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ORIGINAL RESEARCH

Fee competition among Big 4 auditors and audit quality

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Abstract Both the GAO (Public accounting firms: mandated study on consolidation and competition. GAO, Washington, 2003; Audits of public companies: continued concentration in audit market for large public companies does not call for immediate action. GAO, Washington, 2008) and the US Treasury (Advisory committee on the auditing profession: final report, 2008. http://www.tres.gov/offices/domestic-finance/acap/docs/final-report.pdf) have implied that the Big 4 dominated US audit market lacks competition. More recently, the PCAOB has expressed a somewhat different concern, i.e., that because audit committees may be primarily interested in negotiating a lower audit fee (rather than championing higher audit quality) for their clients, fee competition in the US audit market could pressure the incumbent auditor to compromise on audit quality (Doty in Keynote address: the reliability, role and relevance of the audit: a turning point, 2011. www.pcaobus.org). We utilize the notion of counterfactual fees chargeable by auditors to assess fee competition and investigate competing views on the relation between fee competition among Big 4 auditors and audit quality in US local audit markets. To operationalize fee competition at the client-level in the context of each local audit market, we compute a separate counterfactual audit fee that would be charged by *every other* Big 4 auditor for that particular engagement and use the minima of the counterfactuals. We validate our audit fee competition metric by showing a positive relation with the incumbent auditor's switching risk. Collectively, our findings suggest that fee competition is useful as a mechanism for improving audit quality in the highly concentrated US audit market, albeit only in local audit markets where the incumbent auditor has below-median market power

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and only for higher quality clients. Overall, our findings speak to the interplay between fee competition and auditor incentives and are of potential interest to regulators such as the PCAOB concerned about competition in US audit markets.

Keywords Big 4 firms · Audit fee competition · Audit quality · PCAOB

JEL Classification M41 · M42

1 Introduction

Prior research on the Big 4 oligopoly in the US audit market has attempted to examine the relation between competition among Big 4 auditors in local audit markets and audit quality using the *inverse* of the Herfindahl market concentration index as a proxy for competition. However, these prior studies (Boone et al. 2012; Newton et al. 2013) report conflicting results. Moreover, other research suggests that oligopolistic markets can be competitive, i.e., supplier concentration does *not* imply lack of competition (Cabral 2017; Oster 1999; Scherer 1996; Sheth and Sisodia 2002). Hence, a potential explanation for the conflicting evidence on the relation between auditor concentration and audit quality is that concentration need not necessarily imply reduced competition. Although the Herfindahl index is a generally accepted metric of market concentration, to our knowledge there is no generally accepted measure of competition (Cabral 2017).

In this paper, we use the notion of counterfactual fees chargeable by auditors and develop a novel metric of fee competition at the client-level. We first validate our competition metric by showing that greater fee competition is associated with a higher likelihood of the client switching to another Big 4 auditor. We then utilize our competition metric to investigate competing views on the consequences of price competition among Big 4 auditors for Big 4 audit quality in US local audit markets.[1] In particular, we shed light on whether the relation between price competition and audit quality is impacted by the incumbent Big 4 auditor's market power and the quality of the client.

Specifically, we operationalize audit fee competition as the audit fee charged by the incumbent Big 4 auditor less the lowest projected (counterfactual) audit fee that would be charged by *any other* Big 4 auditor for that particular engagement, scaled by client total assets. The projected fee is based on cross-sectional audit fee regressions estimated by year, industry, and *each* Big 4 auditor, controlling for client-specific, auditor-specific and local audit market-specific factors.[2] For audit engagements that have a lower counterfactual fee from any other Big 4 auditor, the audit fee competition metric is positive, implying that the incumbent auditor faces fee competition. By contrast, for audit engagements that do not have a lower counterfactual fee, the audit fee competition metric is negative, implying that the incumbent faces no fee competition.

[1] We focus on the Big 4 firms because of their oligopolistic dominance of the highly concentrated US audit market and to avoid the confounding audit quality effects of Big 4 versus non-Big 4 auditors. Consistent with prior research, we use the terms "city," "local audit market" and "CBSA" (Core Based Statistical Area) interchangeably to vary the exposition. The US Office of Management and Budget defines CBSA as an area surrounding an urban center of "at least 10,000 people and adjacent areas that are socio-economically tied to the urban center by commuting."

[2] As noted by DeFond and Zhang (2014), audit fee models have very high explanatory power (R-squares) and, consequently, estimates derived from audit fee models are reliable. In our study, our fee estimation model R-squares range between 75 and 79%.

Our audit fee competition metric is *fundamentally different* from the notion of "abnormal" audit fees discussed in the prior literature (e.g., Asthana and Boone 2012; Chen et al. 2012; Doogar et al. 2015; Hribar et al. 2014; Kinney and Libby 2002), which is based on the excess of the actual audit fee charged by the incumbent auditor over the *incumbent's own* predicted fee for that client. Consistent with this fundamental difference, the pairwise correlation between our fee competition metric and abnormal audit fees as computed in prior studies is only about 0.02. Further, all our regressions control for audit fees, and disaggregating the audit fee into its normal and abnormal components does not alter our findings. That is, our results for our audit fee competition metric hold, indicating that our fee competition metric has incremental explanatory power over and above abnormal fees.

Our fee competition metric is also client-specific. Because clients are not homogenous, it would be reasonable for the incumbent Big 4 firm to face fee competition from another Big 4 auditor for some of its clients but *not* other clients in the same local audit market. Notably, this feature distinguishes our fee competition metric from prior studies using competition proxies that are either local audit market-specific or local industry-audit market-specific but not client-specific. Also in contrast to prior studies, we attempt to validate our competition construct by examining its relation to the incumbent auditor's switching risk and find a positive relation between our fee competition measure and switching risk, a finding which is intuitively appealing and supportive of the validity of our competition construct. We then utilize our competition measure to investigate the relation between price competition among Big 4 auditors and audit quality in US local audit markets.

Under the extant "client pays" model where companies hire and pay the auditor (and because audit quality is not observable except for the identity of the auditor), at least some audit committees could view the audit as a compliance function generating little more than a standardized report and focus on price rather than quality (Doty 2011).[3] This concern is reinforced by recent evidence indicating that CFOs exercise undue influence over the auditor hiring process by convincing the audit committee to negotiate for lower fees (Cohen et al. 2010; Beck and Mauldin 2014). Consequently, the incumbent Big 4 auditor may feel pressured by fee competition from another Big 4 auditor to lower (discount) the audit fee. In turn, the fee discount can cut the auditor's profit margins, possibly leading to lower audit effort (e.g., fewer "high quality" inputs such as partner or senior manager hours) and lower audit quality. Also, since client retention and renewal is a key profit driver for audit firms, the fee competition could induce the incumbent auditor to attempt to retain/please the client by becoming more acquiescent of the client's financial reporting demands. Further, in the presence of fee competition from another Big 4 auditor, at least some clients (albeit the lower quality ones) could attempt to negotiate with the incumbent Big 4 auditor *not* for lower fees but for *lower* audit quality.[4] In other words, an audit fee

[3] As reported in *Accounting Today,* the commoditization of the Big 4 audit is part of the motivation behind the rapid growth of nonaudit services, albeit to nonaudit clients, at the Big 4 firms from 48 to 62% of total revenues between 2004 and 2013. PCAOB Chairman Doty (2013) notes that within 10 years for these firms audit fees are likely to amount to less than 20% of total revenues.

[4] Cohen et al. (2010) suggest that CFOs, rather than audit committees, continue to hold power in the hiring of the auditor. Also, survey evidence of CFO beliefs suggests that earnings management is common and that approximately a fifth of public companies manage earnings in any given year (Dichev et al. 2013). Hence, it is not unreasonable to view at least some clients with a Big 4 auditor as reprobate or lower quality, i.e., as preferring a lower (rather than a higher) quality Big 4 audit. Relatedly, Doty (2013) notes that PCAOB inspections have identified and documented promises by auditors to clients to be their "trusted partner" and to support the client in obtaining a "desired outcome" in accounting matters. DeFond et al. (2000) report that in China higher audit quality is associated with loss of market share.

higher than that of the competition may reflect an independence-impairing payment to influence the incumbent Big 4 auditor to be more accommodative of the client's accounting transgressions (Kinney and Libby 2002). For these reasons, fee competition from another Big 4 auditor could be detrimental to audit quality.

There are two counter-arguments that militate against the incumbent Big 4 auditor compromising on audit quality in the face of audit fee competition from another Big 4 auditor. First, prior research (e.g., DeFond et al. 2002) suggests that market-based institutional incentives could be sufficient for the incumbent Big 4 auditor to maintain audit quality in the face of fee competition from another Big 4 auditor. Because of the threat of reputation loss, potential litigation, and the auditor's professional values and commitment to the independent watchdog function, the incumbent Big 4 auditor may refuse to compromise on the quality of the audit, even when pressured by audit fee competition to cut back on audit effort.

Second, economic theory suggests that competition is a *good* thing, i.e., competition among Big 4 auditors can spur efficiency (cost reduction) as well as product/service innovation and incentivize auditors to compete for clients (albeit the non-reprobate or higher quality clients) not just on the basis of price but also quality. This argument parallels the standard notion in market economies that self-interested agents take actions that result in better quality possibly at a lower price (Oster 1999; Scherer 1996). In other words, the incumbent Big 4 auditor could respond to audit fee competition from another Big 4 auditor by providing a higher quality audit for the extant (higher) fee such as by offering to assign its more senior/experienced personnel to the audit.[5] Consistent with this view, the higher fee may reflect greater value added by the incumbent due to greater audit effort in response to lower client accounting quality (Hribar et al. 2014), higher auditee demand for audit quality (Ball et al. 2012), the use of a richer labor mix (Bell et al. 2001, 2008; O'Keefe et al. 1994) or researcher-unobserved engagement-specific attributes (Doogar et al. 2015). For these reasons, the relation between Big 4 audit fee competition and audit quality remains an open empirical question.

We assess audit quality using four proxies employed by extant research (DeFond and Zhang 2014): discretionary accruals, the propensity to meet or beat earnings expectations, the likelihood of reporting a small profit, and the likelihood of issuing a going concern audit opinion. The use of these four individual proxies provides greater confidence on the validity and robustness of our findings.

Using data on U.S. local audit markets during 2005–2015, for positive values of the audit fee competition metric, we find that audit fee competition from another Big 4 auditor is *positively* related with the audit quality provided by the incumbent Big 4 auditor. In other words, we find that audit fee competition from any other Big 4 auditor elicits higher audit quality from the incumbent Big 4 auditor. Also, we find the increase to be economically significant (see Sect. 4.6). Further, these findings are resilient to a variety of sensitivity/robustness tests. By contrast, for *negative* values of our fee competition metric (i.e., where the incumbent has the lowest fee and thus faces *no* fee competition from any other Big 4 auditor), we find *no* relation between our fee competition metric and audit quality. Taken

[5] Our discussions with Big 4 auditors suggest that faced with audit fee competition from another Big 4 auditor, the incumbent may offer incentives that are often personnel related. In other words, given the high levels of staff turnover in public accounting, it can be frustrating for a client to have to answer the same questions repeatedly or otherwise "train" the auditor's staff year after year. Hence, an offer of personnel-related incentives (such as more senior/experienced personnel assigned to the audit) may be sufficient to ward-off a client bid process with little or no fee discount.

together, our findings are consistent with the notion that audit engagements facing more fee competition are associated with a *higher* quality audit.

Next, we investigate whether the fee competition-audit quality relation varies cross-sectionally with incumbent auditor incentives. Ceteris paribus, an incumbent auditor with *less* market power has a *greater* incentive to respond to audit fee competition by providing a higher quality service in an attempt at retaining the client. Thus, the positive impact of audit fee competition on audit quality is expected in local audit markets where the incumbent auditor has *less* market power. Consistent with our expectation, we find a positive relation between audit fee competition and audit quality *only* in local audit markets where the incumbent Big 4 auditor has less market power as represented by (1) a *below*-median market concentration (Herfindahl) index, (2) the incumbent *not* being an industry specialist, (3) the incumbent *not* being the local audit market leader, and (4) a *below*-median value for the Numan and Willekens (2012) spatial distance measure (i.e., the absolute difference between the local industry-audit market share of the incumbent Big 4 auditor and that of its closest competitor).

The incumbent Big 4 auditor's incentive to attempt to retain the client by providing a *higher* quality audit also depends on the quality of the client. Potentially, a reprobate or lower quality client (such as Enron) potentially could attempt to negotiate with the incumbent *not* for lower fees but for *lower* audit quality, i.e., attempt to use the current audit fee (i.e., a fee higher than that of the competition) as an independence-impairing payment (Kinney and Libby 2002). Thus, we expect an incumbent auditor to respond to audit fee competition by providing a higher quality service (in an attempt at retaining the client) only for higher quality clients. Using the predicted probability of misstatements based on the misstatement detection model of Dechow et al. (2011) and the relative power of the client's audit committee vis-à-vis the CFO (Beck and Mauldin 2014) as proxies for client quality, we find that the positive relation between audit fee competition and audit quality holds only for higher quality clients. Thus, our findings are consistent with auditor incentives, i.e., other things being equal, the higher the quality of the client, the higher the potential demand for audit quality, and the *greater* the incumbent's incentive to attempt to retain the client (in the face of fee competition from another Big 4 auditor) by providing a higher quality audit.

Our findings that audit fee competition is significantly associated with audit quality and has incremental explanatory power over and above the two competition proxies (i.e., the Herfindahl index and spatial distance) examined in prior research should be of substantial interest to academics and policy makers. Specifically, the Government Accountability Office (GAO) (2003, 2008) and the US Treasury (2008) have all implied that the Big 4 dominated US audit market lacks competition. More recently, the Public Company Accounting Oversight Board (PCAOB) has expressed a somewhat different concern, i.e., that because audit committees may be primarily interested in negotiating a lower audit fee (rather than championing higher audit quality) for their clients, price competition in the US audit market could pressure the incumbent auditor to compromise on audit quality (Doty 2011). Our findings suggest that audit fee competition is useful as a mechanism for improving audit quality in the highly concentrated US audit market, albeit only in local audit markets where the incumbent auditor has below-median market power and only for higher quality clients.

The rest of the paper is organized as follows: In the next section, we develop our hypothesis. Sections 3 and 4 discuss our models, sample selection process, and empirical test results. Section 5 provides concluding remarks.

2 Background and hypotheses development

2.1 Background

The audit market has evolved into separate tiers with the Big 4 firms dominating the audit market and, in particular, the audit market for large clients. In turn, Big 4 dominance has triggered regulatory concerns that market structure (i.e., the small number of large suppliers) is indicative of monopoly power (GAO 2003, 2008; US Treasury 2008). Under the so-called market concentration doctrine (Demsetz 1973; Goldschmeid et al. 1974), concentration per se is viewed as evidence of a serious lack of competition the argument being that it would be easier for a small number of firms that constitute the bulk of an industry's sales to collude in setting prices. Further, the resulting lack of competition may be expected to induce greater complacency, harm innovation and result (in the auditing context) in reduced auditor skepticism and greater leniency, thereby endangering audit quality.

Still, by most estimates, over half of all US industries today are oligopolies and have become more concentrated over time (Oster 1999; Scherer 1996; Sheth and Sisodia 2002). Further, Baumol et al. (1982) and Stiglitz (1987) suggest that competition can be intense even in highly concentrated markets with at least two suppliers. In the context of the audit market, empirical studies to date utilizing the Herfindahl index (a generally accepted measure of market concentration) report conflicting results on the relation between auditor concentration in US local audit markets and the quality of Big 4 audits (Boone et al. 2012; Newton et al. 2013). While these prior studies have examined Big 4 auditor concentration (potentially an invalid proxy for competition) at the local audit market level, we examine competition among Big 4 auditors at a more micro-level, i.e., on a client-by-client basis *within* each local audit market.

2.2 Hypothesis development

Although the auditor is hired and paid by the client, the auditor is required to be independent, i.e., the auditor is expected to play the role of an independent watchdog and ensure that the client reports truthfully. Moreover, in preparing the financial statements, Generally Accepted Accounting Principles (GAAP) permits the client's self-interested managers considerable discretion in the form of measurement choices, judgments, and assumptions about future outcomes. These client-prepared financial reports are then audited to limit bias and otherwise reduce the risk of corporate misconduct (Kinney 2005).

Separately, although Big 4 auditor–client relations are long lasting, they are not permanent, i.e., the switching risk for Big 4 auditors is greater than zero. Given that auditors incur large learning costs in engaging a new audit client and the fact that audits become less costly as the auditor gains knowledge and experience with the client, audit renewals are a key profit driver for audit firms. Hence, other things being equal, audit fee competition from another Big 4 auditor could pressure the incumbent Big 4 auditor to compromise on audit quality to retain the client.

Further, because audit quality is not observable except for the identity of the auditor, Beasley et al. (2009) suggest that audit committees may view a Big 4 audit as a commodity with little or no variation in audit quality across the four firms, i.e., as no more than a standardized audit report issued by a Big 4 auditor. Along the same lines, Doty (2011, 2013) suggests that although SOX moved the responsibility of hiring and oversight

of the auditor from company management to the audit committee, in practice it may be insufficient to ensure auditor independence, i.e., audit committees may continue to view the audit as no more than a required compliance function best obtained at the lowest price (audit fee). Also, Beck and Mauldin (2014) and Cohen et al. (2010) suggest that self-interested company managers (CFOs), not audit committees, continue to wield power in auditor hiring decisions. Consequently, audit fee competition may pressure the incumbent Big 4 auditor to adopt a more "negotiation" mentality, i.e., influence the incumbent auditor to become less objective, less skeptical, and thus more acquiescent of the client's reporting demands in order to please the client.

Relatedly, the quality of an audit—beyond the Big 4 (or non-Big 4) identity of the auditor—is not directly observable by external parties such as users of the financial statements.[6] Consequently, to the extent that some companies view the audit as no more than a required compliance function, they may see opportunity in audit fee competition from another Big 4 auditor, i.e., they may attempt to negotiate with the incumbent Big 4 auditor for *lower* audit quality. In other words, these (albeit reprobate or lower quality) clients such as Enron may seek to utilize the current higher audit fee as a stealth payment in an attempt at influencing the incumbent Big 4 auditor to be more tolerant of the client's accounting transgressions (Kinney and Libby 2002). For these reasons, audit fee competition from another Big 4 auditor could be associated with a lower quality audit from the incumbent Big 4 auditor.

However, there are two counter-arguments that militate against the incumbent Big 4 auditor compromising on audit quality in the face of audit fee competition from another Big 4 auditor. First, Big 4 auditors—by virtue of their "deep pockets" and large fixed investments in brand name reputations—face significant litigation costs and reputation losses if their clients receive lower quality audits (DeFond et al. 2002). In particular, economic theory (e.g., Klein and Leffler 1981) suggests that damage to reputation can result in significant economic losses reflecting decreased demand for the firm's audit services—in the form of increased auditor switching risk and/or lower audit fees from continuing clients—and that it is the threat of these losses that provides Big 4 auditors the necessary economic incentive to maintain their brand name service quality.

Second, audit fee competition can incentivize auditors to become more efficient (i.e., lower their costs) as well as improve product/service quality. This is no more than the standard argument for the notion that although market agents are motivated by self-interest, in market economies these agents generally take actions that benefit society as a whole (Oster 1999; Scherer 1996). Put differently, the incumbent Big 4 auditor could respond to audit fee competition from another Big 4 auditor by providing a higher quality audit for the extant (higher) fee, i.e., by attempting to compete on quality rather than price. In other words, for non-reprobate clients, the auditor may offer to assign more senior/experienced personnel to ward-off a client bid process with little or no fee discounting and also improve the quality of the audit.[7]

[6] "If we want the audit profession to compete on quality more than price, we've got to provide markets more information about the audit," Doty (2013, p. 9). Proposed PCAOB initiatives such as a more explanatory audit report (opinion), identifying the engagement partner on an audit, disclosure of other firms participating in the audit are all intended to help investors better judge audit quality.

[7] As noted previously (fn. 4), the incumbent Big 4 auditor may offer to assign its "A-team" (i.e., its more senior and experienced personnel) to the client's audit. Given the high levels of staff turnover in public accounting, it can be frustrating for a client to have to answer the same questions repeatedly or otherwise "train" the auditor's staff year after year. Hence, an offer of personnel-related incentives may be sufficient to ward-off a client bid process.

For these reasons, the relation between audit fee competition and audit quality remains an open empirical question. Our hypothesis, stated in the null form, is as follows:

H1 In US local audit markets (on a client-by-client basis), there is no relation between audit fee competition from any other Big 4 auditor and the audit quality of the incumbent Big 4 auditor.

3 Research design and sample

3.1 Audit fee competition (AFCOMP) variable

We define our audit fee competition variable (AFCOMP) as the incumbent Big 4 firm's actual audit fee less the lowest projected audit fee from another Big 4 firm (which may or may not have an office in the local audit market), deflated by the client's total assets. The projected fee is based on cross-sectional audit fee regressions estimated by year, industry, and each Big 4 auditor, controlling for client-specific, local audit office-specific, and local audit market-specific factors.[8] Additional details about the computation of AFCOMP are presented in Appendix 1. Also, the variables used in the computation of AFCOMP (as well as our other analyses) are defined in Appendix 2.

Note that audit fee competition is present only for positive values of AFCOMP, i.e., where there is another Big 4 auditor with a counterfactual fee that is lower than that of the incumbent for the particular audit engagement. By contrast, for negative values of AFCOMP, the incumbent Big 4 auditor is the one with the lowest fee for that particular engagement and, by definition, does not face fee competition. We set AFCOMP_POS = AFCOMP if AFCOMP > 0, and 0 otherwise; and, AFCOMP_NEG = AFCOMP if AFCOMP < 0, and 0 otherwise.

Next, we examine the construct validity of our fee competition metric by linking our fee competition metrics, AFCOMP_POS and AFCOMP_NEG, in the current period (t) to auditor switching risk in the next period (t + 1). We expect AFCOMP_POS to be positively related to the switching risk faced by the incumbent Big 4 auditor in the next period.

For this analysis, we use the auditor switching risk model in Boone et al. (2015, Table 5, p. 427). The dependent variable SWITCH is defined as equal to 1 if the client changed auditors between current period (t) and next period (t + 1). Differencing across periods (t, t + 1) for SWITCH and (t − 1, t) for ΔLEV (change in LEV from prior year) and ΔLSIZE (change in LSIZE from prior year) and the requirement that data be available for three contiguous years yields a sample of 9364 observations. The results are presented in Table 1. The coefficient on AFCOMP_POS is positive and significant (24.4985; $p = 0.0398$), suggesting that higher values of AFCOMP_POS in period (t) are associated with an increase in switching risk in period (t + 1). By contrast, AFCOMP_NEG is not

[8] Prior research (e.g., Banker et al. 2003) on the audit industry production function pools data at the *national* level for both Big 4 and non-Big 4 audit firms, i.e., implicitly assumes that the production function is the same for all (Big 4 as well as non-Big 4) audit firms. By contrast, we examine the audit fee model for *each* Big 4 firm separately for *each* year over our study period (2005–2015). Put differently, we add to the degrees of freedom in our estimation of AFCOMP by allowing the fee models (Appendices 1 and 3) to be different for each Big 4 firm each year. The significant differences in the coefficients of the annual regressions for the Big 4 firms (reported in Appendix 1) justify this modeling choice consistent with the reasonable notion that these audit firms are not homogenous and that pricing models can vary by audit firm.

Table 1 Audit fee competition and auditor switching risk

	Dependent variable = SWITCH					
	Full sample		Partition of AFCOMP_POS (non-zero values only)			
			Below median		Above median	
	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value
Intercept	2.4583***	< 0.0001	2.2072***	0.0005	2.0085***	0.0003
Test variables						
AFCOMP_POS	24.4985**	0.0398				
AFCOMP_NEG	0.0062	0.4989				
AFCOMP_POS			57.9058	0.2271	38.9310***	0.0040
Control variables						
GROWTH	0.0122	0.9291	0.3762	0.2347	− 0.1611	0.4529
ABSDACC	0.6046*	0.0929	1.5810*	0.0608	0.6776	0.2345
INVREC	0.3412	0.2019	0.0999	0.8536	0.8454*	0.0520
GCOPN	0.9974***	0.0018	1.6226	0.1437	0.8244**	0.0462
MODOP	0.2837**	0.0328	0.0035	0.9892	0.4554**	0.0406
TENURE	− 0.0386***	< 0.0001	− 0.0275***	0.0032	− 0.0498***	< 0.0001
ROA	− 0.4149	0.4087	− 0.8648	0.4339	− 0.3375	0.6594
LOSS	0.1694	0.2170	0.2432	0.4134	0.0465	0.8256
LEV	1.0919***	< 0.0001	0.7435	0.1083	1.3945***	0.0026
ΔLEV	− 0.4564	0.2060	0.3146	0.6799	− 0.5236	0.3510
CASH	0.6287	0.1986	0.2304	0.8419	0.6937	0.3475
MISMATCH	0.0282	0.7365	0.1660	0.2871	− 0.0876	0.5354
LSIZE	− 0.1146***	0.0001	− 0.0738	0.1935	− 0.1325**	0.0383
ΔLSIZE	− 0.0231	0.7574	− 0.3057	0.1384	0.1207	0.2498
ACQUIRE	− 0.0338	0.7462	− 0.0598	0.7442	0.0282	0.8760
Observations	9364		3096		3096	
Pseudo R^2	0.4742		0.4970		0.4439	
Wald χ^2	2038.9547		651.5148		632.3907	
Probability > χ^2	< 0.0001		< 0.0001		< 0.0001	
% concordant	88.3%		89.6%		87.5%	

The dependent variable SWITCH is equal to 1 if the client changed auditors between current period (t) and next period (t + 1), and 0 otherwise. All explanatory variables are measured in current period (t). Control variables GCOPN, MODOP, TENURE, ROA, LEV, LSIZE and ACQUIRE are as defined previously in Appendix 1. Additional control variables (from Boone et al. 2015) are ΔLEV (change in LEV from prior year), ΔLSIZE (change in LSIZE from prior year), GROWTH (the percentage change in total assets), ABSDACC (the absolute value of DACC defined previously), INVREC (inventory plus receivables deflated by total assets), LOSS = 1 if ROA < 0 (and 0 otherwise), CASH (total cash divided by total assets), MISMATCH = 1 if the Shu (2000) methodology identifies a client/Big 4 incumbent auditor mismatch (and 0 otherwise). ***, **, * imply significance at 1, 5, 10% level (one-tailed for test variables; 2-tailed for control variables). Standard errors are corrected for clustering and heteroskedasticity by year and industry. Year and industry dummy variables are included but not reported for the sake of brevity

significant in Table 1 (0.0062; $p = 0.4989$), indicating (as one might expect) that the absence of fee competition has no impact on switching risk.

It is pertinent to note that auditor switching risk is moderated by the client's auditor switching costs. Dismissing the incumbent auditor can be costly to the client in terms of additional managerial effort and time. Specifically, the client is likely to face substantial switching costs such as having to invite bids, negotiate with the new possible Big 4 auditor, bring the new Big 4 auditor up to speed on the audit by assigning additional company staff to "train" the audit team and answer various questions about the client. In other words, other things being equal, the switching risk is unlikely to be different from zero until a threshold point is reached where the estimated gains from lower audit fees outweigh the switching costs.

To our knowledge, prior research does not provide an estimate of the magnitude of auditor switching costs. In our study, AFCOMP_POS captures the gains to the client from lower audit fees (scaled by client size) following an auditor switch and would need to exceed the client's switching costs for the switching risk to rise significantly above zero. Put differently, the relation between AFCOMP in period (t) and the switching risk in period (t + 1) is likely nonlinear. To investigate this possibility, we start with only non-zero values of AFCOMP_POS (6192 observations) and partition the sample at the median value. Next, we run the switching risk regression separately for each partition. AFCOMP_POS has a significantly positive effect on SWITCH only in the above median subset (38.9310; $p = 0.0040$). These results suggest that switching risk remains at zero until AFCOMP attains a threshold value. Collectively, our findings are supportive of the validity of our AFCOMP_POS metric as a fee competition construct in the Big 4 audit market.

3.2 Test of hypothesis 1

To test our Hypothesis 1, we utilize the piece-wise (segmented) regression model below:

$$\text{Audit Quality} = \beta_0 + \beta_{1A}\text{AFCOMP\_POS} + \beta_{1B}\text{AFCOMP\_NEG} + \sum \beta_2 \text{Controls} + error \quad (1)$$

where all variables are defined in Appendix 2. The test variables AFCOMP_POS and AFCOMP_NEG were discussed previously, the dependent and control variables are discussed below.

3.2.1 Audit quality proxies

DeFond and Zhang (2014, p. 276) define higher audit quality as "greater assurance that the financial statements faithfully reflect the firm's underlying economics, conditioned on its financial reporting system and innate characteristics." As discussed below, we use their framework and utilize output-based audit quality proxies that are both relatively more direct (such as, going concern opinions) as well as relatively less direct (i.e., financial reporting quality measures such as discretionary accruals, meet/beat analyst forecasts, and small profit). Since the pre-audit financial reports are prepared by the client and subsequently opined upon by the auditor, the audited financial statements are viewed as a joint product (negotiated outcome) of the manager and the auditor (Dye 1991; Magee and Tseng 1990). Further, because an important role of the audit is to constrain opportunistic earnings management by the client, higher earnings quality is viewed as a consequence of higher

audit quality, i.e., audit quality is expected to map closely with reporting/earnings quality (Francis et al. 2013). Further, Francis and Michas (2013) argue that cross-sectional differences in the statistical properties of audited earnings are the outcome of the differences in the underlying quality of the audit. Consistent with prior studies (Gul et al. 2009; Krishnan et al. 2011; Lennox and Li 2012; Michas 2011; Prawitt et al. 2009), we use earnings/reporting quality as a proxy for audit quality. However, as pointed out by DeFond and Zhang (2014), since the auditor's influence on reporting quality is likely to be relatively limited, earnings quality measures are less direct than going concern opinions as proxies for audit quality. On the other hand, an advantage of reporting/earnings quality measures is that they capture "within GAAP" earnings manipulations and are therefore able to capture variations in audit quality on a continuum. Below, we discuss our proxies for audit quality in detail.

3.2.1.1 Discretionary accruals We estimate discretionary accruals (DACC) using the performance adjusted modified Jones (1991) model as proposed by DeFond and Jiambalvo (1994) and Kothari et al. (2005). In the model, total accruals (TACC) are regressed on the difference between change in revenue and change in receivables, gross property, plant, and equipment, and return on assets. The model used for the estimation is:

$$TACC/A_{t-1} = \beta_0[1/A_{t-1}] + \beta_1[(\Delta REV - \Delta REC)/A_{t-1}] + \beta_2[PPE/A_{t-1}] + \beta_3 ROA + \varepsilon \quad (2)$$

where TACC is the total accruals in year t; ΔREV is the change in sales from period t − 1 to t; ΔREC is the change in account receivables from period t − 1 to t; PPE is the gross property, plant, and equipment and ROA is the return on assets. All the variables (with the exception of ROA) are deflated by lagged total assets (A_{t-1}). Following Hribar and Collins (2002), we use the difference between net income and cash from operations, deflated by lagged assets as our measure of total accruals. The residual (ε) from model (2) is the estimated discretionary accrual (DACC). Other things being equal, the higher the discretionary accruals (DACC), the lower the reporting/earnings quality and implied audit quality. Following prior research (Ashbaugh et al. 2003; Francis and Yu 2009; Ruddock et al. 2006), we examine signed (rather than absolute) discretionary accruals since absolute discretionary accruals effectively treat upwards and downwards earnings management as symmetric when they are in fact asymmetric, i.e., in the litigious US environment, Big 4 auditors are more likely to constrain income-increasing rather than income-decreasing accruals.

3.2.1.2 Propensity to meet or beat earnings expectations MBEX is defined as a dichotomous variable equal to 1 if the client meets or beats the earnings expectation (proxied by the most recent median consensus analyst forecast available on IBES) by one cent or less; and 0 otherwise. Prior research suggests that just meeting or beating the earnings expectation is motivated by the client's need to support the stock price by avoiding an earnings disappointment and is indicative of earnings management. Other things being equal, the higher the propensity to meet or beat the earnings expectation, the lower the reporting/earnings quality and implied audit quality.

3.2.1.3 Propensity to report a small profit PROFIT is defined as a dichotomous variable equal to 1 if the net income before extraordinary items and cumulative effect of accounting changes deflated by lagged total assets is between 0 and 5%; 0 otherwise. Once again, prior

research (e.g., Francis and Yu 2009) suggests that reporting a small profit is consistent with earnings management, i.e., represents an attempt by the client at supporting the stock price by reporting a profit (albeit a small one) rather than reporting a loss. Other things being equal, the higher the client's propensity to report a small profit, the lower the reporting/earnings quality and implied audit quality.

3.2.1.4 Propensity to issue a going concern opinion GCOPN is defined as a dichotomous variable equal to 1 if the client receives a going concern opinion in the current year; 0 otherwise. DeFond and Zhang (2014) consider going concern opinions a "very direct measure" of audit quality since the audit opinion is the responsibility of the auditor and is directly under his/her control (p. 287). Further, since clients are normally strongly opposed to receiving a going concern qualification (because of its self-fulfilling nature), the auditor's propensity to issue such an opinion is viewed as indicative of the auditor's independence and has been used extensively in extant research (e.g., Francis and Yu 2009; Hope and Langli 2010; Kaplan and Williams 2013; Lennox and Li 2012). Also, Myers et al. (2014) report that the accuracy of going concern reporting has improved after SOX. Other things being equal, the higher the auditor's propensity to issue a going concern opinion, the higher the quality of the audit.

Model (1) is estimated as an ordinary least squares model for DACC as the dependent variable. The other three dependent variables MBEX, PROFIT and GCOPN are dichotomous variables, and model (1) is estimated as a logistic model.

3.2.2 Control variables

The control variables in model (1) are defined in Appendix 2 and discussed briefly below. Variable LSIZE controls for any size-related effects, such as the information environment and visibility costs (Ashbaugh et al. 2003; Geiger and North 2006; Menon and Williams 2004). ROA and EGROWTH capture the effect of client profitability on audit quality. CFFO controls for the effect of cash flow from operations as opposed to accrual-basis earnings (Chung and Kallapur 2003; Frankel et al. 2002). B2M is included to control for the effect of growth opportunities on audit quality (Ashbaugh et al. 2003; Butler et al. 2004; Geiger and North 2006). LEV, CASSET, INVRATIO, SEGMENTS, FOPS, ACQUIRE, FINANCE, REL_AC_CFO[9] and FSCORE are included to control for workload, complexity, and risk of the audit engagement (Asthana 2017; Asthana et al. 2015; Beck and Mauldin 2014; Choi et al. 2010; Dechow et al. 2011; Higgs and Skantz 2006). DeFond and Zhang (2014) argue that financial reporting quality is expected to be lower for clients with difficult to measure innate characteristics. We include PINTAN, LNUMEST, STDEST and ICMW as proxies for client innate characteristics. Hribar and Nichols (2007) show that audit quality may be related to client-specific operating characteristics as measured by SDEARN, SDCFFO, and SDSALE. Also, variables TENURE (Asthana and Boone 2012), INDSP (Balsam et al. 2003; Jaggi et al. 2015), LOFFICE (Francis and Yu 2009), LDELAY (Asthana 2017, Asthana et al. 2015), and LAFEE, LNAFEE, MODOP, ICMW (Jaggi et al. 2015) and BUSY (Doyle et al. 2007) are controls for auditor-related characteristics from prior research. Finally, HERF, INDSP, DISTANCE and LEADER are controls for the local audit market competition proxies used in prior research.

[9] We are grateful to Elaine Mauldin for sharing the audit committee related data.

Table 2 Sample selection procedure

Sampling step	Client-year observations
Data available on audit analytics for the period 2005–2015	49,051
Data also available on Compustat and IBES	37,907
Client has positive book value	30,831
Client is incorporated in the US	26,414
Client's auditor is located in the US	25,992
Client has a Big 4 auditor	20,533
Complete information for all variables used in the analysis is available	17,436
Client is not in the finance, insurance, real estate, transportation, communication or utility industry	13,282
Client did *not* switch auditors during current fiscal year	12,618

The 12,618 client-year observations pertain to 1769 unique clients

3.3 Sample selection

The sample selection procedure is discussed in Table 2. We start with 49,051 observations available on the Audit Analytics database during the period 2005–2015. We start in 2005 since the ICMW variable was first reported in this year for all clients. Merging these observations with Compustat and IBES databases results in 37,907 observations. Additional requirements result in further reduction in sample size as follows: positive client book-values (30,831), US incorporation (26,614), US-based auditor (25,992), Big 4 auditor (20,533), data availability on variables in our model (17,436), and client not in the financial, insurance, real estate, transportation, communication or utility industries (13,282). Finally, excluding clients that switched auditors in the current fiscal year yields the final sample of 12,618 client-year observations for 1769 unique clients for the 2005–2015 period.

4 Empirical results

4.1 Descriptive statistics

Descriptive statistics for the variables used in our study are presented in Panel A of Table 3.[10] The mean DACC is − 0.0056 and the median is − 0.0018. Over 9% of clients are able to meet or beat earnings expectations, 13% report a small profit and less than 1% report a going-concern opinion. The test variables AFCOMP_POS and AFCOMP_NEG, which are deflated by total assets, have a mean (median) of 0.0010 (0.0002) and − 0.0010 (0.0000), respectively. Also, for the clients in our sample, intangible assets (PINTAN) are 19% of the total assets. On average, our clients are followed by 4 analysts and have been with the same auditor for an average of over 17 years. Almost 38% of our sample clients

[10] All variables are winsorized in the (1, 99%) range. To avoid sample attrition, mean values for the industry-year are used for missing control variables. Exclusion of client-years with such missing data does not change conclusions.

Table 3 Descriptive statistics and sample distribution by industry and by auditor (n = 12,618)

Variables	Mean	Median	Std. Dev.	Quartile I	Quartile III
Panel A: Variable distribution					
Dependent variables					
DACC	− 0.0056	− 0.0018	0.1099	− 0.0397	0.0349
MBEX	0.0947	0.0000	0.2988	0.0000	0.0000
PROFIT	0.1329	0.0000	0.3395	0.0000	0.0000
GCOPN	0.0096	0.0000	0.0975	0.0000	0.0000
Test variables					
AFCOMP_POS	0.0010	0.0002	0.0251	0.0000	0.0009
AFCOMP_NEG	− 0.0010	0.0000	0.0154	− 0.0001	0.0000
Client-specific control variables					
LSIZE	6.9930	6.8618	1.7846	5.7057	8.1103
ROA	0.0206	0.0331	0.1418	0.0137	0.0762
EGROWTH	− 0.1328	0.0244	4.9643	− 0.5104	0.3698
CFFO	0.0798	0.0943	0.1273	0.0539	0.1278
B2M	0.5146	0.4173	0.4141	0.2514	0.6606
LEV	0.1888	0.1609	0.1774	0.0111	0.3006
CASSET	0.5033	0.4972	0.2374	0.3330	0.6804
INVRATIO	0.1176	0.0872	0.1262	0.0093	0.1751
SEGMENTS	4.9971	4.0000	3.6273	3.0000	7.0000
FOPS	0.2276	0.0079	0.3257	0.0000	0.4018
ACQUIRE	0.2041	0.0000	0.4031	0.0000	0.0000
FINANCE	0.3119	0.0000	0.4633	0.0000	1.0000
PINTAN	0.1924	0.1328	0.1951	0.0229	0.3114
REL_AC_CFO	− 0.0071	0.0000	1.4365	− 1.0000	1.0000
FSCORE	0.9478	0.8423	0.9654	0.4562	1.2753
SDEARN	0.0792	0.0671	0.0783	0.0294	0.0779
SDCFFO	0.0683	0.0609	0.0576	0.0358	0.0699
SDSALE	0.0790	0.0799	0.0736	0.0005	0.1055
Auditor-specific control variables					
TENURE	17.8644	17.0000	7.6375	12.0000	21.0000
INDSP	0.3776	0.2441	0.4328	0.0000	1.0000
LOFFICE	17.2709	17.4407	1.2559	16.0059	18.0501
LDELAY	4.1083	4.00953	0.2305	4.010	4.3055
LAFEE	14.2501	14.1552	1.0289	14.0031	15.0110
LNAFEE	12.2590	12.3220	1.6901	11.3011	13.4101
MODOP	0.3397	0.0000	0.4423	0.0000	0.0000
ICMW	0.3296	0.0000	1.0540	0.0000	0.0000
BUSY	0.6656	1.0000	0.4718	0.0000	1.0000
Audit market-specific control variables					
HERF	0.3871	0.2995	0.2181	0.2610	0.4011
DISTANCE	0.1820	0.0675	0.2819	0.0279	0.1534
LEADER	0.4247	0.0000	0.4943	0.0000	1.0000

Table 3 continued

Variables	Mean	Median	Std. Dev.	Quartile I	Quartile III
Information environment-specific control variables					
LNUMEST	1.3863	1.9459	0.8554	1.3863	2.4849
STDEST	0.0594	0.0300	0.1192	0.0106	0.0601

One-digit SIC	Industry	Compustat distribution (%)	Sample distribution (%)	No. of observations
Panel B: Sample distribution across industries				
0	Agriculture, Forestry, and Fisheries	0.67	0.40	51
1	Mineral and Construction Industries	9.71	5.85	738
2	Manufacturing	21.84	23.80	3003
3	Manufacturing	33.02	35.28	4452
4	Transportation, Communication and Utilities[a]	0.00	0.00	0
5	Wholesale and Retail Trade	11.21	14.27	1801
6	Finance, Insurance, and Real Estate[a]	0.00	0.00	0
7	Service Industries	16.98	16.90	2133
8	Service Industries	4.68	3.11	392
9	Public Administration	1.88	0.38	48
	Total	100	100	12,618

Auditor	No. of offices	Client-year observations	Unique clients
Panel C: Sample distribution by auditor			
Deloitte	62	2611	409
EY	74	4062	606
KPMG	72	2701	350
PWC	64	3244	404
Total	272	12,618	1769

See Appendix 2 for variable definitions

[a]These industries are excluded from the final sample

are audited by industry experts. Mean ICMW is 0.3296, indicating that for our sample observations the average number of material internal control weaknesses is less than one.

Panel B of Table 3 presents information about the distribution of our sample across industries. Overall, the industry distribution is close to that of the Compustat population: manufacturing has over 50% of the observations and the service industry over 20%, while the agriculture, forestry and fisheries industry and the public administration industry have the lowest share with under 1% of our sample observations. Panel C indicates that the Big 4 firms in our sample have 272 offices in local audit markets in the US, with EY having the most number of local audit offices and unique clients and Deloitte having the least.

4.2 Pairwise correlations

In Table 4, we present the Pearson correlation coefficients for the variables in our analyses. For brevity, we report only the correlation coefficients for the test variables

Table 4 Pearson pairwise correlations (n = 12,618)

Variables	AFCOMP_POS	AFCOMP_NEG	DACC	MBEX	PROFIT	GCOPN
AFCOMP_POS			− 0.0236***	− 0.0695***	− 0.0259***	0.2155***
AFCOMP_NEG			0.0028	0.0112	− 0.0285	− 0.0050
LSIZE	− 0.1952***	0.0287***	0.0139	− 0.0862***	0.0236***	− 0.1529***
ROA	− 0.0252***	0.0225**	0.1037***	0.0912***	− 0.0180**	− 0.2284***
EGROWTH	− 0.0017	− 0.0086	− 0.0095	0.0087	− 0.0330***	0.0096
CFFO	− 0.0261***	0.0162*	− 0.2362***	0.1035***	− 0.0208**	− 0.2413***
B2M	− 0.0384***	− 0.0254***	0.0629***	− 0.1464***	0.1299***	0.0260***
LEV	− 0.1382***	− 0.0091	0.0500***	− 0.0525***	0.0999***	− 0.0135
CASSET	0.1347***	0.0095	− 0.0383***	− 0.0206**	− 0.0951***	0.0542***
INVRATIO	− 0.0866***	0.0277***	0.0618***	− 0.0525***	− 0.0189**	− 0.0278***
SEGMENTS	− 0.1289***	− 0.0003	0.0455***	0.0015	0.0303***	− 0.0703***
FOPS	− 0.0971***	0.0118	0.0236***	0.0504***	0.0787***	− 0.0540***
ACQUIRE	− 0.0471***	− 0.0025	− 0.0166*	0.0376***	0.0204**	− 0.0276***
FINANCE	0.0619***	0.0124	− 0.0177**	− 0.0310***	− 0.0075	0.0689***
PINTAN	− 0.1030***	− 0.0098	− 0.0019	0.1370***	0.0179**	− 0.0362***
REL_AC_CFO	0.0104	0.0009	0.0107	− 0.0240***	0.0278***	0.0107
FSCORE	0.0042	0.0068	0.0223**	0.0311***	− 0.0096	− 0.0270***
SDEARN	0.2062***	− 0.0272***	0.0104	− 0.0597***	− 0.0076	0.0861***
SDCFFO	0.2139***	− 0.0139	0.0341***	− 0.0707***	− 0.0293***	0.1351***
SDSALE	0.1003***	− 0.0121	− 0.0080	0.0016	0.0337***	0.0490***
TENURE	− 0.0597***	0.0126	0.0243***	0.0395***	− 0.0523***	− 0.0095
INDSP	− 0.0316***	0.0028	0.0029	0.0319	− 0.0130	− 0.0001
LOFFICE	− 0.0100	0.0139	0.0007	0.0278	− 0.0010	− 0.0193**
LDELAY	0.1807***	− 0.0216**	− 0.0016	− 0.0933***	0.0336***	0.1063***
LAFEE	0.1162***	0.0324*	0.0127	0.0714***	0.0232***	− 0.1011***
LNAFEE	− 0.1956***	0.0128	0.0117	0.0607***	0.0139	− 0.0864***

Table 4 continued

Variables	AFCOMP_POS	AFCOMP_NEG	DACC	MBEX	PROFIT	GCOPN
MODOP	0.0166*	− 0.0216**	0.0019	− 0.0046	− 0.0132	0.0722***
ICMW	0.1028***	− 0.0064	0.0066	− 0.0207**	0.0233***	0.0253***
BUSY	0.0444***	− 0.0198**	− 0.0045	− 0.0278***	0.0228**	0.0232***
HERF	0.0479***	− 0.0152*	− 0.0259***	0.0326***	− 0.0201**	0.0057
DISTANCE	0.0435***	− 0.0165*	− 0.0235***	0.0336***	− 0.0161*	0.0061
LEADER	0.0053	0.0079	− 0.0049	− 0.0158*	− 0.0054	0.0125
LNUMEST	− 0.2054***	0.0111	− 0.0567***	0.1625***	− 0.0539***	− 0.0966***
STDEST	0.0788***	− 0.0074	− 0.0373***	− 0.1922***	0.0022	0.0738***

See Appendix 2 for variable definitions. ***, **, * imply two-tailed significance at 1, 5, 10% level

(AFCOMP_POS and AFCOMP_NEG) and for the four dependent variables (DACC, MBEX, PROFIT and GCOPN) with the control variables.[11] A high correlation coefficient between the test variables (AFCOMP_POS and AFCOMP_NEG) and any of our 32 control variables could be problematic since it would suggest multicollinearity. As reported in Table 4, out of the 32 correlation coefficients, the correlations of AFCOMP_POS with 27 and AFCOMP_NEG with 12 of our control variables are significant at 10% level or better. However, the largest magnitude of the pairwise correlations is under 0.22, which suggests that multicollinearity is unlikely to be an issue in interpreting our regression results. Later, when we discuss the regression results, we report the variance inflation factors (VIFs) which also suggest that collinearity is not a significant issue in interpreting our findings.

Also in Table 4, AFCOMP_POS is significantly correlated with all 4 dependent variables (audit quality proxies), namely DACC, MBEX, PROFIT and GCOPN. However, these are pairwise correlations and do not take into account the effect of the control variables in our model on the relation between test variables and the dependent variables (these results are discussed later in the paper in the context of our multivariate regressions). For completeness, we also note that our dependent variables are also correlated with our control variables, i.e., DACC, MBEX, PROFIT and GCOPN are significantly correlated with 18, 27, 24 and 25 (out of our 32) control variables, respectively.

4.3 Regression results

Table 5 reports the regression results for our model (1). The adjusted/pseudo r-squares range from 0.1137 to 0.4895 and are all significant at 1% level. The test variable AFCOMP_POS is significant with a negative sign, ($-$ 0.1248, $p = 0.0013$) in the DACC regression, significant with a negative sign ($-$ 6.9216, $p < 0.0001$) in the MBEX regression, significant with a negative sign ($-$ 6.6605, $p = 0.0153$) in the PROFIT regression, and significant with a positive sign (3.4815, $p = 0.0934$) in the regression with GCOPN as the dependent variable, all consistent with a positive relation between audit fee competition and audit quality. By contrast, AFCOMP_NEG is not significant in any of the audit quality regressions. These findings suggest that as audit fee competition from any other Big 4 auditor (AFCOMP_POS) increases, DACC, MBEX, and PROFIT decline significantly, while GCOPN increases. By contrast, there is no relation between AFCOMP_NEG and any of the audit quality metrics.[12] Taken together, the results suggest that audit fee competition from another Big 4 auditor is associated with a higher quality audit, enabling us to reject our null hypothesis H1. As for the control variables, 21, 12, 15 and 14 control variables (out of a total of 32 control variables) are significant at 10% level or better for the DACC, MBEX, PROFIT and GCOPN regressions, respectively. For all the regressions in Table 4, the VIFs are quite low (not exceeding 1.6113 in any regression) indicating that collinearity is not a significant issue in interpreting our regression results.

Potentially, our finding that audit fee competition from another Big 4 auditor is associated with higher audit quality could be viewed as consistent with the notion that "you get what you pay for." In other words, our findings could be viewed as merely reflecting the

[11] Significant correlations among the independent variables (other than the test variables AFCOMP_NEG and AFCOMP_POS) are not a concern since they do not affect any of our test results or interpretations, and are therefore not reported for brevity. Later in the study we report VIFs.

[12] Recall that AFCOM_NEG implies absence of audit fee competition, i.e., for this particular audit engagement no other Big 4 auditor has a counterfactual fee that is lower than that of the incumbent Big 4 auditor.

Table 5 Regression results: audit fee competition and audit quality

Variables	Dependent variables							
	DACC		MBEX		PROFIT		GCOPN	
	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value
Intercept	0.1260***	< 0.0001	0.3161	0.6833	− 4.7857***	0.0003	− 36.5204***	< 0.0001
Test variables								
AFCOMP_POS	− 0.1248***	0.0013	− 6.9216***	< 0.0001	− 6.6605**	0.0153	3.4815*	0.0934
AFCOMP_NEG	0.0073	0.2203	0.1064	0.5376	− 0.1836	0.2808	− 0.3292	0.6959
Client-specific control variables								
LSIZE	− 0.0015	0.2368	− 0.0357	0.3735	− 0.1061*	0.0964	− 1.0654***	< 0.0001
ROA	0.5148***	< 0.0001	− 0.2653	0.3632	0.8656**	0.0315	− 2.3956*	0.0566
EGROWTH	− 0.0004***	0.0050	− 0.0025	0.5921	− 0.0183***	0.0024	0.0058	0.7758
CFFO	− 0.6816***	< 0.0001	0.6579**	0.0491	− 1.7607***	0.0002	− 1.3660	0.3140
B2M	0.0157***	< 0.0001	− 0.6069***	< 0.0001	0.7740***	< 0.0001	0.4404*	0.0667
LEV	0.0176***	0.0004	− 0.6523***	< 0.0001	1.4852***	< 0.0001	2.9516***	0.0004
CASSET	− 0.0518***	< 0.0001	0.1950	0.2148	− 1.1972***	< 0.0001	− 2.3115***	0.0074
INVRATIO	0.0635***	< 0.0001	− 0.5917**	0.0217	− 0.2232	0.5631	− 0.0123	0.9930
SEGMENTS	0.0017***	< 0.0001	− 0.0210***	0.0057	− 0.0135	0.2393	− 0.1633**	0.0431
FOPS	0.0096***	0.0002	0.0166	0.8311	1.1392***	< 0.0001	− 0.6990	0.3651
ACQUIRE	− 0.0035*	0.0708	0.0552	0.3277	0.1351	0.1359	− 0.4390	0.3432
FINANCE	− 0.0159***	< 0.0001	0.0278	0.5811	− 0.0729	0.3739	1.0610***	0.0007
PINTAN	− 0.0147***	0.0038	0.7974***	< 0.0001	− 0.7508***	0.0010	0.6352	0.5201
REL_AC_CFO	− 0.0021***	0.0002	− 0.0173	0.2881	0.0409	0.1177	0.1172	0.3459
FSCORE	0.0030***	0.0006	− 0.0122	0.6373	0.0032	0.9350	− 0.0415	0.6951
SDEARN	0.0916***	< 0.0001	− 0.2035	0.6545	− 0.3319	0.6327	− 5.8861*	0.0972
SDCFFO	− 0.1202***	< 0.0001	− 1.4166**	0.0310	− 1.7837	0.1057	− 2.4666	0.5331
SDSALE	− 0.0450***	0.0002	0.5165	0.1598	2.0001***	0.0003	2.0527	0.3223

Table 5 continued

Variables	Dependent variables							
	DACC		MBEX		PROFIT		GCOPN	
	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value
Auditor-specific control variables								
TENURE	0.0001	0.4664	0.0025	0.4080	− 0.0255***	< 0.0001	0.0571**	0.0273
INDSP	− 0.0024	0.1628	0.0402	0.4298	− 0.0983	0.2399	0.4953	0.2024
LOFFICE	0.0009	0.1678	0.0420**	0.0338	− 0.0143	0.6531	0.3381***	0.0091
LDELAY	− 0.0126***	0.0005	− 0.4041***	0.0011	0.3916*	0.0702	5.5660***	< 0.0001
LAFEE	0.0003	0.8693	0.0198	0.7336	0.1895**	0.0432	0.4822	0.1974
LNAFEE	0.0002	0.6959	− 0.0171	0.3174	− 0.0048	0.8619	− 0.1060	0.3004
MODOP	− 0.0026	0.1860	− 0.0986	0.1004	− 0.1058	0.2734	2.6992***	< 0.0001
ICMW	0.0046**	0.0365	− 0.0135	0.8761	0.0669	0.3841	0.0995	0.6469
BUSY	− 0.0048***	0.0028	0.0620	0.1928	0.0426	0.5952	0.3304	0.3396
Audit market-specific control variables								
HERF	− 0.0026	0.7595	0.2187	0.3805	− 0.0242	0.9526	− 0.9722	0.4641
DISTANCE	− 0.0024	0.7176	0.0596	0.7610	− 0.0617	0.8467	1.0023	0.3592
LEADER	− 0.0008	0.6095	− 0.0559	0.2642	0.0294	0.7138	0.2124	0.5200
Information environment-specific control variables								
LNUMEST	− 0.0017	0.1266	0.4427***	< 0.0001	− 0.2077***	< 0.0001	− 0.4614**	0.0242
STDEST	− 0.0719***	< 0.0001	− 22.9666***	< 0.0001	− 0.0582	0.8598	1.5789***	0.0046
Observations	12,618		12,618		12,618		12,519	
Adj/Pseudo R^2	0.2853		0.2307		0.1137		0.4895	
F/χ^2 value	106.4400		1288.4662		573.4634		208.4339	
Probability > F/χ^2	< 0.0001		< 0.0001		< 0.0001		< 0.0001	
% concordant	–		76.90		72.50		93.9	

Table 5 continued

Variables	Dependent variables							
	DACC		MBEX		PROFIT		GCOPN	
	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value
Highest VIF	1.6113		1.5822		1.5848		1.5945	

See Appendix 2 for variable definitions. ***, **, * imply two-tailed significance at 1, 5, 10% level. Standard errors are corrected for clustering and heteroskedasticity by year and industry. For the going concern opinion (GCOPN) regression, clients that had going concern opinions in the previous year are excluded. As discussed in the paper, the fundamental difference between our audit fee competition metric (AFCOMP) and the notion of "abnormal" fees in the prior literature is empirically demonstrated by the low Pearson correlation of 0.0254 between the two constructs. Dummy variables for year and industry are included but not reported for the sake of brevity

notion that a higher price implies a better quality service. However, a look at the pairwise correlations in Table 4 indicates that the audit fee paid to the incumbent auditor (LAFEE) is positively (albeit insignificantly) related to the adverse audit quality proxy DACC, significantly and positively correlated with our adverse audit quality proxies MBEX and PROFIT, and significantly but negatively correlated with our audit quality proxy GCOPN. The sign and significance of these correlations suggest that contrary to "you get what you pay for," clients pay higher audit fees for a *lower* quality audit. Moreover, the sign and significance of these correlations are consistent with prior research which suggests that higher fees paid to the incumbent auditor often reflect higher auditor effort (because the client has lower accounting quality to begin with) (Hribar et al. 2014), or a stealth payment in an attempt at influencing the incumbent Big 4 auditor to be more tolerant of the client's accounting transgressions (Kinney and Libby 2002). Additionally, our model (1) includes the log of audit fees (LAFEE) to control for the effect of audit fees paid to the incumbent auditor on our audit quality proxies.

As an added precaution, we do the following test: We decompose the control variable LAFEE (the log of audit fees) in model (1) into its predicted and "abnormal" components (where the "abnormal" component represents the excess of the actual audit fee charged by the incumbent auditor over the *incumbent's own* predicted fee for that client), and find that our results and inferences with respect to the AFCOMP_POS and AFCOMP_NEG test variables remain unchanged. Also, we compute the Pearson correlation between our AFCOMP_POS and AFCOMP_NEG metrics and "abnormal" audit fees and find the correlation to be low (0.0443 and 0.0107, respectively), which suggests that our audit fee competition metric is fundamentally different from the notion of abnormal audit fees.[13] Collectively, these findings suggest that our results are not being driven by some spurious correlation between our test variable AFCOMP_POS and higher audit quality.

4.4 Partitioned analysis by incumbent auditor market power

In this section, we examine whether the incumbent Big 4 auditor's audit quality response to the presence of audit fee competition from another Big 4 auditor (AFCOMP_POS) is impacted by the incumbent's market power. Other things being equal, the higher the incumbent auditor's market power, the lower the incumbent's incentive to respond to audit fee competition from another Big 4 auditor by providing a higher quality audit in an attempt at retaining the client. Prior research (e.g., Numan and Willekens 2012) suggests that the incumbent Big 4 firm has more market power when it is an industry specialist and when competition in the local audit market is weaker. Consistent with Numan and Willekens (2012), we utilize HERF, INDSP, LEADER and DISTANCE as measures of market power at the local audit market level. We partition our sample observations into two subsamples corresponding to whether the incumbent has above-median vs. below-median market power. Thus, observations where (a) the Herfindahl index for the local audit market is below-median, (b) the incumbent Big 4 auditor is not an industry expert, (c) the incumbent auditor is not the local industry audit market leader, and (d) the Numan and Willekens (2012) spatial distance measure for the local audit market is below-median, are in the less market power subsample (Table 6, the second column for each market power measure). Thus, in Table 6, for incumbents in less concentrated local audit markets

[13] Additionally, the correlation of AFCOMP with abnormal audit fees for AFCOMP > 0 is 0.0169 and for AFCOMP < 0 is 0.0354. This further confirms that our competition measure is fundamentally different from abnormal audit fees.

HERF $\leq$ median (column 2), the test variable AFCOMP_POS is significant (with the predicted signs) in three of our audit quality regressions, i.e., the regressions where the dependent variables are DACC, MBEX and PROFIT. Consistent with the incumbent auditor's incentives, these findings suggest that the incumbent Big 4 auditor is responsive to audit fee competition from another Big 4 auditor (by providing a higher quality audit) in an attempt to retain the client only when the incumbent operates in a less concentrated audit market, i.e., has *less* market power. Similar interpretations apply to the other market power partitions columns in Table 6. Taken together, the results in Table 6 indicate that the positive relation between audit fee competition (AFCOMP_POS) and audit quality is present only in local audit markets where the incumbent Big 4 auditor has *less* market power. These findings suggest that the incumbent Big 4 auditor responds to audit fee competition by providing a higher quality audit only when the incumbent has *less* market power which is reasonable, i.e., the lower the incumbent's market power, the greater the incentive to respond to fee competition by providing higher audit quality to retain the client. For completeness, we note that AFCOMP_NEG is insignificant in all settings in Table 6 (consistent with findings previously reported in Table 4) and is not tabulated for brevity.

4.5 Partitioned analysis by quality of client

Next, we use two proxies to identify client quality. The first proxy is REL_AC_CFO or the relative power of the audit committee vis-à-vis the CFO (Beck and Mauldin 2014, p. 2065). The *higher* the relative power of the audit committee, the *higher* the quality of the client. Our second proxy for client quality is the FSCORE which represents the risk of a material financial statement misstatement (Dechow et al. 2011, p. 55). The *lower* the FSCORE, the *higher* the client quality. Faced with audit fee competition from another Big 4 auditor, the incumbent Big 4 auditor's incentive to attempt to retain the client by providing a *higher* quality audit is contingent on the quality of the client. Potentially, a lower quality client (such as Enron with a high FSCORE as noted by Dechow et al. 2011, p. 61) may be expected to desire a *lower* quality audit from its incumbent Big 4 auditor. In other words, in the presence of fee competition from another Big 4 auditor, a lower quality client potentially could attempt to negotiate with the incumbent *not* for lower fees but for *lower* audit quality, i.e., attempt to use the current audit fee (a fee higher than that of the competition) as an independence-impairing payment (Kinney and Libby 2002). Put differently, an incumbent auditor is likely to respond to audit fee competition by providing a higher quality service (in an attempt at retaining the client) only for higher quality clients, i.e., those who desire a higher quality audit other things being equal.

Thus, in Table 7, for incumbent Big 4 auditors with higher quality clients (i.e., clients with *above*-median REL_AC_CFO in column 2), the test variable AFCOMP_POS is significant (with the predicted signs) in three of our audit quality regressions, i.e., the regressions where the dependent variables are DACC, MBEX and PROFIT. Similarly, for incumbent auditors with higher quality clients (i.e., clients with *below*-median FSCORE in column 4), the test variable AFCOMP_POS is significant (with the predicted signs) in three of our audit quality regressions, i.e., the regressions where the dependent variables are DACC, MBEX and PROFIT. Consistent with the incumbent auditor's incentives, these findings suggest that the incumbent Big 4 auditor is responsive to audit fee competition from another Big 4 auditor (by providing a higher quality audit) in an attempt to retain the client only when the client is of higher quality. In other words, the significant relation between audit fee competition (AFCOMP_POS) and higher audit quality in the second

Table 6 Partitioned regression results: audit fee competition and audit quality by market power

Dependent variables	Test variable = AFCOMP_POS							
	Proxies for market power							
	HERF		INDSP		LEADER		DISTANCE	
	Above median (1)	Below median (2)	Yes (3)	No (4)	Yes (5)	No (6)	Above median (7)	Below median(8)
DACC	1.0309	− 1.3768**	− 1.0750	− 0.4799***	0.6337	− 2.3282***	0.4744	− 1.5553***
MBEX	− 0.6650	− 6.1397**	− 5.0473	− 5.7055**	− 2.4801	− 4.4698**	− 9.9678	− 4.9598*
PROFIT	− 2.6184	− 1.7060***	− 5.4748	− 1.0070**	− 1.5253	5.8901***	− 7.3969	− 9.7323**
GCOPN	0.4149	− 1.6497	− 4.1820	− 7.6299	2.6019	1.1850*	1.9539	1.9030*
Observations	6309	6309	4765	7853	5359	7259	6309	6309

See Appendix 2 for variable definitions. For market power proxies, column (2), (4), (6), and (8) represent the case where the incumbent Big 4 auditor has less market power, i.e., local audit market concentration as measured by the Herfindahl index (HERF) is below-median, the incumbent is not an industry specialist (INDSP), incumbent is not an industry leader (LEADER), or the distance from the nearest Big 4 competitor in the local audit market (DISTANCE) is below-median. The significant relations between audit fee competition variable AFCOMP_POS and higher audit quality in the lower market power columns suggest that the incumbent Big 4 auditor responds to audit fee competition by providing a higher quality audit only when the incumbent has *less* market power which is reasonable, i.e., the lower the incumbent auditor's market power, the greater the incentive to respond to fee competition by providing higher audit quality to retain the client. Consistent with Table 4, coefficients of AFCOMP_NEG are all insignificant and not reported for brevity

***, **, *Imply two-tailed significance at 1, 5, 10% level. Standard errors are corrected for clustering and heteroskedasticity by year and industry. All control variables are included but not reported for the sake of brevity

Table 7 Partitioned regression results: audit fee competition and audit quality by quality of client

Dependent variables	Test variable = AFCOMP_POS			
	Proxies for client quality			
	REL_AC_CFO		FSCORE	
	Below median (1)	Above median (2)	Above median (3)	Below median (4)
DACC	2.6920***	− 1.0138*	− 0.4571	− 0.8718*
MBEX	− 6.8478	− 7.7667**	− 4.6286	− 7.4340***
PROFIT	− 5.4382	− 1.6890**	− 3.7431	− 1.0380**
GCOPN	− 2.5213	3.7622	4.3850	1.9801
Observations	4,168[a]	3,876[a]	6309	6309

See Appendix 2 for variable definitions. For both client quality (REL_AC_CFO and FSCORE) partitions, the column (2) and (4) represents *higher* client quality, i.e. clients for whom relative power of audit committee vis-à-vis the CFO as measured by REL_AC_CFO is *above* median and the FSCORE is *below* median. The significant relation between audit fee competition (AFCOMP_POS) and higher audit quality in the second column suggests that the incumbent Big 4 auditor responds to audit fee competition from another Big 4 auditor by providing a higher quality audit only when the client is of higher quality which is reasonable, i.e., the incumbent is unlikely to unilaterally provide a higher quality audit without a corresponding desire for higher audit quality from the client which is more likely when the client is a higher (rather than a lower) quality client. Consistent with Table 4, coefficients of AFCOMP_NEG are all insignificant and not reported for brevity

***, **, *Imply two-tailed significance at 1, 5, 10% level. Standard errors are corrected for clustering and heteroskedasticity by year and industry. All control variables are included but not reported for the sake of brevity

[a]Merging with audit committee data and exclusion of REL_AC_CFO = 0 cases results in a subsample of 8044 observations

column suggests that the incumbent Big 4 auditor responds to audit fee competition from another Big 4 auditor by providing a higher quality audit only when the client is a higher quality client which is reasonable, i.e., the incumbent is unlikely to unilaterally provide a higher quality audit without a corresponding desire for higher audit quality from the client which is more likely when the client is a higher (rather than a lower) quality client. Taken together, the results in Table 7 indicate that the positive relation between audit fee competition (AFCOMP_POS) and audit quality is present for incumbent Big 4 auditors only for higher quality clients. Once again, for completeness we note that AFCOMP_NEG is insignificant in all settings in Table 7 (consistent with the findings previously reported in Table 4) and is not tabulated for brevity.[14]

4.6 Additional analyses

Finally, we conduct several additional tests to assess the robustness of our findings:

1. We use the Belsley et al. (1980) procedure to identify and delete influential outliers. The results and inferences remain similar.

[14] In Table 7, for *lower* quality clients, our test variable AFCOMP_POS is significant only for one audit quality proxy (DACC), i.e., significant with a positive sign in column 1, which appears to provide weak support for the PCAOB concern that audit fee competition may lower audit quality. However, this concern applies only for lower quality clients, i.e., clients where the relative power of the audit committee vis-à-vis the CFO is below median.

2. Our current definition of the test variable AFCOMP incorporates audit fee competition from any other Big 4 auditor regardless of whether the auditor with the lowest counterfactual fee has an office in the same CBSA as the incumbent Big 4 auditor. However, it is not at all unusual for the incumbent auditor to be located in a CBSA different from that of the client (Beck et al. 2013; Choi et al. 2012). Further, the geographic proximity of the auditor to the client could impact audit quality and audit fees (Choi et al. 2012; Jensen et al. 2015). As sensitivity analysis, we exclude cases where the auditor with the lowest counterfactual audit fee does not have an office in the client's CBSA. For this reduced sample, our inferences remain unchanged. Thus, our findings that incumbent Big 4 auditors respond to audit fee competition from any other Big 4 auditor by providing a higher quality audit is robust to whether the Big 4 auditor with the lowest counterfactual audit fee does or does not have an office in the same CBSA as the incumbent auditor.
3. Ettredge et al. (2014, 2017) suggest that the relation between audit fees and audit quality was affected during the 2007–2009 recession. To assess whether our findings were affected during the 2007–2009 recession, we re-ran all our tests for this sub-period. The results and inferences for this sub-period (not tabulated for brevity) are consistent with our previous findings, albeit somewhat weaker.
4. We also examine the economic significance of our findings. Specifically, using the median client, we find that as the value of AFCOMP increases from the 10th to the 90th percentile, auditor switching risk increases by 32%. We also find that an increase in the value of the test variable AFCOMP_POS by 10% of its standard deviation is associated with (a) a 14% decline in the income increasing discretionary accruals, (b) a 12, and 14% decrease in the probabilities of meeting-or-beating earnings expectations and reporting a small profit, respectively, and (c) a 9% increase in the probability of a going concern opinion. Collectively, these results suggest that the relation between audit fee competition from another Big 4 auditor (AFCOMP_POS) and the audit quality of the incumbent Big 4 auditor is economically significant.
5. We define AFCOMP as the incumbent's AFEE minus the lowest counterfactual AFEE for any other Big 4 auditor, deflated by client total assets. To ascertain that the results are not sensitive to the measurement of the test variable, in additional tests (not tabulated for the sake of brevity), we use the mean value of the other three counterfactual AFEE instead of the lowest. The conclusions are unchanged.
6. The variability (dispersion) in the other three counterfactual AFEE may have different implications for AFCOMP. For example, the other three counterfactual AFEE may be close to each other (suggesting agreement) versus spread out (suggesting disagreement). AFCOMP might affect auditor behavior differently when there is agreement/disagreement among the counterfactual audit fees of the other three big-4 auditors. To examine this issue, we deflate AFCOMP with the range of the dispersion instead of the client total assets. The range is measured as the difference in the maximum and minimum counterfactual AFEE. We continue to get similar results, suggesting that our conclusions are robust to variability of the test variable.

5 Concluding remarks

In recent years, the GAO (2003, 2008) and the US Treasury (2008) have implied that the Big 4 dominated US audit market lacks competition, whereas the PCAOB (Doty 2011) has expressed the somewhat opposite concern that price competition in the US audit market could pressure the incumbent auditor to compromise on audit quality (Doty 2011). In this study, we investigate whether incumbent Big 4 auditors face audit fee competition in US local audit markets from other Big 4 auditors, and examine the relation between such competition and the quality of the audit.

We assess audit fee competition as the audit fee charged by the incumbent Big 4 auditor less the lowest projected (counterfactual) audit fee that would be charged by any other Big 4 auditor for that particular engagement, scaled by client total assets. For audit engagements that have a lower counterfactual fee (i.e., engagements that have audit fee competition), the audit fee competition metric is positive. A unique feature of our fee competition metric is that it is client-specific and it recognizes that the incumbent Big 4 firm may face fee competition from another Big 4 auditor for some of its clients but *not* other clients in the same local audit market. This feature distinguishes it from other competition proxies (i.e., the Herfindahl index and spatial distance) that are either local audit market-specific or local industry-audit market-specific. Also in contrast to prior studies, we validate our audit fee competition metric by showing a positive relation with the incumbent auditor's switching risk. We also note that our audit fee competition metric is fundamentally different from the notion of "abnormal" fees in the prior literature, i.e., the excess of the actual audit fee charged by the incumbent auditor over the *incumbent's own* predicted fee for that client (Doogar et al. 2015; Hribar et al. 2014; Kinney and Libby 2002). All our analyses control for audit fees, and the results for our fee competition metric hold when we disaggregate the audit fee control variable into its normal/abnormal components, indicating that our fee competition metric has incremental explanatory power over and above abnormal fees.

Consistent with DeFond and Zhang (2014), we view audit quality as a continuum with higher audit quality providing greater assurance of financial reporting quality, and triangulate our results using multiple measures of audit quality. We find that audit fee competition among Big 4 auditors improves Big 4 audit quality only in local audit markets where the incumbent auditor has below-median market power and only for higher quality clients. Our findings speak to the interplay between fee competition and auditor incentives, and suggest that audit fee competition is useful as a mechanism for improving audit quality in some local (albeit highly concentrated) US audit markets. Collectively, our findings should be of interest to regulators such as the PCAOB concerned about competition in the US audit markets.

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Appendix 1: Audit fee competition (AFCOMP) variable

To estimate AFCOMP (audit fee competition) among Big 4 auditors we estimate the following audit fee model (based on prior research, such as Jha and Chen 2015; Choi et al. 2010; Larcker and Richardson 2004; Simunic 1980; Wang et al. 2013; Whisenant et al. 2003; Antle et al. 2006):

$$\begin{aligned} \text{LAFEE} = {} & \gamma_0 + \gamma_1 \text{LSIZE} + \gamma_2 \text{ROA} + \gamma_3 \text{CFFO} + \gamma_4 \text{B2M} + \gamma_5 \text{LEV} + \gamma_6 \text{CASSET} \\ & + \gamma_7 \text{INVRATIO} + \gamma_8 \text{SEGMENTS} + \gamma_9 \text{FOPS} + \gamma_{10} \text{ACQUIRE} \\ & + \gamma_{11} \text{FINANCE} + \gamma_{12} \text{PINTAN} + \gamma_{13} \text{REL\_AC\_CFO} \\ & + \gamma_{14} \text{FSCORE} + \gamma_{15} \text{TENURE} + \gamma_{16} \text{INDSP} + \gamma_{17} \text{LOFFICE} + \gamma_{18} \text{LDELAY} \\ & + \gamma_{19} \text{LNAFEE} + \gamma_{20} \text{MODOP} + \gamma_{21} \text{ICMW} + \gamma_{22} \text{BUSY} + \gamma_{23} \text{HERF} \\ & + \gamma_{24} \text{DISTANCE} + \gamma_{25} \text{LEADER} + \gamma_{26} \text{LNUMEST} + \gamma_{27} \text{STDEST} + \textit{error} \end{aligned} \tag{3}$$

All variables are defined in Appendix 2. The model is estimated separately for each Big 4 auditor, by year and by industry (1-digit SIC code).[15] Next, we use the model parameters to estimate the counterfactual audit fee that each Big 4 auditor (other than the incumbent) would charge, holding client and auditor characteristics constant (with the exception of TENURE which is set = 0) for the client in question. Audit fee (AFEE) is then calculated as the exponential of LAFEE. We then compare the incumbent Big 4 auditor's AFEE with the counterfactual AFEE for each of the other three Big 4 auditors. Then AFCOMP = the incumbent's AFEE minus the lowest counterfactual AFEE for any other Big 4 auditor, deflated by client total assets.[16] See Fig. 1 for more information. Then, AFCOMP_POS = AFCOMP for AFCOMP > 0, and 0 otherwise (see Panel A) and AFCOMP_NEG = AFCOMP for AFCOMP < 0, and 0 otherwise (see Panel B).

Since it is not practical to present 352 regressions (4 Big 4 auditors × 11 years × 8 industries), in Appendix 3 we present the pooled versions of each of the four Big 4 firm regressions with fixed-effects for years and industries. We also compare the coefficients of each of the Big 4 firm regressions taken as a set as well as individually. The 6 Chow tests comparing the 4 sets of coefficients with each other show that all of them are significantly different at 1% level with the F values ranging from 3.89 to 5.37. We also compare the 27 individual coefficients (6 × 27 independent variables = 162 tests). Of these 162 tests, 124 are significant at 10% or better which suggests that the audit fee pricing models of the Big 4 are significantly different from each other, i.e., the audit fees charged by them for any individual client is likely to be significantly different from each other.

[15] We utilize 1-digit (rather than 2-digit) SIC for practical reasons. With 2-digit SIC, there are over 50 industries, and 4 Big 4 auditors × 11 years × 50 industries implies over 2200 regressions with the 12,618 observations in our sample (see Table 1), i.e., an average of only 6 observations per regression. Even with the 1-digit SIC, for industries with SIC codes 0 and 9 we do not have enough observations to run by year and auditor; hence, for these 2 industries (51 + 48 = 99 observations) we run the regressions only by auditor.

[16] One limitation of AFCOMP is that we do not know which audit office of the other Big 4 firm would perform the engagement if in fact the lowest counterfactual fee was accepted by the client. However, when we use the incumbent auditor's attributes and the characteristics of the incumbent's CBSA in estimating AFCOMP, sequential regression analysis shows that 96% of the explanatory power of model (3) comes from client characteristics and only 4% from audit office and audit market characteristics. Hence, the measurement error in AFCOMP is expected to be minimal. Moreover, any measurement error in AFCOMP is likely to bias the coefficient *against* being significant.

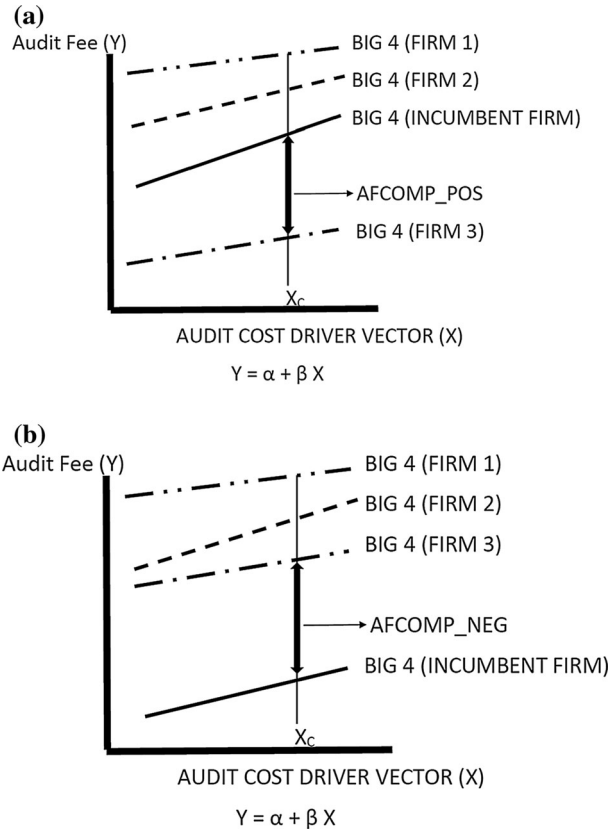

Fig. 1 Audit fee competition (AFCOMP) variable. **a** AFCOMP is positive (AFCOMP_POS). **b** AFCOMP is negative (AFCOMP_NEG)

In Fig. 1, each Big 4 line represents the audit fee model (see Appendix 1) for each of the four Big 4 firms, including the incumbent Big 4 firm. Point X_C on the X-axis represents the client-specific audit fee model vector of the independent variables in the fee model for client C for a particular year. For client C, the lowest counterfactual fee is from Big 4 firm 3. Hence, variable AFCOMP_POS (NEG) is equal to the incumbent's audit fee minus the counterfactual audit fee of the Big 4 firm 3, deflated by client total assets and can be positive or negative (as depicted in the two panels).

Appendix 2: Variable definitions

Variable	Definition
Dependent variables	
DACC	Performance adjusted discretionary accruals calculated using the modified Jones model (DeFond and Jiambalvo 1994) controlling for concurrent performance based on 2-digit SIC code and year (Kothari et al. 2005), deflated by beginning of fiscal year total assets. We use the difference between net income and cash from operations as our measure of total accruals (Hribar and Collins 2002). The higher the DACC, the lower the quality of audited earnings and the lower the implied audit quality
MBEX	A dichotomous variable equal to 1 if the firm meets or beats the earnings expectation (proxied by the most recent median consensus analyst forecast available on IBES file) by one cent or less; 0 otherwise. The higher the probability of MBEX, the lower the quality of audited earnings and the lower the implied audit quality
PROFIT	Dichotomous variable equal to 1 if the net income before extraordinary items and cumulative effect of accounting changes deflated by lagged total assets is between 0 and 5%; 0 otherwise (Francis and Yu 2009). The higher the probability of PROFIT, the lower the quality of audited earnings and the lower the implied audit quality
GCOPN	Dichotomous variable equal to 1 if the client receives a going concern opinion in the current year; 0 otherwise. The higher the probability of GCOPN, the higher the implied audit quality
Test variables	
AFCOMP	Audit fee competition among Big 4 auditors measured as the incumbent Big 4 firm's actual audit fee minus the lowest counterfactual fee from another Big 4 firm (which may or may not have an office in the local audit market) deflated by the client's total assets. The counterfactual fee is based on cross-sectional audit fee regressions run by year, by industry (1 digit SIC code), and by each Big 4 auditor, controlling for client-specific, local audit office-specific, and local audit market-specific factors
AFCOMP_POS	Equals AFCOMP for AFCOMP > 0 and 0 otherwise
AFCOMP_NEG	Equals AFCOMP for AFCOMP < 0 and 0 otherwise
Control variables	
ACQUIRE	A dichotomous variable equal to 1 if the client is involved in acquisition activities during the year; and 0 otherwise
B2M	Book-to-market equity ratio at the end of the fiscal year
BUSY	Dummy variable equal to 1 for December 31st fiscal-year-end clients; 0 otherwise
CASSET	Ratio of current assets to total assets
CFFO	Cash flow from operations divided by total assets
DISTANCE	Spatial distance metric (based on Numan and Willekens 2012) defined as the absolute fee market share difference between the incumbent Big 4 auditor and closest Big 4 competitor in the local industry audit market fiscal year. A local industry audit market consists of all companies within a two-digit SIC code in a CBSA. The *lower* the metric, the *higher* the competition in the local industry audit market.
EGROWTH	Annual growth rate of net income before extraordinary items and cumulative effect of accounting changes
FINANCE	A dichotomous variable equal to 1 if number of outstanding shares increased by at least 10% or long-term debt increased by at least 20% during the year (Geiger and North 2006); and 0 otherwise
FOPS	Proportion of a client's total income from foreign (non-US) operations
FSCORE	Fraud Score calculated using Dechow et al. (2011) methodology on page 55 (Table 7, Panel A, Model 1)

Variable	Definition
HERF	Herfindahl index (concentration measure) for local industry audit market fiscal year, where a local industry audit market consists of all public clients within a two-digit SIC group in a CBSA. Defined as $\Sigma[s/S]^2$, where "s" is the sum of audit fees of the Big 4 audit office from all clients within the 2-digit SIC industry, and "S" is the total audit fees of all Big 4 auditors in the CBSA from all clients in that industry (Numan and Willekens 2012)
ICMW	Number of material internal control weaknesses reported in Audit Analytics
INDSP	Measure of industry specialization, defined as a dichotomous variable equal to 1 when an audit firm has a fee market share of at least 30% in an audit market, 0 otherwise. An audit market is defined as a two-digit SIC industry in a CBSA (Numan and Willekens 2012)
INVRATIO	Inventory deflated by total assets
LAFEE	Natural log of audit fee during the current fiscal year
LDELAY	Natural log of 1 plus the number of calendar days from fiscal year-end to the date of the audit report
LEADER	An indicator variable equal to1 when an audit firm has the largest fee market share in an audit market, 0 otherwise. An audit market is defined as a two-digit SIC industry in a CBSA (Numan and Willekens 2012)
LEV	Long term debt plus debt in current liabilities deflated by average total assets (Lawrence et al. 2011)
LNAFEE	Natural log of non-audit fees during the current fiscal year
LNUMEST	Natural log of the number of analysts' forecasts
LOFFICE	Natural log of total annual audit fees of the local office of the incumbent Big 4 auditor (Francis and Yu 2009)
LSIZE	Natural log of the client's total assets (in millions of dollars)
MODOP	A dichotomous variable equal to 1 if the audit opinion is modified (different from the standard three paragraph report); 0 otherwise
PINTAN	Proportion of intangible assets to total assets
REL_AC_CFO	Power of the audit committee relative to CFO as defined on page 2065 of Beck and Mauldin (2014)
ROA	Net income before extraordinary items and cumulative effect of accounting changes deflated by total assets
SDCFFO	Standard deviation of cash flow from operations deflated by total assets, calculated over the current and prior four years
SDEARN	Standard deviation of earnings deflated by total assets, calculated over the current and prior 4 years
SDSALES	Standard deviation of sales deflated by total assets, calculated over the current and prior 4 years
SEGMENTS	Number of segments reported in Compustat segment file
STDEST	Standard deviation of analysts' earnings forecasts
TENURE	Number of years the client has been with the current auditor

Appendix 3: Big 4 audit fee models (dependent variable = LAFEE)

Variables	Deloitte		EY		KPMG		PWC	
	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value
Intercept	8.7539***	< 0.0001	7.0932***	< 0.0001	7.8903***	< 0.0001	7.5844***	< 0.0001
Client-specific variables								
LSIZE	0.5156***	< 0.0001	0.4393***	< 0.0001	0.4964***	< 0.0001	0.4668***	< 0.0001
ROA	− 0.5378***	< 0.0001	− 0.5381***	< 0.0001	− 0.5740***	< 0.0001	− 0.4686***	< 0.0001
CFFO	− 0.4594***	0.0004	0.1910**	0.0303	0.0415	0.7082	− 0.0929	0.3631
B2M	− 0.0888***	0.0002	− 0.0093	0.6479	− 0.0734***	0.0015	− 0.0247	0.2342
LEV	0.1357**	0.0357	0.1527***	0.0015	0.2091***	0.0005	0.2474***	< 0.0001
CASSET	0.6581***	< 0.0001	0.4565***	< 0.0001	0.9066***	< 0.0001	0.7136***	< 0.0001
INVRATIO	− 0.1055	0.2466	0.1066	0.1551	0.1090	0.2460	0.1561*	0.0635
SEGMENTS	0.0205***	< 0.0001	0.0206***	< 0.0001	0.0282***	< 0.0001	0.0230***	< 0.0001
FOPS	0.2873***	< 0.0001	0.2962***	< 0.0001	0.3029***	< 0.0001	0.3101***	< 0.0001
ACQUIRE	− 0.0020	0.9325	0.0033	0.8660	0.0592***	0.0091	0.0553***	0.0040
FINANCE	0.0267	0.2010	0.0188	0.2486	0.0165	0.3930	− 0.0089	0.5953
PINTAN	0.4407***	< 0.0001	0.4017***	< 0.0001	0.4440***	< 0.0001	0.1260**	0.0138
REL_AC_CFO	0.0175**	0.0124	− 0.0053	0.3129	− 0.0023	0.7178	− 0.0119	0.3290
FSCORE	0.0067	0.4265	0.0176*	0.0486	0.0026	0.7905	0.0059	0.4936
Auditor-specific variables								
TENURE	0.0058***	< 0.0001	0.0044***	< 0.0001	− 0.0014	0.1881	0.0054***	< 0.0001
INDSP	− 0.0203	0.4257	0.0609***	0.0006	− 0.0314	0.2556	0.0779***	0.0002
LOFFICE	0.0560***	< 0.0001	0.0914***	< 0.0001	0.0628***	< 0.0001	0.0624***	< 0.0001
LDELAY	0.0777*	0.0521	0.2530***	< 0.0001	0.1757***	< 0.0001	0.1983***	< 0.0001
LNAFEE	0.0361	< 0.0001	0.0751	< 0.0001	0.0628	< 0.0001	0.0771	< 0.0001
MODOP	0.0440*	0.0685	0.0798***	0.0001	0.0558**	0.0178	0.1148***	< 0.0001
ICMW	0.1597***	< 0.0001	0.2268***	< 0.0001	0.1440***	< 0.0001	0.0787***	0.0001

Variables	Deloitte		EY		KPMG		PWC	
	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value
BUSY	0.0343*	0.0895	0.0540***	0.0007	0.0021	0.9115	0.0883***	< 0.0001
Audit market − specific variables								
HERF	− 0.3125	0.4133	0.4207***	< 0.0001	− 0.2471	0.4018	0.2196***	0.0079
DISTANCE	0.1057	0.2662	− 0.1298	0.2789	0.2419***	0.0003	0.0910	0.1825
LEADER	0.0514**	0.0273	− 0.0128	0.4277	− 0.0212	0.3377	− 0.0272	0.1984
Information environment-specific variables								
LNUMEST	− 0.0908***	< 0.0001	− 0.0619***	< 0.0001	− 0.0605***	< 0.0001	− 0.0450***	< 0.0001
STDEST	0.0126	0.8706	0.1236**	0.0264	0.2650***	0.0062	0.1791**	0.0113
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Observations	2611		4062		2701		3244	
Adj-R square	0.7999		0.7945		0.8226		0.8496	
F value	261.77		393.45		313.96		459.02	
Probability > F	< 0.0001		< 0.0001		< 0.0001		< 0.0001	

See Appendix 2 for variable definitions. ***, **, * imply two-tailed significance at 1, 5, 10% levels. Standard errors are corrected for clustering and heteroskedasticity by year and industry. For estimating audit fee competition among Big 4 auditors (variable AFCOMP), the regressions are run separately for each Big 4 auditor by year and by industry (see Appendix 1 for more information). Pooled regressions for each Big 4 auditor are shown here for presentation purposes only. Pairwise Chow (1960) tests of the coefficients reveal that the Big 4 pricing models are different from each other at 1% or better significance level (F values range from 3.89 to 5.37). Big 4 firms' pricing models are proprietary and it is reasonable to expect different firms to put different weights on each of the various determinants of audit fees.

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