Does the Number of Auditors Matter? Evidence from Local Audit Markets

ABSTRACT: This study examines whether and how auditor turnover, audit fees, and audit quality are associated with the residual number of audit service providers (i.e., audit offices) located in the local city, i.e., the deviation from the normal level predicted by the characteristics of the local city. We first find that the frequency of auditor turnover increases with the residual number of auditors, suggesting that competition among auditors in the local audit market increases with the residual number of auditors. Second, both audit fees and quality decrease with the residual number of auditors. Third, the aforementioned effects are mainly driven by the residual number of non-Big 4 auditors rather than by that of Big 4 auditors. Fourth, such effects are evident only in the market segment comprising small and medium-sized clients, but not in the segment of large clients, who are likely to demand audits exclusively from Big 4 auditors. These findings provide valuable insights into the effect of local audit market structure on audit contracting and audit outcome.

Keywords: *Audit market competition; number of auditors; auditor turnover; audit quality; audit fees*

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I. INTRODUCTION

This study investigates whether the number of auditors operating in the local audit market captures the intensity of audit market competition and, consequently, affects auditor turnover, audit fees, and audit quality. The audit market for public companies has experienced dramatic changes in its structure since the late 1980s. For instance, several large auditors merged, Arthur Andersen collapsed after the Enron scandal, and many small audit firms exited the market due to stricter regulations after the enactment of the Sarbanes-Oxley Act (DeFond and Lennox, 2011). This series of events increased the dominance of a few large auditors and reduced the number of small auditors in the audit market, leading regulators to raise concerns about the structure of the market (e.g., European Commission [EC], 2010, 2011; Government Accountability Office [GAO], 2003, 2008; U.S. Department of the Treasury, 2008).[1] For example, the GAO (2003, 26) expressed a concern that the mergers among auditors reduced the clients' choices, stating that "the most observable impact of consolidation among accounting firms appeared to be the limited number of auditor choices." The U.S. Department of the Treasury (2008, VIII2) also raised concerns that such reduced choices may reduce auditors' incentives to conduct high-quality audits, while allowing them to charge excessive fees: "The lack of competition may not provide sufficient incentive for the dominant auditing firms to deliver high-quality and innovative auditing services."

Consequently, the U.S. Chamber of Commerce (2006) requested regulators to take actions to promote competition among auditors, and the U.S. Department of the Treasury (2008) responded by proposing several recommendations to enhance competition. The recommendations

[1] Besides, the demand for high-quality audit service, such as that provided by Big 4 or industry specialist auditors (Becker et al., 1998; Cahan et al., 2008; Francis, Reichelt, and Wang, 2005; Fung et al., 2012) may increase the dominance of a few large auditors.

included breaking up large auditors to increase the number of large auditors and lowering entry barriers in the audit market to increase the number of small auditors (U.S. Department of the Treasury, 2008; EC, 2010).[2] Despite the rather radical suggestions by regulators, the GAO (2003, 2008) reported that mergers among auditors did not appear to influence audit fees and quality significantly, and called for further research on this issue. Similarly, DeFond and Zhang (2014) emphasized the need for further research to resolve the controversy. Furthermore, the Competition and Market Authority in the U.K. recently launched a formal investigation into the effect of audit market competition on auditor behavior, including audit quality (Coffee, 2019). Therefore, there have been continuing concerns about whether the degree of audit market competition is sufficient and how it affects audit contracting and audit outcome.

Nevertheless, academic research on the effect of audit market competition on audit contracting/outcome is limited. A few studies examine the association between audit market concentration and audit fees or quality but yield mixed results (e.g., Boone et al., 2012; Choi et al., 2017; Kallapur et al., 2010; Newton et al., 2013). Moreover, extant research predominantly uses the Herfindahl index (which was originally developed as a measure of concentration) as an inverse proxy for competition, assuming that higher concentration indicates less competition. However, researchers and practitioners question this assumption because the relationship between concentration and competition is unclear in both theoretical and empirical perspectives (Buijink et al., 1998; DeFond and Zhang, 2014; Newton et al., 2013; Sutton, 1990). Therefore, the effect of audit market competition on audit contracting/outcome remains unresolved in the literature.

[2] Regulators (e.g., EC, 2010, 2011; Financial Reporting Council, 2018) also recommended other policies, such as joint audits and mandatory auditor rotations, to expand the market share of small auditors.

In this study, we use a simple and intuitive measure to capture local audit market competition: the number of audit offices that serve clients in a metropolitan statistical area (MSA). We focus on the MSA as a basic unit of the local market because primary decisions for audit engagements are made at the local office level (Francis, Reichelt, and Wang, 2005) and auditors mostly compete with other auditors located in the same local market (Choi et al., 2012). Using data over the period 2003-2016, we regress the log-transformed number of audit offices located in each MSA–year against various MSA characteristics to estimate a normal, expected number of audit offices, and use the residual from the regression as our proxy for competition. A greater residual number of auditors could represent a more abundant choice of auditors, resulting in greater industry rivalry, a higher threat of auditor substitution, a weaker bargaining power of auditors, and a stronger bargaining power of clients, all of which are important factors that influence the level of competition according to Porter's well-known five forces framework (Porter, 1979, 2008).[3]

To examine whether the residual number of auditors (*RNAUD*) properly captures competition in the local market, we first investigate the association between *RNAUD* and auditor turnover. We find a positive association between them, which suggests that auditors face a greater risk of being replaced (i.e., a higher threat of substitution) when the residual number of auditors is higher. In addition, we find that the Herfindahl index is positively associated with auditor turnover, inconsistent with the premise that the index is an inverse proxy for competition. Such findings suggest that *RNAUD* captures the threat of substitution more effectively than the Herfindahl index.

[3] The five forces framework aims to analyze competition in an industry. The five forces are industry rivalry, threat of new entrants, threat of substitutes, bargaining power of suppliers, and bargaining power of buyers. Among them, industry rivalry is determined by the number of competitors in the industry and their ability to threaten peer companies. The bargaining power of suppliers/buyers and the threat of substitutes are mainly determined by the number of suppliers, the uniqueness of suppliers' product or service, and buyers' cost of switching to another supplier (Porter, 1979, 2008).

Next, we examine the effect of *RNAUD* on audit fees and quality. We find that auditors receive lower audit fees in MSAs with a higher *RNAUD*, suggesting that intense competition induced by a large number of auditors results in a weaker (greater) bargaining power of auditors (clients) in audit fee negotiation. More importantly, we find that higher *RNAUD* is associated with lower audit quality. Specifically, clients located in MSAs with a greater residual number of auditors report a higher level of absolute discretionary accruals and exhibit poorer accruals quality, suggesting that auditor tolerance for earnings management is greater in those MSAs. We continue to find a negative relationship between *RNAUD* and audit quality when audit quality is surrogated by auditors' propensity to issue going concern audit opinions (GCOs), consistent with the notion that auditors' higher risk of being replaced associated with *RNAUD* weakens their independence. One exception is that the relationship is insignificant when we use client restatements as a proxy for audit quality, indicating that our competition measure affects only mild "within GAAP" manipulations and GCO assessments but not the incidences of egregious audit failures. Collectively, these findings suggest that audit market competition driven by a greater *RNAUD* not only imposes downward pressure on audit fees and thus audit effort but also weakens auditor independence, which results in an important cost: lowered audit quality. In contrast, we find that the Herfindahl index is insignificantly associated with audit fees and that its associations with various proxies for audit quality are inconsistent and mixed.

We obtain two additional important findings that provide insights into how competition evolves across auditors in different market segments. First, we find that the residual number of non-Big 4 auditors, rather than that of Big 4 auditors, mainly drives our findings.[4] Second, when

[4] A possible explanation for this finding is that most of our sample clients are located in the MSAs where all Big 4 auditors exist, which results in little variation in the number of Big 4 auditors across MSAs. When we perform

we classify clients into two client segments, one with large clients who are likely to demand audits exclusively from Big 4 auditors and the other with small and medium-sized clients who could choose either Big 4 or non-Big 4 auditors, the effects of *RNAUD* on auditor turnover and audit fees/quality are significant only in the latter segment, regardless of whether their auditors are Big 4 or non-Big 4. This finding suggests that the audit market is not necessarily segmented into Big 4 and non-Big 4 auditors. Rather, it implies that, since small and medium-sized clients view non-Big 4 auditors as a viable option (Keune et al., 2016), all auditors face fierce competitive pressure in this segment as the number of auditors increases. In contrast, since large clients are likely to demand audits exclusively from Big 4 auditors who can handle large-scale audits, these clients are little affected by the presence of a large number of non-Big 4 auditors.

To alleviate a concern that our results are attributable to endogenous relations between audit market structure and audit fees/quality, we perform additional difference-in-differences analyses by comparing the changes in audit fees and quality in MSAs that experience significant shocks to local audit service supply, with those in MSAs without such supply shocks. We find that the inferences from these analyses are largely identical to those from our main analyses.

We note that a concurrent study by Ettredge et al. (2018) also investigates the effects of audit market competition, using a similar residual approach. Specifically, they document that a greater residual number of audit offices (denoted 'Office–Client Balance') is associated with a higher tendency of clients to hire local auditors, lower audit fees, and a lower likelihood of restatements. While our results of audit fees tests are similar to theirs, the results of audit quality tests are in sharp contrast. Our reconciliation analyses reveal that the audit quality tests with restatements are

additional analyses using the data from the Big 8 era (from 1977 to 1988), in which the variation in the number of large auditors is greater than in the Big 4 era, we find some evidence indicating that the number of large auditors is also negatively associated with audit quality.

sensitive to sample periods: When we use the same sample period of 2010-2014 as in Ettredge et al. (2018), our competition measure is negatively associated with the likelihood of restatements, consistent with their results. However, when we extend the sample period to 2003-2014, the negative association disappears. Since restatements are relatively rare events, we believe that the inferences from a longer sample period would be more reliable.[5]

This study contributes to the literature in the following aspects. First, we complement extant studies on the structure of the local audit market and respond to DeFond and Zhang's (2014) call for further research on the consequences of audit market competition. The findings provide important evidence in response to the concerns of regulators about the audit market structure. Unlike prior studies that yield mixed results on audit quality using the Herfindahl index, this study documents reasonably consistent findings based on different proxies for audit quality using a new measure of competition. As a result, our findings provide useful insights into the debate regarding whether it is necessary to split up large audit firms or to lower entry barriers in the audit market in order to enhance competition. Our results suggest that greater competition may not be beneficial to audit clients, since the costs associated with greater competition (i.e., lowered audit quality) can outweigh the benefits (i.e., saved audit fees).

Second, this study provides evidence on the segmentation of the audit market. The findings suggest that the market is segmented by the size of clients who demand audits and not necessarily by the size of auditors who supply audits. Specifically, while auditors face less competition in the

[5] While both Ettredge et al. (2018) and our study help in understanding the dynamics of local audit market competition, our study differs from that of Ettredge et al. in the following ways: (1) we validate the competition measure via analyses of auditor turnover; (2) we demonstrate that the effect of competition on auditor turnover and audit fees/quality varies significantly between two segments with different client size; (3) the number of non-Big 4 auditors greatly affects various audit contracting and outcome, but that of Big 4 auditors does not; and (4) using an extended sample period and a more comprehensive set of audit quality proxies, we find that the number of auditors is *negatively* associated with audit quality.

segment for large clients who have limited auditor choice due to their large and complex structure, auditors compete more intensely in the segment for small and medium-sized clients, which causes a negative consequence on audit fees/quality. Thus, our results help to explain the dynamics of local audit market competition in the two market segments.

The rest of this paper proceeds as follows. Section II summarizes the literature and develops hypotheses. Section III discusses variable measurements and empirical models, and Section IV reports the sample selection procedure. Sections V and VI report the results of our main and additional tests, respectively. Section VII presents the conclusion.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Number of Auditors as a Measure of Competition

In measuring competition in the audit market, we argue that the number of auditors operating in the local area is a reasonable proxy in both theoretical and empirical perspectives. A number of studies in economics suggest that a larger number of suppliers or market participants is theoretically related to greater competition (e.g., Gerardi and Shapiro, 2009; Nalebuff and Stiglitz, 1983; Stigler, 1968). For example, Nalebuff and Stiglitz (1983, 23) state, "as the number of market participants grows, competition becomes more intense." The measure is also widely used in business practice because of its theoretical and intuitive appeal. For example, Porter's five forces framework, which is a tool to analyze the intensity of competition in practice (Martin, 2018), explicitly mentions the number of suppliers as an important determinant of four factors: industry rivalry, threat of substitutes, and bargaining powers of suppliers and buyers (Porter, 1979, 2008).

Specific to the audit market, a greater number of auditors represents a more abundant choice of auditors for clients. Regulators have been concerned that clients have difficulty in finding a

replacement auditor in a market with relatively fewer auditors (GAO, 2003, 2008). In such a market, auditors may perceive a lower threat of substitutes, which is likely to result in a stronger (weaker) bargaining power of auditors (clients). Thus, the diverging bargaining powers of auditors and clients caused by the number of auditors in local audit markets are likely to affect various audit contracts and outcomes. Consistent with this view, the number of auditors has been used to gauge competition in a few auditing studies (Carson et al., 2012; Ettredge et al., 2018; Swanquist and Whited, 2015).[6]

Prior auditing research mostly uses the Herfindahl index as an inverse proxy for competition. Our measure is distinct from the Herfindahl index in the following ways. First, since the Herfindahl index is calculated based on each auditor's market share, the index value is largely determined by large auditors in the market who have greater weight. Although non-Big 4 auditors serving public clients also comply with PCAOB requirements and rules, their effect on the index is not high. Since our measure regards both large and small auditors equally, its variation is greatly influenced by the number of non-Big 4 auditors. To the extent that non-Big 4 auditors compete with Big 4 auditors (especially for small and medium-sized clients), non-Big 4 auditors play a significant role in shaping local competition (Bills and Stephens, 2016), and their effects can be better reflected in our measure.[7] Second, while the Herfindahl index is separately calculated for each local market,

[6] Studies in industrial organization and management more frequently use the number of suppliers as a proxy for market competition. For example, Banker et al. (1998), Borenstein and Rose (1994), Brueckner and Spiller (1991), Calzolari et al. (2017), Li (2013), Martinez-Miera and Repullo (2010), and Mazzeo (2003) use or mention the measure as a proxy for competition. Regulators in other disciplines also use the number of suppliers to measure the intensity of competition. For example, the Competition and Markets Authority (2015) of the U.K. and the Organization for Economic Co-operation and Development (OECD, 2017) specifically suggest that the number of suppliers be used to assess the intensity of competition in an industry.

[7] It is possible that large clients demand audits exclusively from Big 4 auditors and that the number of non-Big 4 auditors may have differential effects on the market segment for large clients and the market segment for small and medium-sized clients. Because of this possibility, we examine the effects of our competition measure on these two market segments separately.

we take a residual approach by using the numbers of auditors in other MSAs as a benchmark. Since this approach teases out the effects of endogenous MSA characteristics, such as the number of clients, the relative market size of Big 4 auditors, local economic conditions, and other MSA characteristics, our measure captures the deviation from the expected or fitted number of auditors in each MSA. Given that the Herfindahl index does not consider such endogenous MSA features, we argue that this residual approach provides advantages in measuring competitive conditions at local audit markets. For example, even if the Herfindahl index value is similar for two MSAs, the intensity of competitive pressures can differ in the two MSAs, depending on the number of auditors conditional on the number of clients, their relative size, and other MSA features. We argue that, if the actual number of auditors in an MSA is greater (smaller) than the fitted number, the positive (negative) residual number indicates that available auditors in the MSA is relatively abundant (scarce), compared to nation-wide norms, causing a more (less) competitive market condition than other local markets. In a later section, we validate this argument by comparing the effects of our measure and the Herfindahl index on auditor turnover and audit fees.

Number of Auditors and Auditor Turnover

Prior research suggests that the frequency of auditor turnover is higher when auditors face greater competition (Buijink et al., 1998; Ghosh and Lustgarten, 2006). For example, Ghosh and Lustgarten (2006) argue that rivalry among auditors results in frequent gains and losses of clients and that auditor turnover captures the degree of competition in the auditing industry. Therefore, we predict the frequency of auditor turnover to increase with our measure of competition, *RNAUD*.

The impact of audit market competition on auditor turnover can be heterogeneous across client segments. Prior studies suggest that small and medium-sized clients and large clients exhibit different preferences for auditor choice. For example, survey responses in GAO (2008) indicate

that many large clients are unwilling to engage with small auditors because such auditors could lack capacity and expertise to handle large clients' complex operations. Moreover, large clients could prefer Big 4 auditors because Big 4 auditors are perceived to provide higher-quality audits and greater insurance against future litigation (DeAngelo, 1981). Given that large clients prefer Big 4 auditors, their choice of auditors is limited. Their choice is further limited when they engage non-audit services with a Big 4 auditor and/or when they exclude Big 4 auditors who currently serve their competitors in the same industry, due to proprietary cost concerns (Aobdia, 2015). Hence, for such large clients, Big 4 auditors can be less susceptible to competitive pressure from other auditors. On the other hand, since small and medium-sized clients could hire either Big 4 or non-Big 4 auditors, all auditors would face greater competition in the segment for small and medium-sized clients (Bills and Stephens, 2016). We therefore predict that the relation between *RNAUD* and auditor turnover would be greater in the small and medium-sized client segment than in the large client segment. This leads to our first set of hypotheses as follows:

H1a: *The frequency of auditor turnover is positively associated with the residual number of auditors in an MSA.*

H1b: *The positive association between auditor turnover and the residual number of auditors in an MSA is more pronounced for small and medium-sized clients than for large clients.*

Number of Auditors and Audit Fees

Competition in the local audit market is also likely to affect audit pricing. To the extent that competition increases auditors' risk of losing a client and lowers their bargaining power, auditors facing greater competition need to offer more competitive audit pricing to avoid losing existing clients and to attract new clients (Ghosh and Lustgarten, 2006). Consistent with this view, theories in economics suggest that when fewer suppliers comprise the market, they are more likely to collude each other and/or exercise greater market power to raise prices (Carlton and Perloff, 2004,

122-125; Varian, 2010, 497-498). In the auditing literature, Jensen and Payne (2005) find that, after removal of restrictions on competitive bidding in Florida to promote auditor competition, audit fees decreased. Keune et al. (2016) also document that audit fees are lower when non-Big 4 local market leaders compete intensely with Big 4 auditors. Given these theories and empirical findings, we predict audit fees to be negatively associated with our measure of competition, *RNAUD*.

We also expect that the effect of competition on audit fees would be more pronounced for small and medium-sized clients than for large clients. Since Big 4 auditors serving large clients face a lower risk of being replaced (given H1b) and they are better able to compete through quality differentiation such as industry specialization, they are less likely to be pressured to reduce audit fees in the presence of high *RNAUD*. On the contrary, auditors of small and medium-sized clients face a greater threat of turnover as *RNAUD* increases in the local market. Thus, we predict that the effect of the residual number of auditors on price competition would be stronger in the small and medium-sized client segment than in the large client segment. This leads to our second set of hypotheses as follows:

H2a: *Audit fees are negatively associated with the residual number of auditors in an MSA.*

H2b: *The negative association between audit fees and the residual number of auditors in an MSA is more pronounced for small and medium-sized clients than for large clients.*

Number of Auditors and Audit Quality

Lastly, we examine the effect of the number of auditors on audit quality. There are two conflicting views on this effect. On the one hand, a greater residual number of auditors may cause audit quality to deteriorate. As proposed by DeAngelo (1981), audit quality is determined by the joint probability that an auditor discovers a breach in the financial statements (i.e., auditor effort and competence) and reports or corrects the breach objectively (i.e., auditor independence). To the

extent that a larger residual number of auditors impose downward pressure on audit fees, auditors may reduce audit effort, resulting in poor audit quality (Newton et al., 2013).[8] Moreover, as auditors' risk of being replaced increases with the residual number of auditors, they could be more likely to acquiesce to client managers' preferences and compromise their independence (Kallapur et al., 2010). These arguments suggest that audit quality could decrease with the number of residual number of auditors in the local market.

On the other hand, it is also possible that a greater residual number of auditors could cause audit quality to improve. When auditors face less competition, they may become more complacent (Boone et al., 2012). In other words, lower competition may induce auditors' self-satisfaction (i.e., a lack of awareness of potential defects in audits), less rigorous audit procedures, and reduced skepticism on their clients' accounting and business practices (GAO, 2008; Kinney, 2005).[9]

In line with these opposite predictions, prior studies based on the Herfindahl index provide sharply conflicting results, depending on proxies for audit quality and research settings (Boone et al., 2012; Choi et al., 2017; Kallapur et al., 2010; Newton et al., 2013). Taken together, in view of conflicting arguments and mixed empirical findings from prior studies, it is difficult to make a directional prediction on the association between the residual number of auditors and audit quality.[10] This leads to our third set of hypotheses in null form as follows:

H3a: *Audit quality is not significantly associated with the residual number of auditors in an MSA.*

[8] Consistent with this view, Caramanis and Lennox (2008) and Bae et al. (2016) document that audit effort is positively related to audit quality.

[9] Note that this view implicitly assumes that clients value high-quality audit services and thus auditors in more competitive audit markets attract new clients from other auditors by improving the quality of audit services. This view contrasts the previous argument that auditors in competitive markets accommodate the aggressive accounting choices of clients who prefer low-quality audits.

[10] While theoretical studies in economics suggest that product or service quality is lower in less competitive industries (see Schmalensee (1979) for review), empirical evidence on the effect of competition on product or service quality is mixed. While Becker and Milbourn (2011) and Skreta and Veldkamp (2009) report that service quality in the credit rating industry deteriorates with competition, Domberger and Sherr (1989) and Mazzeo (2003) find that service quality in the legal service and airline industries increases with competition.

H3b: *The association between audit quality and the residual number of auditors in an MSA does not differ for small and medium-sized clients and for large clients.*

III. VARIABLE MEASUREMENT AND MODEL SPECIFICATION

Number of Auditors in the Local Audit Market

To measure competition in the local audit market, we first count the number of auditors operating in each MSA. Since small audit offices with limited capacity are unlikely to create significant competitive pressure in the local audit market, we count only audit offices that have at least five SEC registrant clients in a given fiscal year. If more than one audit office of the same auditor is located in an MSA, we regard such audit offices as one auditor.[11] To eliminate the effect of MSA characteristics in determining the number of auditors in the area, we use a residual approach. Specifically, we estimate the following model at the MSA–year level:

$$\begin{aligned}\text{Natural log of (1+ the number of auditors)}_{jt} &= \alpha_0 + \alpha_1 GDPPC_{jt} + \alpha_2 WAGE_{jt} + \alpha_3 NCLIENT_{jt} + \alpha_4 B4SHARE_{jt} \\ &+ \alpha_5 MCONC_{jt} + \alpha_6 AREA_{jt} + \text{year / region fixed effects} + e_{jt}, \qquad (1)\end{aligned}$$

where, for MSA *j* and year *t*, the dependent variable is the natural logarithm of the number of local auditors. We control for the local economic conditions, including the natural logarithm of gross domestic product per capita (*GDPPC*) and the natural logarithm of the median wage (*WAGE*). We also control for local business activities using the natural logarithm of the number of clients headquartered in the MSA (*NCLIENT*), the relative market size of Big 4 auditors (*B4SHARE*), the concentration of all clients in the MSA (*MCONC*), and the size of the MSA (*AREA*).[12] We also

[11] Prior office-level studies use a similar approach (e.g., Boone et al., 2012; Francis and Yu, 2009; Kallapur et al., 2010). Our results are qualitatively similar when we count all audit offices separately or count the number of audit offices with at least three SEC registrant clients. In our study, the expression 'qualitatively similar' indicates that all significant results hold so that inferences from the results remain the same.

[12] We include *GDPPC* because the number of audit offices is expected to be greater in economically prosperous MSAs and *WAGE* because the wage proxies for labor cost in the MSA. We include *NCLIENT* because the demand for audit

control for unobservable year- and region-fixed effects.[13] Detailed variable definitions are presented in Appendix A. We define *RNAUD* as the residuals estimated from Eq. (1), which represents the number of auditors in a local audit market that deviates from the normal level determined by the MSA characteristics. Furthermore, we decompose *RNAUD* into two components: the residual number of Big 4 auditors and that of non-Big 4 auditors. Specifically, we replace the dependent variable in Eq. (1) with the natural logarithm of 1 plus the number of Big 4 (non-Big 4) auditors in the MSA and denote the residuals as *RNAUD_B4* (*RNAUD_NB4*). The estimation results for the three regression models are provided in Appendix B. The explanatory powers reported in Appendix B range from 74 to 82 percent, revealing that our models explain the variation in the number of auditors reasonably well.

Definition of Audit Market Segments

Our hypotheses predict that the effect of audit market competition varies with two segments for large clients and for small and medium-sized clients. We define the segments using the following procedure. Among clients of non-Big 4 auditors, we first identify the largest client in terms of total assets within each MSA and year. We then refer to all Big 4 clients that are larger than the identified client (i.e., the largest non-Big 4 client) as large client segment (*LSEG* = 1).[14] We expect that clients in this segment are likely to demand audit services exclusively from Big 4 auditors who have sufficient capacity and expertise to audit large clients' complex operations. We

services is greater in MSAs where a larger number of clients operate. We expect *B4SHARE* to be positively associated with the number of Big 4 auditors and negatively associated with the number of non-Big 4 auditors, and *MCONC* to be negatively associated with the number of auditors. We include *AREA* to control for the positive association between MSA area size and the number of audit offices in the MSA.

[13] Region-fixed effects refer to indicators for West, Northeast, South, and Midwest based on the state in which the audit office is located.

[14] Our inferences remain qualitatively similar when we define market segments using alternative cut-off points such as the second largest non-Big 4 client or 90% of the asset size of the largest non-Big 4 client.

refer to all other clients that are not in this segment as small and medium-sized client segment (*LSEG* = 0), where Big 4 and non-Big 4 auditors compete.

Empirical Model for H1

To test our first set of hypotheses, we estimate the following logistic model:

$$SWITCH_{it+1} = \beta_0 + \beta_1 RNAUD_{jt} + X'\gamma + e_{it}, \quad (2)$$

where, for client *i*, MSA *j*, and year *t*, *SWITCH* equals 1 if a client switches its incumbent auditor in the subsequent year and 0 otherwise. *RNAUD, RNAUD_B4,* and *RNAUD_NB4* are as previously defined and **X'** represents a vector of control variables.[15] To mitigate concerns about potential dependence among observations within an MSA, we cluster standard errors by MSA in all analyses in this study.[16] H1a predicts the coefficient on *RNAUD* (i.e., β_1) in Eq. (2) to be positive. We also repeat the test after replacing *SWITCH* with *SWITCH_UP* (a switch from a non-Big 4 auditor to a Big 4 auditor), *SWITCH_DN* (a switch from a non-Big 4 auditor to a Big 4 auditor), or *SWITCH_LT* (a switch from a non-Big 4 auditor to another non-Big 4 auditor or from a Big 4 auditor to another Big 4 auditor).

To provide further evidence on H1a, we decompose *RNAUD* in Eq. (2) into *RNAUD_B4* and *RNAUD_NB4*, each of which captures local audit market competition driven by the number of Big

[15] Following prior studies (Ettredge et al., 2007; Landsman et al., 2009), we include client-specific controls including total assets (*LNTA*) to control for client size, profitability (*ROA*), a loss indicator (*LOSS*), and one-year market-adjusted return (*RETURN*) to control for firm performance, leverage (*LEV*) and asset growth (*AGROWTH*) to control for firm risk, inventory and receivables (*INVREC*) and cash holdings (*CASH*) to control for business characteristics, an indicator for mergers and acquisitions (*MA*) to control for change in business activities, absolute value of discretionary accruals (*ADACC*) to control for potential earnings management, going-concern opinion (*GCO*) and reported internal control weaknesses (*ICW*) to control for auditors' assessment of client risk, and auditor-client misalignment (*MISMATCH*) to control for possible mismatches. We include auditor-specific controls such as auditor type (*BIG4*), tenure (*TENURE*), auditor industry specialization (*INDSPE*), office size (*OFSIZE*), and level of audit fees (*LNAFEE*). We control for MSA-level characteristics, including audit market concentration (*AUCONC*) and indicator for the presence of local SEC offices within the MSA (*DSECOF*). We also include year- and industry-fixed effects. Appendix A presents detailed definitions of all variables.

[16] Our findings are qualitatively similar when we double cluster standard errors by MSA and year to address both serial and cross-sectional dependence in our data.

4 and non-Big 4 auditors, respectively, as explained in the previous section. Specifically, we expand Eq. (2) to form Eq. (2a) as follows:

$$SWITCH_{it+1} = \delta_0 + \delta_1 RNAUD\_B4_{jt} + \delta_2 RNAUD\_NB4_{jt} + \mathbf{X}'\gamma + e_{it}, \quad (2a)$$

We then examine whether the coefficients on *RNAUD_B4* and *RNAUD_NB4* (i.e., δ_1 and δ_2) in Eq. (2a) are positive. To test H1b, we regress Eqs. (2) and (2a) separately for the large client segment (*LSEG* = 1) and the small and medium-sized client segment (*LSEG* = 0).

Empirical Model for H2

To test our second set of hypotheses, we estimate the following regression models:

$$LNAFEE_{it} = \beta_0 + \beta_1 RNAUD_{jt} + \mathbf{X}'\gamma + e_{it}\,, \quad (3)$$

$$LNAFEE_{it} = \delta_0 + \delta_1 RNAUD\_B4_{jt} + \delta_2 RNAUD\_NB4_{jt} + \mathbf{X}'\gamma + e_{it}\,, \quad (3a)$$

where, for client *i*, MSA *j*, and year *t*, *LNAFEE* is the natural logarithm of audit fees (in thousands of U.S. dollars). *RNAUD, RNAUD_B4,* and *RNAUD_NB4* are as previously defined and **X'** represents a vector of control variables.[17] H2a predicts the coefficient on *RNAUD* (i.e., β_1) in Eq. (3) to be negative. We also examine whether the coefficients on *RNAUD_B4* and *RNAUD_NB4* (i.e., δ_1 and δ_2) in Eq. (3a) are negative. Also, we estimate Eqs. (3) and (3a) separately for the large client segment and the small and medium-sized client segment to test H2b.

[17] We choose control variables following prior studies (Carcello et al., 2002; Choi et al., 2010; Fung et al., 2012; Jha and Chen, 2015; Whisenant et al., 2003). Specifically, we include total assets (*LNTA*) and accelerated filer status (*AFILER*) to capture the effect of client size. To control for various dimensions of client-specific risk, we include operating cash flows (*CFO*), a loss indicator (*LOSS*), leverage ratio (*LEV*), current assets (*LIQUID*), equity or debt issuance (*NEWFIN*), Altman's (1983) *Z*-score (*ZSCORE*), cash flow volatility (*CFOVOL*), and sales volatility (*SALEVOL*). We also include an indicator for book-to-market ratio (*BTM*) and sales growth (*SGROWTH*) to control for clients' growth, and inventory and receivables (*INVREC*), foreign operations (*FOREIGN*), and extraordinary items or discontinued operations (*EXTDIST*), and the number of segments (*LNSEG*) to control for audit complexity. We include delay in financial reporting (*REPORTLAG*) to control for unobserved audit risk and the absolute value of discretionary accruals (*ADACC*) to control for the relation between audit quality and audit fees. We add controls for auditor-specific characteristics such as *BIG4*, *INITIAL*, *INDSPE*, and *OFSIZE*, and MSA-level characteristics such as *AUCONC*, *DSECOF* and *WAGEPHR* (the mean hourly wage rate of auditors and accountants in the MSA). We also include year and industry-fixed effects. Appendix A presents detailed definitions of all variables.

Empirical Model for H3

To test H3, we employ two main proxies for audit quality: the absolute value of discretionary accruals (*ADACC*) and the quality of accruals (*AQ*). To calculate *ADACC*, we estimate the modified Jones model (Dechow et al., 1995) adjusted for firm performance (Kothari et al., 2005) for each year and two-digit SIC industry.[18] Our second proxy, the quality of accruals (*AQ*), measures how well accruals reflect the fundamental operations of the firm, based on the model developed by Dechow and Dichev (2002) and modified by McNichols (2002).[19] Using these two proxies for audit quality, we estimate the following regression models:

$$ADACC_{it}\ [AQ_{it}] = \beta_0 + \beta_1\ RNAUD_{jt} + \mathbf{X}'\underline{\gamma} + e_{it}, \quad (4)$$

$$ADACC_{it}\ [AQ_{it}] = \delta_0 + \delta_1\ RNAUD\_B4_{jt} + \delta_2\ RNAUD\_NB4_{jt} + \mathbf{X}'\gamma + e_{it}, \quad (4a)$$

where, for client *i*, MSA *j*, and year *t*, the dependent variable is either *ADACC* or *AQ*. *RNAUD*, *RNAUD_B4*, and *RNAUD_NB4*, are as previously defined and **X'** represents a vector of control variables.[20] To test H3a, we investigate whether the coefficient on *RNAUD* (i.e., β_1) in Eq. (4) is

[18] Specifically, we regress the following model for each year and industry:

$$TACC_{it}/TA_{it-1} = b_0 + b_1\ (1/TA_{it-1}) + b_2\ (\Delta REV_{it} - \Delta REC_{it})/TA_{it-1} + b_3\ PPE_{it}/TA_{it-1} + e_{it},$$

where for client *i* and year *t*, *TACC* is total accruals; *TA* is total assets; Δ*REV* is the change in revenues compared to the previous year; Δ*REC* is change in accounts receivable compared to the previous year; and *PPE* is gross property, plant, and equipment. We require at least 10 observations within the industry-year to reduce measurement error in the estimation process. The residuals estimated from the regression are denoted as unadjusted discretionary accruals. We estimate the performance-adjusted discretionary accruals by subtracting the median unadjusted discretionary accruals of the performance decile to which the client belongs.

[19] Specifically, we estimate the following regression model within each industry-year:

$$\Delta WCA_{it} = b_0 + b_1\ OCF_{it-1} + b_2\ OCF_{it} + b_3\ OCF_{it+1} + b_3\ \Delta REV_{it} + b_3\ PPE_{it} + e_{it},$$

where, for client *i* and year *t*, Δ*WCA* is the change in working capitals from year *t*-1 to *t*; *OCF* is cash flows from operating activities; Δ*REV* is change in revenues compared to the previous year; and *PPE* is gross property, plant, and equipment. All variables are scaled by average total assets. We again require at least 10 observations within the industry-year. We measure accruals quality, *AQ*, as the standard deviation of residuals estimated from the equation for each client over the years *t*-4 through *t*. A higher value of *AQ* indicates greater noise in accruals, and thus lower audit quality.

[20] We select control variables following prior studies (Ashbaugh et al., 2003; Becker et al., 1998; Boone et al., 2012; DeFond et al., 2015; Francis and Yu, 2009; Hribar and Nichols, 2007; Myers et al., 2003; Reichelt and Wang, 2010). Specifically, we include total assets (*LNTA*) to control for client size, operating cash flows (*CFO*) to control for the potential correlation between accruals and cash flows, and an indicator for negative earnings (*LOSS*) to control for different aspects of accruals between loss and profit clients. We also include leverage ratio (*LEV*) and an indicator for equity or debt issuance (*NEWFIN*) because firms that are highly leveraged or raising capital have incentives for

different from zero. A positive (negative) β_1 indicates that audit quality deteriorates (improves) as the residual number of auditors in the local audit market increases. We also examine whether the coefficients on *RNAUD_B4* and *RNAUD_NB4* (i.e., δ_1 and δ_2) in Eq. (4a) are different from zero. To test H3b, we regress Eqs. (4) and (4a) separately for the large client segment and the small and medium-sized client segment.

IV. SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

Sample Selection

We obtain the initial sample from the intersection of *Compustat* and *Audit Analytics*, which consists of all U.S. firms headquartered in one of the 319 MSAs from 2003 to 2016.[21] From the initial sample of 71,765 client-year observations, we exclude clients in regulated industries (SIC codes 4900–4999 and 6000–6999) and clients in the MSA where none of the local auditors has at least five SEC registrant clients in a given fiscal year, leaving 52,196 observations. We further exclude clients audited by non-local auditors (i.e., auditors located in a different MSA) to focus clearly on the impact of the local audit market structure on the same market participants' behavior, which reduces the sample to 35,588.[22] Lastly, we remove observations that do not have sufficient

earnings management, and Altman's (1983) Z-score (*ZSCORE*) to control for the increased audit risk in financially distressed clients. We include cash flow volatility (*CFOVOL*) and sales volatility (*SALEVOL*) to control for operating volatility, book-to-market ratio (*BTM*) and sales growth (*SGROWTH*) to control for growth, the number of segments (*LNSEG*) to control for audit complexity, and one-year lagged total accruals (*TACC_L1*) to capture the reversal of accruals. We add controls for auditor-specific characteristics (*BIG4*, *INITIAL*, *INDSPE*, and *OFSIZE*) and MSA-level characteristics (*AUCONC* and *DSECOF*). We also include year- and industry-fixed effects. Appendix A presents detailed definitions of all variables.

[21] The list of MSAs is obtained from the Census Bureau's Metropolitan and Micropolitan Statistical Area Reference Files as of August 2017, available at https://www.census.gov/geographies/reference-files/time-series/demo/metro-micro/delineation-files.html. Our sample period starts from 2003 to avoid the impact of a stricter regime following adoption of Sarbanes-Oxley Act in 2002 on audit market structure.

[22] We expect that non-local auditors are little affected by the local audit market structure. With certain incentives, such as audit opinion shopping or relationship-based contracting, clients may intentionally choose non-local auditors who are known to provide lower audit quality at higher audit fees (Choi et al., 2012). Since we cannot control for these incentives perfectly, we remove such clients from our sample.

data to construct required variables (except *AQ*) in Eqs. (2) to (4), resulting in a final sample of 21,905 observations from 81 unique MSAs for our main analyses. In the analyses of *AQ*, the sample further reduces to 16,141 due to additional data requirements. When measuring auditor-related variables, such as *RNAUD*, *AUCONC*, *INDSPE*, and *OFSIZE*, we use all observations with non-missing audit fee data. We winsorize all continuous variables at the bottom and top one percent to prevent outliers from biasing results.

Descriptive Statistics

Table 1 shows the descriptive statistics on auditors with at least five clients (SEC registrants) and clients in an MSA.[23] In Panel A, we present the statistics for the top 10 MSAs based on the average number of local auditors over the sample period. Column (1) indicates that the greatest average number of auditors is 36.14 in the New York-Newark-Jersey City MSA, while the mean value for all MSA-years is 6.17, which suggests a large variation in the number of auditors in our sample. In column (2), the number of Big 4 auditors in an MSA is at most four and relatively stable across MSAs, with a mean value of 2.69. In contrast, in column (3), the number of non-Big 4 auditors varies substantially across the top 10 MSAs. Specifically, it varies from 32.14 in the New York-Newark-Jersey City MSA to 6.50 in the Chicago-Naperville-Elgin MSA. Panel B presents the sample distribution by the number of local auditors in each MSA. Among 894 MSA-years, about 41.1 percent have four Big 4 auditors operating in the MSA, which accounts for 82.7 percent of the client-year observations in the final sample. It is notable that 64 MSA-years do not have any

[23] In Table 2, figures in columns (1) through (3) are calculated using all auditors with at least five SEC registrant clients that have non-missing audit fee data in *Audit Analytics*, and those in column (4) are calculated using all clients of such auditors in the intersection of *Compustat* and *Audit Analytics*. If clients that appear in column (4) do not have all required data for variables used in our multivariate analyses, they are not included in our final sample.

local Big 4 auditors. We also find that about 61.6 (9.6) percent of MSA-years have less (more) than three (eight) non-Big 4 auditors that have at least five SEC registrant clients.

[Insert Table 1 about here]

Table 2 presents the summary statistics for the final sample. Panel A reports the descriptive statistics for the variables used in our analyses. About 5.9 percent of observations switch their auditors in the subsequent year, among which upward, downward, and lateral switches are 0.4 percent, 2.1 percent, and 3.5 percent, respectively. The mean value of *LNAFEE* is 6.876, which is equivalent to $971,626. On average, *ADACC* is 7.3 percent of lagged total assets and *AQ* is 4.5 percent of average total assets. We omit detailed explanations on the other variables for brevity.

Panel B presents the Pearson correlations between selected variables. Our test variables, *RNAUD*, *RNAUD_B4*, and *RNAUD_NB4*, are highly correlated. The magnitude of the correlation between *RNAUD* and *RNAUD1_NB4* is 0.89, suggesting that the residual number of local auditors in an MSA is largely influenced by the residual number of non-Big 4 auditors. Our test variables do not exhibit high correlations with other variables except *AUCONC* and *DSECOF*. *AUCONC* is significantly negatively correlated with *RNAUD* (-0.20) and *RNAUD_NB4* (-0.32), consistent with a greater residual number of auditors reducing concentration in the local audit market. However, the magnitudes of the correlation coefficients are not substantial, suggesting that these variables construct different aspects of the local market structure. *DSECOF* is positively correlated with *RNAUD* (0.25) and *RNAUD_NB4* (0.35), suggesting that the SEC regional offices are located in large MSAs where a greater number of auditors operate.[24]

[Insert Table 2 about here]

[24] Despite the high correlations, we conclude that our results are not subject to multicollinearity for the following reasons. First, we find that the variance inflation factors for our test variables are all below 4. Second, we repeat all analyses after excluding *AUCONC* and *DSECOF* and find that our results are qualitatively similar (untabulated).

V. EMPIRICAL FINDINGS

Analysis for H1: Auditor Turnover

Table 3 presents the results of auditor turnover tests. Panel A reports the results of tests with the full sample. In column (1), we estimate Eq. (2) and find that the coefficient on *RNAUD* is 0.266 and significant at $p < 0.01$. This result suggests that a greater residual number of local auditors is associated with a higher probability of auditor turnover, indicating that the degree of rivalry among auditors increases with our competition measure, consistent with H1a. In column (2), we estimate Eq. (2a) and find that the coefficient on *RNAUD_B4* is insignificant, while that on *RNAUD_NB4* is 0.203 and significant at $p < 0.01$. The results suggest that the increase in auditor turnover is mainly driven by the number of non-Big 4 auditors operating in the local market, rather than by the number of Big 4 auditors.

In columns (3) to (5), we decompose the dependent variable, *SWITCH*, into three cases: switches from a non-Big 4 to a Big 4 auditor (*SWITCH_UP*), switches from a Big 4 to a non-Big 4 auditor (*SWITCH_DN*), and switches within the same type of auditor (*SWITCH_LT*). We find that the coefficient on *RNAUD_NB4* is significantly negative for upward switches in column (3), while it is significantly positive for downward and lateral switches in columns (4) and (5). The results indicate that, when a greater number of non-Big 4 auditors operate in the local market, clients are more likely to switch from a Big 4 to a non-Big 4 auditor or switch within the same type of auditors, and they are less likely to switch from a non-Big 4 auditor to a Big 4 auditor. Thus, the results suggest that not only non-Big 4 auditors but also Big 4 auditors face intensive competition arising from a larger number of non-Big 4 auditors.

In Sections B, C, and D, we report the results on client-specific, auditor-related, and MSA-level control variables, respectively. We omit detailed explanations on these variables for brevity. We note that the coefficient on *AUCONC* is significantly positive in columns (1), (2), and (5) and insignificant in columns (3) and (4). The positive coefficients indicate that auditors face greater threats of turnover in a more concentrated audit market. To the extent that a higher frequency of auditor turnover captures greater competition (Buijink et al., 1998; Ghosh and Lustgarten, 2006), using the Herfindahl index as an inverse proxy for competition does not seem valid.

In Panel B of Table 3, we estimate Eqs. (2) and (2a) for two client segments separately. For the small and medium-sized client segment in columns (1) and (2), we find that the coefficients on *RNAUD* and *RNAUD_NB4* are significantly positive but the coefficient on *RNAUD_B4* is insignificant, consistent with the results for the full sample. On the contrary, for the large client segment in columns (3) and (4), the coefficients on all test variables are insignificant. The results suggest that a higher tendency of auditor turnover stemming from a larger number of auditors in the MSA is observed only for small and medium-sized clients but not for large clients, consistent with H1b.

[Insert Table 3 about here]

Analysis for H2: Audit Fees

Table 4 presents the results of audit fee tests. In Panel A of Table 4, we estimate Eqs. (3) and (3a) for testing H2a and report the results. In column (1), the coefficient on *RNAUD* is –0.072 and significant at $p < 0.05$, which suggests that as the residual number of auditors increases, auditors tend to charge lower audit fees, supporting H2a. In column (2), the coefficient on *RNAUD_B4* is 0.058 and insignificant and that on *RNAUD_NB4* is –0.063 and significant at $p < 0.01$, suggesting that the significant effect of *RNAUD* on audit fees is mainly attributable to the number of non-Big

4 auditors.[25] In Sections B, C, and D, we find that most of the significant coefficients have expected signs, except for *LEV*.[26] We also note that the coefficient on *AUCONC* is insignificant in both columns (1) and (2), suggesting that the Herfindahl index is not significantly associated with audit pricing. We omit detailed explanations on other control variables for brevity.

In Panel B of Table 4, we estimate Eqs. (3) and (3a) separately for two client segments. For the small and medium-sized client segment in columns (1) and (2), we find significantly negative coefficients on *RNAUD* and *RNAUD_NB4*, consistent with the results for the full sample in Panel A.[27] In contrast, for the large client segment in columns (3) and (4), the coefficients on all test variables are insignificant, suggesting that auditors do not charge lower fees in this segment as the residual number of auditors increases. The results suggest that the fee pressure in MSAs with a large number of auditors is observed only for small and medium-sized clients but not for large clients, consistent with H2b.

[Insert Table 4 about here]

Analysis for H3: Audit Quality

Table 5 presents the empirical results for audit quality. In Panel A of Table 5, we present the results for testing H3a. In columns (1) and (2) [(3) and (4)], audit quality is measured with *ADACC* [*AQ*]. In column (1), the coefficient on *RNAUD* is 0.007 and significant at $p < 0.01$. In column (2), the coefficient on *RNAUD_NB4* is 0.006 and significant at $p < 0.01$, while that on *RNAUD_B4* is insignificant. These results suggest that audit quality measured by *ADACC* deteriorates as the

[25] The results are also economically meaningful. For example, the results in column (2) suggest that, as *RNAUD_NB4* increases from –0.225 (the 25th percentile) to 0.461 (the 75th percentile), audit fees on average decrease by 4.3 percent (= –0.063 × 0.686). The 4.3 percent decrease is equivalent to about $41,698 based on the median value of *LNAFEE* (6.878).

[26] One potential reason for the negative coefficient on *LEV* is the high correlation between *LEV* and *ZSCORE*.

[27] The coefficient on *RNAUD_B4* is positive and significant in column (2). However, since it is only marginally significant (p-value = 0.06) and the only exceptional result, we do not consider it seriously.

number of auditors in an MSA increases, rejecting H3a, and that such an effect is mainly attributable to the number of non-Big 4 auditors rather than by that of Big 4 auditors.[28] The significant coefficients on the control variables in Sections B to D are consistent with those in prior studies, except for the coefficient on *LEV*.[29] The results in columns (3) and (4) where *AQ* is used as a proxy for audit quality are qualitatively similar to those in columns (1) and (2).[30]

In Panel B of Table 5, we estimate Eqs. (4) and (4a) separately for the two client segments. For the small and medium-sized client segment in columns (1) and (2), we find significantly positive coefficients on *RNAUD* and *RNAUD_NB4* and insignificant coefficients on *RNAUD_B4*, consistent with the results based on the full sample in Panel A. In contrast, for the large client segment in columns (3) and (4), the coefficients on all test variables are insignificant, indicating that the increase in the number of auditors does not have a significant effect on audit quality in this segment. The results suggest that the negative association between the residual number of auditors and audit quality is prevalent for small and medium-sized clients but not for large clients, rejecting H3b. The results in Panel C, where *AQ* is used as a proxy for audit quality, are qualitatively similar to those in Panel B.

[Insert Table 5 about here]

[28] The results are also economically significant. For example, the results in column (2) indicate that as *RNAUD_NB4* increases from –0.225 (the 25th percentile) to 0.461 (the 75th percentile), the *ADACC* increases by 0.41 percent (= 0.006 × 0.686) of lagged total assets. This translates into an increase in *ADACC* by about 9.3 percent from the median value of *ADACC* (= 0.0041 / 0.044).

[29] The coefficients on *AUCONC* are insignificant in columns (1) and (2), which contrasts the results in Kallapur et al. (2010) that report a negative association between the magnitude of discretionary accruals and audit market concentration. However, in columns (3) and (4), where *AQ* is used as the dependent variable, the coefficients on *AUCONC* are significantly negative, consistent with the results in Kallapur et al. (2010).

[30] To examine a potential nonlinear relation between the number of auditors and audit quality [fees], we estimate Eqs. (4) and (4a) [Eqs. (3) and (3a)] with the squared terms of our test variables. We do not find evidence supporting a nonlinear relation.

Overall, the results indicate that a greater residual number of auditors in the local audit market increases competition, as evidenced by higher auditor turnover. The findings also suggest that, when facing intense competition, auditors tend to discount audit fees, which appears to have adverse effects on auditor effort and audit quality. The effects on auditor turnover, audit fees, and audit quality are all attributable to the number of non-Big 4 auditors, not to that of Big 4 auditors, suggesting that non-Big 4 auditors play an important role in shaping competitive pressures in the local audit market. Also, we report that the effects of competitive pressures on auditor turnover, audit fees, and audit quality are evident in the segment for small and medium-sized clients but not in the segment for large clients.

VI. ADDITIONAL AND SENSITIVITY ANALYSES

Subsample Analyses Based on Auditor Type

In this section, we examine whether the effect of the number of auditors on audit fees and quality varies between clients of Big 4 auditors and non-Big4 auditors. Audit market concentration could increase due to clients' strong demands for a few large auditors who supply high-quality audit service (Becker et al., 1998). If this is the case, the negative relation between *RNAUD* and audit fees/quality should be weaker or disappear for the clients of Big 4 auditors, given that these clients hire Big 4 auditors in anticipation of high audit quality. For this purpose, we divide the small and medium-sized client segment into two subsamples of Big 4 and non-Big 4 auditors' clients and repeat audit fee/quality tests for each subsample.[31]

[31] By definition, all clients in the large client segment are audited by Big 4 auditors. Thus, we do not tabulate the results for clients of Big 4 auditors in the large client segment in this subsection. Alternatively, we examine whether our results differ between the clients of industry specialist auditors and those of non-specialist auditors within the small and medium-sized client segment (Cahan et al., 2008; Francis, Reichelt, and Wang, 2005; Fung et al., 2012). We find that our results of audit fee/quality tests largely hold for the small and medium-sized clients of both industry

Table 6, Panel A presents the results for audit fee tests, and Panel B presents the results for audit quality tests using *ADACC* as the proxy. Panels A and B indicate that the coefficients on *RNAUD* and *RNAUD_NB4* are significant in both Big 4 and non-Big 4 client subsamples. The untabulated results using *AQ* as a proxy for audit quality are qualitatively similar. These results suggest that, in the segment for small and medium-sized auditors, audit fees and quality of both types of auditors are negatively affected by the competitive pressure from a greater number of (non-Big 4) auditors. Such results imply that, since this segment is not clearly separated into Big 4 and non-Big 4 auditor markets, both types of auditors compete fiercely (e.g., Bills and Stephen, 2016), leading to negative consequences on audit fees and quality.

[Insert Table 6 about here]

Difference-in-Differences Analysis

In this section, we employ a difference-in-differences (DiD) method to alleviate a concern that our findings are attributable to endogenous relations between audit market structure and audit outcomes. Specifically, we examine how auditor switch, audit fees, and audit quality change in MSAs that experience shocks to local audit service supply, compared to MSAs without such supply shocks.

We first identify the supply shocks by examining yearly changes in the number of auditors in each MSA. For each MSA, we define year *t* as event year if (1) the number of auditors increases by more than 15% from year *t-1* to *t+1*, and (2) the number of auditors does not change significantly (i.e., increases or decreases by less than 5%) from year *t-2* to *t-1* and from year *t+1*

specialist and non-specialist auditors, except that the results of *ADACC* test become marginally insignificant for the clients of industry specialist auditors, probably due to the reduced sample size (n = 2,380). This evidence suggests that even industry specialist auditors are affected by the competitive pressure for clients in the small and medium-sized segment. Within the large client segment, we continue to find that audit fees and quality are insignificantly associated with the residual number of auditors, regardless of whether the auditors are industry specialists or non-specialists.

to *t+2*. As a result, 24 treatment MSAs are initially identified from our sample. Then, we search for potential control MSAs where (1) the supply shocks never occur during the sample period, and (2) the number of auditors increases or decreases by less than 5% during two years before and after the treatment MSA's event year *t*. We match treatment MSAs to control MSAs conditional on year, the number of clients (*NCLIENT*), and gross domestic product per capita (*GDPPC*).[32] After removing treatment and control MSAs that do not have required data for client observations, the sample used for this DiD test consists of 11 treatment MSAs (*TREAT* = 1) and 21 control MSAs (*TREAT* = 0) for year *t-2* to *t-1* and year *t+1* to *t+2*, yielding 1,645 client-year observations.[33]

To confirm our previous findings with the DiD test, we estimate modified versions of Eqs. (2), (3), and (4) where *RNAUD* is replaced with *TREAT*, *TREAT*POST*, and *POST*. *TREAT* is an indicator that equals one for clients in the treatment MSAs and zero otherwise. *POST* is an indicator that equals one if the observation is from the post-shock period from year *t+1* to *t+2* and zero otherwise (i.e., if it is from the pre-shock period from year *t-2* to *t-1*). *TREAT*POST* is an interaction term between *TREAT* and *POST*.

We report the results in Table 7. In column (1), the coefficient on *TREAT*POST* is not significant, inconsistent with our previous finding. However, we find that the coefficient on *TREAT*POST* is significantly positive when the indicator variable for downward auditor switch (*SWITCH_DN*) is used as the dependent variable (untabulated), suggesting that clients in the

[32] Specifically, we require the differences in the number of client firms and gross domestic product per capita between the treatment and control MSAs to fall within 15%. We allow a treatment MSA to be matched with multiple control MSAs. If a control MSA is matched to multiple treatment MSAs, we retain only the match with the minimum difference in the number of clients. As a result, the number of control MSAs used in the test is greater than that of treatment MSAs.

[33] We regard the event year *t* as a transition period and thus do not include observations in year *t* in the DiD test sample. The supply shocks are largely driven by the opening of new audit offices. In the treatment MSAs, the average number of audit offices increases from 3.27 to 4.45 due to the opening of 1.27 new offices and the closure of 0.09 offices. In the control MSAs, the average number of audit offices remains at 3.19, with 0.38 new and closed offices.

treatment MSAs are more likely to make downward auditor switches in the post period because newly opened offices are mostly non-Big 4 auditors' offices. Moreover, the coefficient on *TREAT*POST* is significantly negative in column (2), while it is significantly positive in columns (3) and (4). These results suggest that audit fees and quality significantly decrease after the treatment MSAs experience shocks to local audit service supply, compared to the control MSAs without such supply shocks. Taken together, these results lend further support to our previous findings on the effect of the number of auditors on auditor switch, audit fees, and audit quality.

[Insert Table 7 about here]

Effect of Spatial Competition

In this section, we examine whether our findings vary with spatial competition in the local audit market. Within a given market structure, auditors may face different competitive forces, depending on their market positions relative to competing auditors (Bills and Stephens, 2016; Numan and Willekens, 2012). Specifically, we expect that the negative effect of market competition on audit fees and quality is less pronounced for auditors whose industry market shares are more distant from their competitors' market shares.

To test this prediction, we define *APART* as an indicator variable that equals one if an incumbent auditor does not have any competing auditors within a 20 percent market share distance in the same MSA-industry (two-digit SIC code) audit market for a given year and zero otherwise.[34] Then, we include the interaction terms between *APART* and our test variables in Eqs. (3), (3a), (4), and (4a). Table 8 presents the results of audit fee tests in columns (1) and (2) and those of audit quality tests in columns (3) to (6). In columns (1) and (2), the coefficients on *RNAUD* and

[34] The results remain qualitatively similar when we use alternative cut-off points of a 15 or 25 percent market share distance in defining *APART*.

RNAUD_NB4 are negative and significant, while the coefficients on their interactions with *APART* (i.e., *RNAUD*APART* or *RNAUD_NB4*APART*) are positive and significant. Similarly, in columns (3) to (6), the coefficients on *RNAUD* and *RNAUD_NB4* are positive and significant, while the coefficients on their interactions with *APART* are negative. Section B shows that the sums of the coefficients on our test variables and their interactions with *APART* are insignificant, suggesting that the negative effect of local market competition on audit fees and quality is not evident for auditors whose market shares are very distant from their closest competitor's market share. These results suggest that the separation in market space within industry reduces competitive pressures faced by auditors.[35]

[Insert Table 8 about here]

Alternative Measures of Audit Quality

We perform additional tests using alternative measures of audit quality. First, lowered audit quality associated with greater *RNAUD* could be attributable to reduced audit efforts caused by lower audit fees and/or auditors' greater tolerance for client earnings management when they face greater competition. The latter possibility suggests that an increase in the residual number of auditors negatively affects auditor independence. Prior studies suggest that auditors are less likely to issue GCOs when their independence is compromised by client pressure to avoid a GCO (DeFond et al., 2002). Thus, we examine whether audit market competition strengthens or weakens auditor independence by investigating the association between *RNAUD* and auditors' propensity to issue GCOs.[36] We estimate this model with a subsample of clients who have a high distress

[35] When we include the interaction term between *APART* and *AUCONC* in the regression models, we fail to find significant results on the interaction term, again suggesting that the Herfindahl index may not be an appropriate proxy for competition in the audit market.

[36] Specifically, we estimate the following logistic model:

$$\Pr[GCO_{it} = 1] = \beta_0 + \beta_1 RNAUD_{jt} + X'\gamma + e_{it},$$

score (i.e., 10,896 observations having Zmijewski's (1984) distress score above the sample median). The results presented in Panel A, Table 9 show that the coefficients on *RNAUD* and *RNAUD_NB4* are significant and negative, while the coefficient on *RNAUD_B4* is insignificant, suggesting that the auditors' propensity to issue GCOs is negatively associated with the residual number of auditors and that this result is mainly driven by the residual number of non-Big 4 auditors. Overall, when GCOs are used as a proxy for audit quality, the results are largely consistent with our previous finding that audit quality is negatively associated with our competition measure. We also find that such a relation is evident only in the small and medium-sized client segment (untabulated).

[Insert Table 9 about here]

Second, we repeat audit quality tests using discretionary accruals adjusted for the nonlinear effects of client performance and growth (Collins et al., 2017) or discretionary component of accruals quality (i.e., accruals quality not explained by innate client characteristics; Francis, Lafond, Olsson, and Schipper, 2005). Untabulated results with these alternative measures are qualitatively similar to our main results.

Third, we use the likelihood of restatements as a measure of audit quality. Ettredge et al. (2018) document that audit fees and the likelihood of subsequent restatements are lower when the residual number of audit offices in the local market is greater. Although their results of audit fee

where, for client *i* and year *t*, *GCO* is an indicator variable that equals one if the auditor issues a GCO. Following prior studies (Choi et al., 2017; DeFond et al., 2002; Francis and Yu, 2009; Reichelt and Wang, 2010), we control for client-specific characteristics, including total assets (*LNTA*), operating cash flows (*CFO*), an indicator for negative earnings in the previous year (*LOSS_L1*), leverage ratio (*LEV*), change in leverage ratio (*CLEV*), cash and investment securities (*INVEST*), Altman's (1983) Z-score (*ZSCORE*), an indicator for equity or debt issuance (*NEWFIN*), cash flow volatility (*CFOVOL*), sales volatility (*SALEVOL*), return volatility (*RETVOL*), market-adjusted stock return (*RETURN*), sales growth (*SGROWTH*), the number of segments (*LNSEG*), delay in financial reporting (*REPORTLAG*), and an indicator for a GCO in the previous year (*GCO_L1*). We also add controls for auditor-specific characteristics (*BIG4*, *INITIAL*, *INDSPE*, and *OFSIZE*) and MSA-level characteristics (*AUCONC* and *DSECOF*). We also include year- and industry-fixed effects. Appendix A presents detailed definitions of all variables.

tests are comparable to ours, the results of restatement tests are in sharp contrast to ours. To reconcile our findings with theirs, we regress an indicator for financial restatements (*RESTATE*) against *RNAUD* and the same control variables used in Ettredge et al. (2018), and report the results in Panel B, Table 9. For this analysis, the sample, unlike the samples used in our main analyses, includes clients of non-local auditors to be consistent with Ettredge et al. (2018).

Columns (1) and (2) present the results for the period of 2010-2014, as in Ettredge et al. (2018), and columns (3) and (4) present those for the extended sample period of 2003-2014. The coefficients on *RNAUD* and *RNAUD_NB4* are significantly negative in columns (1) and (2), consistent with the findings of Ettredge et al. (2018).[37] However, the coefficients become insignificant in the extended sample period in columns (3) and (4). Thus, we find that the results of restatement tests are sensitive to the sample period. Since restatements are relatively rare events, the statistical power of the tests can be low and the results can be prone to outliers when the sample size is small (DeFond and Zhang, 2014). Thus, the inferences from a longer sample period can be more reliable.[38]

Given that the findings of Ettredge et al. (2018) are in sharp contrast to ours, one may question whether our findings are sensitive to sample period. To check this possibility, we repeat

[37] Since auditors are more concerned about overstatements than understatements (Newton et al., 2013), the dependent variable (restatement) is defined as one if earnings in the current year are restated downwards in a subsequent year, and zero otherwise. If we include all restatements regardless of their impact on earnings, the coefficients on *RNAUD* and *RNAUD_NB4* become insignificant in columns (1) and (2). In this analysis, we report the results with standard errors clustered by client, rather than by MSA, to be consistent with Ettredge et al. (2018). If we cluster standard errors by MSA, the coefficient on *RNAUD* (*RNAUD_NB4*) becomes marginally significant (insignificant) in columns (1) and (2). Thus, the documented significant results in columns (1) and (2) for the period of 2010–2014 are weak at best.

[38] The insignificant association from the extended sample period suggests that our competition measure does not significantly affect the likelihood of egregious audit failures, such as restatements. Alternatively, the insignificant result could be attributable to the sticky nature of our competition measure over time. Singer and Zhang (2018) suggest that, for financial misstatements to be restated subsequently, auditors in a subsequent year should be of higher quality in order to discover and correct misstatements. Since the number of auditors within an MSA tends to be sticky over time, our competition measure could affect auditors' willingness and effort in a subsequent year to discover and correct misstatements. Therefore, one should interpret the results of restatement tests cautiously when the explanatory variable is persistent over time.

our analyses on audit fees and quality after dividing our sample period into two subperiods: 2003-2009 and 2010-2016. We find that the results for both subperiods (untabulated) are largely consistent with those for the full sample.

Effect of the Number of Large Auditors

Our descriptive statistics reported in Table 1 reveal little variation in the number of Big 4 auditors, given that 83 percent of sample clients are located in the MSAs where all Big 4 have their offices. The little variation may weaken the statistical power of our tests, resulting in insignificant coefficients on the residual number of Big 4 auditors (*RNAUD_B4*) for audit fee/quality tests. To check this possibility, we perform the following two analyses. First, we create an indicator variable (*BIG4_ALL*) that equals one if all Big 4 auditors have their offices in the MSA and zero otherwise, and estimate equations (3a) and (4a) after replacing *RNAUD_B4* with *BIG4_ALL*. We find some weak evidence indicating that the number of Big 4 auditors also matters in audit fees and quality.[39] Second, using a sample period over the years from 1977 to 1988 in which Big 8 auditors existed, we test whether the number of Big 8 auditors is associated with our proxies for audit quality.[40] Using large variation in the number of Big 8 auditors (from 0 to 8) during this period, we examine whether the previous insignificant results for Big 4 auditors are at least partially attributable to the lack of variation in the number of Big 4 auditors. Untabulated results indicate that the number of Big 8 auditors is negatively associated with audit quality measured by *ADACC* and *AQ*. Overall,

[39] Specifically, using the full sample, we find that the coefficient on *BIG4_ALL* is significantly negative (positive) in the analysis of audit fees (quality), except for the insignificant coefficient in the analysis of *AQ*. We repeat the tests separately for large client and small and medium-size client segments. In the analysis of audit fees, the coefficient on *BIG4_ALL* is significantly negative for the large client segment but not significant for the small and medium-sized client segment. In the analysis of *ADACC*, the coefficient on *BIG4_ALL* is insignificant for the large client segment and positive but marginally insignificant for the small and medium-sized client segment. Taken together, the results provide weak evidence that the number of large auditors explains audit fees and quality to some extent.

[40] There are notable limitations in the dataset used for this analysis. First, we rely on header information from *Compustat* to obtain clients' headquarters locations. Second, since audit office-level data are not available during this period, we assume that all clients are audited by local auditors located in the MSA of clients' headquarters.

these findings, although only suggestive, imply that the number of large auditors can also be associated with audit fees/quality. However, we acknowledge that this test may not fully resolve the concern about little variation in the number of Big 4 auditors.

Other Analyses

We perform several analyses to check the robustness of our findings. First, as shown in Table 3, a greater residual number of auditors leads to more frequent auditor turnover. To check whether lower audit fees and audit quality are attributable to frequent auditor changes (Ghosh and Lustgarten, 2006; Myers et al., 2002), we repeat analyses after removing clients with initial audit engagements (i.e., *INITIAL* = 1) from the sample. The untabulated results with the reduced sample are qualitatively similar to those reported in Tables 4 and 5.

Second, we repeat our main analyses using the natural logarithm of the raw number of auditors plus one, instead of the residual number of auditors. Although the residual number of auditors, *RNAUD*, eliminates the impact of MSA characteristics in determining the number of auditors in the local audit market, this approach may induce measurement errors and cause the results to be sensitive to the model specification in Eq. (1). Untabulated results based on the raw number of auditors are qualitatively similar to our main results.

Third, we examine whether our results are sensitive to the definition of a local audit market. Specifically, assuming that each MSA-industry audit market is distinctive, we calculate the log-transformed numbers of all, Big 4, and non-Big 4 auditors in each MSA-industry audit market and repeat the main analyses. The untabulated results using the three alternative proxies are qualitatively similar to those previously documented, with one exception that the coefficients on *RNAUD* and *RNAUD_NB4* become marginally insignificant in the analysis of audit fees.

VII. CONCLUSION

Given regulators' concerns about the potential lack of auditor competition in the U.S. market, prior academic research examines the effect of audit market concentration on audit fees/quality and provides mixed evidence. We revisit the issue using the residual number of local audit offices as a proxy for competition. Throughout our analyses, we find strong and robust evidence that a greater residual number of auditors is associated with a higher likelihood of auditor turnover, lower audit fees, and lower audit quality. Such associations are evident only in the segment for small and medium-sized clients and not in the segment for large clients. In this respect, our findings provide regulators and other interested parties with valuable insight into the effects of audit market structure on audit contracting and outcome. Specifically, our findings suggest that greater audit market competition caused by a large number of audit service providers may not be beneficial to audit clients and investors, since the costs (i.e., lowered audit quality) associated with greater competition can outweigh the benefits (i.e., saved audit fees).

Our study is subject to several limitations. First, it is possible that some unknown omitted MSA-level factors induce bias to our results. While we use a residual approach to control for various MSA-level characteristics, we acknowledge that the issue may not be resolved completely. Second, although our study reports that the number of Big 4 auditors is not associated with audit fees and quality, the results do not necessarily imply that a further decrease or increase in the number of large auditors would not affect auditor behavior. Third, our results do not address whether there is an optimal number of auditors in local audit markets. These issues need to be explored further in future studies.

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Appendix A. Variable Definitions

Variable	Definition
Dependent variables	
SWITCH	An indicator variable that equals one if a client switches its auditor in the subsequent year, and zero otherwise;
SWITCH_UP	An indicator variable that equals one if a client switches from a non-Big 4 auditor to a Big 4 auditor in the subsequent year, and zero otherwise;
SWITCH_DN	An indicator variable that equals one if a client switches from a Big 4 auditor to a non-Big 4 auditor in the subsequent year, and zero otherwise;
SWITCH_LT	An indicator variable that equals one if a client switches the auditor from a Big (non-Big) 4 auditor to another Big (non-Big) 4 auditor in the subsequent year, and zero otherwise;
LNAFEE	The natural logarithm of audit fees in thousands in a given year;
ADACC	The absolute value of performance-adjusted discretionary accruals, calculated as the difference between discretionary accruals estimated using the modified Jones model (Dechow et al., 1995) and the median discretionary accruals of the performance-matched decile group (Kothari et al., 2005);
AQ	The standard deviation of the residuals over the current and prior four years (Dechow and Dichev, 2002; McNichols, 2002);
RESTATE	An indicator variable that equals one if a client's annual financial statement is subsequently restated and the restated earnings are smaller than the previously-reported earnings, and zero otherwise;
Test variables	
RNAUD	The residual number of auditors estimated from Eq. (1);
RNAUD_B4	The residual number of Big 4 auditors estimated from Eq. (1);
RNAUD_NB4	The residual number of non-Big 4 auditors estimated from Eq. (1);
Client-specific control variables	
AFILER	An indicator variable that equals one for accelerated filers, and zero otherwise;
AGROWTH	The annual percentage change of total assets;
BTM	Book value of equity scaled by market value of equity;
CASH	Cash and cash-equivalent divided by total assets;
CFO	Operating cash flows scaled by lagged total assets;
CFOVOL	The standard deviation of operating cash flows scaled by lagged total assets over the current and prior four years;
CLEV	Change in *LEV* during the fiscal year;
EXTDIST	An indicator variable that equals one if the absolute value of extraordinary items or discontinued operations is greater than $1 million, and zero otherwise;
FOREIGN	An indicator variable that equals one if a client reports positive foreign income taxes for the fiscal year, and zero otherwise;
GCO	An indicator variable that equals one if an auditor issues a going-concern audit opinion, and zero otherwise;

Variable	Definition
GCO_L1	An indicator variable that equals one if an auditor issues a going-concern audit opinion in year *t*-1, and zero otherwise;
ICW	An indicator variable that equals one if a client reports internal control weaknesses under Section 404(b) or Section 302 of the Sarbanes-Oxley Act, and zero otherwise;
INVEST	Short- and long-term investment securities including cash and cash equivalents scaled by total assets;
INVREC	The sum of inventories and receivable scaled by total assets;
LEV	The sum of short- and long-term debts scaled by total assets;
LIQUID	Current assets scaled by current liabilities;
LNSEG	The natural logarithm of the sum of geographical segments and business segments less one;
LNTA	The natural logarithm of total assets in thousands;
LOSS	An indicator variable that equals one if a client reports negative net income, and zero otherwise;
LOSS_L1	An indicator variable that equals one if a client reports negative net income in year *t*-1, and zero otherwise;
LSEG	An indicator variable that equals one if a client is larger than the largest non-Big 4 client in the MSA and year, and zero otherwise;
MA	An indicator variable that equals one if a client engages in a merger or acquisition activity in years *t*-1 and *t*, and zero otherwise;
MISMATCH	An indicator variable that equals one if the client is mismatched with the incumbent auditor, based on the methodology in Shu (2000), and zero otherwise;
NEWFIN	An indicator variable that equals one if the sum of new equity and debt issue exceeds $5 million, and zero otherwise;
REPORTLAG	The number of days between a client's fiscal year-end and its earnings announcement date;
RETURN	The market-adjusted stock returns over the 12-month period starting three months after the beginning of the fiscal year;
RETVOL	The standard deviation of monthly stock returns during the year;
ROA	The income before extraordinary items scaled by lagged total assets;
SALEVOL	The standard deviation of sales scaled by lagged total assets over the current and prior four years;
SGROWTH	Change in sales scaled by lagged sales;
TACC_L1	Total accruals in year *t-1*;
ZSCORE	The annual decile rank of Altman's (1983) Z-score, which ranges from zero (the highest distress) to one (the lowest distress);
Auditor-specific control variables	
APART	An indicator variable that equals one if an auditor does not have any competing auditors within a 20 percent market share distance in the same MSA-industry (two-digit SIC code) audit market, and zero otherwise (Bills and Stephens, 2016);

Variable	Definition
BIG4	An indicator variable that equals one if a client is audited by one of the Big 4 auditors, and zero otherwise;
INDSPE	An indicator variable that equals one if the market share of the auditor is largest in the MSA-industry (two-digit SIC code) and is at least 10% points greater than that of the second largest industry leader, and zero otherwise (Reichelt and Wang, 2010);
INITIAL	An indicator variable that equals one if year *t* is the initial year of an audit engagement, and zero otherwise;
OFSIZE	Audit office size measured by the natural logarithm of the total audit fees (in thousands) earned by the office during the year;
TENURE	The number of consecutive years that the client has been audited by the current auditor;
MSA-level control variables	
AUCONC	The Herfindahl index for auditors in an MSA, defined as the sum of the squared fractional market share of each audit engagement office in the MSA. The market share is measured based on audit fees;
DSECOF	An indicator variable that equals one if one of the SEC regional offices is located in the MSA, and zero otherwise;
WAGEPHR	The natural logarithm of mean hourly wage of accountants in the MSA, retrieved from U.S. Bureau of Labor Statistics;
MSA-level determinants of the number of auditors in an MSA	
AREA	The natural logarithm of the MSA's land area in million square meters, retrieved from U.S. Census Bureau;
B4SHARE	The ratio of the audit market size for Big 4 auditors to that for all auditors in the MSA, where the audit market size for Big 4 auditors is estimated as the number of public clients having total assets greater than the total assets of the largest public client of non-Big 4 auditors, and the audit market size for all auditors is defined as the number of all public clients in the MSA;
GDPPC	The natural logarithm of gross domestic product per capita in the MSA, retrieved from U.S. Bureau of Economic Analysis;
MCONC	The Herfindahl index for all public clients operating in the MSA where the clients are headquartered, defined as the sum of the squared market share (based on sales) of each client in the MSA;
NCLIENT	The natural logarithm of one plus the number of clients headquartered in the MSA;
WAGE	The natural logarithm of the median wage in the MSA, retrieved from U.S. Bureau of Labor Statistics;
Variables used in the difference-in-differences analysis	
TREAT	An indicator that equals one if the client's auditor is located in a treatment MSA where the number of local auditors increases by more than 15% from year *t-1* to *t+1*, and zero if the client's auditor is located in a matched control MSA; and
POST	An indicator that equals one if the client observation is from years *t+1* and *t+2*, and zero if the observation is from years *t-2* and *t-1*, where year *t* is (pseudo) event year in which a shock to local audit service supply occurs in the treatment (control) MSA.

Appendix B. MSA-Level Determinants of the Number of Auditors

Dependent variable =	(1) *NAUD*	(2) *NAUD_B4*	(3) *NAUD_NB4*
GDPPC	0.312***	0.713***	-0.183
	(3.41)	(8.33)	(-1.40)
WAGE	-0.488***	-0.291**	-0.660***
	(-3.21)	(-2.05)	(-3.04)
NCLIENT	0.459***	0.255***	0.522***
	(28.19)	(16.74)	(22.52)
B4SHARE	-0.337***	0.473***	-1.189***
	(-9.44)	(14.16)	(-23.37)
MCONC	-0.300***	-0.535***	0.110
	(-3.88)	(-7.40)	(1.00)
AREA	0.068***	0.094***	-0.013
	(3.35)	(4.95)	(-0.43)
Intercept	1.237	-5.463***	8.595***
	(1.00)	(-4.70)	(4.86)
Year fixed effects	Included	Included	Included
Region fixed effects	Included	Included	Included
Observations	976	976	976
Adjusted R-squared	0.822	0.741	0.740

This table presents the empirical results of estimating Eq. (1). The dependent variable is the natural logarithm of the number of auditors (*NAUD*), Big 4 auditors (*NAUD_B4*), and non-Big 4 auditors (*NAUD_NB4*) operating in an MSA in columns (1), (2), and (3), respectively. The numbers in parentheses represent *t*-statistics. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed). See Appendix A for detailed variable definitions.

Table 1. Descriptive Statistics for the Number of Auditors and Clients in Local Audit Markets

Panel A. Number of Auditors and Clients in Top 10 MSAs

	MSA name	(1) Average number of auditors	(2) Average number of Big 4 auditors	(3) Average number of non-Big 4 auditors	(4) Average number of clients
1	New York-Newark-Jersey City, NY-NJ-PA	36.14	4.00	32.14	602.71
2	Los Angeles-Long Beach-Anaheim, CA	24.86	4.00	20.86	296.36
3	Miami-Fort Lauderdale-West Palm Beach, FL	16.93	3.79	13.14	125.00
4	Denver-Aurora-Lakewood, CO	16.21	4.00	12.21	112.29
5	Houston-The Woodlands-Sugar Land, TX	13.93	4.00	9.93	225.21
6	Dallas-Fort Worth-Arlington, TX	12.93	4.00	8.93	214.43
7	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	12.57	4.00	8.57	153.79
8	Salt Lake City, UT	10.93	2.86	8.07	37.21
9	San Francisco-Oakland-Hayward, CA	10.64	4.00	6.64	197.93
10	Chicago-Naperville-Elgin, IL-IN-WI	10.50	4.00	6.50	194.79
	Other 71 MSAs not in the top 10 MSAs	4.23	2.48	1.76	42.18
	Mean statistics for all MSA-years (894 MSA-years)	**6.17**	**2.69**	**3.47**	**69.39**

Panel B. Sample Distribution by the Number of Auditors in the MSA

	(1)		(2)			(3)		(4)	
# of Big 4 auditors	MSA-years		Client-years		# of non-Big 4 auditors	MSA-years		Client-years	
	# of obs.	(%)	# of obs.	(%)		# of obs.	(%)	# of obs.	(%)
zero	64	(7.2)	137	(0.6)	less than three	551	(61.6)	5,119	(23.4)
one	145	(16.2)	579	(2.6)	three to five	157	(17.6)	4,557	(20.8)
two	158	(17.7)	1,098	(5.0)	six to eight	100	(11.2)	5,352	(24.4)
three	160	(17.9)	1,970	(9.0)	nine to twelve	40	(4.5)	2,197	(10.0)
four	367	(41.1)	18,121	(82.7)	more than twelve	46	(5.1)	4,680	(21.4)
Total	894	(100.0)	21,905	(100.0)	Total	894	(100.0)	21,905	(100.0)

This table presents descriptions on the number of auditors with at least five clients (SEC registrants) in an MSA. Panel A presents the average numbers of all auditors, Big 4 auditors, non-Big 4 auditors, and clients in each MSA for the top 10 MSAs, and the average values of the variables of all other MSAs. The rank is determined based on the average number of auditors located in the MSA in column (1). Numbers in columns (1) through (3) are calculated using all audit offices with non-missing audit fees in *Audit Analytics*, and those in column (4) are calculated using all client observations in the intersection of *Compustat* and *Audit Analytics*. Panel B shows the sample distribution of MSA-years and client-years by the number of Big 4 auditors in an MSA in columns (1) and (2), and by that of non-Big 4 auditors in an MSA in columns (3) and (4).

Table 2. Summary Statistics
Panel A. Descriptive Statistics

Variable	N	Mean	Std.	P10	P25	P50	P75	P90
Dependent variables								
SWITCH	21,905	0.059	0.236	0.000	0.000	0.000	0.000	0.000
SWITCH_UP	21,905	0.004	0.060	0.000	0.000	0.000	0.000	0.000
SWITCH_DN	21,905	0.021	0.144	0.000	0.000	0.000	0.000	0.000
SWITCH_LT	21,905	0.035	0.183	0.000	0.000	0.000	0.000	0.000
LNAFEE	21,905	6.874	1.237	5.198	6.047	6.877	7.676	8.476
ADACC	21,905	0.074	0.094	0.007	0.019	0.044	0.089	0.167
AQ	16,141	0.045	0.034	0.015	0.023	0.035	0.057	0.088
Test variables								
RNAUD	21,905	0.057	0.351	-0.364	-0.192	0.002	0.250	0.563
RNAUD_B4	21,905	-0.050	0.211	-0.310	-0.181	-0.077	0.055	0.262
RNAUD_NB4	21,905	0.138	0.503	-0.463	-0.225	0.094	0.461	0.936
Client-specific controls								
LNTA	21,905	13.186	2.010	10.509	11.734	13.135	14.568	15.849
AFILER	21,905	0.837	0.369	0.000	1.000	1.000	1.000	1.000
ROA	21,905	0.028	0.189	-0.161	0.003	0.070	0.120	0.178
LOSS	21,905	0.176	0.176	0.000	0.003	0.140	0.289	0.430
LEV	21,905	0.311	0.463	0.000	0.000	0.000	1.000	1.000
AGROWTH	21,905	0.109	0.318	-0.150	-0.035	0.053	0.166	0.385
INVREC	21,905	0.258	0.179	0.048	0.114	0.231	0.364	0.514
CASH	21,905	0.223	0.223	0.015	0.048	0.144	0.330	0.569
MA	21,905	0.277	0.448	0.000	0.000	0.000	1.000	1.000
RETURN	21,905	0.068	0.550	-0.463	-0.254	-0.026	0.243	0.640
GCO	21,905	0.017	0.130	0.000	0.000	0.000	0.000	0.000
ICW	21,905	0.071	0.257	0.000	0.000	0.000	0.000	0.000
MISMATCH	21,905	0.457	0.498	0.000	0.000	0.000	1.000	1.000
CFO	21,905	0.067	0.169	-0.091	0.031	0.092	0.150	0.218
LIQUID	21,905	2.938	2.436	1.051	1.480	2.188	3.438	5.668
NEWFIN	21,905	0.500	0.319	0.111	0.222	0.556	0.778	0.889
ZSCORE	21,905	0.635	0.481	0.000	0.000	1.000	1.000	1.000
CFOVOL	21,905	0.094	0.141	0.018	0.031	0.053	0.097	0.187
SALEVOL	21,905	0.266	0.295	0.052	0.093	0.173	0.319	0.571
BTM	21,905	0.546	0.428	0.148	0.257	0.437	0.703	1.056
SGROWTH	21,905	0.126	0.363	-0.157	-0.021	0.074	0.195	0.402
FOREIGN	21,905	0.568	0.495	0.000	0.000	1.000	1.000	1.000
EXTDIST	21,905	0.133	0.340	0.000	0.000	0.000	0.000	1.000
LNSEG	21,905	0.860	0.767	0.000	0.000	1.099	1.386	1.946
REPORTLAG	21,905	50.811	19.291	28.000	36.000	48.000	62.000	77.000
TACC_L1	21,905	-0.074	0.112	-0.186	-0.110	-0.059	-0.021	0.024
LSEG	21,905	0.430	0.495	0.000	0.000	0.000	1.000	1.000
Auditor-specific controls								
BIG4	21,905	0.779	0.415	0.000	1.000	1.000	1.000	1.000
TENURE	21,905	5.996	4.141	1.000	3.000	5.000	9.000	12.000

Variable	N	Mean	Std.	P10	P25	P50	P75	P90
INITIAL	21,905	0.062	0.241	0.000	0.000	0.000	0.000	0.000
INDSPE	21,905	0.273	0.446	0.000	0.000	0.000	1.000	1.000
OFSIZE	21,905	10.605	1.717	8.164	9.528	10.971	11.915	12.367
APART	21,905	0.438	0.496	0.000	0.000	0.000	1.000	1.000
MSA-level controls								
AUCONC	21,905	0.277	0.073	0.214	0.234	0.255	0.299	0.356
DSECOF	21,905	0.497	0.500	0.000	0.000	0.000	1.000	1.000
WAGEPHR	21,905	3.511	0.151	3.320	3.396	3.516	3.619	3.722

Panel B. Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) *SWITCH*	1.00																		
(2) *LNAFEE*	**-0.13**	1.00																	
(3) *ADACC*	**0.06**	**-0.18**	1.00																
(4) *RNAUD*	**0.03**	**-0.03**	**0.03**	1.00															
(5) *RNAUD_B4*	**-0.02**	**0.02**	-0.01	**0.12**	1.00														
(6) *RNAUD_NB4*	**0.04**	**-0.05**	**0.04**	**0.89**	**-0.27**	1.00													
(7) *LNTA*	**-0.17**	**0.87**	**-0.23**	**-0.04**	**0.02**	**-0.05**	1.00												
(8) *CFO*	**-0.02**	**0.27**	**-0.05**	0.01	-0.01	0.01	**0.36**	1.00											
(9) *LOSS*	**0.09**	**-0.23**	**0.21**	-0.00	**-0.02**	**0.02**	**-0.34**	0.01	1.00										
(10) *LEV*	**-0.07**	**0.24**	**-0.19**	**-0.02**	-0.01	**-0.02**	**0.35**	0.01	**-0.55**	1.00									
(11) *CFOVOL*	**0.04**	**-0.29**	**0.25**	0.01	0.00	**0.02**	**-0.34**	**-0.16**	**0.29**	**-0.39**	1.00								
(12) *BTM*	**0.05**	**-0.12**	**-0.02**	**0.05**	-0.01	**0.05**	**-0.10**	-0.00	**0.19**	**-0.06**	**-0.10**	1.00							
(13) *BIG4*	**-0.11**	**0.51**	**-0.13**	**-0.16**	**0.08**	**-0.18**	**0.50**	**0.14**	**-0.14**	**0.14**	**-0.14**	**-0.14**	1.00						
(14) *TENURE*	**-0.07**	**0.38**	**-0.12**	**-0.04**	**0.08**	**-0.07**	**0.37**	**0.10**	**-0.14**	**0.11**	**-0.19**	**-0.05**	**0.32**	1.00					
(15) *INITIAL*	-0.01	**-0.16**	**0.05**	**0.04**	**-0.02**	**0.05**	**-0.15**	**-0.04**	**0.06**	**-0.05**	**0.05**	**0.04**	**-0.25**	**-0.37**	1.00				
(16) *INDSPE*	**-0.05**	**0.29**	**-0.04**	**-0.05**	**0.06**	**-0.06**	**0.25**	**0.06**	**-0.05**	**0.03**	**-0.05**	**-0.07**	**0.27**	**0.14**	**-0.08**	1.00			
(17) *OFSIZE*	**-0.09**	**0.54**	**-0.10**	**0.03**	**-0.23**	**0.11**	**0.45**	**0.07**	**-0.08**	**0.10**	**-0.09**	**-0.13**	**0.69**	**0.26**	**-0.20**	**0.23**	1.00		
(18) *AUCONC*	-0.01	0.01	**-0.03**	**-0.20**	**0.18**	**-0.32**	**0.07**	**0.05**	**-0.08**	**0.05**	**-0.07**	0.01	**0.12**	**0.04**	**-0.02**	0.00	**-0.20**	1.00	
(19) *DSECOF*	**0.03**	**-0.03**	**0.03**	**0.25**	**-0.35**	**0.35**	**-0.09**	**-0.04**	**0.06**	**-0.08**	**0.05**	-0.00	**-0.13**	**-0.08**	**0.05**	**-0.02**	**0.25**	**-0.46**	1.00
(20) *WAGEPHR*	**-0.01**	**0.21**	-0.01	**0.22**	**-0.17**	**0.26**	**0.11**	**-0.02**	**0.07**	**-0.06**	**0.02**	**-0.02**	**-0.09**	**0.32**	0.00	-0.00	**0.30**	**-0.23**	**0.27**

This table presents the summary statistics for variables used in the main analyses. Panel A presents the descriptive statistics for the dependent and control variables used in the main tests for the full sample. Panel B shows the Pearson correlations between selected variables used in the main tests, where figures in bold indicate statistical significance at the 5% level. See Appendix A for detailed variable definitions.

Table 3. The Effect of Local Audit Market Competition on Auditor Turnover
Panel A. Full sample analyses

Dep. variable =	Pr[*SWITCH*=1]	Pr[*SWITCH*=1]	Pr[*SWITCH_UP*=1]	Pr[*SWITCH_DN*=1]	Pr[*SWITCH_LT*=1]
	(1)	(2)	(3)	(4)	(5)
Section A: Test variables					
RNAUD	0.266***				
	(3.59)				
RNAUD_B4		0.136	0.287	-0.070	0.180
		(0.97)	(0.36)	(-0.24)	(0.83)
RNAUD_NB4		0.203***	-0.459**	0.259**	0.226**
		(3.06)	(-2.22)	(2.14)	(2.24)
Section B: Client-specific controls					
LNTA	-0.560***	-0.559***	0.647***	-1.263***	-0.294***
	(-17.40)	(-17.37)	(3.60)	(-13.85)	(-6.35)
ROA	0.841***	0.840***	-0.163	1.687***	0.531**
	(4.43)	(4.45)	(-0.13)	(5.17)	(2.28)
LOSS	0.247**	0.247**	0.513	0.709***	0.017
	(2.44)	(2.44)	(1.25)	(5.19)	(0.15)
RETURN	-0.045	-0.045	0.277	-0.211**	0.026
	(-0.90)	(-0.91)	(1.42)	(-2.38)	(0.56)
LEV	0.788***	0.786***	-0.476	0.598**	1.147***
	(4.36)	(4.36)	(-0.59)	(2.00)	(4.54)
AGROWTH	-0.036	-0.036	0.293	-0.090	-0.038
	(-0.32)	(-0.32)	(1.24)	(-0.63)	(-0.28)
INVREC	0.057	0.057	-0.982	0.208	0.308
	(0.26)	(0.26)	(-0.90)	(0.69)	(0.97)
CASH	-0.325**	-0.326**	0.142	-1.125***	0.044
	(-2.15)	(-2.17)	(0.22)	(-3.89)	(0.23)
MA	0.065	0.065	0.120	0.085	0.006
	(0.89)	(0.89)	(0.43)	(0.70)	(0.05)
ADACC	0.423*	0.424*	0.589	0.446	0.440
	(1.76)	(1.77)	(0.48)	(0.99)	(1.33)
GCO	0.366**	0.365**		1.218***	-0.041
	(2.55)	(2.56)		(5.85)	(-0.22)

ICW	0.985***	0.983***	1.172***	1.226***	0.808***
	(12.67)	(12.71)	(3.28)	(10.36)	(7.12)
MISMATCH	0.270***	0.269***	-1.099***	-0.093	-0.199
	(2.89)	(2.88)	(-3.26)	(-0.47)	(-1.46)
Section C: Auditor-specific controls					
BIG4	-0.419**	-0.419**	-19.362***	18.167***	-0.917***
	(-2.47)	(-2.40)	(-21.66)	(41.04)	(-5.13)
TENURE	0.019*	0.019*	0.067**	0.019	0.024
	(1.67)	(1.67)	(2.33)	(0.90)	(1.29)
INDSPE	-0.091	-0.092	-0.101	-0.126	-0.001
	(-1.06)	(-1.08)	(-0.21)	(-1.08)	(-0.02)
OFSIZE	0.032	0.032	0.012	0.195***	-0.104***
	(0.93)	(0.89)	(0.11)	(3.41)	(-2.64)
LNAFEE	0.282***	0.284***	0.124	0.377***	0.201***
	(4.38)	(4.38)	(0.52)	(3.24)	(2.93)
Section D: MSA-level controls					
AUCONC	0.902**	1.009**	1.170	0.086	1.646**
	(2.17)	(2.31)	(0.49)	(0.09)	(2.43)
DSECOF	0.065	0.071	0.369	-0.163	0.286**
	(0.93)	(1.04)	(1.06)	(-1.19)	(2.43)
Year FE	Included	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included	Included
Observations	21,905	21,905	21,905	21,905	21,905
Pseudo R^2	0.115	0.115	0.361	0.344	0.119

Panel B. Subsample analyses

Dep. variable =	Prob [*SWITCH* = 1]			
Market Segment =	Small and medium-sized client segment (*LSEG* = 0)		Large client segment (*LSEG* = 1)	
	(1)	(2)	(3)	(4)
RNAD	0.284***		0.237	
	(3.50)		(1.15)	
RNAD_B4		0.167		0.092
		(0.92)		(0.29)
RNAD_NB4		0.228***		0.099
		(3.25)		(0.64)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	12,478	12,478	9,427	9,427
Pseudo R^2	0.0905	0.0907	0.130	0.130

This table presents the empirical results of testing H1a and H1b with logistic regressions using Eqs. (2) and (2a). Panel A presents the results for the full sample and Panel B presents those for the subsamples based on client size. In columns (1) and (2) of Panel A, the dependent variable is *SWITCH*. In columns (3), (4), and (5) of Panel A, the dependent variable is the *SWITCH_UP, SWITCH_DN,* and *SWITCH_LT*, respectively. In column (3), the coefficient on *GCO* is not estimated because all observations with *SWITCH_UP* = 1 have *GCO* = 0. In Panel B, the dependent variable is *SWITCH*. In Panel B, columns (1) and (2) present the results for the small and medium-sized client segment and columns (3) and (4) present the results for the large client segment. Numbers in parentheses represent *z*-statistics based on standard errors clustered by MSA. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed). See Appendix A for detailed variable definitions.

Table 4. The Effect of Local Audit Market Competition on Audit Fees
Panel A. Full sample analyses

Dep. variable =	*LNAFEE*	
	(1)	(2)
Section A: Test variables		
RNAUD	-0.072**	
	(-2.10)	
RNAUD_B4		0.058
		(0.90)
RNAUD_NB4		-0.063**
		(-2.50)
Section B: Client-specific controls		
LNTA	0.494***	0.494***
	(44.32)	(44.35)
AFILER	0.114***	0.110***
	(4.31)	(4.29)
CFO	-0.262***	-0.261***
	(-5.76)	(-5.77)
LOSS	0.094***	0.093***
	(4.50)	(4.46)
LEV	-0.306***	-0.302***
	(-6.91)	(-6.92)
LIQUID	-0.024***	-0.024***
	(-7.32)	(-7.28)
NEWFIN	-0.016	-0.016
	(-1.24)	(-1.29)
ZSCORE	-0.233***	-0.230***
	(-7.09)	(-7.35)
CFOVOL	-0.037	-0.041
	(-0.97)	(-1.08)
SALEVOL	0.123***	0.124***
	(5.92)	(5.96)
BTM	-0.088***	-0.088***
	(-4.86)	(-4.85)
SGROWTH	-0.048***	-0.048***
	(-3.06)	(-3.08)
INVREC	0.494***	0.497***
	(7.95)	(7.90)
FOREIGN	0.231***	0.230***
	(15.94)	(15.85)
EXTDIST	0.138***	0.137***
	(9.32)	(9.30)
LNSEG	0.094***	0.094***
	(9.83)	(9.66)
REPORTLAG	0.005***	0.005***
	(9.09)	(9.45)
ADACC	0.107***	0.108***
	(2.80)	(2.88)

Section C: Auditor-specific controls		
BIG4	0.155***	0.134***
	(3.70)	(3.13)
INITIAL	-0.063***	-0.064***
	(-4.52)	(-4.53)
INDSPE	0.126***	0.124***
	(7.73)	(7.26)
OFSIZE	0.066***	0.072***
	(5.35)	(5.89)
Section D: MSA-level controls		
AUCONC	-0.240	-0.263
	(-1.20)	(-1.49)
DSECOF	-0.008	-0.000
	(-0.22)	(-0.01)
WAGEPHR	0.349*	0.363**
	(1.89)	(2.12)
Year FE	Included	Included
Industry FE	Included	Included
Observations	21,905	21,905
Adjusted R^2	0.870	0.870

Panel B. Subsample sample analyses

Dep. variable =	*LNAFEE*			
Market segment =	Small and medium-sized client segment (*LSEG* = 0)		Large client segment (*LSEG* = 1)	
	(1)	(2)	(3)	(4)
RNAUD	-0.122***		0.018	
	(-2.82)		(0.40)	
RNAUD_B4		0.174*		-0.000
		(1.92)		(-0.00)
RNAUD_NB4		-0.118***		0.002
		(-3.55)		(0.06)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	12,478	12,478	9,427	9,427
Adjusted R^2	0.827	0.828	0.839	0.839

This table presents the empirical results of testing H2a and H2b with ordinary least squares estimations using Eqs. (3) and (3a). Panel A presents the results for the full sample and Panel B presents those for the subsamples based on client size. In Panel B, columns (1) and (2) present the results for the small and medium-sized client segment and columns (3) and (4) present the results for the large client segment. Numbers in parentheses represent *t*-statistics based on standard errors clustered by MSA. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed). See Appendix A for detailed variable definitions.

Table 5. The Effect of Local Audit Market Competition on Audit Quality
Panel A. Full sample analyses

Dep. variable =	*ADACC*		*AQ*	
	(1)	(2)	(3)	(4)
Section A: Test variables				
RNAUD	0.007***		0.004***	
	(2.91)		(3.81)	
RNAUD_B4		-0.003		0.000
		(-0.60)		(0.23)
RNAUD_NB4		0.006***		0.003***
		(3.07)		(3.11)
Section B: Client-specific controls				
LNTA	-0.007***	-0.007***	-0.004***	-0.004***
	(-11.57)	(-11.46)	(-11.62)	(-11.57)
CFO	0.005	0.005	-0.015***	-0.015***
	(0.33)	(0.32)	(-3.61)	(-3.63)
LOSS	0.015***	0.015***	0.001	0.001
	(4.85)	(4.87)	(0.61)	(0.61)
LEV	-0.020***	-0.020***	-0.011***	-0.011***
	(-3.90)	(-3.99)	(-2.78)	(-2.78)
NEWFIN	0.004**	0.004**	-0.001	-0.001
	(2.42)	(2.44)	(-0.71)	(-0.71)
ZSCORE	-0.033***	-0.033***	-0.012***	-0.012***
	(-7.50)	(-7.65)	(-6.21)	(-6.28)
CFOVOL	0.064***	0.064***	0.043***	0.043***
	(7.20)	(7.19)	(7.06)	(7.07)
SALEVOL	0.018***	0.018***	0.023***	0.023***
	(4.72)	(4.70)	(10.89)	(10.92)
BTM	-0.006***	-0.006***	-0.003***	-0.003***
	(-3.16)	(-3.24)	(-3.89)	(-3.95)
SGROWTH	0.020***	0.020***	0.001	0.001
	(5.97)	(5.97)	(1.33)	(1.32)
LNSEG	-0.001	-0.001	0.000	0.000
	(-0.64)	(-0.59)	(0.40)	(0.44)
TACC_L1	-0.032***	-0.032***	0.008**	0.008**
	(-4.41)	(-4.39)	(2.12)	(2.13)
Section C: Auditor-specific controls				
BIG4	-0.006**	-0.004	-0.003*	-0.003*
	(-2.22)	(-1.49)	(-1.94)	(-1.81)
INITIAL	0.001	0.001	0.001	0.001
	(0.15)	(0.16)	(0.91)	(0.93)
INDSPE	0.001	0.001	0.000	0.000
	(0.75)	(0.81)	(0.12)	(0.14)
OFSIZE	-0.000	-0.001	-0.000	-0.000
	(-0.56)	(-1.00)	(-0.55)	(-0.69)
Section D: MSA-level controls				

AUCONC	0.005	0.008	-0.013**	-0.012*
	(0.54)	(0.77)	(-2.20)	(-1.99)
DSECOF	-0.004*	-0.005**	-0.002	-0.002
	(-1.98)	(-2.22)	(-1.51)	(-1.50)
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	21,905	21,905	16,141	16,141
Adjusted R^2	0.162	0.162	0.305	0.305

Panel B. Subsample analyses with *ADACC*

Dep. variable =	*ADACC*			
Market segment =	Small and medium-sized client segment (*LSEG* = 0)		Large client segment (*LSEG* = 1)	
	(1)	(2)	(3)	(4)
RNAUD	0.012***		-0.002	
	(4.41)		(-0.55)	
RNAUD_B4		-0.005		0.000
		(-0.83)		(0.08)
RNAUD_NB4		0.010***		-0.001
		(5.28)		(-0.36)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	12,478	12,478	9,427	9,427
Adjusted R^2	0.151	0.151	0.151	0.151

Panel C. Subsample analyses with *AQ*

Dep. variable =	*AQ*			
Market segment =	Small and medium-sized client segment (*LSEG* = 0)		Large client segment (*LSEG* = 1)	
	(1)	(2)	(3)	(4)
RNAUD	0.006***		0.001	
	(4.79)		(0.92)	
RNAUD_B4		0.003		-0.001
		(0.79)		(-0.69)
RNAUD_NB4		0.004***		0.001
		(4.04)		(1.10)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	8,689	8,689	7,452	7,452
Adjusted R^2	0.275	0.275	0.247	0.247

This table presents the empirical results of testing H3a and H3b with ordinary least squares estimations using Eqs. (4) and (4a). Panel A presents the results for the full sample and Panels B and C present those for the subsamples based on client size. Columns (1) and (2) in Panel A and all columns in Panel B present

the results for *ADACC*. Columns (3) and (4) in Panel A and all columns in Panel C present the results for *AQ*. For Panels B and C, columns (1) and (2) present the results for the small and medium-sized client segment and columns (3) and (4) present the results for the large client segment. Numbers in parentheses represent *t*-statistics based on standard errors clustered by MSA. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed). See Appendix A for detailed variable definitions.

Table 6. Big 4 versus Non-Big 4 Auditors within the Small and Medium-Sized Client Segment

Panel A. Analysis of audit fees

Dep. variable =	*LNAFEE*			
Market segment =	Small and medium-sized client segment (*LSEG* = 0)			
Auditor type =	Big 4 auditors (*BIG* = 1)		Non-Big 4 auditors (*BIG* = 0)	
	(1)	(2)	(3)	(4)
RNAUD	-0.100***		-0.145**	
	(-3.16)		(-2.29)	
RNAUD_B4		0.150		0.134
		(1.42)		(1.36)
RNAUD_NB4		-0.096***		-0.138***
		(-3.52)		(-2.91)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	7,643	7,643	4,835	4,835
Adjusted R^2	0.784	0.785	0.780	0.782

Panel B. Analysis of audit quality

Dep. variable =	*ADACC*			
Market segment =	Small and medium-sized client segment (*LSEG* = 0)			
Auditor type =	Big 4 auditors (*BIG* = 1)		Non-Big 4 auditors (*BIG* = 0)	
	(1)	(2)	(3)	(4)
RNAUD	0.008***		0.013***	
	(3.25)		(2.88)	
RNAUD_B4		0.004		-0.006
		(0.72)		(-0.59)
RNAUD_NB4		0.007***		0.009***
		(3.56)		(3.09)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	7,643	7,643	4,835	4,835
Adjusted R^2	0.135	0.135	0.171	0.171

This table presents the empirical results of testing H2a and H3a for subsamples based on auditor type within the small and medium-sized client segment. Panels A and B present the results for audit fees and audit quality, respectively. For both panels, columns (1) and (2) present the results for clients of Big 4 auditors and columns (3) and (4) present the results for clients of non-Big 4 auditors. Numbers in parentheses represent *t*-statistics based on standard errors clustered by MSA. *** and ** indicate statistical significance at the 1% and 5% levels, respectively (two-tailed). See Appendix A for detailed variable definitions.

Table 7. Difference-in-Differences analysis

	H1 (Auditor switch)	H2 (Audit fees)	H3 (Audit quality)	
Dep. variable =	Pr[*SWITCH*=1]	*LNAFEE*	*ADACC*	*AQ*
	(1)	(2)	(3)	(4)
TREAT	0.003	0.005	-0.021*	-0.001
	(0.01)	(0.10)	(-1.77)	(-0.41)
*TREAT*POST*	-0.212	-0.081**	0.046***	0.005**
	(-0.63)	(-2.14)	(2.88)	(2.24)
POST	0.245	0.120*	-0.024	-0.018***
	(0.32)	(1.77)	(-1.31)	(-3.97)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	1,645	1,645	1,645	1,454
Pseudo/Adjusted R^2	0.171	0.842	0.215	0.273

This table presents the empirical results from the difference-in-differences analyses. The sample consists of client-years in the treatment MSAs with local supply shocks of audit service, and those in the control MSAs without such supply shocks. A supply shock of audit service in year *t* is defined if the number of auditors increases by more than 15% from year *t-1* to *t+1*. Given a supply shock of audit service in event year *t*, only client-year observations in years from *t-2* to *t+2* except event year *t* are included in the sample. Columns (1) and (2) present the results on auditor switch and audit fees, respectively. Columns (3) and (4) present the results on audit quality. Control variables in columns (1), (2), and (3) and (4) are identical to those in Eqs. (3), (4), and (5), respectively. Numbers in parentheses represent *z*-statistics or *t*-statistics based on standard errors clustered by MSA. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed). See Appendix A for detailed variable definitions.

Table 8. The Interaction Effect of the Number of Auditors and Spatial Competition

Dep. variable =	H2 (Audit fees)		H3 (Audit quality)			
	LNAFEE		*ADACC*		*AQ*	
	(1)	(2)	(3)	(4)	(5)	(6)
Section A: Test variables						
RNAUD	-0.104***		0.010***		0.005***	
	(-3.06)		(3.69)		(5.15)	
*RNAUD*APART*	0.098**		-0.009**		-0.004**	
	(2.22)		(-2.23)		(-2.17)	
RNAUD_B4		0.048		-0.002		-0.001
		(0.56)		(-0.40)		(-0.20)
*RNAUD_B4*APART*		0.015		-0.001		0.001
		(0.19)		(-0.25)		(0.32)
RNAUD_NB4		-0.084***		0.008***		0.004***
		(-3.07)		(3.69)		(4.52)
*RNAUD_NB4*APART*		0.059**		-0.005*		-0.003**
		(1.99)		(-1.97)		(-2.27)
APART	0.037**	0.030	-0.001	-0.000	0.001	0.001
	(2.10)	(1.59)	(-0.38)	(-0.04)	(0.76)	(0.97)
Section B: Tests of the sum of coefficients						
RNAUD						
*+ RNAUD*APART*	-0.006		0.001		0.001	
(*F*-statistic)	(0.02)		(0.14)		(0.27)	
RNAUD_B4						
*+ RNAUD_B4*APART*		0.063		-0.003		0.000
(*F*-statistic)		(0.084)		(0.52)		(0.00)
RNAUD_NB4						
*+ RNAUD_NB4*APART*		-0.025		0.003		0.001
(*F*-statistic)		(0.74)		(1.15)		(0.34)
Controls	Included	Included	Included	Included	Included	Included
Year FE	Included	Included	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included	Included	Included
Observations	21,905	21,905	21,905	21,905	16,141	16,141
Adjusted R^2	0.871	0.871	0.162	0.162	0.305	0.305

This table presents the empirical results of testing the interaction effect of spatial competition on H2a and H3a. Columns (1) and (2) present the results on audit fees using Eqs. (3) and (3a). Columns (3) to (6) present the results on audit quality using Eqs. (4) and (4a) where columns (3) and (4) present the results using *ADACC* and columns (5) and (6) present those using *AQ*. Numbers in parentheses in Section A (Section B) represent *t*-statistics (*F*-statistics) based on standard errors clustered by MSA. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively (two-tailed). See Appendix A for detailed variable definitions.

Table 9. Tests with Alternative Measures of Audit Quality
Panel A. Full distress sample analyses of GCO

Dep. variable =	Pr [*GCO* = 1]	
	(1)	(2)
Section A: Test variables		
RNAUD	-0.648***	
	(-2.96)	
RNAUD_B4		0.247
		(0.56)
RNAUD_NB4		-0.478**
		(-2.56)
Section B: Client-specific controls		
LNTA	-0.364***	-0.371***
	(-3.29)	(-3.37)
CFO	-2.066***	-2.060***
	(-3.60)	(-3.58)
LOSS_L1	0.190	0.189
	(0.81)	(0.80)
LEV	1.008*	1.018*
	(1.89)	(1.92)
CLEV	1.177	1.167
	(1.21)	(1.21)
INVEST	-2.108***	-2.114***
	(-4.67)	(-4.74)
ZSCORE	-3.877***	-3.859***
	(-4.96)	(-4.91)
NEWFIN	-0.077	-0.073
	(-0.40)	(-0.39)
CFOVOL	0.098	0.074
	(0.34)	(0.26)
SALEVOL	0.199	0.212
	(0.97)	(1.05)
RETVOL	3.643***	3.630***
	(5.33)	(5.32)
RETURN	-0.993***	-0.990***
	(-8.34)	(-8.42)
SGROWTH	-0.250**	-0.252**
	(-2.46)	(-2.46)
LNSEG	-0.131	-0.133
	(-0.85)	(-0.86)
REPORTLAG	0.044***	0.044***
	(7.85)	(7.74)
GCO_L1	2.689***	2.695***
	(11.62)	(11.45)
Section C: Auditor-specific controls		
BIG4	0.124	0.051
	(0.50)	(0.19)

INITIAL	0.457**	0.451**
	(2.08)	(2.07)
INDSPE	0.405**	0.374*
	(2.03)	(1.81)
OFSIZE	0.093**	0.119**
	(2.07)	(2.05)
Section D: MSA-level controls		
AUCONC	2.426**	2.501**
	(2.08)	(2.04)
DSECOF	0.049	0.104
	(0.37)	(0.69)
Year FE	Included	Included
Industry FE	Included	Included
Observations	10,896	10,896
Pseudo R^2	0.530	0.530

Panel B. Tests with restatements

Dep. variable =	**Pr [*RESTATE* = 1]**			
Sample period =	2010-2014		2003-2014	
	(1)	(2)	(3)	(4)
RNAUD	-0.312**		-0.095	
	(-2.00)		(-0.97)	
RNAUD_B4		0.222		0.201
		(0.84)		(1.26)
RNAUD_NB4		-0.220**		-0.100
		(-1.97)		(-1.40)
Controls	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Industry FE	Included	Included	Included	Included
Observations	9,727	9,727	26,024	26,024
Pseudo R^2	0.0755	0.0759	0.0672	0.0676

This table presents the empirical results of testing audit quality with alternative measures. Panel A presents the results when *GCO* is used as the dependent variable with distressed sample. Panel B presents the results when restatements are used as the dependent variable. Columns (1) and (2) present the results for the period from 2010 to 2014, and columns (3) and (4) present those for the period from 2003 to 2014. Control variables are included as in Ettredge et al. (2018). Numbers in parentheses represent *z*-statistics based on standard errors clustered by client. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively. See Appendix A for detailed variable definitions.