

Industry specialization as a means to soften price competition in the audit market

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Abstract

This study empirically examines competition among auditors, arguing that auditors behave as oligopolists. Based on prior economic theory (see Hotelling, 1929) using game-theoretic models to predict market outcomes in differentiated product oligopolies, we hypothesize that the audit fee is affected by an auditor's relative location in a market segment. An audit office's relative location is specified in terms of product differentiation through industry specialization (i.e. fee market share in a two-digit SIC industry) per U.S. Metropolitan Statistical Area (MSA). Accordingly, competitive pressure is measured in local audit markets (per MSA). We find that the presence of competitive auditors with a higher (lower) degree of industry specialization puts (removes) pressure on (from) audit fees. Our results suggest that auditors do compete on audit fees, but clients are willing to pay a premium for specialist auditors.

I. Introduction

In this paper we examine how auditors compete, arguing that the audit market is a differentiated-product oligopoly. While there are ample studies investigating the effect of audit-firm characteristics (for example, auditor size and industry specialist auditors) on audit pricing¹ and audit quality² supplied at the client level, there are very few empirical studies examining how auditors compete. Most previous audit fee studies generally report fee premiums for Big N auditors or industry specialists, but are not able to distinguish whether this fee premium is due to a lack of competition or to clients' willingness to pay a premium for an industry specialist. Our paper contributes to the existing auditing literature by directly examining the effect of the presence of competitors on audit fees, taking into account that auditors can use product differentiation (such as industry specialization) as a means to soften price competition (Tirole, 1988). Our analysis provides more insight in the relation between competition and product differentiation through industry specialization by auditors.

Examining the competitiveness in the audit industry is worthwhile as the audit market is characterized by a high level of concentration, a given demand for audits and high entry barriers due to reputation effects and need for specialized knowledge. Quite often, regulators in different countries express concerns about (the lack) of competition in the audit market. In a speech at the 2005 AICPA National Conference SEC Chairman Christopher Cox expresses his concern about the degree of competitiveness in the audit industry as follows:

¹ For example, see Simunic (1980) and Francis (1984) for landmark studies that triggered ample subsequent pricing studies at the client level. Hay et al. 2006 provide an overview and meta-analysis of audit fee research.

² For a thorough review of the audit quality literature see Francis (2004).

“... within the accounting profession and within the SEC, we are forced to ask ourselves: “Is this intense concentration in the market for large public company auditing good for America?” If you believe, as I do, that genuine competition is essential to the proper function of any market the answer is no.”

In the U.K. the Financial Reporting Council (FRC) released proposals to create more competition and choice in the audit market based on the results of a study on competition in the audit market performed by the FRC and the Department of Trade and Industry³. Peter Wyman, head of professional affairs at PricewaterhouseCoopers (PWC), responded to this report by claiming that “they are operating in a fiercely competitive market” (Grant, 2006). However it remains an unresolved issue whether or not auditors competitively price the service they supply.

In Simunic’s (1980) landmark audit pricing study a model of competition in the audit industry is proposed in which the audit market is segmented into an oligopolistic segment of large audit clients and a competitive segment consisting of small clients. He assumes that audit pricing in the small client segment is competitive (due to lower concentration levels in that market segment), and uses this as a benchmark to assess whether pricing in the oligopolistic segment includes a premium. This premium can then be explained by either market power, product differentiation or relative product (in)efficiencies. In his empirical tests, Simunic (1980) finds no significant premiums for the Big 8 audit firms and therefore cannot reject the hypothesis that price competition is present in the audit industry. On the contrary, subsequent empirical audit pricing studies generally do report a fee premium for audit firms classified as Big 8/6/5/4 firms. This

³ The report is titled “Competition and Choice in the UK audit market” and is online available at the website of the FRC; <http://www.berr.gov.uk/files/file28529.pdf>

finding is often interpreted as a signal of superior quality of these Big N audit firms and not so much as a signal of uncompetitive behavior (for an overview see Hay et al. 2006), despite the lack of *direct* evidence that fee premiums are associated with higher audit or accounting quality. Consistent with Simunic's model (1980) Ghosh and Lustgarten (2006) also distinguish between oligopolistic and atomistic audit market segments, and report that fee discounting on initial audit engagements is more intensive in the atomistic segment as compared to the oligopolistic segment. They explain this result using market structure theory, i.e. that there is more fierce competition in the atomistic market segment.

Other empirical literature on audit competition has directly investigated the relation between the level of concentration in the audit market and audit fees (i.e. Pearson and Trompeter 1994, Bandyopadhyay and Kao 2004, Willekens and Achmadi 2003, Feldman 2006), where concentration levels are used as a proxy for competition. The findings in these studies are mixed. Pearson and Trompeter (1994) find that industry concentration negatively impacts audit fees, suggesting that higher concentration is associated with increased price competition. In addition, Bandyopadhyay and Kao (2004) do not find support for their prediction that audit fees are higher in more concentrated markets. Willekens and Achmadi (2003) find that audit fees are positively associated with the auditor's market share and Feldman (2006) finds that after the demise of Arthur Andersen both market concentration and audit fees increased. However, as suggested by Pearson and Trompeter (1994), concentration measures may not be appropriate to assess price competition in the audit market as they are unable to capture (potential) price competition among the market leaders (i.e. the Big N auditors).

Taking this caveat into account, we do not examine the effect of auditor concentration on pricing, but instead examine how the relative location of competing auditors in the same market segment affects audit pricing, arguing that auditors use product differentiation as a competitive strategy to acquire market share. Prior economic theory on competition amongst oligopolists proposes that firms compete on prices and quantities once all the firms in the market have made product entry and space decisions (Hotelling, 1929; Shapiro, 1989). Competing firms that differentiate their products may be able to maintain higher prices than marginal cost in equilibrium without losing market share. The basic tradeoff between price and market share underlies the profit-maximizing choices of product space locations by firms (Tirole, 1988). The relative product-space location of competitors also affects the relevant price-elasticities. In cases where the other firms are located nearby in product space, theory predicts that equilibrium prices will be closer to marginal cost. Based on the predictions from these location models, we hypothesize that the presence of competing auditors with audit service locations that are closer to those desired by the client (e.g. a higher degree of industry specialization than the audit firm in charge) has a negative impact on the audit fee. The auditor has to give a discount on the fee to be able to attract the client. On the contrary, the presence of competing auditors with product-space locations that are farther removed from the location desired by the client (e.g. competitors are less specialized than the auditor in charge), enables the auditor in charge to ask a higher audit fee. The auditor is able to ask a premium as the client is willing to pay a higher fee for an auditor that is more specialized vis-à-vis the client's characteristics as this will accrue to a net benefit for the client.

Our hypotheses are tested empirically by using U.S. data on audit fees and client characteristics of relatively large public companies for the years 2005 and 2006. Consistent with recent literature (Francis et al. 2005) we argue that auditors compete for clients at local office level (rather than at a national level) and define the audit market in 2-digit SIC industry segments per U.S. Metropolitan Statistical Area (MSA). We estimate an audit fee model including standard explanatory variables derived from the audit fee literature (Hay et al. 2006). Our two test variables are designed to capture whether audit pricing is a function of both the presence of competitors and the incumbent auditor's relative product differentiation through industry specialization. In particular, two types of competitive pressure are distinguished: competitive pressure by competing audit offices with a higher industry market share and competitive pressure by competing audit offices with a lower industry market share. As such the location of an audit office in the audit market is measured in terms of industry specialization.

We find that the presence of competitors with higher industry specialization than the auditor in charge negatively impacts the auditor's fee premium, where the presence of competitors with lower specialization levels than the auditor in charge positively impact the auditor's fee premium. These results are in line with auditors competing according to a Hotelling-type of model. Auditors compete fiercely on audit fees, but clients are willing to pay a premium for auditors that are more specialized towards their characteristics. Hence, to soften price competition auditors can opt to specialize into certain industries. Because we cannot observe the price-cost margins of auditors, we are unable to formally examine whether they earn excessive (monopoly) rents. Our results do indicate that auditors compete on audit fee levels and we do not find evidence of anti-competitive

behavior or collusion practices. However our analyses also indicate that the impact of one individual competitor on audit fees seems to be substantial, which may be a concern for regulators should concentration levels further increase.

The remainder of this paper is organized as follows. The next section presents the underlying economic theory to motivate our empirical hypotheses. In section III the research design is discussed and section IV presents the sample and data descriptions. The primary results are discussed in section V, where section VI discusses some robustness checks. Limitations and some possible extensions are discussed in section VII and section VIII concludes the study.

II. Theory and empirical hypotheses

Prior analytical audit research on audit competition mainly focuses on pricing policies of audit firms such as low-balling, but assumes the market is perfectly competitive (e.g. DeAngelo 1981a, Magee and Tseng 1990, Dye 1991, Kanodia and Mukerji 1994). Exceptions are Gigler and Penno (1995), Chan (1999) and Chan et al. (working paper, 2004), who model the audit market as imperfectly competitive. Gigler and Penno (1995) examine the effect of imperfect competition on pricing by explicitly modeling cost differences across auditors as a source of economic rents and competitive advantage. As client characteristics change overtime and auditors have different audit technologies, cost minimizing auditor-client matches also change overtime. They show that under such conditions switching costs may actually reduce the auditor's economic rents to the benefit of the client (instead of increase under a perfect competition assumption). Chan (1999) also analyses imperfect competition in the audit market, but

unlike Gigler and Penno (1995) does not assume that audit firms are ex ante heterogeneous, but rather strategically choose to become ex post heterogeneous through specialization. In particular, Chan (1999) analyses the effect of low-balling based on a spatial competition model with discriminatory pricing, which is a variant of the model of Hotelling (1929). He assumes that the audit market has a large number of clients with different characteristics that determine audit effort and audit costs. As a result each client pays a unique audit fee that is tailored towards these client characteristics. Chan (1999) further assumes that from the viewpoint of the users, audits are perceived to be homogeneous and that audit firms earn rents because they have different cost functions due to specialization. He shows that low-balling is a natural consequence of competition among audit firms, and that a policy of banning low-balling not only results in increased profits for audit firms and higher audit fees, but also in audit firms choosing specializations in a more efficient way, thereby reducing auditing costs. Chan et al. (2004) also develop a location model and assume that audit firms can specialize on multiple dimensions. Like Chan (1999), they assume in their main analysis that audit services are of homogeneous quality (from the viewpoint of the client). In additional analyses, they relax this assumption and assume clients value audit firms differently on multiple dimensions. Chan et al. (2004) test their location model by examining the impact of the 1997 merger between Price Waterhouse and Coopers & Lybrand on audit fees in Australia. Consistent with their hypothesis, they find that after the merger, audit fees of clients in locations where the two firms were close competitors increased.

In this paper, we do not focus on the effects of a merger between two audit firms on pricing, but on how the presence of all competing audit firms in an audit market

impacts audit fees using U.S. data. Consistent with Chan (1999) and Chan et al. (2004) we motivate our hypotheses based on spatial competition theory. Hotelling (1929) studied how two identical, single product firms compete in price and location in a bounded linear market. As auditors charge unique audit fees to their clients, the extensions of the Hotelling model that examine markets with discriminatory pricing (i.e. Hoover, 1936; Lederer and Hurter 1985) seem appropriate to the audit setting. These models⁴ propose that firms compete in prices and quantities once all the firms in the market have made product entry and space decisions. Competing firms that differentiate their products may be able to maintain higher prices than marginal cost in equilibrium without losing market share. The basic tradeoff between price and market share underlies the profit-maximizing choices of product space locations by firms (Tirole, 1988). The relevant product-space location of competitors also affects the relevant price-elasticities. In cases where the other firms are located nearby in product space, theory predicts that equilibrium prices will be closer to marginal cost.

In particular, we argue that the audit market is not perfectly competitive and has a large number of clients with different characteristics that determine audit effort and audit costs. As a result each client pays a unique audit fee that is tailored towards these client characteristics. We further argue that clients value audits differently and want to pay different fees for audits performed by different types of auditors. Note that this is consistent with early evidence reported by Shockley and Holt (1983) that clients differentiate between different types of audit firms, and with results reported by many subsequent audit fee studies indicating that certain clients are willing to pay a premium for audits performed by Big N audit firms (for an overview see Hay et al. 2006). In

⁴ See Shapiro (1989) for an overview.

addition more recent audit fee studies show that industry specialist auditors are able to charge higher fees, *ceteris paribus* (e.g. Craswell et al. 1995, Francis et al. 2005). All this evidence corroborates the assumption that audit clients gain different net benefits from audits performed by different types of auditors and that audit clients have different preferences in the demand for an auditor. For this reason, auditors can differentiate their products and maintain prices higher than marginal cost, without losing their entire market share.

Given the differentiation strategy adopted by an auditor, the closer the match (fit; alignment) between a client's preferences (which are determined by certain client characteristics) and an auditor's differentiation (or, specialization) choice, the stronger the competitive position of the auditor and the higher the price he will be able to charge. However, in line with the theoretical arguments presented above, the relative product-space location of competing auditors also affects the price level the (incumbent) auditor will be able to charge in equilibrium. When the incumbent auditor's specialization choice is located closer to the client's preferences as compared to that of competing auditors, the incumbent auditor will be able to charge a higher price than the auditors whose specialization choices are farther removed from the client's preferences. In addition, the more other auditors there are in the audit market with specialization (differentiation, location) choices that are farther removed from the client's preferences, the less competitive pressure the incumbent auditor will experience, and hence the higher the price the incumbent auditor will be able to charge in equilibrium. This leads to our first hypothesis:

Hypothesis 1: The audit fee charged by the incumbent auditor is increasing in the number of competing auditors whose differentiation strategy is less aligned with the client's preferences than the incumbent auditor's differentiation strategy, ceteris paribus.

On the contrary, in cases where the competing auditors in the market are located closer to the client's preferences in product space than the incumbent auditor, the latter will experience more competitive pressure and will have to drop the price in order to attract (or keep) the client. Again, the more other auditors there are in the audit market with specialization choices that are better aligned with the client's preferences, the more competitive pressure the incumbent auditor will experience, and hence the lower the price the incumbent auditor will charge in equilibrium. This leads to our second hypothesis:

Hypothesis 2: The audit fee charged by the incumbent auditor is decreasing in the number of competing auditors whose differentiation strategy is more aligned with the client's preferences than the incumbent auditor's differentiation strategy, ceteris paribus.

III. Research Design

To test our hypotheses, we specify the following OLS regression model of audit fees including two new test variables and a number of explanatory variables that are consistent with a wide body of audit fee studies (see Hay et al. 2006)⁵:

⁵ The regression specification is similar to the regression specification in Francis et al. (2005), as they also examine U.S. data.

$$\begin{aligned} \ln fee = & a_0 + a_1 \ln_other_fit_high + a_2 \ln_other_fit_low + a_3 size + a_4 \ln bu + a_5 foreign \\ & + a_6 cata + a_7 quick + a_8 de + a_9 roi + a_{10} loss + a_{11} ye + a_{12} year_dummy + a_{14} Opinion \\ & + a_{15} Switch + a_{16} Big4 + a_{17} Herfindex + \varepsilon, \end{aligned} \quad (1)$$

where:

Dependent variable

Infee = natural log of audit fees

Explanatory variables

Competition variables:

ln_other_fit_high = natural log of 1 + the number of competing audit offices in an audit market with a market share larger than audit office *i*, where market share is defined as percentage of total audit fees in a two-digit SIC industry. An audit market is defined as a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. Census Bureau definition).

ln_other_fit_low = natural log of 1 + the number of competing audit offices in an audit market with a market share lower than audit office *i*, where market share is defined as percentage of total audit fees in a two-digit SIC industry. An audit market is defined as a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. Census Bureau definition).

Control variables:

size = natural log of total assets (compustat item 6)

lnbu = natural log of number of business segments

foreign = natural log of total foreign segments

cata = ratio of current assets to total assets (compustat item 4 / compustat item 6)

quick = ratio of current assets (less inventories) to current liabilities ((compustat item 4 - compustat item 3)/compustat item 5)

de = ratio of long-term debt to total assets (compustat item 9 / compustat item 6)

roi = ratio of earnings before interest and tax to total assets ((compustat item 170 + compustat item 15) / compustat item 6)

loss = indicator variable equal to 1 if loss in current year, 0 otherwise

ye = indicator variable equal to 1 if non-dec 31st year=end, 0 otherwise

year_dummy = indicator variable equal to 1 if year=2006, 0 otherwise

Opinion = indicator variable equal to 1 if a client receives a qualified opinion, 0 otherwise

Switch = indicator variable equal to 1 if a client changed its auditor in a year, 0 otherwise

Big4 = indicator variable equal to 1 if an audit office is a Big 4 auditor, 0 otherwise

Herfindex = Herfindahl concentration index per audit market, where the Herfindahl index is calculated as $H \equiv \sum_{i=1}^n s_i^2$, where i is an audit office in an audit market and s is market share in an audit market based on total fees. An audit market is defined as a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. Census Bureau definition).

Test variables: two measures of competitive pressure

The two test variables included in equation (1) are measures of competitive pressure from other audit suppliers in a particular audit market segment. Instead of testing the impact of the total number of competitors in an audit market segment on audit price, we differentiate between competitors whose differentiation (specialization) strategy is less well aligned with the client's preferences (as compared to the incumbent auditor's strategy, see hypothesis 1), and suppliers whose differentiation (specialization) strategy is better aligned with the client's preferences (hypothesis 2). Note that this approach is inspired by tests of price competition in product oligopolies developed in the industrial organization literature by Mazzeo (2002) and Cohen and Mazzeo (2007). Mazzeo (2002) develops an empirical test to assess whether competition is less intense in markets with equal concentration but differing degrees of differentiation among the products offered. He uses data from oligopolistic motel markets, and finds that firms benefit substantially from offering differentiated products. He concludes that in such oligopolies differentiation is an optimal choice as it decreases the resulting competition among firms.

Since our aim is to test the effect of competition through differentiation (or specialization) on audit pricing, we need to define the audit market segments in which auditors compete through differentiation. Recent literature indicates that auditors tend to

specialize in certain industries and that clients pay a premium for an industry specialist (i.e. Craswell et al., 1995; Francis et al. 2005). We therefore use industry specialization as the measure of fit between an auditor and a client in our empirical test. Consistent with prior literature we define audit markets by using 2-digit SIC industries. Consistent with recent audit pricing studies (see e.g. Ferguson et al. 2003) and Francis et al. 2005) we also choose local audit offices rather than national audit firms as our unit of analysis. Francis et al. (2005) show that for the U.S. audit market fee premiums are paid for industry specialization at the local audit firm level, and not at the national level. Industry specialization of an auditor is hence measured as the percentage of fees of an auditor in a two-digit SIC industry per U.S. Metropolitan Statistical Area in year t .

The next step is to specify how we measure the competitive pressure from other audit suppliers in an audit market segment. As we specify industry specialization as the measure of fit between the auditor and the client, we classify other audit suppliers in two categories: those who are less specialized than the incumbent auditor in the industry of a client (hypothesis 1), and those who are more specialized than the incumbent auditor in industry of a client (hypothesis 2). We measure the number of competing auditors with a better or worse fit by counting the number of competing auditors with a higher or lower industry market share. As we predict a significant association between the audit fee and the number of competing auditors in each category, the test variables *ln_other_fit_high* and *ln_other_fit_low* are specified to capture the competitive pressure per category of competitors.

Control variables

Note that consistent with prior fee research (Hay et al. 2006) control variables are included to capture the effects on fees of size (*size*), complexity (ln *bu* and *foreign*) and risk (*cata*, *quick*, *de*, *roi*, *loss*). In addition indicator variables for non-December year-ends (*ye*), audit opinion type (*opinion*) and switching (*Switch*) are included. Note that we also include a Big 4 indicator (*Big4*) in our model to control for the Big 4 reputation effect on audit fees. We also explicitly control for potential market power effects on audit fees by including the Herfindahl index as a control variable in the model (*Herfindex*). Finally, indicators for year effects are included.

IV. Sample and Data

We collect financial statement data for audit clients from the Compustat Industrial Annual and Segment files. Audit fee data are obtained from Audit Analytics. Audit Analytics has audit fee data available from 2000 onwards. Several studies investigate audit fees immediately after the introduction of SOx and find that audit fees increased, especially for higher risk clients (Asthana et al. 2004, Griffin and Lont, 2007). Other studies show that switching activity, in terms of both dismissals and resignations, increased after SOx (Griffin and Lont 2005, Ettredge et al. 2007). We therefore only focus on the most recent years in the databases, namely 2005 and 2006 as these years can be considered as being more stable. Table 1 shows the composition of our sample. We start with client observations for which all data items are available in Compustat and Audit Analytics. We exclude firms in the financial sector (Sic codes 6000 to 6999) and foreign firms. Like Francis et al. (2005) we require a minimum number of clients per two-digit SIC industry per U.S. MSA, to make sure that audit offices are able to compete

for different clients. Therefore, we exclude offices in those audit markets (industry-MSA combinations) in which there are less than two observations. To control for outliers, we truncate all regression variables in model (1) at the top and bottom 1% level⁶. Our final sample consists of 4,770 clients for the 2005-2006 period.

[Include Table 1 here]

Table 2 reports descriptive statistics about the composition of the audit markets..In 2005 (2006) there are 2,737 (2,033) clients distributed over 415 (305) audit markets (2-digit SIC industries on MSA level). The average (median) number of audit firms per MSA audit market is 4 (3), while the average (median) number of clients is 7 (4). For both years, more than 67% is audited by a Big 4 audit office, while there are respectively 217 and 162 non-Big 4 audit firms active in 2005 and 2006.

[Include Table 2 here]

Descriptive statistics for the regression variables are presented in Table 3. The average (median) audit fee is \$1,323,000 (\$624,648). For both years, the average (median) number of competing audit offices in an audit market with an industry market share larger than the audit office in charge is 2.066. (1). The average (median) number of competing audit offices with a lower market share than the auditor in charge equals 5.733 (4). Untabulated results show that the average industry market share per audit office for the time period 2005-2006 is 0.47%. For the Big 4 audit firms, Ernst & Young is most

⁶ We also winsorize the data at the top and bottom 1% level and the results are consistent.

often the industry leader in an audit market for both years (in 22% (24%) of the audit markets for 2005 (2006)), followed by PWC (in 18% of the MSA audit markets for both years), Deloitte (in 18% (17%) of the audit markets for 2005 (2006)) and KPMG (in 15% (14%) of the audit markets in 2005 (2006)). Although the Big 4 firms seem to play a dominant role, non-Big 4 firm were industry leader in 27% of the audit markets (in both 2005 and 2006). Industry leaders have an average market share of 88% in both 2005 and 2006. Table 3 also presents descriptive statistics about the other control variables. The average (median) size of a client is \$1,540 (\$190) million. Only a very few clients receive a qualified audit opinion (less than 0.02%) and 11.4% of the clients switch from auditor during the sample period. The average (median) Herfindahl index is 0.443 (0.396). The Herfindahl index provides a better measure of market concentration than for example the sum of concentration measures of the largest audit offices, because it takes into account the relative sizes of firm market shares. However, the Herfindahl index is also more difficult to interpret. The Herfindahl index varies between 0 (minimum concentration) and 1 (maximum concentration, i.e. a monopoly). To give an indication of concentration levels in an audit market, the sum of the market shares of the largest 4 audit offices is on average 0.98.

[Include Table 3 here]

V. Results

In Table 4 both Pearson and Spearman correlations for the variables of model (1) are presented for the total sample. Correlations between the dependent and independent

variables are as expected and no multicollinearity problems are identified, except for the *Big4* dummy, which is highly correlated with our competition variables and the client *size* variable. Notwithstanding the high correlations, we include the *Big4* dummy in our model, as we want to distinguish between competition by means of industry specialization and a *Big 4* reputation effect. Note that the inclusion of the *Big4* dummy does not influence the coefficients on *ln_other_fit_high*, *ln_other_fit_low* and *size*. In addition in all our regression analyses the variance inflation factors stay below 5 for all variables. To address further concerns, we also estimate our model for the sub-sample of Big 4 clients only, and our results are consistent with the main analyses.

[Include Table 4 here]

Table 5 presents the OLS regression results of model (1) run on the entire sample of 4,770 observations. To address the possibility that certain audit firm effects are overstated because of repeated observations, we also cluster standard errors per (national) audit firm using Rogers (1993) procedure. This results in a total of 250 audit firm clusters. Given our sample size, this is the most detailed cluster level we were able to consider⁷. We also include industry fixed effects. The regression model is significant ($p < .0001$), with an adjusted R^2 of 0.8061. As predicted in hypothesis 1, the number of competitors with a lower industry specialization level positively affects the audit fee of the incumbent audit office. The coefficients on *ln_other_fit_low* are significantly positive ($p\text{-value} < .0001$; (estimate = 0.156)). The number of competitors with a higher specialization level in an

⁷ We also considered less detailed clusters such as U.S. state levels. We also run the analysis for each year separately and without any adjustment for clustering. All these different specifications do not affect our results.

industry, negatively impacts the fee an audit office can charge, in line with hypothesis 2. The coefficient on *ln_other_fit_high* is significantly negative (p-value<.0001; estimate =-0.181). The regression coefficients of the client level control variables are consistent with expected signs based on previous research, except for *lnbu*, *de* and *ye* which are not significant. Recall that *Big4*, *Switch* and *Herfindex* are included to capture alternative explanations on competition between audit offices, next to our explanation of competition by means of (industry) specialization. The alternative competition explanations considered are a low-balling effect (*Switch* dummy), a Big 4 reputation effect (*Big4* dummy) and a market power explanation (*Herfindex*). The results on the *Big4* dummy and the *Switch* dummy are in line with expectations. If a company is audited by a Big 4 audit office, this positively impacts the audit fee (p-value <0.10). The *Switch* dummy is significantly negative with a p-value <.0001. This result is consistent with audit offices following a low-balling strategy in order to attract new clients. The Herfindalh index has significant negative impact on the audit fee (p-value <.001), which may suggest that in more concentrated market competition is more intense.

[Include Table 5 here]

In Table 6 and Figures 1 and 2 we report expected fee changes in raw dollars to give some economic intuition behind the regression results in Table 5. As suggested in King et al. (2000), we generate 1,000 simulations of changes in expected audit fees when *ln_other_fit_low* and *ln_other_fit_high* are changing, while keeping all other variables at their median values. When the number of competitors with a lower specialization level

increases from 0 to 1 (while keeping all other variables at their median values), the mean change in expected fees is \$45,762. The positive impact on expected fees is declining when the number of competitors increases. For example, if the number of competitors with a lower specialization level increases from 4 (median) to 5 the increase in mean expected fee is \$14,839. The expected audit fee decreases in the presence of competitors with higher specialization levels. If the number of more specialized competitors increases from 0 to 1, the mean decrease in fee is -\$86,266. Again this negative price impact becomes smaller if competition increases. If the number of more specialized competitors increases from its median value of 1 to 2, the negative change in fee is -\$49,698.

[Include Table 6 here]

[Include figures 1 and 2 here]

The results are consistent with Hypotheses 1 and 2. If an audit office faces competition with lower specialization levels, the client wants to pay a premium for the specialization level the audit office offers, so the audit fee will be higher. The audit fee is lower in the presence of competitors with higher specialization levels towards a client, because the client is not willing to pay the audit office a premium in the presence of better alternatives. The results indicate that audit offices do compete on audit fees, but try to soften this competition by specializing themselves into certain industries in order to earn a fee premium. The audit market competes in line with predictions from a spatial competition in a Hotelling-type of model. As we cannot observe price-cost margins of

auditors, we cannot infer the magnitude of the rents audit offices extract or whether these rent levels are acceptable from a social welfare perspective. Our results, however, do not seem to be in line with anti-competitive behavior of audit offices or audit offices earning monopoly rents through collusion.

VI. Robustness checks

Big 4 effect

Previous literature has shown extensively that the U.S. audit market is dominated by Big 4 audit firms (for an overview see Hay et al. 2006). In addition, most industry specialization literature focuses on Big N audit firms (i.e. Francis et al. 2006; Ferguson et al. 2003). As we examine competition in audit markets, we include all competitors (Big 4 and non-Big 4 audit firms) in our analysis. Although the variance inflation factors in our regressions are low, from Table 4 we learned that the correlation between the competition variables (*ln_other_fit_high* and *ln_other_fit_low*) and the *Big4* variable is strong. In particular correlations for *ln_other_fit_high* and *Big4* are below -0.67 (p-value <0.01)., To address the concern that our competition variables could pick up a Big 4 effect, we run an additional regression for the subsample of Big 4 audit firms only. Furthermore it is also interesting to see how Big 4 firms are affected by competition. The results of this analysis are presented in Table 7, showing a positive significant coefficient for *ln_other_fit_low* (p-value <0.05) and a negative significant coefficient for *ln_other_fit_high* (p-value <0.01). Hence, we show that the prior analysis on the netire sample is not driven by the Big 4 audit firms. These results also suggest that audit fees

charged by Big 4 audit firms are affected by competitive pressure in the audit market segment in a way that is consistent with our hypotheses.

[Include Table 7 here]

Client size

In his seminal paper, Simunic (1980) argues that the audit market is segmented according to client size, and he presumes that the segment of smaller clients is price competitive. He further uses the pricing in the small client segment as a benchmark to assess the pricing in the segment of larger clients, and establishes a theoretical framework to test for effects of product differentiation, monopolistic pricing and audit efficiencies on audit pricing in the large client segment. Ghosh and Lustgarten (2006) also use a segmentation of the market based on client size, but focus on the pricing of initial audit engagements. In addition, other literature shows that fee premiums for industry specialization, industry leadership and Big N audit firms are sensitive to client size (i.e. Craswell et al. 1995, Ferguson and Stokes (2002), Carson and Fargher (2007)). To investigate whether competition between auditors differs in client size segments, we split our sample into quintiles based on client total assets and run the model for each quintile separately. The results for the first and fifth quintile are tabulated in Table 8⁸. In all quintiles, the results are in line with our hypotheses, but in the last quintile the coefficient on *ln_other_fit_high* is insignificant. This insignificant result may reflect that larger clients are more likely to hire an industry specialist or leader, which results in fewer

⁸ The variable *opinion* is not included in the estimation, as there was no variation in the observations in the first and fifth quintile.

competitors with a higher level of specialization. This result is consistent with previous literature showing that premiums for industry specialists are more likely to be present for larger clients. Further descriptive analysis of the data indeed indicates that the number of competing audit firms decreases as client size increases. This is in line with with Simunic (1980) and Gosh and Lustgarten (2006) who also report bigger concentration in the market for the larger clients.

[Include Table 8 here]

Combined regression at National and MSA level

In our research design, we specified competition variables at MSA level. This choice was mainly motivated by recent literature that shows that industry specialization is also audit-office specific (i.e. Francis et al. 2005). An underlying assumption of this design choice is that clients consider audit offices located nearby as potential auditor candidates and that local audit offices compete to attract clients. However, it could also be that competition takes place at the national level. To address this concern we re-run the regression analyses based on measures of competition at a National level. Hence, instead of examining an audit market (2-digit SIC industries) at MSA level, we examine audit markets (2-digit SIC industries) at the National level. This yields only 46 (42) audit markets in 2005 (2006), compared to 415 (305) audit markets at the MSA level in 2005 (2006). Table 9, Panel A shows descriptive statistics for the competition variables at the National level. From these statistics it is clear that competition is far more intense at the National level. The mean (median) competitors with a market share lower than the audit

firm in charge is 18 (0) in national markets, compared to 6 (4) in local audit markets. The mean (median) competitors with a higher market share than the audit firm in charge is 63 (55) in national audit markets compared to 2(1) in local audit markets, suggesting that the market is dominated by a few large audit firms in the national audit market.

Table 9, Panel B reports the regression results for the national markets. These show that more or less competitive pressure due to the presence of auditors with a higher or lower degree of specialization at a national level does not seem to affect pricing. The coefficients on *ln_other_fit_low_National* and *ln_other_fit_high_National* both have a negative coefficient but are not significant (p-value<0.25). The negative signs on both competition estimates may indicate negative pressure from the presence of national competitors in general, although they are not statistically different from zero. As an additional analysis we also investigate how local and national competitive pressure jointly affect audit fees. For that purpose we run another regression model including both the MSA and the National competition variables. The results of this regression analysis are also presented in Table 9 and are consistent with the previous results. That is, the MSA competition variables are in line with our hypotheses (p-value <0.0001), but the National competition variables have negative signs and are not significant (p-value <0.30)⁹. In some additional sensitivity checks we find that the results are consistent when testing the joint model for the subsample of Big 4 firms only. Furthermore, these results are also similar for the different client size quintiles. In aggregate, the tests on national

⁹ The correlation between the competition variables at National level and MSA level is strong. *ln_other_fit_high (MSA)* and *ln_other_fit_high (National)* have a Pearson Correlation of 0.71 and *ln_other_fit_low (MSA)* and *ln_other_fit_low (National)* have a Pearson Correlation of 0.54. When estimating the regression equation, the variance inflation factors report values below 4 for all regression variables. This may mitigate some multicollinearity concerns.

level competition variables suggest that an audit office only faces competitive pressure from competitors with a similar specialization at the local audit market level.

Large audit markets vs. Small audit markets

The descriptive statistics in Table 2 show there is quite some variation in the number of audit offices and the number of clients in an audit market. We also observe in Table 8 that the larger the clients in an audit market segment, the smaller the number of competing auditors, suggesting that competition is more concentrated for larger clients. The Hotelling model that we use to motivate our hypotheses is designed to capture competition between a small number of competing firms (Hotelling, 1929) and although the descriptives show the largest part of our sample consists of small audit markets (the 75th percentile is 5 auditors per audit market), there are quite some large audit markets in the sample for which the results could be different. Note that Francis et al. (2005) also indicate that the pricing of industry expertise is sensitive to the size of the audit market. Therefore, we split up our sample into quintiles based on the total number of audit firms (i.e. suppliers) in an audit market. In other words, we split up our sample based on the number of total competitors in an audit market. The untabulated results show that, in general findings are in line with our hypotheses. The results are consistent for the different quintiles, so the size of the audit markets does not seem to affect our results.

[Include Table 10]

Additional specification checks

Another concern is that clients may choose an audit office that is located in another MSA. Unfortunately, we can only observe the U.S. State in which the auditor is located. Hence, as a sensitivity check we re-run model (1) on subsample of clients which choose an auditor from within the same U.S. State. Note that in our sample only 18% of clients choose an auditor that is located in a different state. It can be that clients choose an auditor in a different state because they cannot find an audit office that is specialized enough in their own state. To make sure that these observations do not affect our analysis we exclude these 18% of clients and rerun the analyses. The results do not change, suggesting that clients that choose an out-of-state auditor do not affect the outcome of our analyses.

Finally, we also ran the regression analysis for each of the years included in the sample separately. Again, this yields similar results compared to the combined sample. We also re-ran the analysis using an alternative outlier removal treatment. In particular, instead of truncating the sample at the 1st percentile, we used winsorizing. Again we found that our results are not affected. As a last sensitivity check, we estimate our models using Generalized Estimation Equations (GEEs) in which we allow for an unstructured correlation matrix with the national audit firm as a subject effect. The results are completely consistent, mitigating the concern that our results are affected by clustering issues.

VII. Limitations and possibilities for future research

Notwithstanding the robustness of the results reported above, our study is subject to some limitations. First, endogeneity issues may be a concern as there is no strict causal

relationship between audit fees and concentration measures such as market shares. In addition, the choice to become an industry specialist may also be endogenous. One argument against these concerns is that industry specialization measures seem quite stable over time. Second, it could be that our measure of industry specialization may capture market power of bigger auditors. In a sense, we are interested in market power of firms, as we are investigating competitive pressure as a result of a firm's specialization strategy. To our defense, we do control for more general measures of market power (*Big 4* dummy, *Herfindex*) in order to capture these effects. Our results indicate, however, that industry specialization is a key strategic determinant that audit firms compete on.

Future research could test alternative measures of fit or specialization of an auditor towards a client. In addition, our definition of audit market as a two digit SIC-industry at state level could be challenged. Further extensions could also look at different market definitions and at different measures to capture the presence of competition in an audit market. Finally, another possibility for future research is to examine the competition between auditors in the market for non-audit services and to see how competition in both markets affect each other.

VIII. Conclusion

The purpose of this study is to examine whether auditors compete in terms of pricing, given that they choose to specialize in serving certain industries. Based on spatial competition theory (Hotelling model), we predict that the audit fee charged by the incumbent auditor decreases in the number of competing auditors active in an audit market and with higher industry specialization than the incumbent auditor. On the

contrary, we also predict that the audit fee charged by the incumbent auditor increases in the number of competing auditors active in an audit market and with lower specialization than the incumbent auditor. These predictions are tested using U.S. data on audit fees and client characteristics for the years 2005-2006. Given the theoretical foundation of our predictions that auditors behave as oligopolists, competition between local audit offices is examined at the MSA (city) level. Specialization is measured in terms of audit fee market share in a 2-digit SIC industry. The results confirm our predictions. In supplementary analyses we also test whether the predictions hold when industry specialization and competition are measured for the national audit market, and find that this is not the case. Hence, the results only hold in local audit markets where industry specialization is measured at MSA level, suggesting that competitive pressure on audit pricing from more and less specialized auditors only plays a role at the local audit market and not at the national audit market. In aggregate, our results indicate that auditors compete on audit fees, but by specializing into certain industries auditors are able to soften this price competition. Due to lack of price-cost margin data we cannot examine whether auditors earn excessive (monopoly) rents. Given that we find that auditors compete on audit fees, our results are not consistent with anti-competitive pricing behavior or collusion. However the results from our simulation analysis indicate a relative strong impact of one (additional) individual competitor on the level of the audit fee.

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Appendix A

Variable definitions

Dependent variable

Audit Fees in \$ = audit fees in dollars
 lnfee = natural log of audit fees

Independent variables

Competition variables

$N_other_fit_low$ = number of competing audit offices in an audit market with a smaller market share than the incumbent audit office. Market share is defined as percentage of total audit fees in a two-digit SIC industry in an audit market. An audit market is defined as a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. Census Bureau definition).
 $ln_other_fit_low$ = natural log of ($N_other_fit_low$ +1)
 $N_other_fit_high$ = number of competing audit offices in an audit market with a larger market share than the incumbent audit office. Market share is defined as percentage of total audit fees in a two-digit SIC industry in an audit market. An audit market is defined as a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. Census Bureau Definition).
 $ln_other_fit_high$ = natural log of ($N_other_fit_high$ +1)

Control variables

Total Assets in million \$ = total assets in million of dollars (compustat item 6)
 size = natural log of total assets
 # of BU segments = number of business segments
 lnbu = natural log of number of business segments
 # of Geographical segments = number of foreign segments
 foreign = natural log of total foreign segments
 cata = ratio of current assets to total assets (compustat item 4 / compustat item 6)
 quick = ratio of current assets (less inventories) to current liabilities ((compustat item 4 - compustat item 3)/compustat item 5)
 de = ratio of long-term debt to total assets (compustat item 9 / compustat item 6)
 roi = ratio of earnings before interest and tax to total assets ((compustat item 170 + compustat item 15) /compustat item 6)
 loss = indicator variable equal to 1 if loss in current year, 0 otherwise
 ye = indicator variable equal to 1 if non-dec 31st year=end, 0 otherwise
 opinion = indicator variable equal to 1 if a client receives a qualified opinion, 0 otherwise
 switch = indicator variable equal to 1 if a client changed its' auditor in a year, 0 otherwise
 Big4 = indicator variable equal to 1 if an audit office is a Big 4 audit firm, 0 otherwise
 herfindex = Herfindahl concentration index per audit market,

where the Herfindahl index is calculated as $H \equiv \sum_{i=1}^n s_i^2$,

where i is an audit office in an audit market and s is market share in an audit market based on total fees.

An audit market is defined as a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. Census Bureau definition)

Table 1
Selection of total client sample for time period 2005-2006

	Time period: 2005-2006	
Companies available in Audit analytics	32,385	
Companies available in Compustat	<u>45,267</u>	
Total companies with all data items available in merged sample		9,567
<i>Less:</i>		
Financial Sector	-588	
Foreign firms	-963	
Less than two observations per audit market	-2,656	
Truncating all regression variables at top and bottom 1% level	<u>-590</u>	
Final sample size		4,770

Table 2
Descriptive Statistics Audit market Sample

	Year 2005	Year 2006				
Number of Audit markets	415	305				
Number of Clients audited by Big 4 audit firm	1855 (68%)	1378 (68%)				
Number of Clients audited by Non Big 4 audit firm	882 (32%)	655 (32%)				
Number of Non-Big 4 audit firms	217	162				
	Min	25th percentile	Median	Mean	75th Percentile	Max
Audit firms per MSA	1	3	8	21	23	222
Clients per MSA	1	4	10	37	35	388
Audit firms per Industry	1	5.5	13	31	36	213
Clients per Industry	1	7	17.5	54	55	410
Number of Clients per Industry per MSA	1	3	4	7	7	72
Number of Auditors per Industry per MSA	1	2	3	4	5	19

These descriptive statistics are based on a sample of 4,770 clients audited in 2005-2006 in the U.S. An Audit market is a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. census bureau definition). The data are collected from Compustat and Audit Analytics.

Table 3
Descriptive statistics total sample, Years: 2005-2006

	N	Mean	StdDev	Min	P25	Median	P75	Max
Dependent variable								
Audit fees in \$	4770	1323000	1982468	9150	192176	624648	1530260	17320000
lnfee	4770	13.212	1.440	9.122	12.166	13.345	14.241	16.667
Independent variables								
<i>Competition variables</i>								
N_other_fit_low	4770	5.733	6.444	0.000	1.000	4.000	8.000	34.000
ln_other_fit_low	4770	1.525	0.886	0.000	0.693	1.609	2.197	3.555
N_other_fit_high	4770	2.066	2.690	0.000	0.000	1.000	3.000	18.000
ln_other_fit_high	4770	0.834	0.730	0.000	0.000	0.693	1.386	2.944
<i>Control variables</i>								
Total assets in million \$	4770	1539.84	4042.39	0.08	37.28	189.80	966.60	35991.00
size	4770	5.212	2.333	-2.551	3.619	5.246	6.874	10.491
# of BU segments	4770	1.783	1.516	0.000	1.000	1.000	3.000	7.000
lnbu	4770	0.893	0.503	0.000	0.693	0.693	1.386	2.079
# of geographical segments	4770	2.122	3.259	0.000	0.000	0.000	4.000	14.000
foreign	4770	0.600	0.852	0.000	0.000	0.000	1.386	2.639
cata	4770	0.538	0.265	0.047	0.326	0.541	0.762	1.000
quick	4770	2.429	2.721	0.023	0.920	1.474	2.856	21.319
de	4770	0.180	0.240	0.000	0.000	0.091	0.278	1.713
roi	4770	-0.150	0.767	-11.236	-0.119	0.050	0.110	0.488
loss	4770	0.418	0.493	0.000	0.000	0.000	1.000	1.000
ye	4770	0.328	0.470	0.000	0.000	0.000	1.000	1.000
opinion	4770	0.000	0.014	0.000	0.000	0.000	0.000	1.000
switch	4770	0.114	0.318	0.000	0.000	0.000	0.000	1.000
Big4	4770	0.678	0.467	0.000	0.000	1.000	1.000	1.000
herfindex	4770	0.443	0.192	0.152	0.298	0.396	0.535	1.000

Variables are defined as in Appendix A

Table 4
Correlations regression variables

Variable	1	2	3	4	5	6	7	8
1 Infee	1.00	0.19 ***	-0.54 ***	0.86 ***	0.17 ***	0.29 ***	-0.29 ***	-0.05 ***
2 ln_other_fit_low	0.22 ***	1.00	-0.05 ***	0.08 ***	-0.06 ***	0.14 ***	0.12 ***	0.25 ***
3 ln_other_fit_high	-0.55 ***	-0.03 **	1.00	-0.54 ***	-0.06 ***	-0.11 ***	0.16 ***	-0.04 ***
4 size	0.85 ***	0.10 ***	-0.55 ***	1.00	0.18 ***	0.22 ***	-0.45 ***	-0.08 ***
5 lnbu	0.16 ***	-0.06 ***	-0.06 ***	0.18 ***	1.00	0.34 ***	-0.10 ***	-0.08 ***
6 foreign	0.30 ***	0.14 ***	-0.12 ***	0.24 ***	0.35 ***	1.00	0.04 ***	0.06 ***
7 cata	-0.28 ***	0.12 ***	0.16 ***	-0.44 ***	-0.09 ***	0.04 ***	1.00	0.44 ***
8 quick	-0.13 ***	0.16 ***	0.00	-0.12 ***	-0.10 ***	-0.03 **	0.40 ***	1.00
9 de	0.16 ***	-0.05 ***	-0.10 ***	0.22 ***	0.02	-0.06 ***	-0.36 ***	-0.18 ***
10 roi	0.32 ***	0.02	-0.22 ***	0.46 ***	0.09 ***	0.13 ***	-0.16 ***	0.02
11 loss	-0.36 ***	0.05 ***	0.24 ***	-0.47 ***	-0.13 ***	-0.13 ***	0.19 ***	0.13 ***
12 opinion	0.01	-0.01	0.00	0.00	-0.03 *	-0.01	-0.01	0.00
13 ye	-0.11 ***	-0.02	0.11 ***	-0.13 ***	0.01	0.02	0.12 ***	-0.06 ***
14 Big4	0.62 ***	0.17 ***	-0.68 ***	0.62 ***	0.05 ***	0.17 ***	-0.14 ***	0.05 ***
15 switch	-0.21 ***	-0.05 ***	0.14 ***	-0.15 ***	-0.01	-0.03 *	0.02 *	-0.02
16 herfindex	0.04 ***	-0.49 ***	-0.33 ***	0.12 ***	0.04 ***	-0.08 ***	-0.10 ***	-0.07 ***

Variables are defined as in Appendix A. Pearson Correlations: Below diagonal, Spearman Correlations: Above diagonal.

p-value <0.1 *
p-value <0.05 **
p-value <0.01 ***

Table 4
Correlations regression variables, continued

Variable	9	10	11	12	13	14	15	16
1 Infee	0.29 ***	0.36 ***	-0.37 ***	0.01	-0.10 ***	0.62 ***	-0.20 ***	0.03 *
2 ln_other_fit_low	-0.09 ***	-0.04 ***	0.05 ***	-0.02	-0.02	0.18 ***	-0.05 ***	-0.52 ***
3 ln_other_fit_high	-0.18 ***	-0.22 ***	0.23 ***	0.00	0.10 ***	-0.67 ***	0.14 ***	-0.33 ***
4 size	0.40 ***	0.49 ***	-0.47 ***	0.00	-0.12 ***	0.62 ***	-0.15 ***	0.10 ***
5 lnbu	0.10 ***	0.11 ***	-0.14 ***	-0.02 *	0.02	0.05 ***	-0.01	0.05 ***
6 foreign	-0.02 *	0.12 ***	-0.13 ***	-0.01	0.02	0.17 ***	-0.03 *	-0.08 ***
7 cata	-0.49 ***	-0.20 ***	0.19 ***	-0.01	0.12 ***	-0.15 ***	0.02 *	-0.07 ***
8 quick	-0.32 ***	-0.01	0.01	0.01	-0.04 ***	0.12 ***	-0.05 ***	-0.10 ***
9 de	1.00	0.11 ***	-0.06 ***	0.01	-0.09 ***	0.17 ***	-0.02	0.12 ***
10 roi	0.04 **	1.00	-0.83 ***	0.02	0.01	0.26 ***	-0.09 ***	0.04 **
11 loss	0.06 ***	-0.41 ***	1.00	-0.01	-0.01	-0.27 ***	0.09 ***	-0.04 ***
12 opinion	0.00	0.01	-0.01	1.00	-0.01	0.01	-0.01	0.01
13 ye	-0.08 ***	0.00	-0.01	-0.01	1.00	-0.11 ***	0.04 ***	-0.06 ***
14 Big4	0.10 ***	0.24 ***	-0.27 ***	0.01 ***	-0.11	1.00	-0.21 ***	0.11 ***
15 switch	-0.01	-0.08 ***	0.09 ***	-0.01 ***	0.04 ***	-0.21	1.00	-0.03 **
16 herfindex	0.08 ***	0.03 **	-0.05 ***	0.01 ***	-0.06 ***	0.11	-0.02	1.00

Variables are defined as in Appendix A. Pearson Correlations: Below diagonal, Spearman Correlations: Above diagonal.

p-value <0.1 *
p-value <0.05 **
p-value <0.01 ***

Table 5
Regression on MSA level
 OLS regressions with clustering on audit firm level, N=4,770, Years: 2005-2006
 Dependent variable: Infee

	Estimate	t-stat	Prob
intercept	10.299	70.58	0.0000
ln_other_fit_low	0.156	7.70	0.0000
ln_other_fit_high	-0.181	-7.71	0.0000
size	0.525	43.09	0.0000
lnbu	-0.010	-0.27	0.7885
foreign	0.084	7.45	0.0000
cata	0.425	5.85	0.0000
quick	-0.049	-9.15	0.0000
de	-0.001	-0.02	0.9840
roi	-0.155	-8.77	0.0000
loss	0.104	3.57	0.0004
ye	-0.037	-1.51	0.1335
year_dummy	0.093	4.54	0.0000
opinion	0.683	8.38	0.0000
Big 4	0.118	1.74	0.0832
switch	-0.337	-4.23	0.0000
herfindex	-0.161	-2.67	0.0081
F-value		12343.6	
Adj R ²		0.8061	
Number of obs.		4770	
Number of clusters		250	
Industry fixed effects		Yes	

Variables are defined as in Appendix A, except for
 year_dummy = indicator variable equal to 1 if year =2006, 0 otherwise.
 t-statistics are based on a two-tailed test and are based on clustered standard errors at audit firm level.

Table 6
Economic significance main results at MSA level
Changes in Expected fees for changes in N_other_fit_high and N_other_fit_low

N_other_fit_low				N_other_fit_high			
	From	To	Mean Change in expected fees		From	To	Mean Change in expected fees
Minimum	0	1	\$45.762	Minimum, 25 th percentile	0	1	-\$86.266
25th percentile	1	2	\$29.178	Median	1	2	-\$49.698
	2	3	\$21.813		2	3	-\$30.280
	3	4	\$17.644		75th Percentile	3	4
Median	4	5	\$14.839	4		5	-\$17.268
	5	6	\$12.853	5		6	-\$14.043
	6	7	\$11.431	6		7	-\$11.771
75th percentile	7	8	\$10.247	7		8	-\$10.085
	8	9	\$9.337	8	9	-\$8.792	
	9	10	\$8.611	9	10	-\$7.759	
	10	11	\$7.966	10	11	-\$6.959	
	11	12	\$7.383	11	12	-\$6.272	
	12	13	\$6.927	12	13	-\$5.704	
	13	14	\$6.545	13	14	-\$5.222	
	14	15	\$6.180	14	15	-\$4.809	
	15	16	\$5.866	15	16	-\$4.475	
	16	17	\$5.542	16	17	-\$4.122	
Max	17	18	\$5.336	Max	17	18	-\$3.868
	18	19	\$5.059				
	19	20	\$4.905				
	20	21	\$4.681				
	21	22	\$4.518				
	22	23	\$4.285				
	23	24	\$4.246				
	24	25	\$4.005				
	25	26	\$3.962				
	26	27	\$3.782				
	27	28	\$3.667				
	28	29	\$3.619				
	29	30	\$3.432				
	30	31	\$3.449				
	31	32	\$3.258				
	32	33	\$3.273				
	Max	33	34		\$3.078		

The mean changes in Expected fees are based on the regression results on MSA level in Table 5 and are approximated by 1,000 simulations. The expected changes for ln_other_fit_low (ln_other_fit_high) are estimated by keeping all other variables in the regression at their median values.

Table 7
Regression Big 4 firms on MSA level
 OLS regressions with clustering on audit firm level, N=3,233, Years: 2005-2006
 Dependent variable: Infee

	Estimate	t-stat	Prob
intercept	10.375	119.18	0.0000
ln_other_fit_low	0.106	4.05	0.0272
ln_other_fit_high	-0.146	-10.02	0.0021
size	0.545	39.95	0.0000
lnbu	-0.013	-0.24	0.8224
foreign	0.066	5.72	0.0106
cata	0.612	8.89	0.0030
quick	-0.059	-17.52	0.0004
de	0.022	0.29	0.7903
roi	-0.214	-2.49	0.0883
loss	0.074	1.88	0.1567
ye	0.004	0.26	0.8140
year_dummy	0.080	2.16	0.1197
opinion	0.640	5.04	0.0150
switch	-0.578	-5.05	0.0150
herfindex	-0.131	-2.36	0.0994
F-value		6.04	
Adj R ²		0.6890	
Number of obs.		3233	
Number of clusters		4	
Industry fixed effects		Yes	

Variables are defined as in Appendix A, except for
 year_dummy = indicator variable equal to 1 if year =2006, 0 otherwise.
 t-statistics are based on a two-tailed test and are based on clustered standard errors at audit firm level

Table 8
Regressions on MSA level audit markets per client size quintile
 OLS regressions with clustering at audit firm level, N=4,770, Years: 2005-2006
 Dependent variable: Infee

	First quintile			Fifth quintile			t-test difference
	Estimate	t-stat	Prob.	Estimate	t-stat	Prob	
intercept	10.369	56.76	0.0000	9.494	19.46	0.0000	-3.46
ln_other_fit_low	0.227	7.61	0.0000	0.116	2.10	0.0625	0.51
ln_other_fit_high	-0.160	-3.47	0.0006	-0.031	-0.51	0.6231	2.38
size	0.399	17.79	0.0000	0.587	19.60	0.0000	2.42
lnbu	-0.047	-0.63	0.5279	0.025	0.56	0.5880	0.64
foreign	0.096	2.41	0.0168	0.063	3.13	0.0106	1.53
cata	0.294	2.77	0.0060	1.154	9.25	0.0000	5.91
quick	-0.031	-2.97	0.0033	-0.145	-9.46	0.0000	-9.23
de	0.141	1.50	0.1362	0.442	2.41	0.0368	1.99
roi	-0.092	-5.11	0.0000	-0.401	-2.18	0.0541	-1.07
loss	0.199	3.81	0.0002	0.057	0.80	0.4402	-0.60
ye	-0.114	-3.06	0.0025	0.032	0.85	0.4173	0.91
year_dummy	0.133	3.99	0.0001	0.046	2.22	0.0509	-2.58
Big 4	0.209	1.56	0.1191	0.037	0.22	0.8332	-0.09
switch	-0.160	-2.35	0.0198	-0.023	-0.23	0.8220	2.64
herfindex	-0.163	-1.07	0.2878	0.091	0.81	0.4364	2.45
F-value		115.64			61543.70		
Adj R^2		0.5599			0.5693		
Number of obs.		953			953		
Number of clusters		220			11		
Industry fixed effects		Yes			Yes		

Variables are defined as in Appendix A, except for
 year_dummy = indicator variable equal to 1 if year =2006, 0 otherwise.
 t-statistics are based on a two-tailed test and are based on clustered standard errors at audit firm level

Table 9
Regressions on National level and MSA level audit markets
 OLS regression with clustering at audit firm level, N= 4,770, Years: 2005-2006
 Dependent variable: Infee

Panel A: Descriptive statistics national competition variables

	N	Mean	StdDev	Min	P25	Median	P75	Max
<i>Competition variables</i>								
N_other_fit_low_National	4770	17.961	30.511	0.000	0.000	0.000	23.000	171.000
ln_other_fit_low_National	4770	1.553	1.739	0.000	0.000	0.000	3.178	5.147
N_other_fit_high_National	4770	63.514	50.488	0.000	19.000	55.000	105.000	171.000
ln_other_fit_high_National	4770	3.656	1.232	0.000	2.996	4.025	4.663	5.147

Panel B: Regression results

	Estimate	t-stat	Prob.	Estimate	t-stat	Estimate
intercept	10.429	55.87	0.0000	10.394	56.91	0.0000
ln_other_fit_low_National	-0.012	-1.18	0.2380	-0.012	-1.26	0.2088
ln_other_fit_high_National	-0.024	-1.29	0.1984	-0.021	-1.14	0.2552
ln_other_fit_low_MSA				0.156	7.67	0.0000
ln_other_fit_high_MSA				-0.181	-7.66	0.0000
size	0.555	45.40	0.0000	0.525	43.84	0.0000
lnbu	-0.019	-0.50	0.6186	-0.009	-0.23	0.8194
foreign	0.086	6.41	0.0000	0.083	7.39	0.0000
cata	0.495	7.25	0.0000	0.424	5.80	0.0000
quick	-0.050	-9.54	0.0000	-0.049	-9.16	0.0000
de	-0.013	-0.30	0.7658	0.000	0.00	0.9997
roi	-0.156	-8.25	0.0000	-0.154	-8.73	0.0000
loss	0.123	3.81	0.0002	0.102	3.32	0.0010
ye	-0.032	-1.39	0.1667	-0.034	-1.48	0.1392
year_dummy	0.071	3.46	0.0006	0.088	4.09	0.0001
opinion	0.587	6.49	0.0000	0.679	7.71	0.0000
Big 4	0.299	3.98	0.0001	0.115	1.66	0.0990
switch	-0.341	-4.09	0.0001	-0.337	-4.24	0.0000
herfindex	-0.291	-4.41	0.0000	-0.164	-2.70	0.0075
F-value		4687.05			8704.24	
Adj R ²		0.7969			0.8062	
Number of obs.		4770			4770	
Number of clusters		250			250	
Industry fixed effects		Yes			Yes	

Table 9, continued

Variables are defined as in Appendix A, except for

<p>$N_other_fit_low_National =$</p> <p>$\ln_other_fit_low_National =$</p> <p>$N_other_fit_high_National =$</p> <p>$\ln_other_fit_high_National =$</p> <p>$year_dummy =$</p> <p>$Herfindex =$</p>	<p>number of competing audit offices in an audit market with a smaller market share than the incumbent audit office.</p> <p>Market share is defined as percentage of total audit fees in a two-digit SIC industry in an audit market.</p> <p>An audit market is defined as a two-digit SIC industry.</p> <p>natural log of ($N_other_fit_low_National + 1$)</p> <p>number of competing audit offices in an audit market with a larger market share than the incumbent audit office.</p> <p>Market share is defined as percentage of total audit fees in a two-digit SIC industry in an audit market</p> <p>An audit market is defined as a two-digit SIC industry.</p> <p>natural log of ($N_other_fit_high_National + 1$)</p> <p>indicator variable equal to 1 if year = 2006, 0 otherwise.</p> <p>Herfindahl concentration index per audit market,</p> <p>where the Herfindahl index is calculated as $H \equiv \sum_{i=1}^n s_i^2$, where i is an audit office in an audit market and s is market share in an audit market based on total fees.</p> <p>An audit market is defined as a two-digit SIC industry.</p>
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t-statistics are based on a two-tailed test and are based on clustered standard errors at audit firm level

Expected fees in presence of more specialized competitors

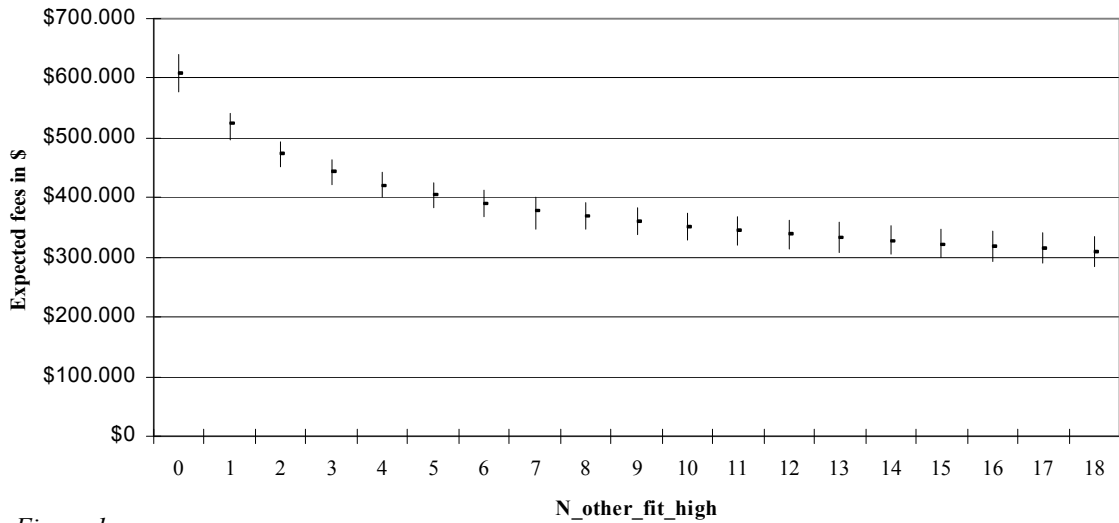


Figure 1.

The expected fees with 95 percent confidence intervals are based on regression results in Table 5 and are approximated by 1,000 simulations. All variables, expect $\ln_other_fit_high$ are kept at their median values.

Expected fees in presence of less specialized competitors

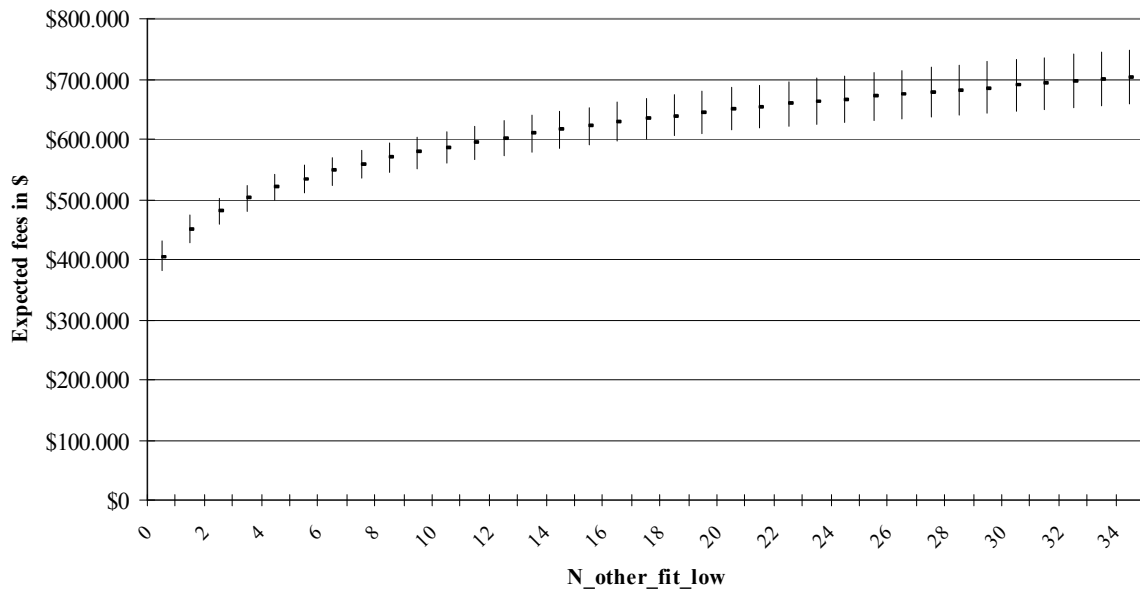


Figure 2.

The expected fees with 95 percent confidence intervals are based on regression results in Table 5 and are approximated by 1,000 simulations. All variables, expect $\ln_other_fit_low$ are kept at their median values.

