treated and control groups. Untabulated analysis suggests that there is no significant difference, at the 10% level, in the *P-Score* or any component covariate in the t-tests between the two groups. No significant difference is found between the treated and control groups in industry distributions ($p >$ 0.998 in the χ^2 test) or yearly distributions ($p > 0.583$ in the χ^2 test). However, the two groups differ significantly in audit quality measures. The MAO rate for treated and control groups are 12.89% and 15.97%, respectively, and the difference is significant in the χ^2 test ($p < 0.01$). The two groups' means in *REST* are 20.20% and 15.88%, respectively, with the difference being significant at the 0.001 level in the χ^2 test.

Table 7 presents our regression analyses, and as matching has balanced the treatment and control groups in the covariates, it minimizes the correlation between *CO_CPA* and the covariates within each pair. There is thus no need to include other controls or the client fixed-effects (Allison 2012, §8). We therefore regress *MAO* or *REST* on *CO_CPA* only by the conventional logistic model. In the matched data, variable *CO_CPA* takes the value of either one or zero within each matched pair, leading to cross-correlation of residuals within pairs. We correct for such a correlation pattern by clustering the standard errors by match pairs. The results reported in Panel A1 confirm our findings from the DiD-based pooled regressions. Significant at the 1% level, the coefficient on *CO_CPA* in the *MAO* regression suggests that the odds for co-signers of implicated CPAs in rendering MAOs are 22.4%

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[32] Consistent with the observation of DeFond et al. (2016) that matching ratio choice generally does not affect match-based design results, the results are qualitatively the same as those reported below if we use a 1:1, 1:2, 1:3, or 1:4 matching. However, matching at the 1:5 or higher ratios is not successful in that the differences between the treated and control groups in *P-Score* and some covariates become significant at the 10% level.

lower [= exp(–0.253) – 1] than otherwise similar audit engagements handled by CPAs free from the contagion. Audits performed by co-signers are also characterized by more subsequent restatements as the significantly positive coefficient on *CO_CPA* in the *REST* regression suggests: the chance of revising earnings or equity downwards is 34.1% higher [= exp(0.294) – 1] than comparable audits.

We also control for the fixed effect for each pairing and fit the regressions by LPM. Under this approach, the coefficient on *CO_CPA* indicator can be interpreted as the effect of pairwise differences in *CO_CPA* on pairwise differences in the outcome variables, namely *MAO* and *REST* (Cram et al. 2009). The results reported in Panel A2 continue to hold under this approach.

To verify whether the contagion effect can be observed among CPAs who are merely colleagues of those implicated in sanctioned cases, we repeat the above matching analysis on variable *COLL_CPA*. The *P-Score* is then obtained from the following logistic model:

$$Prob(COLL\_CPA_{ijt} = 1) = G(\alpha + \delta \mathbf{X}_{ijt} + \kappa_k + \lambda_t + \varepsilon_{ijt}). \quad (4)$$

The prediction model is the same as (3) except that the dependent variable is *COLL_CPA*. We match observations audited by those in the *COLL_CPA* group with those audited by CPAs who are not colleagues of the sanctioned CPAs by the *P-Score* estimated from the above model. Again, matching is successful in that the treated *COLL_CPA* group does not differ from the matched control group in the overall *P-Score* or any covariate in the t-tests. The regression results are reported in Panel B. None of the coefficient on *COLL_CPA* is statistically significant. With the match design, we still observe no sign of contagion spreading from the contagious CPAs to their non-teammate colleagues.

4.3.3. Placebo tests

Following Atanasov and Black's (2016) suggestion, we also assess the credibility of the DiD design by the following placebo test. For each sanctioned client-year, we randomly draw, without replacement, a client in the same year and industry who is *not* involved in any regulatory sanction, as a pseudo sanction case. We treat the signatory CPAs of the pseudo cases as sanctioned CPAs, and redefine the experimental variables, *SCPA*, *SCPAAFE*, *CO_COLL*, and *CO_CPA*. We then fit the regressions with the pseudo data. This procedure is repeated 999 times. Pseudo data should generate null results, so the coefficients from these tests can be compared with those obtained from actual data, providing a method of estimating standard errors. By inserting actual coefficients into the distributions of placebo-test coefficients, we obtain the bootstrap Z-statistics.[33] The distributions of placebo-test coefficients are reported in Table 8, and as expected, their means and medians are generally close to zero. Importantly, the bootstrap *p*-values for the actual coefficients of the experimental variables are consistent with those previously reported, except the *COLL_CPA* coefficient becomes significant at the 10% level in the *MAO* test (but the positive coefficient sign is contradictory to the argument that colleague CPAs have worse quality). Overall, the placebo tests suggest that test statistics based on the conventional method are well specified. The lack of evidence on misbehavior and its contagion by randomly selected innocent CPAs also suggests that results from actual data better reflects the contagion of behavior from failing CPAs to their teammates, rather than selection or clustering.

4.4. Cross-sectional variation of the contagion effect

In this subsection, we explore the cross-sectional variation of the contagion effect, initially by considering CPA-specific factors. First, the social network theory suggests that opinion leaders exert influence over group members through behavior transmission (Rogers 2003). Bikhchandani et al. (1992) argue that low-precision individuals rationally ignore or under-weigh their private information and tend to imitate high-precision individuals, leading to information cascade. If an auditor is respected as an opinion leader due to experience, prestige, and status in the social network, then we expect any contagion effects on audit quality to be stronger. We use two variables to measure the experience, prestige, and status of the sanctioned CPA; the amount of client assets (in millions of RMB and taking the natural logarithm) during the contact period from $T – 4$ to T (*SCPAEXP*),[34] and borrowing from the social network literature, network closeness centrality (*Closeness*) in his/her audit firm. A higher value of *Closeness* represents closer ties with other CPAs, so the sanctioned CPA is more central in the audit firm network, which we associate with greater status in the audit firm and thus greater contagion. Second, previous studies show that the transmission of behavior through social networks is stronger between individuals who are similar (e.g., Pool et al. 2015), so we consider two similarity measures: (a) *Cohort*, which is an indicator for cases where the absolute age difference

[33] For example, if the actual coefficient is placed at the 99th quantile of the distribution, then it is significant at the 1% level.

[34] Results are similar if we use the number of audits performed during the contact period to proxy for *SCPAEXP*.

between sanctioned and team CPAs is below five, and (b) *LocalTies*, which is an indicator for cases where sanctioned and team CPAs' alma maters are located in the same region.[35] We expect CPAs to be more similar if they are from the same birth cohort or share the same geographic locations in their early life.

Third, we also predict contagion to be more prominent if the sanction is more severe, which is analogous to the epidemiological situation where a more vital or severe infection causes greater contagion. We therefore expect the contagion of poor audit quality to be more prominent if the sanction is so severe that implicated CPAs are banned from practice by regulators.[36] This is measured by *SCPABAN*.

Fourth, we also consider the audit firm characteristic of firm size. Large auditors are perceived to provide higher audit quality as their reputational capital is at stake (DeAngelo 1981), they invest more in auditing technologies (Craswell et al. 1995), and have more rigorous firm-level quality control mechanisms (Nelson and Tan 2005). Thus, we expect the contagion of poor audit quality to be mitigated in bigger audit firms, as measured by *BigN* and *AFRANK*.

Last, we examine client characteristics. Wang et al. (2008) find that better regional institutional developments ameliorate Chinese firms' tendency to employ low quality auditors, so we use the marketization index compiled by Fan et al. (2011) (*Marketization*) to proxy for the local institutional level. *FORESHR* measures whether clients have issued B-/H-shares to foreign investors and thus are subject to stricter monitoring due to additional reporting/auditing requirements (Gul et al. 2010). We test whether the contagion effect is attenuated for clients in better localized institutional environments and issue B/H shares.

The cross-sectional analysis results are reported in Table 9. With respect to CPA characteristics, we find that for both audit reporting and accounting restatements, the contagion effect is stronger when a team CPA is exposed to a sanctioned CPA who is more prestigious and has closer ties to others in the audit firm network, as measured by both *SCPAEXP* and *Closeness*, or when the team CPA and the sanctioned CPA graduated from schools that are located in the same region. There is evidence that

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[35] We measure local ties by school locations as we do not have the data for individual CPAs' birth places.

[36] In our sample, 23 out of 230 implicated CPAs are banned from the securities market or their practice licenses are revoked by the regulators.

the contagion in terms of lenient audit reporting is stronger when the team CPA is exposed to a sanctioned CPA who is banned from practice by regulators, or when the team CPA is similar in age to the sanctioned CPA. With respect to audit reporting, we observe that audit firm size mitigates the contagion effect, as measured by *AFRANK*. With respect to restatements, we also find some evidence to suggest that better local institutions and the issuance of shares to foreign investors mitigate the contagion.

4.5. The economic consequences of conducting poor quality audits

We have found that poor audit quality is contagious through the exposure to implicated auditors of others, because of the direct interactions and learning in an audit team. However, without economic incentives, exposed auditors can remain immune to the bad behavior. To rationalize the exposed auditors' reaction to bad behavior, we further examine the economic consequences in terms of their clientele size, on the ground that CPAs generally derive utility from a larger clientele (Knechel et al. 2013). We analyze the time-series of clientele size surrounding *T*, the period when substandard audits occur, by the following regression with CPA-year as the unit of analysis:

$$\begin{aligned} y_{jt} = {} & \alpha_j + \lambda_t + (\beta_1 \mathit{Pre\text{-}Event}_{jt} + \beta_2 \mathit{Event}_{jt} + \beta_3 \mathit{Post\text{-}Event}_{jt}) \times \mathit{SCPA}_{jt} \\ & + (\gamma_1 \mathit{Pre\text{-}Event}_{jt} + \gamma_2 \mathit{Event}_{jt} + \gamma_3 \mathit{Post\text{-}Event}_{jt}) \times \mathit{COLL\_CPA}_{jt} \\ & + (\delta_1 \mathit{Pre\text{-}Event}_{jt} + \delta_2 \mathit{Event}_{jt} + \delta_3 \mathit{Post\text{-}Event}_{jt}) \times \mathit{CO\_CPA}_{jt} \\ & + \zeta_1 \mathit{Age}_{jt} + \zeta_2 \mathit{Age}_{jt}^2 + \varepsilon_{jt}, \end{aligned} \tag{5}$$

where j indexes CPAs and t indexes time, y_{jt} is the clientele size measured by the sum of audited clients' total assets (in logarithm and adjusted for inflation) or the logarithm of one plus the number of clients for CPA j in year t, α_j is the CPA fixed effects, λ_t is the year fixed effects, and the three time period indicators are *Pre-Event*, *Event*, and *Post-Event* for the periods between $T - 4$ to $T - 1$, T, and $T + 1$ to $T + 4$, respectively. The three indicators denote the three groups of CPAs of interest: *SCPA* for those who are sanctioned, *COLL_CPA* for colleagues of sanctioned auditors, and *CO_CPA* for those who have co-signed with sanctioned auditors in the past. We are interested in the interaction terms between the time indicators and the CPA-group indicators. With both year and CPA fixed effects, the coefficients on the interaction terms can be naturally interpreted as the within-CPA changes in y during specific periods for particular CPA groups. We also include CPAs' practice *Age*, defined as the number of years since the CPA first signed audit reports for public firms, to control for the change in clientele size over the CPAs' careers and its squared term, Age^2, to allow the non-linearity in the relation between *Age* and clientele size.[37]

The regression results based on two clientele size measures are presented in Table 10. The lower part of the table reports the relevant joint F-tests for the differences in the coefficients between event periods for each of the three groups of CPAs. As the CO_CPA group is a subset of the COLL_CPA, the time-series variations of both groups should be evaluated in conjunction. We discuss the results based on total audited clients' assets (in logarithm) in column (1) only as the inferences from column (2) are similar. The coefficient on *SCPA×Pre-Event*, β_1 is significantly positive, suggesting that sanctioned CPAs have a relatively larger clientele before audit failures. They generally increase their clientele during the audit failure period, as indicated by the positive difference between *Event* and *Pre-Event* coefficients (i.e., $\beta_2 - \beta_1$). It thus appears that acquiescent auditors effectively expand their businesses, consistent with the notion that less skeptical auditor are better able to satisfy clients (Behn et al. 1997). However, this effect is at best transitory—the difference between *Post-Event* and *Pre-Event* coefficients (i.e., $\beta_3 - \beta_1$) is significantly negative. The post-event shrinkage of sanctioned CPAs' clientele likely reflects client attrition when audit failures gradually unfold. These changes are economically large when benchmarked against the sample mean value of 12.71 for the dependent variable (untabulated). We observe that the COLL_CPA group also increases its clientele during the event period, but at a lower magnitude than the sanctioned CPAs, and then experience a drop during the post-event period. Nevertheless, they appear able to keep their clientele intact from the pre- to post-event period, as the coefficient difference ($\gamma_3 - \gamma_1$) is quite small and statistically insignificant. Finally, the time-series pattern of the SCPA group can be largely mapped on to that of the CO_CPA group: the event-period clientele is significantly larger than in the pre-event period [i.e., $(\gamma_2 + \delta_2) - (\gamma_1 + \delta_1)$], and the post-event period clientele size declines significantly relative to the pre-event period [i.e., $(\gamma_3 + \delta_3) - (\gamma_1 + \delta_1)$].[38] This finding confirms that by following the auditing strategy of the

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[37] A CPA may not have any public clients in a given year, so for these CPA-years we assign a zero value to the dependent variables to capture the complete time-series of his/her entire career. Our results are not sensitive to simply discarding these CPA-years from the sample.

[38] To rule out the concern that sanctioned and team CPAs are of lower audit quality because of their busyness (larger clientele size) in year *T*, we also control for the clientele size of a CPA in the main regression – Model (1).

sanctioned auditors, who are more lenient and lax with their clients, team auditors are also able to gain more clients. Importantly, these economic benefits do not last long and eventually reverse. Sanctions thus only cause “collateral damage” to the teammates of implicated CPAs, but not to other colleagues. This evidence corroborates our main audit quality analysis from a market perspective. After observing the sanctions the market can infer that teammates may learn from the implicated CPAs, even though they are not explicitly punished by regulators, and provide substandard audits. Clients may then shun them to protect themselves against the possible consequences of low-quality audits.

5. Concluding remarks

In this study, we examine the social learning of bad behavior at an individual auditor level. By identifying a group of auditors who are sanctioned due to audit failure and a group of team auditors who have previously co-signed with the sanctioned auditors, we test whether the team auditors also exhibit poor audit quality, to infer a contagion effect. Our various analyses all point to a mechanism that results from the social interaction and learning of individual auditors who have a close working relationship in an audit team, rather than by clustering or selection.

Our study is the first to examine audit team interactions using archival data, and to document a distinct contagion effect brought about by social learning in the auditing context. Two contrasting explanations of low-quality audits have been put forward in the literature. Francis and Michas (2013) suggest that low quality for specific clients reflects the systematic audit quality problems of the entire office, while Li et al. (2016) and Gul et al. (2015) conclude that low audit quality is specific to individual auditors involved in audit failures, and cannot be generalized to their colleagues. Our evidence suggests that neither view is complete: the symptoms of poor quality audits can be observed in both individual (those implicated in sanctions) and firm/office (those who work closely with the implicated individuals) dimensions. We show that a diagnostic based on teamwork among individual auditors can be developed to detect inferior audits, and can be used by audit firms to avoid audit failures, to enable regulators to carefully target resources in fraud detection, and for users to evaluate

(Footnote continued.)

We continue to find robust results that the sanctioned and team CPAs are of lower audit quality, but not the colleague CPAs.

the quality of audited financial statements. In light of this, regulators in other countries may also consider disclosure of more than just the name of the engagement auditor. Finally, there is a moral lesson to be learned from our finding that teammates of sanctioned auditors are ultimately punished by the market; to achieve long-run career success, auditors should both maintain ethical integrity and actively monitor the behavior of their partners.

Before closing, a few caveats are in order. First, a common issue in the methodology of fraud research is that only detected frauds can be observed by researchers. Our study is not immune from this identification problem: some "faultless" auditors could have performed substandard audits but have not been caught.[39] Second, the use of Chinese data may limit the generalizability of our findings. Although human behavior such as social learning is ubiquitous across cultures, the external validity of this study should be assessed by data from locations where cooperation between audit partners can be observed (e.g., Germany and Taiwan). Third, we only show the negative side of auditors' teamwork experiences in this study. As overall audit quality is generally acceptable (Francis 2004) and reputation concerns are important in motivating auditors to provide high-quality audits (DeFond and Zhang 2014), we believe that there is a positive side to auditors' social learning behavior; the dissemination of good auditing practices via interactions between individual auditors. We look forward to future research on this important issue.

[39] To the extent that unobserved low-quality audits are also contagious, rendering the audit quality of observations served as control sample lower, this problem should work against finding significant contagion effects.

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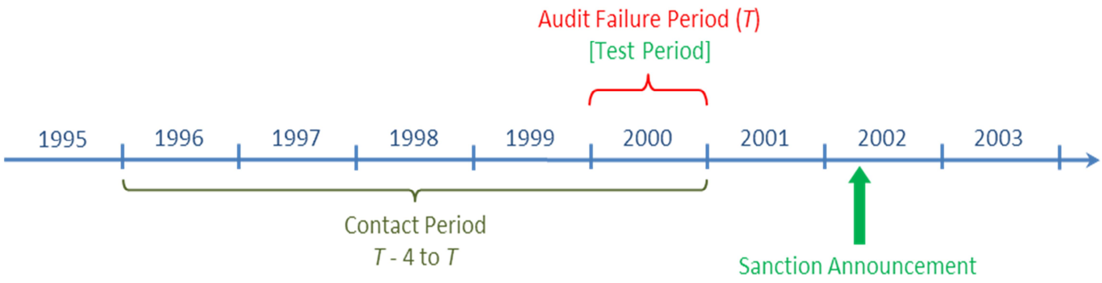
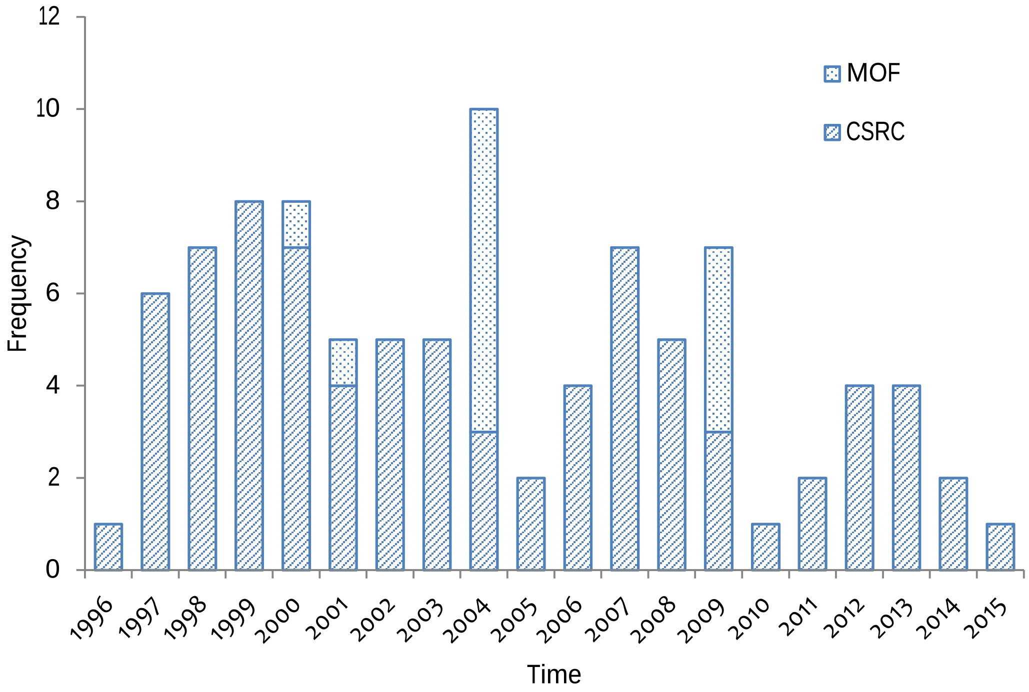
Exhibit 1: Time frame of auditor sanctions



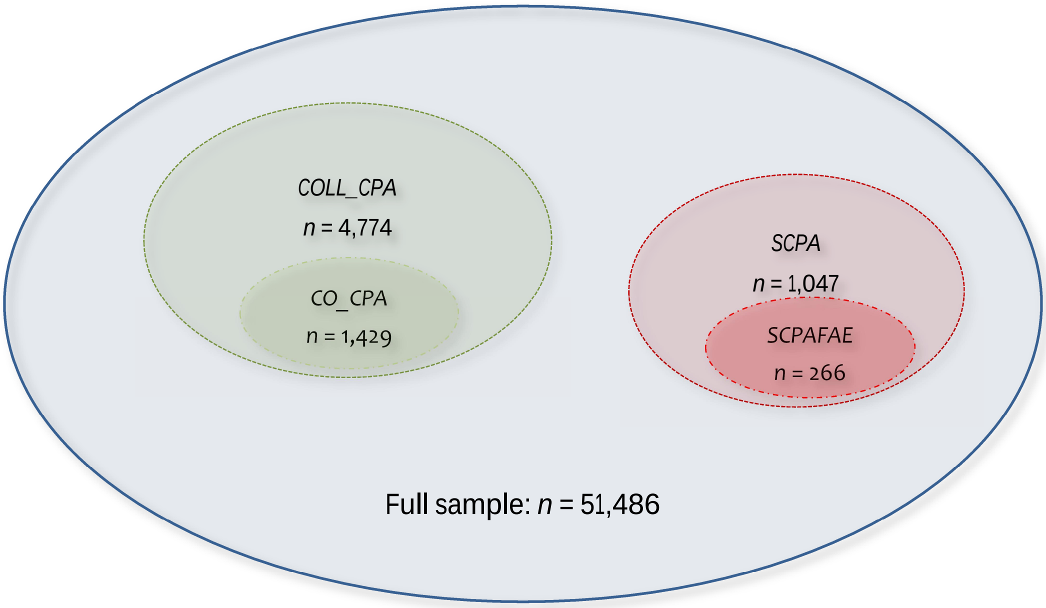
The exhibit is based on the fraud of YinGuangXia (stock code: 000557), which was dubbed “the Chinese Enron.” The company manipulated its earnings by fabricating sales and non-existent plants during FY2000. Its auditor, ZhongTianQin, had issued clean opinions on the company. The case was exposed by *CaiJing* in August 2001. After investigation, the CSRC deemed it to be a very serious audit failure. In March 2002, the MOF revoked ZhongTianQin’s license and the certificates of the two signatory auditors, Liu Jiarong and Xu Linwen.

Exhibit 2: Distribution of sanctions against CPAs by time and regulatory agencies



The time refers to the year in which the sanctions were announced.

Exhibit 3: Subsamples formed by the four indicator variables

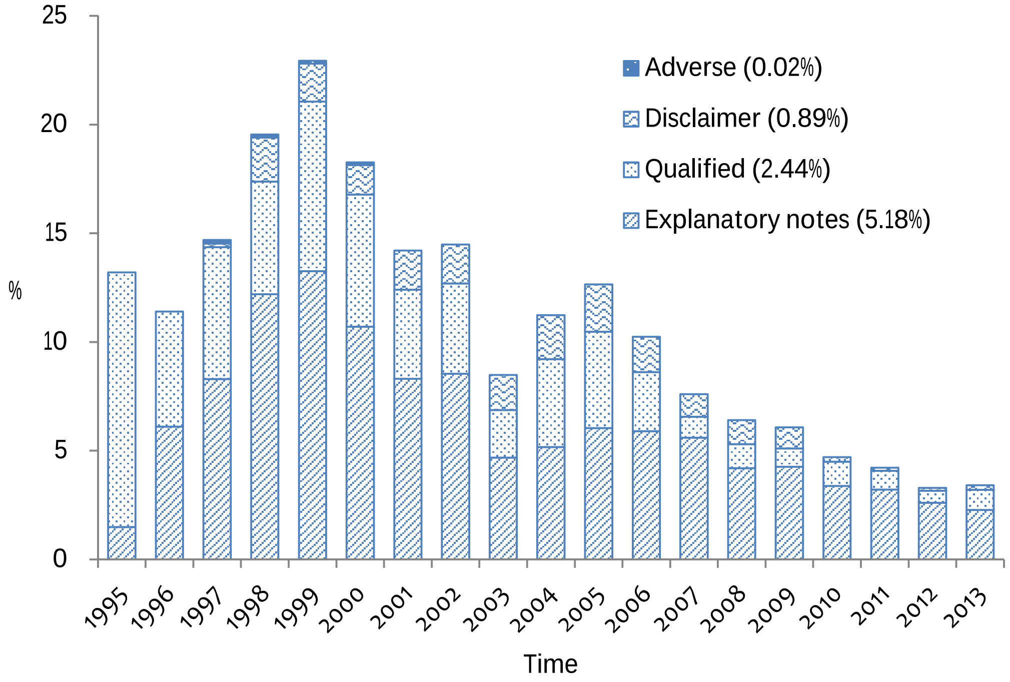


The figure is not drawn to scale by sample size.

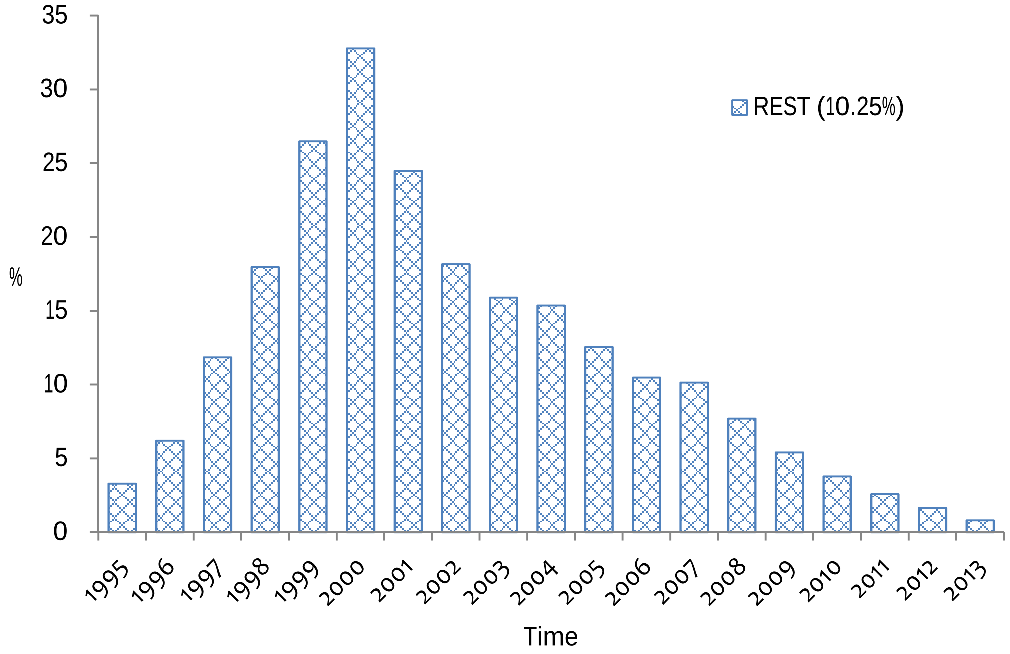
SCPA	=	Indicator for observations that are audited by the sanctioned CPAs during *T*, where *T* are the fiscal years involved in the sanction cases.
SCPAFAE	=	Indicator for audit observations that are sanctioned by the regulators due to auditor negligence.
COLL_CPA	=	Indicator for observations during *T* that are audited by CPAs who work in the same accounting firm as the contagious ones during *T* – 4 to *T*.
CO_CPA	=	Indicator for observations during *T* that are audited by CPAs who co-sign with contagious CPAs during *T* – 4 to *T*.

Exhibit 4: Distribution of MAOs and accounting restatements over time

Panel A: MAOs



Panel B: Accounting restatements



The percentages in the parentheses are the relative frequencies of MAOs or restatements in the pooled sample.

Table 1: Descriptive statistics of the sanction cases

Attributes	N	Mean	Min.	Q1	Median	Q3	Max.	Std. Dev.
(1) Number of fiscal years involved in each sanction	94	1.649	1.000	1.000	1.000	2.000	4.000	0.958
(2) Time lag between FYE and sanction time [a]	94	2.590	0.435	1.424	2.253	3.247	9.873	1.600
(3) Number of CPAs involved in each sanction	94	2.489	1.000	2.000	2.000	3.000	6.000	0.800
(4) Big N membership [b]	155	0.045	0.000	0.000	0.000	0.000	1.000	0.208
(5) Percentile ranking of audit firms [b]	155	0.634	0.011	0.356	0.740	0.871	0.987	0.286

a. Defined as the number of days from the end of the last fiscal year involved in the sanctions to the date when the regulatory announced the sanctions, divided by 365.

b. The unit of analysis is fiscal years involved in the sanctions. Big N membership is an indicator if the auditor is one of the Big N's Chinese member firms. Percentile ranking of firms is based on total assets audited (in millions RMB, taking the natural logarithm) in each fiscal year.

Table 2: Descriptive statistics of the independent variables

Variables	Mean	Q1	Median	Q3	Std. Dev.
Panel A. Experimental variables					
SCPA	0.020	0.000	0.000	0.000	0.141
SCPAFAE	0.005	0.000	0.000	0.000	0.072
COLL_CPA	0.093	0.000	0.000	0.000	0.290
CO_CPA	0.028	0.000	0.000	0.000	0.164
Panel B. Client characteristics ($\mathbf{X}^{\mathbf{C}}$)					
CR	2.115	0.969	1.383	2.143	2.731
AR	0.128	0.038	0.100	0.185	0.113
INV	0.159	0.063	0.125	0.207	0.143
LEV	0.477	0.313	0.468	0.617	0.258
RPTLEND	0.023	0.000	0.000	0.011	0.068
CROA	0.051	0.023	0.052	0.086	0.072
Loss	0.108	0.000	0.000	0.000	0.310
RET	0.067	–0.161	0.024	0.253	0.359
Q	0.058	–0.262	–0.002	0.315	0.458
Ln(*TAST*)	20.760	19.980	20.620	21.390	1.191
Age	10.760	6.585	10.450	14.430	5.316
FORESHR	0.098	0.000	0.000	0.000	0.297
Panel C. Auditor characteristics ($\mathbf{X}^{\mathbf{A}}$)					
BigN	0.060	0.000	0.000	0.000	0.237
AFRANK	0.721	0.565	0.792	0.925	0.238
NLOCAL	0.304	0.000	0.000	1.000	0.460
CI	0.289	0.133	0.207	0.342	0.241
Tenure	2.267	1.000	2.000	3.000	1.487
MAO	0.127	0.000	0.000	0.000	0.463

Variable definitions:

SCPA = Indicator for observations that are audited by the sanctioned CPAs during *T*, where *T* are the fiscal years involved in the sanction cases.

SCPAFAE = Indicator for audit observations that are sanctioned by the regulators due to auditor negligence.

COLL_CPA = Indicator for observations during *T* that are audited by CPAs who work in the same accounting firm as contagious CPAs during *T* – 4 to *T*.

CO_CPA = Indicator for observations during *T* that are audited by CPAs who co-sign with contagious CPAs during *T* – 4 to *T*.

CR = Current ratio, computed as current assets divided by current liabilities at the end of the year.

AR = Accounts receivable intensity, computed as the ending balances of accounts receivable divided by total assets at the end of the year.

INV = Inventory intensity, computed as the ending balances of inventories divided by total assets at the end of the year.

LEV = Leverage ratio, computed as total liabilities divided by total assets at the end of the year.

RPTLEND = Total lendings to related parties divided by total assets at the end of the year.

(The table continues on the next page.)

Table 2 (Continued)

CROA	=	Core operating net income divided by the average of beginning and ending total assets.
Loss	=	Indicator for bottom-line losses.
RET	=	Market-adjusted stock returns during the year.
Q	=	Year-end Tobin's *q* adjusted by the market median, where Tobin's q is computed as the sum of the book value of total debts and market value of shareholder equity, divided by the book value of total assets.
Ln(*TAST*)	=	Natural logarithm of year-end total assets (expressed in RMB at the beginning of 1995).
Age	=	Number of years a company has been listed.
FORESHR	=	Indicator for firms that have issued B- or H-shares to foreign investors.
BigN	=	Indicator variable for observations that are audited by the international Big N auditors.
AFRANK	=	Annual percentile rankings of audit firm size, measured as the natural logarithm of the total audited assets (in millions of RMB) of the listed clientele.
NLOCAL	=	Indicator for firms headquartered in a province where the incumbent audit firm does not have a practice office.
CI	=	Client importance at the CPA level, measured as client size, $\text{Ln}(TAST)_i$, divided by the annual client portfolio size of a CPA, $\sum \text{Ln}(TAST)_i$, where *i* is the number of public company clients audited by a particular CPA in a particular year.
Tenure	=	The number of continuous years that the CPA has audited the incumbent client.
MAO	=	Equals zero to four for: clean opinions, unqualified opinions with explanatory notes, qualified opinions, disclaimers, and adverse opinions, respectively.

Table 3: Regression analysis of audit reporting

Variables	(1) Linear probability model		(2) Hybrid logistic model	
	Coefficients	t-values	Coefficients	Z-values
SCPA	**–0.049**	**–3.697*****	**-0.351**	**-2.378****
SCPAFAE	**–0.086**	**–3.242*****	**-0.002**	**-0.007**
COLL_CPA	**0.011**	**1.556**	**-0.007**	**-0.085**
CO_CPA	**–0.045**	**–3.854*****	**-0.325**	**-2.586*****
CR	0.008	6.887***	-0.024	-1.067
AR	0.257	10.594***	1.355	5.969***
INV	–0.229	–12.189***	-1.817	-7.770***
LEV	0.485	45.168***	1.716	17.412***
RPTLEND	0.906	30.384***	2.251	9.513***
CROA	–1.227	–33.117***	-7.371	-20.035***
Loss	0.191	27.670***	1.022	16.084***
RET	–0.045	–8.505***	-0.231	-3.336***
Q	0.081	11.540***	-0.258	-2.833***
Ln(*TAST*)	–0.006	–1.445	-0.327	-6.567***
Age	0.021	1.466	0.196	7.168***
FORESHR	–0.004	–0.078	-0.057	-0.032
BigN	0.009	0.788	-0.231	-1.556
AFRANK	0.030	3.044***	0.350	2.915***
NLOCAL	0.024	4.165***	0.256	3.848***
CI	0.011	1.290	0.033	0.302
Tenure	–0.001	–1.060	-0.020	-1.320
Year fixed effects	Y		Y	
Firm fixed effects	Y		N	
Random effect	N		Y	
SCPA + SCPAFAE	**–0.135**	**–5.714*****	**-0.353**	**-1.769***
COLL_CPA + CO_CPA	**–0.034**	**–3.359*****	**-0.332**	**-3.059*****
Model fit statistics	R^2 = 46.23%		LR = 23635.60	
N	51,486		51,486	

The dependent variable is *MAO*, which equals zero to four for: clean opinions, unqualified opinions with explanatory notes, qualified opinions, disclaimers, and adverse opinions, respectively. See Table 2 for the definitions of all independent variables. For the hybrid model, the coefficients on the "mean" terms, though included in the estimation, are not tabulated.

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

Table 4: Regression analysis of Type I and II errors in audit reporting

Variables	(1) Type I Error		(2) Type II Error	
	Coefficients	t-values	Coefficients	t-values
SCPA	**–0.006**	**–0.601**	**–0.148**	**–3.889*****
SCPAFAE	**0.015**	**0.603**	**–0.139**	**–1.996****
COLL_CPA	**–0.001**	**–0.262**	**–0.004**	**–0.201**
CO_CPA	**–0.009**	**–1.043**	**–0.105**	**–3.316*****
CR	0.000	0.276	–0.009	–1.196
AR	0.139	6.225***	0.249	3.828***
INV	–0.133	–7.874***	–0.245	–4.284***
LEV	0.035	2.311**	0.488	20.271***
RPTLEND	0.200	6.377***	0.842	13.020***
CROA	–0.296	–9.006***	–1.960	–21.071***
Loss	0.324	3.464***	0.088	6.525***
RET	–0.006	–1.466	–0.078	–4.662***
Q	0.008	1.392	0.020	0.832
Ln(*TAST*)	–0.005	–1.463	0.009	0.711
Age	0.044	4.655***	0.005	0.100
FORESHR	0.021	0.681	0.000	-
BigN	–0.004	–0.473	0.087	2.396**
AFRANK	0.015	1.808*	0.107	3.627***
NLOCAL	–0.010	–1.985**	0.016	0.984
CI	0.007	1.027	–0.001	–0.056
Tenure	0.001	0.729	–0.004	–1.220
Year fixed effects	Y		Y	
Firm fixed effects	Y		Y	
SCPA + SCPAFAE	**0.009**	**0.387**	**–0.286**	**–4.791*****
COLL_CPA + CO_CPA	**–0.011**	**–1.371**	**–0.109**	**–3.932*****
Model fit statistics	R^2 = 34.56%		R^2 = 58.38%	
N	24,593		13,618	

The dependent variable is *MAO*, which equals zero to four for: clean opinions, unqualified opinions with explanatory notes, qualified opinions, disclaimers, and adverse opinions, respectively. See Table 2 for the definitions of all the independent variables. For the hybrid model, the coefficients on the "mean" terms, though included in the estimation, are not tabulated. The Type I Error test in column (1) [Type II Error test in column (2)] is based on sample observations that have a Z_{China}Score value greater than 0.9 (lower than 0.5), following Altman et al. (2010). The regressions are estimated by LPM.

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

Table 5: Regression analysis of accounting restatements

Variables	(1) Linear probability model		(2) Hybrid logistic model	
	Coefficients	t-values	Coefficients	Z-values
SCPA	**0.038**	**3.791*****	**0.373**	**3.204*****
SCPAFAE	**0.135**	**6.772*****	**0.649**	**3.147*****
COLL_CPA	**0.001**	**0.184**	**0.031**	**0.423**
CO_CPA	**0.025**	**2.829*****	**0.221**	**2.021****
CR	0.000	–0.117	0.024	1.359
AR	0.186	10.256***	0.944	3.771***
INV	–0.029	–2.073**	–0.043	–0.195
LEV	–0.037	–4.462***	–0.153	–1.287
RPTLEND	–0.117	–5.196***	–1.343	–4.662***
CROA	–0.158	–5.638***	–1.907	–4.569***
Loss	0.014	2.667***	0.161	2.224**
RET	0.000	–0.052	0.038	0.596
Q	–0.024	–4.563***	–0.407	–4.674***
Ln(*TAST*)	0.023	8.202***	0.205	4.056***
Age	–0.021	–1.906*	0.043	1.528
FORESHR	–0.131	–3.156***	–2.297	–2.600***
BigN	–0.021	–2.484**	–0.394	–2.602***
AFRANK	–0.021	–2.814***	–0.144	–1.305
NLOCAL	–0.032	–7.532***	–0.315	–4.839***
CI	0.013	2.070**	0.235	2.367**
Tenure	0.001	0.893	0.023	1.725
MAO	0.018	5.380***	0.118	2.909***
Year fixed effects	Y		Y	
Firm fixed effects	Y		N	
Random effect	N		Y	
SCPA + SCPAFAE	**0.172**	**9.736*****	**1.022**	**5.790*****
COLL_CPA + CO_CPA	**0.026**	**3.396*****	**0.252**	**2.748*****
Model fit statistics	R^2 = 29.50%		LR = 23435.70	
N	51,486		51,486	

The dependent variable is *REST*, which equals one for observations that have downward restatements in subsequent years and zero otherwise. See Table 2 for the definitions of all the independent variables. For the hybrid model, the coefficients on the "mean" terms, though included in the estimation, are not tabulated.

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

Table 6: Regression analysis of upward accounting restatements

Variables	(1) Linear probability model		(2) Hybrid logistic model	
	Coefficients	t-values	Coefficients	Z-values
SCPA	0.005	0.941	0.070	0.284
SCPAFAE	0.016	1.495	0.669	1.507
COLL_CPA	–0.002	–0.541	–0.113	–0.818
CO_CPA	–0.004	–0.817	–0.187	–0.815
CR	–0.001	–1.503	–0.052	–1.571
AR	0.000	0.012	0.293	0.631
INV	–0.017	–2.180**	–0.397	–1.019
LEV	0.003	0.745	–0.088	–0.467
RPTLEND	0.032	2.651***	0.597	1.232
CROA	–0.074	–4.919	–3.097	–4.423***
Loss	–0.002	–0.605	–0.095	–0.742
RET	0.003	1.371	0.157	1.410
Q	0.007	2.408**	0.174	1.170
Ln(*TAST*)	0.004	2.333**	0.127	1.512
Age	–0.013	–2.292**	0.095	2.183**
FORESHR	–0.004	–0.166	–0.345	–0.075
BigN	–0.007	–1.610	–0.753	–2.134**
AFRANK	–0.021	–5.175***	–0.918	–4.668***
NLOCAL	0.000	–0.043	0.171	1.462
CI	–0.005	–1.355	–0.183	–1.018
Tenure	0.000	–0.168	0.015	0.628
MAO	0.012	6.587***	0.325	4.660***
Year fixed effects	Y		Y	
Firm fixed effects	Y		N	
Random effect	N		Y	
SCPA + SCPAFAE	**0.021**	**2.207****	**0.738**	**1.936***
COLL_CPA + CO_CPA	**–0.005**	**–1.323**	**–0.300**	**–1.497**
Model fit statistics	R^2 = 15.49%		LR = 8776.23	
N	51,486		51,486	

The dependent variable is an indicator variable equal to one for observations that have upward restatements in subsequent years and zero otherwise. See Table 2 for the definitions of all the independent variables. For the hybrid model, the coefficients on the "mean" terms, though included in the estimation, are not tabulated.

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

Table 7: Analysis based on the covariate balanced sample

Panel A: Match by *CO_CPA* (*n* = 5,572, including 1,396 co-signers' audits and 4,176 paired matches)

Variables	(1) Audit reporting *y = MAO*		(2) Accounting restatements *y = REST*	
	Coefficients	Z/t-values	Coefficients	Z/t-values
A1: Logistic regression				
CO_CPA	**-0.253**	**-2.719*****	**0.294**	**3.534*****
Pseudo R^2	0.15%		0.24%	
A2: Fixed-effect regression				
CO_CPA	**–0.051**	**–2.745*****	**0.043**	**3.907*****
Pair fixed effects	Y		Y	
R^2	32.65%		31.74%	

Panel B: Match by *COLL_CPA* (*n* = 13,288, including 3,326 colleague CPAs' audits and 9,962 paired matches)

Variables	(1) Audit reporting *y = MAO*		(2) Accounting restatements *y = REST*	
	Coefficients	Z/t-values	Coefficients	Z/t-values
B1: Logistic regression				
COLL_CPA	**0.006**	**0.100**	**0.010**	**0.157**
Pseudo R^2	0.00%		0.00%	
B2: Fixed-effect regression				
COLL_CPA	**0.002**	**0.162**	**0.001**	**0.170**
Pair fixed effects	Y		Y	
R^2	32.91%		30.43%	

In Panel A, observations with *CO_CPA* equal to one are matched with those with *CO_CPA* equal to zero by *P-Score* at the 1:3 ratio, without replacement, and at the caliper value of 0.01. *P-Score* is estimated by a logistic model that predicts the probability of *CO_CPA* [model (3) in the text]. In Panel B, the matching procedure is similar but is based on *COLL_CPA* by the *P-Score* to predict the probability of *COLL_CPA* [model (4) in the text].

MAO is an ordered category variable, taking values of zero to four for: clean opinions, unqualified opinions with explanatory notes, qualified opinions, disclaimers, and adverse opinions, respectively. *REST* is an indicator variable equal to one for observations that have downward restatements in subsequent years, and zero otherwise. See Table 2 for the definition of *COLL_CPA*. The logistic model is conventional logistic, with standard errors clustered by match pairs. The fixed-effect models control for the fixed effects for each pairing. Intercepts are included in all the regressions but are not reported.

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

Table 8: Placebo test

Variables	Distributions of placebo-test coefficients										**Actual**	**Bootstrap**
	Mean	P1	P5	P10	Q1	Median	Q3	P90	P95	P99	**Coefficient**	***p*-value**
Panel A: *y* = *MAO*												
SCPA	0.005	–0.042	–0.030	–0.023	–0.010	0.004	0.020	0.032	0.040	0.056	**–0.049**	**0.005**
SCPAAFE	–0.011	–0.122	–0.089	–0.069	–0.044	–0.010	0.020	0.049	0.066	0.107	**–0.086**	**0.055**
COLL_CPA	0.000	–0.021	–0.015	–0.012	–0.006	0.000	0.005	0.011	0.015	0.022	**0.011**	**0.100**
CO_CPA	0.003	–0.030	–0.021	–0.015	–0.006	0.003	0.012	0.021	0.026	0.038	**–0.045**	**0.001**
Panel B: *y* = *REST*												
SCPA	0.000	–0.036	–0.025	–0.021	–0.011	0.000	0.011	0.019	0.025	0.038	**0.038**	**0.010**
SCPAAFE	0.000	–0.081	–0.055	–0.042	–0.024	–0.001	0.023	0.046	0.060	0.091	**0.135**	**0.000**
COLL_CPA	–0.001	–0.018	–0.013	–0.010	–0.006	0.000	0.005	0.010	0.012	0.018	**0.001**	**0.425**
CO_CPA	0.000	–0.029	–0.019	–0.015	–0.008	0.001	0.008	0.015	0.019	0.028	**0.025**	**0.018**

We perform the placebo tests as follows. For each sanctioned client-year, we randomly draw, without replacement, a client in the same year and industry as implicated but *not* involved in any regulatory sanction as a pseudo sanction case. Treating the pseudo cases' signatory CPAs as sanctioned CPAs, we redefine the experimental variables, *SCPA*, *SCPAAFE*, *CO_COLL*, and *CO_CPA*. We then fit the regressions with the pseudo data. The placebo-test coefficients are based on 999 iterations of the above procedures. The actual coefficients are based on LPM estimated on the actual data. The bootstrap *p*-values are estimated by the quantile position of the actual coefficients in the distributions of the placebo-test coefficients.

Table 9: Variations in the contagious effect

Variables	(1) Audit reporting $y = MAO$		(2) Accounting restatements $y = REST$	
	Coefficients	t-values	Coefficients	t-values
SCPA	–0.049	–3.674***	0.038	3.847***
SCPAFAE	–0.085	–3.195***	0.133	6.703***
COLL_CPA	0.011	1.603	0.001	0.150
CO_CPA	0.025	0.492	0.019	0.505
CO_CPA* × *SCPAEXP	**–0.275**	**–2.694*****	**0.192**	**2.515****
CO_CPA* × *Closeness	**–0.524**	**–2.617*****	**0.347**	**2.316****
CO_CPA* × *Cohort	**–0.045**	**–2.221****	**–0.014**	**–0.931**
CO_CPA* × *LocalTie	**–0.038**	**–1.820***	**0.029**	**1.842***
CO_CPA* × *SCPABAN	**–0.100**	**–3.279*****	**–0.009**	**–0.412**
CO_CPA* × *BigN	**–0.029**	**–0.724**	**–0.015**	**–0.511**
CO_CPA* × *AFRANK	**0.111**	**2.143****	**0.008**	**0.209**
CO_CPA* × *Marketization	**–0.006**	**–0.164**	**–0.084**	**–3.173*****
CO_CPA* × *FORESHR	**–0.044**	**–1.370**	**–0.047**	**–1.934***
Control variables	Y		Y	
Firm fixed effects	Y		Y	
Year fixed effects	Y		Y	
R^2	46.28%		29.56%	
N	51,486		51,486	

MAO is an ordered category variable, taking values of zero to four for: clean opinions, unqualified opinions with explanatory notes, qualified opinions, disclaimers, and adverse opinions, respectively. *REST* is an indicator variable equal to one for observations that have downward restatements in subsequent years, and zero otherwise. *SCPAEXP* is the experience of the contagions auditor by the amount of client assets (in millions of RMB and taking the natural logarithm) during the contagious period from *T* – 4 to *T*. *Closeness* is computed as the inverse of the average distance between the sanctioned CPA and any other CPAs in his/her firm between *T* – 4 and *T*. *Cohort* is an indicator for cases where the absolute difference in age between sanctioned and co-signing CPAs is below five. *LocalTies* is an indicator for cases where sanctioned and co-signing CPAs' alma maters are located in the same region. *SCPABAN* is an indicator for cases where the contagions auditors are banned from the securities market or their practice licenses are revoked by the regulators. *Marketization* is the marketization index compiled by Fan et al. (2011) for measuring the market-based institution development levels at the provincial level. See Table 2 for the definitions of other independent variables. The regressions are estimated by LPM. All the control variables are controlled for as before but are not tabulated.

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

Table 10: Client clientele size analysis

Variables	(1) Total assets audited		(2) Number of clients	
	Coeff.	t-values	Coeff.	t-values
SCPA×*Pre-Event* (β_1)	4.881	7.240***	0.128	4.347***
SCPA×*Event* (β_2)	11.193	14.951***	0.429	13.044
SCPA×*Post-Event* (β_3)	2.409	3.952***	0.072	2.665***
COLL_CPA×*Pre-Event* (γ_1)	0.123	0.332	0.002	0.103
COLL_CPA×*Event* (γ_2)	2.480	6.185***	0.178	10.122***
COLL_CPA×*Post-Event* (γ_3)	0.066	0.196	0.017	1.166
CO_CPA×*Pre-Event* (δ_1)	1.731	2.672***	0.118	4.155***
CO_CPA×*Event* (δ_2)	2.528	3.608***	0.126	4.090***
CO_CPA×*Post-Event* (δ_3)	0.159	0.288	0.024	0.997
Age	1.816	6.558***	0.094	7.724***
Age^2	–0.029	–8.722***	–0.000	–1.867*
Year fixed effects	Included		Included	
CPA fixed effects	Included		Included	
R^2	54.09%		51.02%	
N	29,302		29,464	
Joint tests	Coeff.	t-values	Coeff.	t-values
SCPA's *Event* – *Pre-Event* ($\beta_2 - \beta_1$)	6.313	7.743***	0.301	8.417***
SCPA's *Post-Event* – *Pre-Event* ($\beta_3 - \beta_1$)	–2.471	–3.454***	–0.057	–1.811*
COLL_CPA's *Event* – *Pre-Event* ($\gamma_2 - \gamma_1$)	2.357	5.897***	0.177	10.064***
COLL_CPA's *Post-Event* – *Pre-Event* ($\gamma_3 - \gamma_1$)	–0.057	–0.173	0.016	1.000
CO_CPA's *Event* – *Pre-Event* [$(\gamma_2 + \delta_2) - (\gamma_1 + \delta_1)$]	3.155	4.730***	0.184	6.277***
CO_CPA's *Post-Event* – *Pre-Event* [$(\gamma_3 + \delta_3) - (\gamma_1 + \delta_1)$]	–1.628	–2.827***	–0.078	–3.092***

The unit of analysis is CPA-year. In columns (1) and (2), the dependent variables are the sum of audited clients' total assets (in millions of RMB, adjusted for inflation, and in natural logarithm) and the logarithm of one plus the number of clients, respectively, for CPA *i* in year *t*. *Pre-Event*, *Event*, and *Post-Event* are indicators for the periods between $T - 4$ to $T - 1$, T, and $T + 1$ to $T + 4$, respectively. *SCPA* indicates CPAs who are sanctioned, *COLL_CPA* indicates colleagues of sanctioned auditors, and *CO_CPA* indicates those who have co-signed with sanctioned auditors in the past. *Age* is the number of years since the CPA first sign audit reports for public firms. The sample size in column (1) is smaller than that in column (2) due to missing clients' total assets data.

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