Are the Big 4 audit firms homogeneous? Further evidence from audit pricing

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We provide new evidence on audit pricing differences within the Big 4 audit firms in the U.S. market. Industry expertise research argues that an audit firm with greater competencies can differentiate itself from competitors in terms of within-industry market share and charge an audit fee premium for its services. We show that while KPMG's average fee premium is smaller than those of other Big 4 audit firms, PricewaterhouseCoopers consistently earns an above-average fee premium and has remained the market share leader across most U.S. industries. More importantly, the supposed effects of industry specialization on audit fees become statistically insignificant after controlling for individual pricing differences within the Big 4. Overall, we conclude that the Big 4 firms are not homogeneous in audit pricing, and that the literature has apparently confounded an individual audit firm reputational effect (as first observed by Simunic, 1980) with an industry specialist fee premium in the U.S. audit market.

KEYWORDS
Audit Fees, Auditor Industry Specialization, Big 4 Auditors

JEL CLASSIFICATION
M40; M42

1 INTRODUCTION

The dominant Big 4 public accounting firms (KPMG, Deloitte, EY, and PwC), which have long been argued to offer differentially higher audit quality than non-Big 4 firms (DeAngelo, 1981), are treated as a homogeneous set in extant research. However, in Simunic’s (1980) classic study, a statistically significant audit fee premium, ceteris paribus, was observed for clients of Price Waterhouse (later PwC) relative to other firms in the (then) Big 8. This finding was interpreted as consistent with price competition in the audit market, with a (somehow) differentiated product offered by Price Waterhouse (PW) and purchased voluntarily by PW clients. In addition, Peat Marwick (later KPMG) has been labeled a price cutter and found to earn below-average audit fee premiums (Bernstein, 1978; Moizer, 1997), again relative to the other Big firms. However, empirical results in the 1990s and 2000s did not show a significant premium or discount for any Big audit firm. Instead, research shifted to the possible existence of auditor–industry specialization (Craswell, Francis, & Taylor, 1995), and tested the hypothesis that developing industry-specialized expertise facilitates delivering high-quality audits, thereby increasing auditor reputation and earning such industry specialist auditors a significant fee premium.

In this study, we focus on audit pricing differences during the period 2003–2017 within the Big 4 firms, which are the dominant suppliers of audit services to U.S. public (listed) companies. Answering Hay’s (2013) call for more studies on the PwC premium, we raise the empirical question of whether, besides the general Big 4 audit fee premium, individual pricing differences can be detected within the Big 4 firms in the U.S. market. If the Big 4 are truly a homogeneous set of
high-quality firms and earn significant fee premiums due to their brand name reputation as a group, there should be no significant systematic audit pricing differences among them. However, we find that PwC has not only maintained its position as the market share leader in the United States but also earns an above-average audit fee premium over the other Big 4 firms. We also find that KPMG has been identified as an industry specialist in the fewest industries and earns a below-average fee premium relative to the rest of the Big 4.

Moon, Shipman, Swanquist, and Whited (2019) recently examined the connection between individual audit firm fee premiums and various measures of audit quality. Among the Big 4, they find a statistically significant variation in average individual firm premiums of about 6%. As the first step in our analyses, we extend Moon et al.’s results by disentangling the specific audit firm fee premiums within the Big 4 (i.e., PwC vs. Ernst & Young vs. Deloitte vs. KPMG) and show that these premiums persist when clients are classified into size quintiles. This suggests that the premiums are associated with auditor brand names rather than with client characteristics that drive audit fees, most important of which is client size. We then extend our analyses by considering the interaction between individual audit firm pricing differences and auditor industry specialization, and show that individual audit firm brand names are important determinants of the fee premiums earned by industry specialists.

According to the GAO (2008), large companies primarily choose Big 4 audit firms as their external auditors due to their general technical capabilities and industry-specialized expertise. Thus, each audit firm has to compete intensively to meet the demand for high audit quality through developing brand name reputation and industry specialization (Craswell et al., 1995). A useful illustration is provided by PwC (2012, p. 3):

The PwC Network has invested hundreds of millions of dollars in the development and roll-out of a new proprietary global audit software tool that will help further improve quality on even our most complex multinational clients; trains over 60,000 audit professionals annually at a significant cost; and maintains global systems to provide controls over audit quality and compliance with many independence requirements—both those imposed externally and those required by PwC internal policy. Therefore, both generalized expertise and industry-specialized expertise are likely to enable differentiation of the audit services within the Big 4 firms, improve audit quality, and result in higher audit fees.

Although the concept of auditor industry specialization has been extensively examined in the auditing literature, there is no consensus on how to empirically measure specialization. Because the actual level of specialization of audit firms is unobservable, several proxy measures have been introduced that reflect the complexity of the concept, including market share-based measures (Craswell et al., 1995; Zeff & Fossum, 1967), the portfolio proportion of clients (Kwon, 1996), and weighted market shares (Neal & Riley, 2004). Audoussset-Coulier, Jenny, and Jiang (2015) recently showed that these approaches yield inconsistent classifications of audit firms as industry specialists, and subsequently lead to inconsistent inferences from audit pricing and earnings quality models.

Using the within-industry market share approach to measure industry specialization, we find that PwC is designated an industry specialist in the highest number of industries (Audoussset-Coulier et al., 2015; Cahan, Jeter, & Naiker, 2011; Knechel, Naiker, & Pacheco, 2007; Li, Xie, & Zhou, 2010), followed by Ernst & Young (EY), Deloitte, and KPMG. This raises a further empirical question of whether an individual audit firm’s generalized competencies confound the effect of industry specialization on audit pricing. Accordingly, to test whether the lack of proper control over the historically observed PwC fee premium significantly affects the inferences drawn from the audit pricing model, we examine the differential effect of industry specialization on the audit fees charged by each Big 4 firm. In particular, we find that the observed fee premium for specialists is highly sensitive to the identity of the incumbent auditor. After controlling for individual differences within the Big 4 firms, we find that the industry specialization fee premium is only detected and significant for EY and Deloitte specialists, and not for PwC and KPMG specialists.

In additional analyses, we estimate the audit fee model partitioned by asset size quintiles to prevent the model’s residuals from being correlated with client size. We find that the evidence of audit pricing differences at the interaudit firm level is robust to client size subsample regressions. Sensitivity tests using audit firms’ competitive position (Chu, Simunic, Ye, & Zhang, 2018; Numan & Willekens, 2012), a measure of unexplained audit fees (hereafter UAF), and two alternative measures of industry specialization at the metropolitan statistical area (hereafter MSA) level (Ferguson, Francis, & Stokes, 2003; Francis, Reichelt, & Wang, 2005) further confirm that individual differences within the Big 4 firms strongly impact on the industry specialization effect in the audit fee model.

Our study makes several contributions to the auditing literature. First, while Big 4 firms are typically treated as homogeneous and identified using a Big 4 dummy variable, we document that PwC (KPMG) earns an above-average (below-average) fee premium, indicating that there are systematic pricing differences at the interfirm level. The evidence of variation in audit pricing at the interaudit firm level suggests that Big 4 firms are not homogeneous and that individual brand names, which capture generalized firm expertise and reputation, play an important role in the audit market, partially explaining existing differences among these firms. Second, and more importantly, we explain the inconsistent results regarding the impact of industry specialization on audit fees by showing the differential effect of industry specialization on the audit fees charged by each Big 4 firm, which are necessary to support the existence and maintenance of a differentiated brand.

Overall, we document the importance of distinguishing among individual Big 4 firms and argue that treating all Big 4 firms as homogeneous creates a potentially significant omitted variable in certain audit fee studies (Hirbar, Kravet, & Wilson, 2014). Beyond this technical result, our findings reinforce the importance of capital investments for understanding audit production and the market for audit services. Most auditing research treats audit production as a black box in which...
labor hours are somehow transformed into audit assurance (O’Keefe, Simunic, & Stein, 1994). This characterization makes it difficult to explain the differences between Big 4 and non-Big 4 firms, and also provides no basis for differentiation within the Big 4. However, when both capital investments and labor hours are incorporated into audit production (Siros, Marmouze, & Simunic, 2016), it is natural for product differentiation to arise in a market. This can occur at the group level (i.e., Big 4 vs. non-Big 4), client-industry level (i.e., specialist vs. nonspecialist), and individual supplier level. Our article can, therefore, be viewed as an indirect test (through audit pricing) of the relative importance of capital investments at these various levels. Capital investments and their role in oligopolistic competition have been examined in the economics literature (Sutton, 1991). However, the potential importance of audit firm specific investments has essentially gone unrecognized in the auditing literature.

2 | LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

While the auditing literature typically uses Big 4/5 membership as a surrogate for audit quality (DeAngelo, 1981), DeFond and Zhang (2014) argue that larger audit firms have not only greater incentives (e.g., reputation loss from ex post discovery of low audit quality) to supply high-quality audits but also greater competencies (e.g., better audit inputs, industry expertise) to deliver high-quality audits. Thus, researchers have begun to tease out the effects of competencies on audit quality using several auditor characteristics, including auditor industry specialization and general audit firm competencies.

2.1 | Evidence from auditor industry specialization

The concept of auditor industry specialization was introduced in the early literature to examine quality variation at the inter-audit firm level. The supply of quality-differentiated audits can be motivated by agency and contracting theory (Jensen & Meckling, 1976; Watts & Zimmerman, 1983) as service differentials explain both brand name and industry specialization reputation as a function of increasing agency costs. Craswell et al. (1995) argue that there is a demand for quality-differentiated audits based on industry expertise, which drives audit firm investments in technology and expertise to develop industry specialization. Because developing such expertise is costly, industry specialization is presumably associated with higher audit fees (Carson, 2009; Ferguson et al., 2003; Francis et al., 2005) and higher quality audit services (Balsam, Krishnan, & Yang, 2003; Lim & Tan, 2010; Romanus, Maher, & Fleming, 2008).

In early studies, Zeff and Fossum (1967) and Palmrose (1986) identified industry expertise based on the market share of each audit firm in each industrial category. The market leader is designated an industry specialist on the assumption that industry specialists provide higher audit quality, attract more clients, and ultimately build larger market shares. Because information on audit fees was not publicly available before the 2000s, the choice of variables for calculating auditor market share has not been consistent in the literature. For example, some researchers use client size or the number of audit clients as alternative proxies to calculate the market share of each audit firm.

An alternative way to identify industry specialists is the client portfolio-based approach (Kwon, 1996; Neal & Riley, 2004), which assumes that industries in which a given audit firm holds the largest portfolio share reflect that firm’s allocation of higher-than-average resources and its development of industry-specific knowledge. This approach captures the aggregate distribution of audit services across various industries for each audit firm, and defines industries in which an audit firm is considered an industry specialist as those that constitute its three largest portfolio shares. Neal and Riley (2004) also introduced the weighted market share cut-off, which captures the complementary effects of the market share and portfolio approaches.

While the impact of industry expertise on audit pricing and audit quality has been extensively examined in the literature, the results of studies on industry specialization suggest that PwC has managed to differentiate itself from competitors regarding its within-industry market share position. For example, Knechel et al. (2007) document that the identification of industry specialists is highly stable, with PwC dominating in 23 of 40 industries, followed by EY (14 industries), Deloitte (10 industries), and KPMG (5 industries). Li et al. (2010) also report that PwC had the highest number of joint national and city industry leaders in each of the six years in their study period. Cahan et al. (2011) used the official websites of Big 4 firms to develop a list of key industries; they find that the self-proclaimed areas of industry experts are stable and consistent with the number of industries in which the audit firms qualify as industry specialists based on the market share approach.

2.2 | Evidence from audit firm competencies

The classic study by Simunic (1980) provides early evidence of a significantly positive coefficient on a PW dummy variable in the audit pricing model, suggesting that the measure captured some unique characteristics of that firm and/or its clients that resulted in a significant fee premium relative to other Big 8 firms. Moizer (1997) showed that in addition to the top-tier audit fee premium, PW and Peat Marwick earned audit fee premiums and discounts, respectively, in the U.S. market. Another quality-differentiated characteristic of large audit firms documented by Dunn and Mayhew (2004) is that Coopers and Lybrand LLP (later PwC) provided additional services beyond the standard audit through implementing enhanced financial disclosure practices.

While studies in the 1990s and early 2000s did not show a significant premium for any audit firm in the United States, Hay, Knechel, and Wong (2006) and Hay (2013) argue that there is some evidence of PwC receiving a significant fee premium in
international settings (Firth & Lau, 2004; Pong & Burnett, 2006). Ferguson and Scott (2014) also document that the Australian market over the period 2002–2004 was dominated by the three largest audit firms—PwC, EY, and KPMG—and that the overall audit fee premium for this group of firms was driven by a robust PwC fee premium.

2.3 | Hypotheses development

The nature of competition among the Big 4 audit firms has been a concern for regulators, particularly when the audit market is highly concentrated and dominated by the four largest firms. However, the survey results of the GAO (2008) conclude that the current level of concentration does not adversely affect auditor choice, audit prices, and audit quality. Also, PwC (2012) argues that there is intense competition among the large audit firms to develop their own networks and intensively invest in industry expertise, audit methodologies, and talented people, so as to meet the market’s demands for high-quality audits and effectively serve the capital markets at competitive prices. This is consistent with the analysis of Sirois et al. (2016), who argue that the Big 4 firms behave as non-colluding oligopolists who make capital investments in technology and other inputs (e.g., staff training) to distinguish themselves from their peers, thereby providing high levels of audit value (quality/price), and consequently dominating the market for audit services. This characterization is also consistent with statements on the Big 4 firms’ official websites:

At PwC, we’re doing just that—investing in leading-edge technology, significant process improvements, and leadership and performance development for our people.

With a common, consistent strategy and structure, we [EY] serve our global and local clients with the same intensive focus on quality.

Applying Lean methodologies to the financial statement audit in order to help enhance audit quality and increase value is a uniquely KPMG innovation.

Deloitte’s Assurance services deliver advanced-level insights across all industries – this uniquely puts us to understand the challenges and opportunities facing your business.

Given the historical evidence of a PwC fee premium and PwC’s continuing status as market share leader in the United States, we investigate whether there are significant systematic differences in audit pricing among the Big 4 audit firms. A differential PwC brand reputation is supported by the results of Vault’s annual accounting survey, which has consistently ranked PwC as the most prestigious audit firm from 2003 to 2016, followed by EY, Deloitte, and KPMG. In addition, PwC has retained its position as the number one professional services brand, and one of the world’s ten most powerful brands based on Brand Finance’s Brand Strength Index, with an estimated brand value of $18.5 billion in 2017.

While empirical results in the 1990s and early 2000s did not show a significant premium or discount for any Big audit firm, there may have been a fundamental shift after the enactment of the Sarbanes-Oxley Act (SOX) and the collapse of Arthur Andersen in 2002. The requirements of SOX substantially increased audit effort and expected legal liability, which subsequently led to higher audit fees (Ghosh & Pawlewicz, 2009; Griffin & Lont, 2007). We hypothesize that the individual firm reputational effect, particularly the PwC effect, is associated with above-average fee levels, consistent with Simunic’s (1980) early evidence of a PW effect. Our first hypothesis is as follows:

**H1.** PwC earns a significant audit fee premium compared to other Big 4 firms.

Next, we break down industry specialists by audit firm and fiscal year. While each of the Big 4 firms is well represented in the distribution of industry specialists, we note that PwC is designated an industry specialist most often across industries and years, followed by EY, Deloitte, and KPMG (Cahan et al., 2011; Knechel et al., 2007; Li et al., 2010). Given the prevalence of PwC and EY across most auditor industry specialization measures, the question arises of whether a lack of proper control for individual differences in fee premiums within the Big 4 significantly affects the observed association between audit fees and industry specialization. We hypothesize that the individual firm reputational effect is more relevant to determining price premium than the industry specialization effect. The second set of hypotheses are as follows:

**H2.** The industry specialization fee premium is confounded by the individual firm reputational effect.

**H2a.** PwC specialists earn a significant audit fee premium compared to PwC nonspecialists.

**H2b.** EY specialists earn a significant audit fee premium compared to EY nonspecialists.

**H2c.** Deloitte specialists earn a significant audit fee premium compared to Deloitte nonspecialists.

**H2d.** KPMG specialists earn a significant audit fee premium compared to KPMG nonspecialists.

3 | RESEARCH DESIGN

To test H1, we investigate whether there are cross-sectional differences in audit pricing within the Big 4 firms by breaking down the Big 4 indicator variable into four individual firm indicator variables (PwC, EY, KPMG, and Deloitte). Based on existing audit fee studies (Hay, 2013; Hay et al., 2006; Simunic, 1980), we estimate the following empirical model, whose variables are defined in Table 1:

$$
\text{ Fee Premium}_{it} = \beta_0 + \beta_1 \text{PwC Specialization}_{it} + \beta_2 \text{EY Specialization}_{it} + \beta_3 \text{Deloitte Specialization}_{it} + \beta_4 \text{KPMG Specialization}_{it} + \epsilon_{it}
$$

Where:

- Fee Premium: the audit fee premium for firm $i$ in year $t$.
- PwC Specialization: a dummy variable that equals 1 if the firm is a PwC specialist, 0 otherwise.
- EY Specialization: a dummy variable that equals 1 if the firm is an EY specialist, 0 otherwise.
- Deloitte Specialization: a dummy variable that equals 1 if the firm is a Deloitte specialist, 0 otherwise.
- KPMG Specialization: a dummy variable that equals 1 if the firm is a KPMG specialist, 0 otherwise.
- $\epsilon$: the error term.
Variables | N | M | SD | Q1 | Mdn | Q3 | Min. | Max. |
--- | --- | --- | --- | --- | --- | --- | --- | --- |
LNAFEES | 53,500 | 13.57 | 1.39 | 13.62 | 12.59 | 14.49 | 10.14 | 17.12 |
LNTTFEES | 53,500 | 13.76 | 1.41 | 13.79 | 12.78 | 14.68 | 10.26 | 17.37 |
LNASSET | 53,500 | 6.02 | 2.34 | 6.05 | 4.39 | 7.65 | 0.64 | 11.80 |
CURRENT | 53,500 | 2.83 | 2.81 | 1.97 | 1.27 | 3.25 | 0.17 | 17.99 |
INVREC | 53,500 | 0.25 | 0.19 | 0.21 | 0.09 | 0.36 | 0.00 | 0.80 |
LEVERAGE | 53,500 | 0.23 | 0.26 | 0.18 | 0.01 | 0.35 | 0.00 | 1.41 |
ROA | 53,500 | -0.05 | 0.29 | 0.03 | -0.06 | 0.08 | -1.62 | 0.35 |
MTB | 53,500 | 2.17 | 1.85 | 1.57 | 1.14 | 2.41 | 0.54 | 12.16 |
ATENURE | 53,500 | 12.16 | 15.12 | 7.00 | 3.00 | 14.00 | 0.00 | 84.00 |
LNBUSSEG | 53,500 | 0.94 | 0.53 | 0.69 | 0.69 | 1.39 | 0.00 | 2.08 |
LNGEOSEG | 53,500 | 0.36 | 0.65 | 0.00 | 0.00 | 0.69 | 0.00 | 2.30 |
SPI_DM | 53,500 | 0.66 | 0.47 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 |
LOSS | 53,500 | 0.37 | 0.48 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 |
MA | 53,500 | 0.29 | 0.45 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 |
IPO | 53,500 | 0.02 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
SEO | 53,500 | 0.06 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
BUSY | 53,500 | 0.71 | 0.45 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 |
HIGHLIT | 53,500 | 0.37 | 0.48 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 |
OPINION | 53,500 | 0.33 | 0.47 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 |
ICWEAK | 53,500 | 0.04 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
AUDCHG | 53,500 | 0.02 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
BIG4 | 53,500 | 0.72 | 0.45 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 |
PwC | 53,500 | 0.17 | 0.38 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
EY | 53,500 | 0.23 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
Deloitte | 53,500 | 0.15 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
KPMG | 53,500 | 0.16 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |

Note. This table reports the summary statistics of variables used in the audit fee model from fiscal year 2003 to 2017. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions for the audit fee model are as follows: LNAFEES = the natural logarithm of audit fees; LNTTFEES = the natural logarithm of total fees (the sum of audit fees and non-audit fees); LNASSET = the natural logarithm of total assets (in millions); CURRENT = the ratio of current assets to current liabilities; INVREC = the ratio of total inventory and receivables to total assets; LEVERAGE = the sum of short-term and long-term debt, divided by total assets; ROA = income before extraordinary items, scaled by total assets; MTB = the firm’s market value divided by its book value; ATENURE = the number of years the company has been audited by the same audit firm; LNBUSSEG = the natural logarithm of one plus the number of business segments; LNGEOSEG = the natural logarithm of one plus the number of geographical segments; SPI_DM = indicator variable equal to one if an audit client has a special item during the year, and zero otherwise; AUDCHG = indicator variable equal to one if there is a change in auditor in the current period, and zero otherwise; LOSS = indicator variable equal to one if income before extraordinary items is negative in the current period, and zero otherwise; MA = indicator variable equal to one if an audit client is engaged in a merger or acquisition during the year, and zero otherwise; SEO = indicator variable equal to one if an audit client is engaged in an initial public offering during the year, and zero otherwise; BUSY = indicator variable equal to one if an audit client is engaged in a seasoned equity offering during the year, and zero otherwise; HIGHLIT = indicator variable equal to one if an audit client’s year-end falls on December 31, and zero otherwise; OPINION = indicator variable equal to one if high litigation risk industries as defined by Francis, Philbrick, and Schipper (1994), and zero otherwise; ICWEAK = indicator variable equal to one if the auditor’s opinion of the effectiveness of the company’s internal control is adverse or disclaimer, and zero otherwise; SPI_DM = indicator variable equal to one if there is a change in auditor in the current period, and zero otherwise; BIG4 = indicator variable equal to one if the firm’s auditor is a member of the Big 4 audit firms (PwC, EY, KPMG, and Deloitte), and zero otherwise; PwC = indicator variable equal to one if the firm’s auditor is PwC (EY, Deloitte, and KPMG, respectively), and zero otherwise.

\[ \text{LNAFEES}_t = \alpha_0 + \alpha_1 \text{LNASSET}_t + \alpha_2 \text{CURRENT}_t + \alpha_3 \text{INVREC}_t + \alpha_4 \text{LEVERAGE}_t + \alpha_5 \text{ROA}_t + \alpha_6 \text{MTB}_t + \alpha_7 \text{ATENURE}_t + \alpha_8 \text{LNBUSSEG}_t + \alpha_9 \text{LNGEOSEG}_t + \alpha_{10} \text{SPI_DM}_t + \alpha_{11} \text{LOSS}_t + \alpha_{12} \text{MA}_t + \alpha_{13} \text{PO}_t + \alpha_{14} \text{SEO}_t + \alpha_{15} \text{BUSY}_t + \alpha_{16} \text{HIGHLIT}_t + \alpha_{17} \text{OPINION}_t + \alpha_{18} \text{ICWEAK}_t + \alpha_{19} \text{AUDCHG}_t + \alpha_{20} \text{PwC}_t + \alpha_{21} \text{EY}_t + \alpha_{22} \text{KPMG}_t + \alpha_{23} \text{Deloitte}_t + \text{Year and Industry Fixed Effects} + \varepsilon_t \] (1)

H1 predicts that the estimated coefficient of PwC will differ from those of the other Big 4 firms. Specifically, we expect \( \alpha_{20} \) (PwC) to be significantly larger than \( \alpha_{21} \) (EY), \( \alpha_{22} \) (KPMG), and \( \alpha_{23} \) (Deloitte). Additionally, to focus on the pricing differences between these major audit firms, we exclude client firms audited by non-Big 4 audit firms and rerun the audit fee model including
variables identifying audits by PwC, EY, and Deloitte (with KPMG audits in the intercept). We also examine trends in auditor premiums over time by dividing our sample into three equal time periods (2003–2007, 2008–2012, and 2013–2017) and investigating whether the variation in auditor premiums remains constant over time.

To test the second set of hypotheses, we investigate whether the evidence of auditor industry specialization (SPEC) essentially reflects the individual audit firm’s generalized competencies. First, we use audit fees to calculate the auditor market share within an industry and take the within-industry market share approach, in which an individual audit firm is considered an industry specialist if it holds a

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**TABLE 2** The percentage of aggregated audit revenues (in millions) and aggregated client assets (in billions), earned by major audit firms from fiscal year 2000 to 2017

| Panel A Fiscal year | Aggregated audit revenues | PwC  | EY   | Deloitte | KPMG | Arthur Andersen | Others |
|---------------------|--------------------------|------|------|----------|------|----------------|--------|
| 2000                | 2,355.3                  | 25.3%| 26.0%| 14.6%    | 14.8%| 16.4%          | 2.8%   |
| 2001                | 3,984.7                  | 29.0%| 21.8%| 17.0%    | 15.4%| 14.1%          | 2.8%   |
| 2002                | 7,401.4                  | 29.6%| 23.9%| 19.7%    | 22.3%| 1.0%           | 3.5%   |
| 2003                | 9,559.0                  | 30.0%| 23.7%| 21.2%    | 21.4%|                | 3.7%   |
| 2004                | 13,957.9                 | 30.7%| 22.3%| 21.6%    | 21.4%|                | 3.9%   |
| 2005                | 15,000.8                 | 29.9%| 23.1%| 22.0%    | 19.7%|                | 5.4%   |
| 2006                | 16,096.5                 | 28.6%| 23.2%| 22.1%    | 20.1%|                | 6.0%   |
| 2007                | 15,560.6                 | 27.1%| 23.6%| 23.1%    | 19.7%|                | 6.5%   |
| 2008                | 15,477.9                 | 27.8%| 23.3%| 23.0%    | 19.5%|                | 6.4%   |
| 2009                | 14,173.7                 | 28.7%| 23.8%| 22.5%    | 18.7%|                | 6.2%   |
| 2010                | 13,802.6                 | 28.6%| 24.4%| 22.5%    | 18.6%|                | 5.9%   |
| 2011                | 14,086.0                 | 28.7%| 25.1%| 21.9%    | 18.8%|                | 5.6%   |
| 2012                | 14,641.6                 | 29.2%| 24.7%| 22.2%    | 18.6%|                | 5.2%   |
| 2013                | 15,125.7                 | 29.2%| 25.3%| 22.4%    | 18.0%|                | 5.0%   |
| 2014                | 15,483.9                 | 29.1%| 24.0%| 23.3%    | 18.3%|                | 5.4%   |
| 2015                | 15,703.0                 | 29.8%| 24.5%| 22.5%    | 17.8%|                | 5.5%   |
| 2016                | 15,823.8                 | 30.8%| 24.9%| 20.5%    | 18.1%|                | 5.7%   |
| 2017                | 16,627.4                 | 30.1%| 24.7%| 20.3%    | 19.3%|                | 5.6%   |
| Average             |                         | 29.0%| 24.0%| 21.2%    | 18.9%| 10.5%          | 5.1%   |

| Panel B Fiscal year | Aggregated client assets | PwC  | EY   | Deloitte | KPMG | Arthur Andersen | Others |
|---------------------|--------------------------|------|------|----------|------|----------------|--------|
| 2000                | 18,329.4                 | 27.3%| 17.3%| 19.3%    | 22.1%| 12.9%          | 1.0%   |
| 2001                | 25,648.6                 | 30.4%| 15.6%| 17.2%    | 24.0%| 11.8%          | 1.0%   |
| 2002                | 47,286.1                 | 27.9%| 19.1%| 19.8%    | 28.5%| 2.9%           | 1.7%   |
| 2003                | 58,326.8                 | 26.2%| 19.3%| 21.8%    | 31.4%|                | 1.3%   |
| 2004                | 67,391.8                 | 26.1%| 19.7%| 24.4%    | 28.7%|                | 1.2%   |
| 2005                | 75,255.5                 | 26.3%| 19.0%| 24.4%    | 29.0%|                | 1.2%   |
| 2006                | 79,257.8                 | 26.6%| 20.3%| 25.7%    | 26.1%|                | 1.4%   |
| 2007                | 86,923.4                 | 26.4%| 19.1%| 26.5%    | 26.7%|                | 1.4%   |
| 2008                | 84,146.3                 | 27.9%| 19.6%| 25.9%    | 24.9%|                | 1.7%   |
| 2009                | 81,668.0                 | 29.1%| 19.2%| 27.6%    | 22.7%|                | 1.4%   |
| 2010                | 87,239.9                 | 29.7%| 19.0%| 26.4%    | 23.7%|                | 1.3%   |
| 2011                | 91,763.7                 | 28.2%| 20.2%| 26.1%    | 24.2%|                | 1.2%   |
| 2012                | 95,092.8                 | 28.8%| 19.4%| 26.3%    | 24.3%|                | 1.3%   |
| 2013                | 95,294.7                 | 27.8%| 19.7%| 26.9%    | 24.1%|                | 1.5%   |
| 2014                | 95,462.3                 | 28.5%| 19.1%| 26.7%    | 24.0%|                | 1.7%   |
| 2015                | 92,416.3                 | 32.0%| 19.1%| 26.4%    | 20.6%|                | 1.8%   |
| 2016                | 95,204.6                 | 34.5%| 19.8%| 22.1%    | 21.6%|                | 2.1%   |
| 2017                | 100,082.7                | 33.3%| 20.0%| 20.1%    | 24.7%|                | 1.9%   |
| Average             |                         | 28.5%| 19.1%| 24.3%    | 25.1%| 9.2%           | 1.4%   |
### Table 3: Audit Fee Model

| Panel A | Full sample FY 2003–2007 | FY 2008–2012 | FY 2013–2017 |
|---------|---------------------------|--------------|--------------|
| Variables | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. |
| Intercept | 10.25 *** | 278.18 | 10.10 *** | 223.83 | 10.35 *** | 264.84 | 10.24 *** | 141.16 |
| LNASSET | 0.51 *** | 107.53 | 0.53 *** | 95.32 | 0.51 *** | 89.17 | 0.51 *** | 82.52 |
| CURRENT | -0.02 *** | -12.24 | -0.03 *** | -9.53 | -0.02 *** | -7.79 | -0.02 *** | -10.01 |
| INVREC | 0.55 *** | 12.71 | 0.54 *** | 10.25 | 0.52 *** | 9.92 | 0.57 *** | 9.79 |
| LEVERAGE | -0.07 *** | -3.16 | -0.05 *** | -1.71 | -0.12 *** | -3.90 | -0.02 | -0.69 |
| ROA | -0.28 *** | -12.04 | -0.27 *** | -8.05 | -0.32 *** | -10.30 | -0.27 *** | -8.18 |
| MTB | 0.02 *** | 7.25 | 0.03 *** | 6.34 | 0.02 *** | 4.75 | 0.02 *** | 4.77 |
| ATENURE | 0.00 *** | 4.50 | 0.00 *** | 3.39 | 0.00 *** | 3.34 | 0.00 *** | 4.69 |
| LNBUSSEG | 0.03 ** | 2.45 | 0.04 *** | 2.81 | 0.03 * | 1.83 | 0.02 | 0.91 |
| LNGEOSEG | 0.03 *** | 3.11 | 0.00 | 0.03 *** | 2.82 | 0.05 *** | 3.67 |
| SPI_DM | 0.17 *** | 18.71 | 0.19 *** | 15.45 | 0.16 *** | 12.16 | 0.16 *** | 11.41 |
| LOSS | 0.12 *** | 11.08 | 0.13 *** | 7.64 | 0.10 *** | 6.84 | 0.14 *** | 8.53 |
| MA | 0.06 *** | 6.39 | 0.05 *** | 3.46 | 0.06 *** | 4.75 | 0.07 *** | 5.37 |
| IPO | 0.26 *** | 11.82 | 0.26 *** | 7.55 | 0.20 *** | 5.38 | 0.31 *** | 8.38 |
| SEO | 0.08 *** | 6.03 | 0.12 *** | 5.26 | 0.05 *** | 2.66 | 0.07 *** | 3.46 |
| BUSY | 0.04 ** | 2.29 | 0.09 *** | 5.03 | -0.01 | -0.46 | 0.00 | 0.22 |
| HIGHLIT | 0.03 | 1.42 | 0.05 * | 1.85 | 0.03 | 1.25 | 0.01 | 0.18 |
| OPINION | 0.09 *** | 11.42 | 0.11 *** | 9.70 | 0.10 *** | 8.15 | 0.02 | 1.28 |
| ICWEAK | 0.45 *** | 21.05 | 0.56 *** | 21.47 | 0.31 *** | 6.12 | 0.35 *** | 10.97 |
| AUDCHG | -0.06 *** | -2.66 | -0.01 | -0.36 | -0.16 *** | -4.39 | -0.05 | -0.89 |
| PwC | 0.40 *** | 18.28 | 0.34 *** | 12.85 | 0.42 *** | 15.21 | 0.45 *** | 15.22 |
| EY | 0.34 *** | 17.14 | 0.28 *** | 11.46 | 0.33 *** | 13.57 | 0.43 *** | 16.21 |
| Deloitte | 0.33 *** | 15.02 | 0.25 *** | 8.91 | 0.37 *** | 13.31 | 0.40 *** | 14.62 |
| KPMG | 0.27 *** | 12.61 | 0.24 *** | 8.92 | 0.30 *** | 10.85 | 0.29 *** | 10.51 |
| Fixed effects (FE) – Industry & Year | Yes | Yes | Yes | Yes |
| Observations | 53,500 | 19,313 | 17,990 | 16,197 |
| Adjusted R² | 84.5% | 82.1% | 85.2% | 86.1% |
| Diff|PwC – EY | 0.05 *** | 2.62 | 0.05* | 2.33 | 0.08 *** | 3.54 | 0.02 | 0.84 |
| Diff|PwC – Deloitte | 0.06 *** | 2.97 | 0.09 *** | 3.53 | 0.05* | 1.91 | 0.05 * | 1.84 |
| Diff|PwC – KPMG | 0.12 *** | 5.50 | 0.10 *** | 3.93 | 0.12 *** | 4.57 | 0.16 *** | 5.41 |
| Diff|EY – KPMG | 0.07 *** | 3.35 | 0.05 * | 1.94 | 0.04 | 1.60 | 0.13 *** | 5.08 |
| Diff|Deloitte – KPMG | 0.06 ** | 2.53 | 0.01 | 0.37 | 0.07 *** | 2.67 | 0.10 *** | 3.76 |
| Diff|EY – Deloitte | 0.01 | 0.62 | 0.0 | 1.50 | -0.03 | -1.36 | 0.03 | 1.18 |

### Panel B

| Variables | Full sample FY 2003–2007 | FY 2008–2012 | FY 2013–2017 |
|-----------|---------------------------|--------------|--------------|
| Variables | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. |
| PwC | 0.42 *** | 19.92 | 0.36 *** | 14.00 | 0.44 *** | 16.21 | 0.48 *** | 16.89 |
| EY | 0.35 *** | 18.30 | 0.28 *** | 11.85 | 0.35 *** | 14.42 | 0.45 *** | 17.60 |
| Deloitte | 0.38 *** | 17.60 | 0.30 *** | 11.32 | 0.40 *** | 14.89 | 0.44 *** | 16.47 |
| KPMG | 0.27 *** | 12.59 | 0.21 *** | 8.42 | 0.29 *** | 10.79 | 0.30 *** | 10.98 |

(Continues)
significant portion of the market share in that industry. Specifically, we adopt two widely used assignment approaches to designate industry specialists: dominant market share (AF_DOM) and market share cut-off at 30% (AF_30). The dominant market share approach includes the market leader in each year and industry (based on two-digit SIC code) together with the firm with the second largest market share in industries with less than 10% difference in market share between the top two firms. To be designated an industry specialist under the market share cut-off approach, an audit firm must earn audit fee revenue from an industry that amounts to at least 30% of the total audit fees paid to all firms in that industry.

We then include each individual audit firm indicator variable (PwC, EY, Deloitte, and KPMG), SPEC, and its interaction term in the audit fee model to examine whether an individual audit firm’s generalized competencies confound the effect of industry specialization on audit pricing. For this test, if the individual differences among the Big 4 firms do not supersede a fee premium for industry specialization and industry specialization results in higher audit fees, the industry specialization effect will remain positive and significant across each Big 4 firm. Additionally, we argue that any significant difference between the fee premium earned by industry specialists suggests a confounding effect of the individual audit firm’s generalized competencies on the usually observed industry specialization premium.

### 3.1 Sample selection

Our sample includes all U.S. listed firms with available datasets from the Audit Analytics database from 2003 through 2017. We then
merge these data with the Compustat fundamental annual files to obtain necessary financial data for all firm-year observations. We exclude all observations related to firms in the financial (SIC 6000–6,999) and utility (SIC 4900–4,949) industries because the audit fee model for these firms differs from that for other industries (Fields, Fraser, & Wilkins, 2004; Hay et al., 2006). We also exclude firms with missing values and firms with total assets of less than $1 million. These sample selection procedures yield a final sample of 53,500 firm-year observations, including 15,160 for clients of non-Big 4 firms (28.3%) and 38,340 for clients of Big 4 firms (71.7%). Finally, we winsorize all observations that fall in the top and bottom 1% of the distribution for each nondiscrete variable to mitigate potential problems of outliers.

### Table 4

**Audit fee model (size partition)**

| Panel A | Quintile 1 (Small) | Quintile 2 | Quintile 3 | Quintile 4 | Quintile 5 (Large) |
|---------|------------------|------------|------------|------------|------------------|
|         | DV = LNAFEES     | DV = LNAFEES | DV = LNAFEES | DV = LNAFEES | DV = LNAFEES |
| PwC     | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. |
| 0.57 *** | 11.89 | 0.46 *** | 12.65 | 0.38 *** | 10.55 | 0.34 *** | 6.36 | 0.29 ** | 2.45 |
| EY      | 0.40 *** | 9.07 | 0.41 *** | 12.61 | 0.38 *** | 10.83 | 0.25 *** | 4.74 | 0.22 * | 1.82 |
| Deloitte| 0.32 *** | 5.66 | 0.36 *** | 9.36 | 0.38 *** | 10.29 | 0.27 *** | 4.83 | 0.20 | 1.64 |
| KPMG    | 0.36 *** | 7.97 | 0.33 *** | 9.74 | 0.30 *** | 7.93 | 0.20 *** | 3.57 | 0.16 | 1.32 |

| Control variables (FE) | Yes | Yes | Yes | Yes | Yes |

| Observations | 11,041 | 10,687 | 10,680 | 9,994 | 11,098 |
| Adjusted R²  | 68.2%  | 60.2%  | 55.8%  | 53.5%  | 71.7% |

| Diff|PwC – KPMG | 0.22 *** | 3.69 | 0.13 *** | 3.13 | 0.08 ** | 2.42 | 0.14 *** | 3.71 |
| Diff|EY – KPMG  | 0.04   | 0.76 | 0.08 **  | 2.18 | 0.08 **  | 2.49 | 0.05   | 1.39 |
| Diff|Deloitte – KPMG | -0.04 | -0.56 | 0.03 | 0.73 | 0.08 ** | 2.54 | 0.07 * | 1.77 |

| Panel B | Quintile 1 (Small) | Quintile 2 | Quintile 3 | Quintile 4 | Quintile 5 (Large) |
|---------|------------------|------------|------------|------------|------------------|
|         | DV = LNTTFEES    | DV = LNTTFEES | DV = LNTTFEES | DV = LNTTFEES | DV = LNTTFEES |
| PwC     | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. |
| 0.61 *** | 13.88 | 0.46 *** | 13.50 | 0.43 *** | 12.59 | 0.43 *** | 8.47 | 0.39 *** | 3.17 |
| EY      | 0.40 *** | 9.65 | 0.42 *** | 13.37 | 0.40 *** | 12.04 | 0.31 *** | 6.26 | 0.32 *** | 2.61 |
| Deloitte| 0.37 *** | 6.48 | 0.41 *** | 10.88 | 0.44 *** | 12.10 | 0.37 *** | 7.09 | 0.34 *** | 2.73 |
| KPMG    | 0.35 *** | 7.92 | 0.31 *** | 9.69 | 0.32 *** | 8.83 | 0.26 *** | 4.88 | 0.22 * | 1.79 |

| Control variables (FE) | Yes | Yes | Yes | Yes | Yes |

| Observations | 11,041 | 10,687 | 10,680 | 9,994 | 11,098 |
| Adjusted R²  | 69.6%  | 60.5%  | 55.3%  | 51.4%  | 70.6% |

| Diff|PwC – KPMG | 0.26 *** | 4.78 | 0.15 *** | 3.95 | 0.11 *** | 3.42 | 0.17 *** | 4.60 |
| Diff|EY – KPMG  | 0.05   | 0.98 | 0.11 *** | 3.01 | 0.08 *** | 2.59 | 0.05   | 1.57 |
| Diff|Deloitte – KPMG | 0.03 | 0.40 | 0.10 ** | 2.47 | 0.12 *** | 3.60 | 0.12 *** | 2.98 |

Note. This table partitions our main regression model based on quintiles for LNAFEES (Panel A) and LNTTFEES (Panel B) as the dependent variable. Control variables are the set given in Table 3, Panel A. FE are industry and year fixed effects.

- *, **, *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively, using two-tailed tests.

**4 | EMPIRICAL RESULTS**

Table 1 reports the descriptive statistics and definitions for all variables used in the audit fee model during the 2003 to 2017 period.

To provide detailed insight into the rankings of each major audit firm across the sample period, Table 2 reports the percentage of aggregated audit revenues earned (Panel A) and the aggregated client assets (Panel B) by each major audit firm from fiscal year 2000 to 2017. Overall, when aggregated audit revenues are considered as the ranking criteria, we find that PwC consistently places first with 29% market share on average, followed by EY (24%), Deloitte (21.2%), and KPMG (18.9%). Similarly, when aggregated client assets are considered as the ranking criteria, PwC is the top-ranked audit firm with an
TABLE 5  Percentage of industries in which an audit firm is identified as an industry specialist over fiscal years 2000 to 2017

| SPEC measure | Measurement variable | Audit fees | Market share cut-off at 30% |
|--------------|----------------------|------------|-----------------------------|
|              |                      | Audit fees | AF_30                       | AF.DOM |
| Audit firm   |                       |            | PwC   | EY   | Deloitte | KPMG | PwC   | EY   | Deloitte | KPMG |
| Fiscal year  |                       |            | PwC   | EY   | Deloitte | KPMG | PwC   | EY   | Deloitte | KPMG |
| 2000         |                       |            | 35.71 | 33.25 | 2.55     | 5.52 | 31.72 | 30.57 | 3.18     | 17.32 |
| 2001         |                       |            | 35.31 | 29.28 | 9.20     | 8.09 | 45.98 | 17.25 | 8.55     | 17.11 |
| 2002         |                       |            | 38.50 | 31.68 | 10.14    | 12.72| 37.27 | 25.62 | 12.57    | 24.49 |
| 2003         |                       |            | 40.25 | 26.64 | 14.91    | 12.21| 45.23 | 20.67 | 15.08    | 18.97 |
| 2004         |                       |            | 36.38 | 29.76 | 13.07    | 13.67| 45.47 | 17.36 | 14.79    | 22.38 |
| 2005         |                       |            | 39.95 | 28.59 | 13.26    | 11.68| 43.51 | 24.12 | 16.68    | 15.7 |
| 2006         |                       |            | 28.51 | 33.95 | 21.53    | 10.32| 38.85 | 19.67 | 21.53    | 19.81 |
| 2007         |                       |            | 27.31 | 31.57 | 23.52    | 12.13| 37.35 | 29.55 | 23.33    | 9.69 |
| 2008         |                       |            | 25.31 | 25.42 | 27.19    | 16.62| 39.23 | 24.77 | 25.96    | 9.87 |
| 2009         |                       |            | 28.73 | 34.19 | 26.19    | 8.66 | 41.00 | 29.15 | 20.85    | 8.69 |
| 2010         |                       |            | 34.78 | 26.47 | 28.38    | 7.69 | 40.69 | 26.18 | 24.25    | 8.73 |
| 2011         |                       |            | 24.45 | 34.33 | 24.50    | 14.80| 34.94 | 25.47 | 23.07    | 16.3 |
| 2012         |                       |            | 27.89 | 36.66 | 22.39    | 11.21| 35.09 | 35.43 | 20.42    | 9.92 |
| 2013         |                       |            | 30.51 | 32.64 | 22.69    | 12.53| 36.58 | 33.19 | 21.14    | 8.95 |
| 2014         |                       |            | 35.29 | 28.18 | 23.87    | 10.57| 33.72 | 34.57 | 21.19    | 10.38 |
| 2015         |                       |            | 38.11 | 27.51 | 23.31    | 8.98 | 37.16 | 34.84 | 22.69    | 5.16 |
| 2016         |                       |            | 38.60 | 34.78 | 20.34    | 8.92 | 38.42 | 34.68 | 22.58    | 4.18 |
| 2017         |                       |            | 38.84 | 31.02 | 15.92    | 13.63| 37.86 | 32.56 | 19.19    | 10.25 |
| Average      |                       |            | 33.58 | 30.88 | 19.05    | 15.08| 38.89 | 27.54 | 18.73    | 13.16 |

| SPEC measure | Measurement variable | Client assets | Number of clients |
|--------------|----------------------|---------------|-------------------|
|              |                      | AT_30         | NC_30             |
| Audit firm   |                      | PwC | EY | Deloitte | KPMG | PwC | EY | Deloitte | KPMG |
| Fiscal year  |                      |            | PwC | EY | Deloitte | KPMG | PwC | EY | Deloitte | KPMG |
| 2000         |                      |            | 41.09 | 14.60 | 7.11 | 22.74 | 13.88 | 48.04 | 3.56 | 1.42 |
| 2001         |                      |            | 48.22 | 12.86 | 7.48 | 18.38 | 31.22 | 18.05 | 17.56 | 6.34 |
| 2002         |                      |            | 35.33 | 29.33 | 12.01 | 23.11 | 24.23 | 26.02 | 41.84 | 6.89 |
| 2003         |                      |            | 40.90 | 23.37 | 15.55 | 20.18 | 39.05 | 23.27 | 32.15 | 4.54 |
| 2004         |                      |            | 36.90 | 20.40 | 21.14 | 21.51 | 22.65 | 14.41 | 53.53 | 8.53 |
| 2005         |                      |            | 37.21 | 18.88 | 24.34 | 19.52 | 11.76 | 25.49 | 51.63 | 10.13 |
| 2006         |                      |            | 35.00 | 21.63 | 23.31 | 19.89 | 9.24  | 31.68 | 48.51 | 9.57 |
| 2007         |                      |            | 35.91 | 24.81 | 19.42 | 19.55 | 14.57 | 27.13 | 49.80 | 5.26 |
| 2008         |                      |            | 36.78 | 28.38 | 22.44 | 12.18 | 6.03  | 27.59 | 56.03 | 5.60 |
| 2009         |                      |            | 33.27 | 32.96 | 21.52 | 12.00 | 10.32 | 28.57 | 50.79 | 5.56 |
| 2010         |                      |            | 32.08 | 27.33 | 22.38 | 18.02 | 9.92  | 33.21 | 48.09 | 5.34 |
| 2011         |                      |            | 29.53 | 39.23 | 14.95 | 16.23 | 16.48 | 28.74 | 46.74 | 5.36 |
| 2012         |                      |            | 31.70 | 39.31 | 16.73 | 12.14 | 8.66  | 33.57 | 46.21 | 8.30 |
| 2013         |                      |            | 26.96 | 39.72 | 18.93 | 14.26 | 6.70  | 25.70 | 56.98 | 8.38 |
average market share of 28.5%, followed by KPMG (25.1%), Deloitte (24.5%), and EY (19.1%). Table 3 reports the regression results used to test H1.9 Instead of treating the Big 4 firms as a homogeneous set, we break down the Big 4 indicator variable (BIG4) into four individual firm indicator variables. As shown in column (1) of Panel A, the estimated coefficient on PwC (0.40) is significantly larger than those of the other Big 4 firms (EY = 0.34; Deloitte = 0.33; KPMG = 0.27), indicating that PwC earns, on average, a significant audit fee premium relative to the other Big 4 audit firms and that Big 4 auditors have heterogeneous pricing structures.10

Additionally, we observe a narrowing gap in the audit fee premium among PwC, EY, and Deloitte over the three time periods: 2003–2007 (column 2), 2008–2012 (column 3), and 2013–2017 (column 4). Over the same time periods, we observe a substantial widening gap in the audit fee premium between KPMG and the other Big 4 firms (PwC, EY and Deloitte), supporting Bernstein’s (1978) early evidence that Peat Marwick was a price cutter in the U.S. market.

Inferences remain unchanged when we estimate our regression models using the sum of audit fees and nonaudit fees (LNTTFEES) as the dependent variable in Panel B, and when we exclude client firms audited by non-Big 4 audit firms in Panel C. Overall, the regression results indicate that PwC exhibits a significantly larger fee premium across our sample period, and that the average fee premium earned by KPMG is relatively lower than those of the other Big 4.11

Given that client size is the factor most closely related to auditor selection (e.g., Lawrence, Minutti-Meza, & Zhang, 2011), we divide each year and industry sample into quintiles based on total client assets and report the results using the same format as in Table 3. We report the results in Table 4, which documents that the PwC coefficients are significantly larger than those of KPMG across all asset size quintiles, particularly in smaller quintiles. We also provide evidence of a significant pricing difference between KPMG and both EY and Deloitte, particularly when the sum of audit fees and nonaudit fees (LNTTFEES) is used as the dependent variable in Panel B. Collectively, these results confirm that there is clear evidence of systematic variations in audit pricing across the Big 4 audit firms, particularly for PwC and KPMG.

To examine whether an individual audit firm’s generalized competencies confound the effect of industry specialization on audit pricing, we first identify industry specialists in each industry according to the four different assignment methods and measurement variables: dominant market share (AF_DOM) and market share cut-off at 30% of aggregated audit revenues (AF_30), aggregated client assets (AT_30), and aggregated number of audit clients (NC_30). As we have argued, an individual audit firm’s generalized competencies might be a confounding variable that is correlated with both audit fees (dependent variable) and auditor industry specialization12 (independent variable) in the audit fee model.

Table 5 reveals that the popular measures of industry specialization based on market shares (AF_DOM, AF_30, and AT_30) are highly concentrated and dominated by PwC and EY throughout the sample period. By contrast, KPMG is identified as an industry specialist in the fewest industries across the various industry specialist measures and fiscal periods. However, when number of clients is used as the measurement variable, NC_30 is dominated by Deloitte, followed by EY, PwC, and KPMG. These findings suggest that the relationship between audit fees and auditor industry specialization may be significantly influenced by variations in audit firm specific pricing.

The regression results used to test H2(a–d) are reported in Table 6 for each measure of auditor industry specialization (SPEC): AF_DOM (Column 1), AF_30 (Column 2), AT_30 (Column 3), and NC_30 (Column 4).

First, we find that the estimated coefficients of SPEC (Panel A) and the fee premium earned by Big 4 specialists (Panel B) are positive and significant across all measures of industry specialization, except for NC_30. Second, we break down the indicator variable BIG4 into...
To control for the possibility that the interactive effects of the control variables are correlated with the interactions of SPEC and each audit firm indicator, we extend the regression model in Table 6 and include interactions of SPEC and each control variable. We find that the main inferences are unchanged when we use a fully interacted model.

### TABLE 6 Audit fee model: Estimation of industry specialist premium

| Panel A | (1) Full sample | (2) Full sample | (3) Full sample | (4) Full sample |
|---------|----------------|----------------|----------------|----------------|
| Variables | DV = LNAFEES | DV = LNAFEES | DV = LNAFEES | DV = LNAFEES |
| SPEC = AF_DOM | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. |
| SPEC | 0.05 *** | 4.40 | 0.06 *** | 4.61 | 0.02* | 1.65 | -0.04 | -1.14 |
| BIG4 | 0.31 *** | 17.60 | 0.32 *** | 18.36 | 0.33** | 18.62 | 0.33*** | 19.61 |
| Control variables (& FE) | Yes | Yes | Yes | Yes |
| Observations | 53,500 | 53,500 | 53,500 | 53,500 |
| Adjusted R² | 84.5% | 82.1% | 85.2% | 86.1% |

### Panel B

| (1) SPEC | (2) BIG4 | (3) SPEC * BIG4 |
|---------|---------|----------------|
| Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. |
| -0.05 | -0.55 | -0.43* | -1.80 | -0.50* | -1.66 | -0.04 | -1.14 |
| 0.31 *** | 17.59 | 0.32 *** | 18.36 | 0.33 *** | 18.60 | 0.33 *** | 19.61 |
| 0.11 | 1.08 | 0.50 ** | 2.07 | 0.52* | 1.74 | 0.00 |
| Control variables (& FE) | Yes | Yes | Yes | Yes |
| Observations | 53,500 | 53,500 | 53,500 | 53,500 |
| Adjusted R² | 84.5% | 82.1% | 85.2% | 86.1% |

### Panel C

| (1) SPEC | (2) PwC | (3) EY | (4) Deloitte | (5) KPMG | (6) SPEC * PwC | (7) SPEC * EY | (8) SPEC * Deloitte | (9) SPEC * KPMG |
|---------|---------|-------|-------------|---------|----------------|----------|-----------------|-------------|
| Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. | Coef. | t-stat. |
| -0.06 | -0.61 | -0.43* | -1.77 | -0.50* | -1.65 | -0.05 | -0.53 |
| 0.38 *** | 14.26 | 0.39 *** | 16.03 | 0.40 *** | 15.54 | 0.40 *** | 18.39 |
| 0.32 *** | 14.84 | 0.32 *** | 15.39 | 0.34 *** | 15.79 | 0.35 *** | 17.10 |
| 0.31 *** | 13.57 | 0.32 *** | 14.03 | 0.32 *** | 14.34 | 0.33 *** | 14.77 |
| 0.28 *** | 12.08 | 0.28 *** | 12.57 | 0.28 *** | 11.97 | 0.27 *** | 12.54 |
| 0.09 | 0.88 | 0.44* | 1.82 | 0.50 | 1.64 | -0.07 | -0.62 |
| 0.10 | 1.01 | 0.51 ** | 2.09 | 0.50* | 1.66 | 0.01 | 0.15 |
| 0.11 | 1.14 | 0.56 ** | 2.26 | 0.55* | 1.80 | 0.04 | 0.32 |
| 0.04 | 0.36 | 0.37 | 1.52 | 0.47 | 1.53 | 0.00 |
| Control variables (& FE) | Yes | Yes | Yes | Yes |
| Observations | 53,500 | 53,500 | 53,500 | 53,500 |
| Adjusted R² | 84.5% | 82.1% | 85.2% | 86.1% |

Note. This table presents regression results of the audit fee model for LNAFEES including auditor industry specialization measures (SPEC) and their interaction term with each individual audit firm indicator variable. Control variables are the set given in Table 3, Panel A. FE are industry and year fixed effects. *, **, *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively, using two-tailed tests. T-statistics are based on clustered standard errors at client firm level.

four individual firm indicator variables in Panel C. While the estimated coefficients on individual Big 4 firms remain positive and significant at less than the 1% level, the industry specialization premium is only observed for EY and Deloitte specialists (Columns 1 and 2) when the audit fee-based measures are used to identify industry specialists, and not for PwC and KPMG specialists.13
Taken together, our results suggest that the variation in audit pricing at the interaudit firm level has a strong impact on the measured audit fee effect usually attributed to industry specialization. We perform several sensitivity tests to determine the sensitivity of our main results to different specifications.

### 4.1 Sensitivity analysis using audit firm’s competitive position

First, we follow Chu et al.’s (2018) methodology to obtain a measure of audit firms’ competitive positions in a local market by calculating the difference in market shares based on aggregated audit fees (DIFF_AFEE) between the incumbent audit firm and the largest audit firm in each two-digit SIC industry. Specifically, this measure captures the competitive disadvantage of all other audit firms operating in a client-industry market relative to the largest audit firm in that market, which negatively affects the pricing power of (smaller) incumbent audit firms. A low value of DIFF_AFEE implies that an audit firm has a strong competitive position relative to the dominant market firm, while a high value of DIFF_AFEE implies that an audit firm is a small player in a market and has a weak competitive position.

In Table 7, while we consistently observe a negative and highly significant coefficient on the difference in market shares (DIFF_AFEE), we do not observe statistical significance in either of the Big 4 specialists’ groups (Columns 1 and 3). Columns (2) and (4) report results when we include each individual audit firm indicator variable, the industry specialization measure, and its interaction term in the audit fee model. Overall, we find that the effects of auditor industry specialization largely become either negative or insignificant when we include competitive position in the analysis. Also, we consistently find that KPMG specialists earn a below-average fee premium compared to those of other Big 4 specialists after controlling for the audit firm’s competitive position in the market.

### TABLE 7 Audit fee model: Estimation of industry specialist premium with audit firm’s competitive position

| Variables               | (1) Full sample | (2) Full sample | (3) Full sample | (4) Full sample |
|-------------------------|-----------------|-----------------|-----------------|-----------------|
| DV = LNAFEES            |                 |                 |                 |                 |
| SPEC = AF_DOM           |                 |                 |                 |                 |
| Coef.                   | -0.18 *         | -0.17 *         | -0.56 **        | -0.54 **        |
| t-stat.                 | -1.92           | -1.86           | -2.51           | -2.36           |
| BIG4                    | 0.25 ***        | 0.25 ***        | 0.55 **         | 1.19            |
| Coef.                   | 11.88           | 11.99           | 2.48            |                 |
| t-stat.                 |                 |                 |                 |                 |
| SPEC * BIG4             | 0.16 *          | -0.37 ***       | -0.38 ***       | -0.31 ***       |
| Coef.                   | 1.74            | -5.72           | -6.14           | -5.11           |
| t-stat.                 |                 |                 |                 |                 |
| DIFF_AFEE               | -0.42 ***       | -0.37 ***       | -0.38 ***       | -0.31 ***       |
| Coef.                   | -6.52           | -5.72           | -6.14           | -5.11           |
| t-stat.                 |                 |                 |                 |                 |
| PwC                     | 0.31 ***        | 0.37 ***        | 0.38 ***        | 0.42 ***        |
| Coef.                   | 10.68           | 10.34           | 10.63           | 1.84            |
| t-stat.                 |                 |                 |                 |                 |
| EY                      | 0.26 ***        | 0.26 ***        | 0.26 ***        | 0.26 ***        |
| Coef.                   | 10.37           | 10.34           | 10.63           | 9.49            |
| t-stat.                 |                 |                 |                 |                 |
| KPMG                    | 0.23 ***        | 0.14            | 0.50 **         | 0.50 **         |
| Coef.                   | 9.18            | 1.48            | 2.17            | 2.47            |
| t-stat.                 |                 |                 |                 |                 |
| SPEC * PwC              | 0.16 *          | 0.16 *          | 0.16 *          | 0.16 *          |
| Coef.                   | 1.72            | 1.72            | 1.75            | 1.75            |
| t-stat.                 |                 |                 |                 |                 |
| SPEC * EY               | 0.08            | 0.08            | 0.08            | 0.08            |
| Coef.                   |                 |                 |                 |                 |
| t-stat.                 |                 |                 |                 |                 |
| SPEC * Deloitte         |                 |                 |                 |                 |
| Coef.                   |                 |                 |                 |                 |
| t-stat.                 |                 |                 |                 |                 |
| SPEC * KPMG             |                 |                 |                 |                 |
| Coef.                   |                 |                 |                 |                 |
| t-stat.                 |                 |                 |                 |                 |

**Control variables (F & FE)**

| Observations | 53,500 | 53,500 | 53,500 | 53,500 |
|--------------|--------|--------|--------|--------|
| Adjusted R²  | 84.5%  | 84.6%  | 84.5%  | 84.6%  |

Note. This table presents the regression results of the audit fee model including auditor industry specialization measures (SPEC) and audit firm’s competitive position (DIFF_AFEE). Control variables are the set given in Table 3, Panel A. FE are industry and year fixed effects.

*, **, *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively, using two-tailed tests. T-statistics are based on clustered standard errors at client firm level.
| Fiscal year | Non-Big 4 firms | PwC | EY | Deloitte | KPMG |
|------------|-----------------|-----|-----|----------|------|
|            | N       | M     | t-stat. | N       | M     | t-stat. | N       | M     | t-stat. | N       | M     | t-stat. |
| 2003       | 646     | 0.00  | -0.12   | 766     | 0.02  | 1.29    | 919     | 0.01  | 0.52    | 596     | -0.02 | -1.02   |
| 2004       | 838     | 0.00  | -0.14   | 771     | 0.07  | 3.63 ***| 896     | 0.00  | 0.13    | 609     | -0.07 | -3.21 ***|
| 2005       | 1,064   | 0.00  | -0.15   | 724     | 0.07  | 3.53 ***| 916     | 0.01  | 0.56    | 613     | -0.03 | -1.67 *  |
| 2006       | 1,216   | 0.00  | 0.01    | 705     | 0.08  | 4.15 ***| 938     | 0.00  | -0.21   | 634     | -0.02 | -1.11   |
| 2007       | 1,232   | 0.00  | 0.18    | 645     | 0.05  | 2.77 ***| 914     | -0.01 | -0.54   | 609     | 0.01  | 0.32    |
| 2008       | 1,170   | 0.00  | 0.03    | 614     | 0.05  | 2.88 ***| 872     | -0.03 | -2.07 **| 574     | 0.03  | 1.44    |
| 2009       | 1,120   | 0.00  | -0.05   | 597     | 0.05  | 2.79 ***| 836     | -0.02 | -1.29   | 569     | 0.01  | 0.48    |
| 2010       | 1,074   | 0.00  | -0.01   | 608     | 0.05  | 3.40 ***| 816     | -0.02 | -1.22   | 562     | -0.02 | -0.93   |
| 2011       | 1,008   | 0.00  | -0.02   | 597     | 0.06  | 3.84 ***| 812     | -0.02 | -1.60   | 529     | -0.01 | -0.40   |
| 2012       | 982     | 0.00  | -0.14   | 580     | 0.07  | 3.87 ***| 803     | -0.01 | -0.71   | 523     | 0.00  | 0.22    |
| 2013       | 993     | 0.00  | -0.03   | 596     | 0.08  | 4.83 ***| 808     | 0.00  | -0.06   | 512     | -0.02 | -1.29   |
| 2014       | 1,043   | 0.00  | -0.03   | 589     | 0.07  | 4.22 ***| 787     | 0.00  | 0.06    | 523     | 0.01  | 0.41    |
| 2015       | 966     | 0.00  | -0.14   | 555     | 0.05  | 2.97 ***| 733     | 0.02  | 1.44    | 491     | -0.01 | -0.63   |
| 2016       | 937     | 0.00  | -0.07   | 523     | 0.04  | 2.24 ** | 687     | 0.03  | 1.64    | 440     | -0.01 | -0.35   |
| 2017       | 871     | 0.00  | -0.04   | 481     | 0.03  | 1.29    | 648     | 0.03  | 1.76 *  | 410     | 0.01  | 0.35    |

Panel B. Mean UAF by each fiscal year across Big 4 audit firms (excluding BIG4 dummy from the regression model)

| Fiscal year | Non-Big 4 firms | PwC | EY | Deloitte | KPMG |
|------------|-----------------|-----|-----|----------|------|
|            | N       | M     | t-stat. | N       | M     | t-stat. | N       | M     | t-stat. | N       | M     | t-stat. |
| 2003       | 646     | -0.10 | -5.36 ***| 766     | 0.04  | 2.34 ** | 919     | 0.03  | 1.77 *  | 596     | 0.00  | 0.12    |
| 2004       | 838     | -0.10 | -5.66 ***| 771     | 0.09  | 4.90 ***| 896     | 0.03  | 1.69 *  | 609     | -0.04 | -1.91 * |
| 2005       | 1,064   | -0.10 | -5.84 ***| 724     | 0.10  | 4.85 ***| 916     | 0.05  | 2.63 ***| 613     | 0.00  | -0.02   |
| 2006       | 1,216   | -0.07 | -5.04 ***| 705     | 0.10  | 5.23 ***| 938     | 0.03  | 1.95 *  | 634     | 0.01  | 0.32    |
| 2007       | 1,232   | -0.10 | -5.67 ***| 645     | 0.08  | 4.19 ***| 914     | 0.03  | 2.15 **| 609     | 0.04  | 1.95 *  |
| 2008       | 1,170   | -0.10 | -6.79 ***| 614     | 0.08  | 4.74 ***| 872     | 0.02  | 1.31    | 574     | 0.07  | 3.62 ***|
| 2009       | 1,120   | -0.10 | -7.43 ***| 597     | 0.08  | 4.64 ***| 836     | 0.03  | 2.16 **| 569     | 0.05  | 2.71 ***|
| 2010       | 1,074   | -0.10 | -7.00 ***| 608     | 0.09  | 5.29 ***| 816     | 0.03  | 1.76 *  | 562     | 0.02  | 1.33    |
| 2011       | 1,008   | -0.11 | -7.75 ***| 597     | 0.09  | 5.44 ***| 812     | 0.02  | 1.55    | 529     | 0.04  | 2.31 ** |
| 2012       | 982     | -0.10 | -7.11 ***| 580     | 0.09  | 5.31 ***| 803     | 0.03  | 2.03 **| 523     | 0.05  | 2.70 ***|
| 2013       | 993     | -0.12 | -8.87 ***| 596     | 0.12  | 6.75 ***| 808     | 0.05  | 3.31 ***| 512     | 0.03  | 1.39    |
| 2014       | 1,043   | -0.13 | -9.15 ***| 589     | 0.11  | 6.13 ***| 787     | 0.06  | 3.76 ***| 523     | 0.06  | 3.38 ***|
Second, we follow Hribar et al.'s (2014) methodology to obtain a measure of UAF by regressing the natural logarithm of audit fees on a set of explanatory variables, including the indicator variable BIG4, in the audit fee model by fiscal year and asset size decile.

Table 8, Panel A presents the mean UAF values separately reported by each fiscal year across all different audit firms. While the mean UAF values of companies audited by firms other than PwC are either negative or nonsignificant across the sample period, the mean UAF values of companies audited by PwC are positive and significantly different from zero across all fiscal years (except 2003). Also, the mean UAF values of companies audited by KPMG are negative and significantly different from zero, particularly in more recent years.

In Panel B, we modify the model used to measure UAF by purposely excluding the BIG4 indicator variable to remove this variation in audit pricing from the residual. Overall, we find robust, highly significant and positive mean UAF values for companies audited by PwC and KPMG, and highly significant and negative mean UAF values for companies audited by non-Big 4 firms. Additionally, we observe weaker results for EY and Deloitte, which are still positive and significant across most fiscal years. Conversely, the mean UAF values for companies audited by KPMG are either negative or insignificant.

Taken together, by focusing on the variations in UAF means at the interaudit firm level across the sample period, these results indicate that not all Big 4 audit firms are the same, particularly PwC and KPMG in the post-SOX period.

### 4.3 Sensitivity analysis using industry specialization at the MSA level

Third, guided by the research stream on auditor industry specialization at the MSA level (Ferguson et al., 2003; Francis et al., 2005), we repeat our main tests for H2(a–d) using alternative measures of industry specialization at the MSA level. Specifically, we use the U.S. Census Bureau’s definition of MSA and identify metropolitan areas based on the five-digit zip codes available in Compustat for each firm-year observation. We then classify an audit firm as an industry specialist using two audit fee-based measures at the MSA level: CAF_LRG, which represents an audit firm with the largest market share in each two-digit SIC code and fiscal year; and CAF_30, which represents an audit firm with a market share greater than or equal to 30%. The results are reported in Table 9.

Again, while the fee premium earned by Big 4 specialists (Columns 1 and 3) is positive and significant at less than the 1% level, the industry specialization premium is only observed for PwC (Columns 2 and 4) and EY (Column 2) at the MSA level. The effects of the industry specialist fee premium become negative and significant after controlling for the audit firm’s competitive position at the MSA level (DIFF_AFEE_MSA), except for PwC specialists, for whom the effect becomes nonsignificant (Column 3). Taken
| Variables                  | (1) DV = LNAFEES | (2) DV = LNAFEES | (3) DV = LNAFEES | (4) DV = LNAFEES | (5) DV = LNAFEES | (6) DV = LNAFEES |
|---------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| SPEC = CAF_LRG            |                  |                  |                  |                  |                  |                  |
| Coef.                     | 0.12 ***         | 0.12 ***         | -0.07            | 0.13 ***         | 0.13 ***         | -0.07 *          |
| t-stat.                   | 2.92             | 2.89             | -1.50            | 3.67             | 3.63             | -1.68            |
| SPEC * BIG4               |                  |                  |                  |                  |                  |                  |
| Coef.                     | 0.38 ***         | -0.06            | -0.37 ***        | -0.42 ***        | -0.42 ***        | -11.09           |
| t-stat.                   | 18.79            | -1.32            | 10.23            | 11.96            | 12.71            | 11.96            |
| [4] DIFF_AFEE_MSA         |                  |                  |                  |                  |                  |                  |
| Coef.                     | -0.06            | -0.06            | -0.08 **         | -0.06            | -0.08 **         | -0.08 **         |
| t-stat.                   | -2.57            | -1.95            | -2.64            | -1.64            | -2.53            | -1.64            |
| [5] PwC                   |                  |                  |                  |                  |                  |                  |
| Coef.                     | 0.41 ***         | 0.40 ***         | 0.40 ***         | 0.40 ***         | 0.40 ***         | 0.40 ***         |
| t-stat.                   | 17.97            | 15.78            | 13.31            | 13.20            | 13.74            | 13.20            |
| [6] EY                    |                  |                  |                  |                  |                  |                  |
| Coef.                     | 0.39 ***         | 0.39 ***         | 0.39 ***         | 0.39 ***         | 0.39 ***         | 0.39 ***         |
| t-stat.                   | 12.69            | 12.69            | 11.61            | 11.61            | 11.61            | 11.61            |
| [7] Deloitte              |                  |                  |                  |                  |                  |                  |
| Coef.                     | 0.36 ***         | 0.32 ***         | 0.32 ***         | 0.32 ***         | 0.32 ***         | 0.32 ***         |
| t-stat.                   | 19.97            | 15.78            | 13.31            | 13.20            | 13.74            | 13.20            |
| [8] KPMG                  |                  |                  |                  |                  |                  |                  |
| Coef.                     | -0.11 **         | -0.21            | -0.92            | -0.13 **         | -0.25            | -0.25            |
| t-stat.                   | -2.57            | -1.60            | -0.92            | -2.57            | -1.60            | -0.92            |
| Control variables (& FE)  | Yes              | Yes              | Yes              | Yes              | Yes              | Yes              |
| Observations              | 31,185           | 31,185           | 31,185           | 31,185           | 31,185           | 31,185           |
| Adjusted R²               | 84.5%            | 85.7%            | 85.9%            | 85.7%            | 85.7%            | 85.7%            |
| [1+3] BIG4 Specialist Premium | 0.06 ***     | 0.06 ***         | 0.06 ***         | 0.06 ***         | 0.06 ***         | 0.06 ***         |
| t-stat.                   | 4.16             | 4.16             | 4.16             | 4.16             | 4.16             | 4.16             |
| [1+9] PwC Specialist Premium | 0.10 ***     | 0.10 ***         | 0.10 ***         | 0.10 ***         | 0.10 ***         | 0.10 ***         |
| t-stat.                   | 3.70             | 3.70             | 3.70             | 3.70             | 3.70             | 3.70             |
| [1+10] EY Specialist Premium | 0.04 *        | 0.04 *           | 0.04 **          | 0.04             | 0.04             | 0.04             |
| t-stat.                   | 1.67             | 1.67             | -2.91            | 1.59             | 1.59             | 1.59             |
| [1+11] Deloitte Specialist Premium | 0.05          | 0.05             | -0.08 **         | 0.04             | 0.04             | 0.04             |
| t-stat.                   | 1.41             | 1.41             | -2.12            | 1.13             | 1.13             | 1.13             |
| [1+12] KPMG Specialist Premium | 0.01          | 0.01             | -0.11 ***        | 0.00             | 0.00             | 0.00             |
| t-stat.                   | 0.31             | 0.31             | -3.15            | 0.02             | 0.02             | 0.02             |

Note. This table presents the regression results of the audit fee model including alternative measures of industry specialization at the MSA level.

*, **, *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively, using two-tailed tests. T-statistics are determined by clustered standard errors at client firm level. Variable definitions: CAF_LRG = indicator variable equal to one if the company uses an audit firm with the largest market share in that particular industry at the MSA level, and zero otherwise; CAF_30 = indicator variable equal to one if the company uses an audit firm whose market share based on aggregated audit fees is greater than or equal to 30% in that particular industry at the MSA level, and zero otherwise; DIFF_AFEE_MSA = the difference in market share based on aggregated audit fees between the incumbent audit firm and the largest firm in each two-digit SIC industry at the MSA level.
together, our findings suggest that the effects of industry specialization on audit fees are highly sensitive to individual differences within the Big 4 firms.

5 | CONCLUSION

In this article, we tested the importance of specific audit firm reputations by investigating audit pricing differences for listed clients across Big 4 audit firms during the period 2003–2017. In addition to the general Big 4 fee premium, we argue that individual audit firm reputation also plays an important role in the U.S. market, enabling PwC (KPMG) to earn an above-average (below-average) fee premium relative to the other Big 4 firms.

Furthermore, we argue that the positive relationship between audit fees and auditor industry specialization documented in the literature is exaggerated by the confounding effect of the individual audit firm’s generalized competencies. After controlling for individual price differences within the Big 4 audit firms, we find that the industry specialization premium is only observed for EY and Deloitte specialists, and not for PwC and KPMG specialists.

Overall, this study demonstrates that it is not appropriate to treat the Big 4 audit firms as a homogenous group, since we evidence that these firms are not the same in their pricing of audit services, ceteris paribus. Our findings are consistent with Sirois et al.’s (2016) argument that Big 4 firms act strategically to distinguish themselves from competitors by making capital investments in technology and other inputs. These investments allow the Big 4 firms as a group to dominate the audit services market by providing superior average audit value (audit quality/audit price) relative to non-Big 4 firms. They also provide a basis for individual firms to differentiate themselves from one another. PwC’s above-average audit fee premium indicates that, over time, the firm has quite successfully distinguished itself from the other Big 4(6)(8) firms. Conversely, KPMG’s below-average audit fee premium implies that the firm has not made the same level of investments as the other Big 4 firms. We conclude that individual differences within the Big 4 firms are key to understanding the economic forces operating in the audit services market.

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ENDNOTES

1 PricewaterhouseCoopers (which formally shortens its brand name to PwC) was formed in 1998 from a merger between Price Waterhouse (PW) and Coopers & Lybrand.

2 KPMG was formed in 1987 from a merger between Klynveld Main Goerdeler (KMG) and Peat Marwick International.

3 PwC earned 36% of the total audit fees paid by U.S. public (listed) companies in fiscal year 2004, followed by EY (24%), KPMG (19%), Deloitte (17%), and other audit firms (4%). The overall rankings and market shares of audit firms for other fiscal years are qualitatively similar to those in fiscal year 2004, as reported in Table 2.

4 The Big 4 indicator has been shown to be associated with almost all other audit quality proxies, including lower incidence of accounting fraud (Lennox & Pittman, 2010), lower incidence of accounting restatements (Eshleman & Guo, 2014), lower discretionary accruals (Becker, DeFond, Jiambalvo, & Subramanyam, 1998; Francis, Maydew, & Sparks, 1999), higher audit fees (Craswell et al., 1995; Hay et al., 2006), increased ERCs (Teoh & Wong, 1993), improved analyst earnings forecasts (Behn, Choi, & Kang, 2008), and lower cost of debt and equity (Khurana & Raman, 2004).

5 Vault’s annual accounting survey asks thousands of accounting professionals at the top audit firms to rate their competitor firms in terms of prestige and to provide a few words describing their perception of those competitors.

6 We use the oldest possible sample of client firms from the Audit Analytics database to calculate the auditor market share within an industry.

7 We also eliminate any firm with less than four observations. Inferences are unchanged if we include all firms with sufficient data.

8 In untabulated results, we also find that EY leads the rankings for the number of clients with an average of 16.4%, followed by PwC (13.8%), Deloitte (12.5%), and KPMG (12.3%).

9 We estimate the variance inflation factor of each independent variable to detect severe multicollinearity problems in the audit pricing model. In untabulated results, there is no sign of severe multicollinearity problems.

10 Consistent with empirical results in the 1990s and early 2000s, we run the analyses (untabulated) in the pre-SOX period (before fiscal year 2003) and find no evidence of either an above-average fee premium for PwC or a below-average fee premium for KPMG.

11 Because companies are not randomly assigned to audit firms, it is possible that company characteristic(s)—as opposed to auditor characteristic(s)—explain a portion of the variation in audit fees across auditors (e.g., tolerance for risky clients could vary significantly across audit firms). To control for this selection effect, we follow Ireland and Lennox (2002) by employing a two-stage Heckman (1979) selection model. Specifically, we estimate the audit fee model and include the inverse Mills ratio calculated based on the annual regression results from the following auditor selection model:

$$BIG4_t = α_0 + α_1LNASSET_t + α_2ATURN_t + α_3CURRENT_t + α_4LEVERAGE_t + α_5ROA_t + ε_t$$

Consistent with the main analyses, we find that, on average, PwC earns a significant audit fee premium relative to the other Big 4 firms after controlling for the Mills variable.

12 In untabulated results, we find that the Spearman correlation coefficients between the indicator variable for PwC and various industry specialization measures range from 0.35 to 0.45 and are significant at less than the 1% level.
In untabulated results, the inferences remain unchanged when we estimate our regression models using the sum of audit fees and non-audit fees (LNTTFEES) as the dependent variable.

This is consistent with Huang, Liu, Raghunandan, and Rama (2007), who indicate that an audit fee premium is sensitive to the time period.

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