Journal of Accounting and Economics 65 (2018) 129–147

Contents lists available at ScienceDirect

Journal of Accounting and Economics

journal homepage: www.elsevier.com/locate/jacceco

Transaction costs and competition among audit firms in local markets☆

Ling Chu[a], Dan A. Simunic[b,*], Minlei Ye[c], Ping Zhang[c]

[a] School of Business and Economics, Wilfred Laurier University, 75 University Avenue West, Waterloo, ON, N2L 3C5 Canada
[b] Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2 Canada
[c] Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6 Canada

ARTICLE INFO

Article history:
Received 1 July 2014
Revised 26 June 2017
Accepted 16 November 2017
Available online 22 November 2017

Keywords:
Audit pricing
Competition
Transaction costs

ABSTRACT

We develop a measure to capture an audit firm's competitive position in a local audit market based on the transaction costs of changing audit firms included in DeAngelo's (1981) multi-period audit pricing model. Our competition measure reflects the size difference between the largest audit firm in a market specified by client industry at the city level and the other audit firms operating in that market. We find that audit fees of a client decrease as this size difference increases. This result suggests that smaller audit firms charge lower audit fees because of their competitive disadvantage to the local largest firm.

1. Introduction

We develop a measure to capture an audit firm's competitive position in a local audit market based on the transaction costs of changing audit firms included in DeAngelo's (1981) multi-period audit pricing model. Audit markets in the U.S. and elsewhere have clearly become more concentrated since the late 1980s after several rounds of consolidation among the largest public accounting firms (Ferguson et al., 2014). The nature of competition among audit firms has been of concern to regulators (e.g., Subcommittee on Reports, Accounting and Management of the Commission on Government Operations U.S. Senate, 1977; Government Accountability Office [GAO], 2003, 2008) and of interest to researchers (e.g., Dopuch and Simunic, 1980). Regulators' concerns center on the possibility that a lack of competition among audit firms will lead to higher audit prices, lower audit quality, and hence a lower quality of financial reporting by companies. Auditor competition is therefore an important issue, but to understand the nature of competition, it is essential for auditors' competitive positions to be properly measured.

We develop our measure based on the effects of variations in the size of suppliers (audit firms) in a market on audit service production and pricing. It is well known that client companies retain their audit firms for multiple years, rather than

☆ We appreciate the very helpful comments from Michelle Hanlon (the editor) and Karen Nelson (the referee). We are also thankful for constructive insights from Jeffrey Callen, Tracy Gu, Clive Lennox, Mike Stein and participants in accounting research workshops at the University of British Columbia, University of Hong Kong, University of Pittsburgh, University of Toronto, Lehigh University, and University of Technology - Sydney, as well as conference participants at the 2014 Auditing Section Midyear Meeting, the 2014 European Accounting Association Conference, and the 2014 Canadian Academic Accounting Association Conference. Dan Simunic thanks the Social Sciences and Humanities Research Council of Canada for financial support. Ling Chu and Ping Zhang also thank the Social Sciences and Humanities Research Council of Canada for financial support.

* Corresponding author.
E-mail address: dan.simunic@sauder.ubc.ca (D.A. Simunic).

https://doi.org/10.1016/j.jacceco.2017.11.004
0165-4101/

changing them every few years, presumably because the transaction costs (i.e., audit firm learning costs and client-incurred switching costs) of audit firm change are non-trivial. This leads to the multi-period pricing of audit services analyzed in DeAngelo (1981), Magee and Tseng (1990), and Sabac and Simunic (2001). We argue that the competitive pressure on any incumbent audit firm's fees depends fundamentally upon the ease with which the audit firm's clients can switch to a competing audit firm. If the transaction costs are low, the ability of the incumbent audit firm to extract economic rents from clients is limited;[1] conversely, high costs of changing auditors give an incumbent auditor greater pricing power. We conjecture that transaction costs are decreasing in the relative operational size differences among competing audit firms in a market. The greater the operational size difference between the largest available supplier (auditor) and the incumbent supplier, the lower will be the transaction costs for a client of the incumbent firm to switch to the largest supplier and hence the lower the incumbent's audit fee.

In any study of price competition, it is important to identify the boundaries of the market within which competition occurs. We first consider competition in MSA-Industry markets that are defined by U.S. Metropolitan Statistical Areas (MSA, U.S. Census Bureau definition) and client two-digit Standard Industrial Classification (SIC). We measure an audit firm's operational size in an MSA-Industry market as the total audit fees the audit firm receives in this market, which basically captures the industry-specific size of staff and facilities involved in performing the audits in this market. Beginning with the paper by Craswell et al. (1995), a large literature in the economics of auditing posits that the two-digit SIC industry in which a client operates is important in defining a market for audits. That is, specialized, two-digit-industry-specific knowledge is assumed to be necessary for an audit firm to compete within a market. Based on the premise that all audit firms with clients in an industry have the necessary expertise to audit their clients properly, an audit firm's relative operational size within an industry should be the most relevant determinant of the transaction costs of auditor change in the industry.

We combine these arguments with the simple multi-period audit pricing model in DeAngelo (1981) to develop empirical predictions concerning audit fees as a function of the size of the conjectured costs of audit firm change. Our arguments predict that, ceteris paribus, audit fees charged by an incumbent audit firm that does not have the largest operation in an MSA-Industry market are a decreasing function of the relative size of its operation. That is, for any audit firm operating in an MSA-Industry market, *ceteris paribus*, audit fees will decrease as the relative size of the operation decreases. This effect is captured by our variable DIFFERENCE, which measures differences in audit firm market shares within MSA-Industry markets. We define DIFFERENCE as the total audit fees earned by the largest audit firm in an MSA-Industry market, minus the total audit fees earned by the incumbent audit firm, scaled by total audit fees earned by all audit firms in this market.

We next consider the possibility that the relevant boundaries of local audit markets are simply defined by geographic U.S. Metropolitan Statistical Areas, without considering client industry. While prior literature normally incorporates client industry in the definition of audit markets, the appropriate definition of industry is not obvious. Many differences at the 2-digit industry level may not be relevant to auditors. For example, whether an audit client manufactures "textile mill products" (SIC industry 22) or "apparel & other textile products" (SIC industry 23) or "lumber and wood products" (SIC industry 24) may not matter. Since many industries identified by the 2-digit SIC codes have similar business processes and accounting practices, audits of companies in specific industries may not require unique industry expertise. In this case, auditor competition may not be bounded by client industry. To consider this possibility, we also test our competition measure using a simple geographic definition of markets as defined by U.S. Metropolitan Statistical Areas. However, given the importance of client industry in prior research, we expect that the operational size in an MSA-Industry market is more relevant to determining audit fees than the operational size in a geographic MSA market.

Although an audit firm's operations *outside* an MSA-Industry market likely do not have the same impact on transaction costs compared to operations *within* the market, it is plausible that the operations outside a market can still affect the magnitude of transaction costs, particularly for the largest audit firm within an MSA-Industry market. If the largest firm in an MSA-Industry market also has the largest operations outside the MSA-Industry market, its competitive advantage within an MSA-Industry market may increase, allowing it to charge relatively higher audit fees. We posit that the transaction costs of an audit firm are the lowest in an MSA-Industry market if the firm has the largest operations both in the MSA-Industry market and outside the market. We examine three measures of operations outside of an MSA-Industry market: (i) operations in the same MSA but in other industries, (ii) operations in the same industry but in all other MSAs, and (iii) operations outside of the MSA.

We test our audit pricing hypotheses using U.S. public company audit fee data from 2000–2011. We find that the audit fee charged by an incumbent audit firm decreases as the size difference between the largest audit firm in an MSA-Industry market and the incumbent audit firm increases. *Ceteris paribus*, an audit firm with DIFFERENCE equal to the average in our sample charges fees 7.6% lower than the largest audit firm in the MSA-Industry market. Importantly, the operational size difference between the largest audit firm in an MSA-Industry market and the incumbent audit firm is not associated with lower audit quality proxied by abnormal accruals, suggesting that our measure of competitive position captures market power rather than audit quality differences. Moreover, we show that competition occurs mainly within an MSA-Industry market rather than a purely geographic MSA market. Finally, we show that the size of operations outside an MSA-Industry market of the largest audit firm in the MSA-Industry market support the dominant firm's competitive position within the MSA-Industry market.

[1] In the limit, if the transaction costs of auditor change are zero, then audits would simply be purchased and priced independently each period.

Our paper contributes to the auditing literature by explaining the economic reasons for the higher audit fees charged by MSA-Industry dominant audit firms. We show that a market leader (i.e., usually considered a "city-level client-industry specialist" in the existing literature) is able to charge a price premium (relative to smaller firms) due to its market power. This is because it is relatively costlier for its clients - relative to the clients of smaller audit firms in the market - to switch to an alternative supplier. Moreover, this fee premium is a *continuous function* of market power as measured by the differences in audit firm size in a market. The fee premium is not dichotomous as would be the case if there was a fixed audit quality difference between the high market share "specialist auditors" and the lower market share "non-specialist" auditors.[2]

We further provide evidence that our measure of competitive position in an MSA-Industry market (i.e., DIFFERENCE) is an improvement on the existing literature. Specifically, our measure of competitive position among audit firms in a market contrasts with that of Numan and Willekens (2012, hereafter "NW"). NW advance our understanding of audit market competition by examining whether or not price competition is auditor-specific. They find that audit fees increase as the absolute difference (termed "distance") between the incumbent auditor's market share and the closest non-incumbent's market share increases, *whether the non-incumbent's share is smaller or larger than the incumbent's share.* We argue that the greatest price pressure in a market comes from the largest audit firm in the market rather than from firms of similar size or smaller firms, and indeed we find that the effect of the NW distance variable is not statistically significant after controlling for the competitive advantage of the dominant firm in a market using our variable DIFFERENCE.

The remainder of the paper is organized as follows. Section 2 reviews related literature. In Section 3, we develop our hypotheses concerning the crucial role of transaction costs in audit market competition. Section 4 lays out the empirical test design, including definitions of key variables. Data are described and results of the hypothesis tests as well as various additional (sensitivity) tests are reported in Section 5. Section 6 summarizes and concludes the paper.

2. Prior literature

In markets for physical goods, and perhaps most services, there will be a uniform market price at which a good or service can be purchased, with this price increasing if dominant suppliers are able to extract economic rents from customers. However, the situation is more complex in the market for audit services. Audit production is highly client-specific and the characteristics of the audit service and audit fees are known to vary greatly with the size, complexity, and cash-flow risk of clients. In addition, characteristics of the audit firm (e.g., whether it is a Big 4 or non-Big 4 firm) will also affect audit quality and audit fees. As a result, overall industry dominance (e.g., high concentration ratio) by a subset of suppliers may not allow all auditors in the market to charge higher audit fees. For example, using market concentration (i.e., the Herfindahl index) as a proxy for the overall level of competition, Pearson and Trompeter (1994) find that higher industry concentration *negatively* affects audit fees, and Bandyopadhyay and Kao (2004) do not find that average audit fees are higher in more concentrated markets.[3] However, Feldman (2006) documents how audit fees have increased with increased market concentration after the demise of Arthur Anderson. Gerakos and Syverson (2015) estimate that exit by one of the Big 4 would increase audit fees by $0.3–0.5 billion per year. Such mixed results call for better understanding of and more appropriate measures for audit firm competition.

Consistent with this perspective, NW argue that it is not often the case that all firms in an industry face the same level of competition. Based on spatial competition theory of oligopolistic pricing with differentiated products as analyzed in Chan et al. (2004), NW predict and find that, *ceteris paribus*, audit fees increase in the "spatial distance" between the incumbent auditor office and that of the incumbent auditor's closest competitor, where distance is measured by the relative size of industry market shares. They find that competitive pressure from a "nearby" competitor has a negative effect on audit fees for all audit firms, even for the dominant firms that may be considered "industry specialists." Thus, NW make progress in measuring market competition by testing whether or not price competition is indeed "local" and auditor-specific. NW, however, treat the competitive pressure from a larger neighbor the same as that from a smaller neighbor. We posit that it is likely that the pressure from a larger neighbor may be greater than that from a smaller neighbor based on the argument that larger firms have greater available resources to handle new clients. Thus, it is important to examine empirically whether the competitive pressure comes equally from both directions or mainly from one direction (the larger audit firms in the market). In this paper, we propose an alternative measure (i.e., DIFFERENCE) to capture an audit firm's relative competitive position in a market by using an audit firm's operational size relative to the largest audit firm in a market.

Because our measure is based on audit firms' market shares, it is related to the auditor specialization literature. Beginning with Craswell et al. (1995), a large stream of auditing papers (e.g., Ferguson and Stokes, 2002; Ferguson et al., 2003; Francis et al., 2005; Fung et al., 2012) have used the market shares of auditors in servicing clients within specific industries in a country (e.g., mining, banking, insurance firms in Australia) or clients within industries in local geographic areas (e.g.,

[2] Audit quality could be a continuous function of an auditor's portfolio size. However, this would create a constraint on the relationship between demanded audit quality and supplied audit quality. For example, if a client demands a certain quality from its auditor, then the supplied quality changes when its auditor gains or loses other clients because of portfolio size change. Our test shows that audit quality, as proxied by abnormal accruals, is not a function of DIFFERENCE.

[3] The Herfindahl index is a standard measure of concentration and potential market power of firms in a market and is calculated as: $H = \sum_{i=1}^{N} s_i^2$, where s_i is the market share of firm i in the market, and N is the number of firms. H ranges in value from $\frac{1}{N}$ to 1, where a small index suggests a competitive industry with no dominant firms, while a large index value indicates a market with a dominant player(s).

Table 1
Description of data.

Panel A: Sample Selection	
Observations in U.S. with audit fee and MSA data for 2000–2011 on Audit Analytics	99,800
Less:	
Observations not on Compustat	(37,304)
Financial sector (SIC 6000–6999)	(17,637)
Missing control variables	(5,166)
Audit market with only one auditor	(7,594)
Audit engagements in the first or second year	(5,223)
Final Sample (sample for regression analysis)	26,876

Panel B: Descriptive Statistics (N = 26,876)

VARIABLES	Mean	Median	Standard Deviation	P25	P75
LAF	13.221	13.223	1.392	12.184	14.169
Audit_Fees ($)	1,468,094	553,125	3,112,548	195,619	1,424,495
DIFFERENCE	0.233	0.127	0.265	0	0.426
MSA_DIFFERENCE	0.178	0.154	0.168	0	0.298
MSA_DOM_DIFF	0.102	0	0.221	0	0
IND_DOM_DIFF	0.105	0	0.223	0	0
NATION_DOM_DIFF	0.076	0	0.188	0	0
LTA	5.695	5.657	2.213	4.149	7.244
LBSEG	0.445	0	0.628	0	1.099
LGSEG	0.606	0	0.704	0	1.099
CATA	0.51	0.512	0.263	0.295	0.722
QUICK	2.673	1.523	3.732	0.932	2.836
LEV	0.259	0.178	0.279	0.035	0.407
ROI	-0.01	0.054	0.222	-0.053	0.108
FOREIGN	0.413	0	0.492	0	1
OPINION	0.056	0	0.229	0	0
YE	0.706	1	0.456	0	1
LOSS	0.406	0	0.491	0	1
BIG	0.770	1	0.421	1	1
SPECIALIST	0.411	0	0.492	0	1
DISTANCE	0.239	0.100	0.282	0.024	0.386
PORTFOLIO	0.178	0.107	0.203	0.038	0.237
INDUSTRY_NATION	0.061	0.065	0.039	0.018	0.088
HERFINDAHL	0.475	0.430	0.197	0.315	0.592
MSA_DOM	0.451	0	0.498	0	1
IND_DOM	0.450	0	0.498	0	1
NATION_DOM	0.313	0	0.464	0	1

Panel C: Spearman Correlation (Italic font denotes significant at 5% or lower)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	LAF	*1.00*																					
2	DIFFERENCE	*-0.41*	*1.00*																				
3	MSA_DIFFERENCE	*-0.39*	*0.45*	*1.00*																			
4	MSA_DOM_DIFF	*-0.25*	*0.51*	*0.43*	*1.00*																		
5	IND_DOM_DIFF	*-0.25*	*0.52*	*0.29*	*0.51*	*1.00*																	
6	NATION_DOM_DIFF	*-0.12*	*0.40*	*0.21*	*0.39*	*0.41*	*1.00*																
7	LTA	*0.82*	*-0.41*	*-0.38*	*-0.24*	*-0.25*	*-0.13*	*1.00*															
8	LBSEG	*0.31*	*-0.11*	*-0.10*	*-0.05*	*-0.05*	*-0.05*	*0.33*	*1.00*														
9	LGSEG	*0.43*	*-0.17*	*-0.16*	*-0.10*	*-0.10*	*-0.01*	*0.32*	*0.18*	*1.00*													
10	CATA	*-0.26*	*0.12*	*0.06*	*0.07*	*0.08*	*0.07*	*-0.45*	*-0.19*	*0.09*	*1.00*												
11	QUICK	*-0.15*	*0.03*	*-0.05*	*0.01*	*0.03*	*0.08*	*-0.20*	*-0.14*	*0.09*	*0.52*	*1.00*											
12	LEV	*0.37*	*-0.18*	*-0.13*	*-0.09*	*-0.11*	*-0.08*	*0.49*	*0.19*	*-0.03*	*-0.57*	*-0.43*	*1.00*										
13	ROI	*0.33*	*-0.12*	*-0.11*	*-0.08*	*-0.07*	*-0.06*	*0.43*	*0.20*	*0.19*	*-0.18*	*-0.10*	*0.15*	*1.00*									
14	FOREIGN	*0.46*	*-0.17*	*-0.16*	*-0.12*	*-0.12*	*-0.03*	*0.35*	*0.14*	*0.60*	*0.04*	*0.04*	*0.04*	*0.21*	*1.00*								
15	OPINION	*-0.20*	*0.13*	*0.15*	*0.08*	*0.08*	*0.03*	*-0.27*	*-0.11*	*-0.14*	*-0.04*	*-0.22*	*-0.03*	*-0.26*	*-0.13*	*1.00*							
16	YE	*0.06*	*-0.05*	*-0.06*	*-0.02*	*-0.02*	*0.01*	0.07	*0.01*	*-0.05*	*-0.13*	0.00	*0.12*	*-0.06*	*-0.06*	*0.00*	*1.00*						
17	LOSS	*-0.28*	*0.11*	*0.09*	*0.07*	*0.07*	*0.06*	*-0.38*	*-0.19*	*-0.14*	*0.16*	*0.06*	*-0.10*	*-0.74*	*-0.16*	*0.24*	*0.04*	*1.00*					
18	BIG	*0.46*	*-0.45*	*-0.58*	*-0.28*	*-0.27*	*-0.11*	*0.52*	*0.13*	*0.24*	*-0.09*	*0.06*	*0.19*	*0.17*	*0.22*	*-0.23*	*0.07*	*-0.15*	*1.00*				
19	SPECIALIST	*0.33*	*-0.88*	*-0.38*	*-0.46*	*-0.46*	*-0.40*	*0.34*	*0.10*	*0.12*	*-0.10*	*-0.05*	*0.17*	*0.11*	*0.12*	*-0.09*	*0.05*	*-0.10*	*0.36*	*1.00*			
20	DISTANCE	*0.30*	*-0.53*	*-0.32*	*-0.20*	*-0.18*	*-0.26*	*0.34*	*0.13*	*0.08*	*-0.12*	*-0.09*	*0.22*	*0.14*	*0.09*	*-0.12*	*0.05*	*-0.13*	*0.38*	*0.61*	*1.00*		
21	PORTFOLIO	*0.09*	*-0.19*	*0.16*	*-0.04*	*-0.09*	*-0.03*	*0.04*	*-0.03*	*0.11*	*-0.04*	0.01	-0.01	*-0.08*	*0.08*	*0.03*	*0.05*	*0.05*	*-0.23*	*0.16*	*0.05*	*1.00*	
22	INDUSTRY_NATION	0.01	*0.03*	*-0.04*	0.00	*-0.05*	*0.05*	*-0.09*	*-0.05*	*0.13*	*0.19*	*0.22*	*-0.19*	*-0.16*	*0.11*	-0.01	*0.03*	*0.11*	*0.03*	*-0.08*	*-0.20*	*0.28*	*1.00*
23	HERFINDAHL	*0.05*	*0.02*	*-0.04*	*0.07*	*0.09*	*-0.06*	*0.09*	*0.08*	*-0.07*	*-0.08*	*-0.13*	*0.17*	*0.08*	*-0.06*	-0.01	*0.04*	*-0.08*	*0.07*	*0.26*	*0.59*	*-0.09*	*-0.28*

mining, banking, insurance firms operating in specific metropolitan areas in Australia, U.S., etc.) as a measure of *auditor-industry specialization*. In this literature, auditors with the highest market shares are viewed as "industry specialists" who have (presumably) incurred costs to develop industry-specific expertise, and therefore produce a systematically higher level of audit quality and charge a systematically higher audit fee for their higher quality of service.

For consumer goods, if both a higher- and lower-quality product are available in a market, the market shares of the two products will depend upon their relative prices, consumers' tastes and preferences (indifference curves), and income (wealth) constraints. Depending upon these factors, either the higher- or lower-quality product could enjoy the larger market share. Although audits are not consumer goods, but rather intermediate services purchased by client companies for the purpose of maximizing firm value, the factors that drive client demand for higher- vs. lower-quality audits are analogous. That is, a client firm will voluntarily choose between higher and lower audit quality depending upon their relative prices, firm-specific factors that influence the relative values of higher vs. lower audit quality (e.g., whether the firm's shares publicly traded vs. closely held), and any budget constraints (e.g., whether the firm faces a high bankruptcy risk and therefore must conserve cash). Given these determinants of client firm demand, it seems questionable to *assume* that audit firms enjoying high client-industry market shares are *necessarily* higher-quality auditors. This could be the case in some contexts, but is almost certainly not the case in all contexts.

In their recent comprehensive review of archival auditing research, DeFond and Zhang (2014) point out that many studies have indeed found that *national-level* industry-specialist auditors are, *on average*, associated with several high audit quality proxies, including abnormal accruals, earnings response coefficients, going concern opinions, analyst forecast accuracy, and other measures. Moreover, there is evidence that *city-level* industry specialists, *on average*, provide higher audit quality (Reichelt and Wang, 2010). However, other researchers have found limited evidence that auditors with high market share provide increased audit quality (Cadman and Stein, 2007; Jamal and Sunder, 2011). A recent paper by Minutti-Meza (2013) suggests that the relation between audit quality proxies and auditor industry specialists can be explained by self-selection. He shows that after matching clients of specialist and non-specialist auditors on a number of dimensions, there are no statistically significant differences in the audit quality proxies between the two groups of auditors.

In summary, given the weak conceptual underpinnings linking audit firm client-industry dominance to industry expertise and higher audit quality, and the mixed empirical results testing these links, our proposed competition measure may provide a better explanation for the fee premiums charged by dominant firms. As noted earlier, our measure differs from that of NW, and consequently, in this paper we also compare the validity of our measure with that of NW.

3. Hypotheses development: transaction costs and audit pricing

3.1. Nature of transaction costs of audit firm change

DeAngelo (1981) develops a simple multi-period (perpetuity) audit pricing model that incorporates the effects of the various determinants of an audit firm's fee, including start-up costs of auditor learning and client-incurred switching costs.[4] In this paper, we consider both the start-up costs and the switching costs incurred if a client changes its audit firm to be the transaction costs of the change. Once an incumbent audit firm is in place, audit fees depend only on the audit production costs and the transaction costs of audit firm change, with the incumbent auditor pricing the audit so as to deter entry. More generally, however, weak competition among audit firms in the real world may allow a dominant incumbent firm(s) to earn real rents in all periods. In our tests, these two possible effects are combined as we are unable to identify whether higher audit fees represent rents or quasi-rents because they have the same impact on audit fees.

The costs associated with audit firm switching are conceptually very broad and for a potential audit firm may include various costs of learning about a new audit client's business, transaction flows, accounting, and internal control systems; assessing the abilities and integrity of key client personnel; and assessing the risks of various kinds of material financial statement misstatements. For the client who changes audit firms, these costs could include the time needed to assess competing audit firm bids and adjustment costs of learning to work with and "training" a new audit team in the details of the company's operations and systems.

To our knowledge, no prior research has measured these transaction costs directly, and we do not attempt to do so in this paper. Rather, our main argument is that these costs are associated with the relative size of the client portfolios of the audit firms in a market. Specifically, the costs will be *positively related* to the incumbent audit firm's client portfolio size and *inversely related* to the size of competing audit firms' client portfolios. For example, all of the existing clients of a small audit firm in a market can *potentially* switch to the largest firm operating in the market at relatively low cost. Conversely, the existing clients of the largest firm in a market would incur relatively higher transaction costs in attempting to switch to alternative, smaller suppliers.[5]

Our argument that transaction costs are lower to switch to a larger auditor is based on the fact that the production of audit services is highly labor intensive (O' Keefe et al., 1994) with labor-embodied human capital (e.g., knowledge) playing

[4] DeAngelo's multi-period pricing model is summarized briefly in Appendix B.

[5] However, no *actual* audit firm change is expected to occur because we assume that all audits are priced optimally so as to deter auditor change. Rather, the relative size of transaction costs of audit firm change affects the pricing power of the incumbent audit firm and its ability to extract rents and/or quasi-rents.

Table 2
Audit Fees and DIFFERENCE in an MSA-Industry Market.

VARIABLES	(1) LAF	(2) LAF	(3) LAF	(4) LAF
DIFFERENCE	-0.340***	-0.331***		-0.343***
	(−11.22)	(−9.49)		(−8.73)
SPECIALIST			0.117***	-0.002
			(8.58)	(−0.13)
LTA	0.468***	0.384***	0.477***	0.468***
	(13.36)	(10.17)	(13.50)	(13.36)
LBSEG	0.104***	0.103***	0.104***	0.104***
	(10.11)	(8.15)	(10.09)	(10.11)
LGSEG	0.128***	0.121***	0.130***	0.128***
	(10.94)	(9.10)	(10.90)	(10.94)
CATA	0.415***	0.399***	0.416***	0.415***
	(11.14)	(10.03)	(11.31)	(11.14)
QUICK	-0.034***	-0.033***	-0.035***	-0.034***
	(−13.67)	(−11.89)	(−13.41)	(−13.66)
LEV	0.096***	0.065**	0.098***	0.096***
	(3.38)	(2.09)	(3.41)	(3.39)
ROI	-0.253***	-0.234***	-0.266***	-0.253***
	(−7.66)	(−6.53)	(−7.92)	(−7.67)
FOREIGN	0.240***	0.208***	0.239***	0.240***
	(14.14)	(9.66)	(14.20)	(14.14)
OPINION	0.119***	0.097***	0.118***	0.119***
	(5.20)	(3.39)	(5.23)	(5.20)
YE	0.101*	0.095**	0.101*	0.101*
	(1.96)	(2.19)	(1.95)	(1.96)
LOSS	0.088***	0.076***	0.090***	0.088***
	(6.39)	(6.35)	(6.51)	(6.39)
BIG	0.317***	0.328***	0.352***	0.317***
	(15.85)	(17.75)	(17.61)	(15.89)
Constant	9.521***	8.687***	9.275***	9.523***
	(54.83)	(44.24)	(49.91)	(55.67)
N	26,876	15,828	26,876	26,876
Adjusted R^2	0.866	0.850	0.864	0.866
MSA FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

This table presents results from three main regressions. Column (1) reports the results of Eq. (1) with DIFFERENCE as the test variable for the full sample. Column (2) focuses on the subsample excluding the specialists. Column (3) includes only SPECIALIST as the test variable for the full sample. Column (4) includes both DIFFERENCE and SPECIALIST in the full sample. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively, using two-tailed tests. t-statistics determined by clustered standard errors in both company and year are presented in parentheses.

an important role in audit production. In a given auditor-client market (e.g., a specific industry in a metropolitan area), if a client decides to switch from an incumbent to a competitor, then the competitor must have the capacity, such as appropriate personnel with needed expertise, to staff the new engagement. For a profit-maximizing audit firm in a steady state, a local auditor office's existing personnel will mainly be employed to service current engagements, and the slack in staff is presumably set at an optimal level. Given the potential new demand, the office would have to hire additional personnel to staff its now larger portfolio of engagements, and in addition to sheer number of staff, the potential competitor audit firm would have to obtain (i.e., hire or reassign) staff with the appropriate competence, including knowledge of the industry in which the new client operates, to serve a new client. It is reasonable to argue that larger auditor offices have greater elasticity in resources to deal with potential new demand. This effect is likely to be stronger if the office has larger operations in the industry of the new client. As a result, auditors with larger operations in an MSA-Industry market are likely to be more efficient and have lower costs than smaller competitors, with respect to the transaction costs of audit firm change.

In summary, we assume that the transaction costs of auditor change are a monotonically decreasing function of the size of an auditor's operation in an MSA-Industry market (i.e., these transaction costs are highest for the clients of the largest audit firm and decrease as the size of the incumbent firm decreases). Note that aside from differences in transaction costs of auditor change, we assume that the recurring costs of performing an audit are the same across all audit firms.

3.2. Incumbent auditor office's pricing of audit services

The incumbent auditor office faces differential competitive pressures from various potential suppliers operating in an MSA-Industry market. As per the pricing model, the incumbent auditor office must price its continuing audits correctly (limit pricing) such that its clients will not switch to any of its competitors. Consequently, an incumbent auditor office's

Table 3
Audit Fees, MSA_DIFFERENCE, and DIFFERENCE.

VARIABLES	(1) LAF	(2) LAF
MSA_DIFFERENCE	-0.193***	-0.060
	(−4.32)	(−1.47)
DIFFERENCE		-0.333***
		(−11.21)
LTA	0.482***	0.467***
	(13.96)	(13.40)
LBSEG	0.104***	0.104***
	(10.04)	(10.10)
LGSEG	0.132***	0.128***
	(11.06)	(10.95)
CATA	0.425***	0.415***
	(11.64)	(11.14)
QUICK	-0.035***	-0.034***
	(−13.87)	(−13.78)
LEV	0.104***	0.096***
	(3.62)	(3.39)
ROI	-0.270***	-0.253***
	(−8.16)	(−7.67)
FOREIGN	0.240***	0.240***
	(13.77)	(14.12)
OPINION	0.119***	0.119***
	(5.32)	(5.19)
YE	0.103*	0.101*
	(1.94)	(1.95)
LOSS	0.090***	0.088***
	(6.44)	(6.40)
BIG	0.343***	0.305***
	(16.17)	(14.43)
Constant	9.373***	9.537***
	(49.63)	(55.06)
N	26,876	26,876
Adjusted R^2	0.863	0.866
MSA FE	YES	YES
Industry FE	YES	YES
Year FE	YES	YES

This table presents regression results using fee differences calculated in MSA markets and MSA-Industry markets. Column (1) includes only MSA_DIFFERENCE in addition to all control variables. Column (2) adds DIFFERENCE to the Column (1) regression. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively, using two-tailed tests. t-statistics determined by clustered standard errors in both company and year are presented in parentheses.

fees must reflect the *lowest* transaction costs of its clients changing auditors, which are most likely the transaction costs of changing to the largest audit firm in the market. Therefore, although audit firms in a market may have many competitors, we posit that the highest competitive pressure comes from the largest supplier (audit firm) in the market, who has the lowest start-up learning costs and to whom clients have the lowest costs of switching. In other words, the largest audit firm in a market is a reference point for the level of competitive pressure faced by all other audit firms in the same market.

To illustrate, suppose there are three audit firms in a market, say Big, Middle, and Small. Both Middle and Small must price their continuing engagements so as to deter clients from switching to Big. The larger the audit firm, Big, the lower the audit fees of its smaller competitors. What about the fees charged by Big? According to our assumption that the transaction costs of switching to Big are the lowest for switching to any auditors currently in the market, Big's audit fees will be constrained by possible client switching to Middle and Small and Big's fees will be greater than the fees charged by both Middle and Small. Also, the greater the size difference between Big and the next largest auditor in the market, the greater will be the fee difference.[6]

Taking the argument one step further, it is reasonable to assume that the smaller an audit firm, the easier (cheaper) it is for the largest audit firm in the market to accommodate any client of the small audit firm. Therefore, the competitive pressure on an auditor office is an increasing function of the operational *size difference* between that audit firm and the largest audit firm in the market. As a result, the pricing for the existing clients by an incumbent audit firm depends not

[6] One could argue that competitive pressure on the Big audit office comes from potential new entry outside the current market structure. However, a new audit firm entrant to a client industry will likely incur additional start-up costs. This new entry effect is outside the scope of this paper.

only on the size of the biggest competitor, but also the difference in audit firm size between the incumbent and the largest competitor.[7] These arguments lead to the following hypothesis:

Hypothesis 1. *The audit fee charged by an incumbent audit firm in an MSA-Industry market is a decreasing function of the relative size of the largest audit firm in the market compared to the incumbent audit firm.*

Prior literature claims that the higher audit fees charged by "city industry specialists" - the dominant audit firms in MSA-Industry markets - reflect higher audit quality (Francis et al., 2005; Reichelt and Wang, 2010; etc.). Hypothesis 1 provides an alternative explanation for the underlying cause of such fee premiums. A market leader (i.e., city industry specialist) is able to charge a price premium due to its market power and this fee premium is a continuous function of market power. Hypothesis 1 does not posit any audit quality differences between the dominant firm in a market and its smaller competitors.

Hypothesis 1 is based on the assumption that the transaction costs of auditor change are mainly determined by the audit firm's operational size in an MSA-Industry market. Based on the premise that all audit firms with clients in an industry possess the necessary expertise to audit their clients properly, the operational scale within the industry should be more relevant than the operational scale outside the industry to the transaction costs of auditor change in the industry. However, it is possible that an industry does not require any specific auditing expertise to conduct the audit. In that case, competition may simply occur within an MSA market, rather than an MSA-Industry market. Therefore, it is an empirical question whether auditor competition occurs mainly within an MSA-Industry market or a geographic MSA market. We hypothesize that the size difference between the incumbent audit firm and the largest audit firm in an MSA-Industry market is more relevant in determining the incumbent's fee than the size difference between the incumbent and the largest audit firm operating in a geographic MSA market.

Hypothesis 2. *Audit price competition occurs mainly within an MSA-Industry market rather than a geographic MSA market.*

The test of this hypothesis will provide evidence on whether availability of resources within an industry rather than outside the industry can more effectively reduce the transaction costs of auditor change for clients within the industry. If the resources outside an industry have a similar impact on transaction costs compared to resources within an industry, the audit firm's competitive position would be better measured by its overall operational scale in a geographic MSA.

Related to Hypothesis 2, even if the auditor's resources outside an industry do not have a similar impact on transaction costs compared to resources within the industry, it is plausible that the resources outside the industry can still help to reduce transaction costs. If the operational scale beyond an MSA-Industry market is large, the audit firm can quickly assemble its staff within the region to meet the new demand. More specifically, we expect that the transaction costs of the largest audit firm in an MSA-Industry market may be further reduced if the audit firm also has dominant operations outside the MSA-Industry market, thus placing greater competitive pressure on other audit firms in a given MSA-Industry market. We examine the impact of three other measures of operations outside of the MSA-Industry market specified progressively as follows: (i) operations in the same MSA but other industries, (ii) operations in the same industry but other MSAs, and (iii) operations outside the MSA. We predict that the market leader in an MSA-Industry market charges higher fees than its smaller competitors if the leader also has dominant operations outside the MSA-Industry market. Hypothesis 3 presents the prediction formally.

Hypothesis 3. *Audit price competition within an MSA-Industry market is more severe if the largest audit firm in the market also has the largest operations outside the MSA-Industry market.*

4. Research design and variables

4.1. The empirical model

Building on prior audit fee research (Simunic, 1980; Francis et al., 2005; Hay et al., 2006), we use the following basic empirical model for our tests:

$$LAF = \alpha_0 + \Phi X + \Theta Y + FIXED\_EFFECTS + \varepsilon, \tag{1}$$

where LAF equals the natural log of audit fees paid by a client i in a period; X is a vector of test variables relating to the characteristics of the client's incumbent auditor in the period and Φ is the vector of corresponding coefficients; Y is a vector of control variables that can affect the audit fees paid by client i in the period and Θ is the vector of corresponding coefficients; FIXED_EFFECTS include the effect of year, industry, and MSA; and ε is the random-error term.

[7] In a theoretical analysis of audit market formation and auditor competition, Chu and Zhang (2016) come to the same conclusion, based on the assumptions that the transaction costs are an increasing function of client size and a decreasing function of auditor size, and that the intensity of competition is an increasing function of the number of auditors competing for clients.

Table 4
Audit fees and the outside dominance of the largest audit firm in an MSA-industry market.

VARIABLES	(1) LAF	(2) LAF	(3) LAF
DIFFERENCE	-0.303***	-0.295***	-0.291***
	(−7.13)	(−6.53)	(−6.37)
MSA_DOM_DIFF	-0.078**	-0.069*	-0.067*
	(−2.33)	(−1.81)	(−1.74)
IND_DOM_DIFF		-0.026	-0.020
		(−0.70)	(−0.51)
NATION_DOM_DIFF			-0.053
			(−1.30)
SPECIALIST	-0.003	-0.003	-0.004
	(−0.17)	(−0.15)	(−0.23)
LTA	0.469***	0.469***	0.468***
	(13.35)	(13.38)	(13.60)
LBSEG	0.104***	0.104***	0.103***
	(10.10)	(10.09)	(10.06)
LGSEG	0.129***	0.129***	0.127***
	(10.96)	(10.96)	(10.91)
CATA	0.416***	0.415***	0.413***
	(11.23)	(11.18)	(10.99)
QUICK	-0.034***	-0.034***	-0.034***
	(−13.66)	(−13.67)	(−13.65)
LEV	0.095***	0.095***	0.096***
	(3.36)	(3.37)	(3.40)
ROI	-0.254***	-0.253***	-0.255***
	(−7.71)	(−7.68)	(−7.71)
FOREIGN	0.240***	0.240***	0.239***
	(14.13)	(14.16)	(14.10)
OPINION	0.119***	0.119***	0.120***
	(5.23)	(5.23)	(5.25)
YE	0.101**	0.101**	0.101*
	(1.96)	(1.96)	(1.95)
LOSS	0.088***	0.088***	0.088***
	(6.40)	(6.42)	(6.37)
BIG	0.315***	0.315***	0.312***
	(15.80)	(15.75)	(15.71)
MSA_DOM	0.024*	0.022	0.015
	(1.83)	(1.63)	(1.12)
IND_DOM		0.005	-0.004
		(0.35)	(−0.30)
NATION_DOM			0.060***
			(3.95)
Constant	9.501***	9.500***	9.489***
	(55.43)	(72.97)	(73.32)
Observations	26,876	26,876	26,876
Adjusted R^2	0.866	0.866	0.866
MSA FE	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

This table presents results testing whether the outside market operation of the largest audit firm in an MSA-Industry market enhances the audit firm's competitive pressure on other audit firms. Column (1) includes SPECIALIST, DIFFERENCE, and MSA_DOM_DIFF as test variables. Column (2) adds IND_DOM_DIFF and Column (3) adds NATION_DOM_DIFF. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively, using two-tailed tests. t-statistics determined by clustered standard errors in both company and year are presented in parentheses.

4.2. Measures of audit firms' relative competitive positions

We first describe several main variables used to test the hypotheses. To test Hypothesis 1, we construct a variable, DIFFERENCE, to capture an audit firm's relative competitive position in an MSA-Industry market:

$$DIFFERENCE_{at} = \frac{\sum_{i\in\text{dominant auditor in MSA}-\text{Industry}} AF_{it} - \sum_{i\in\text{auditor } a \text{ in MSA}-\text{Industry}} AF_{it}}{\sum_{i\in\text{ MSA}-\text{Industry}} AF_{it}},$$

where AF_{it} is the audit fees paid by client i in fiscal year t, $i \in$ dominant auditor in MSA-Industry indicates client i is audited by the dominant auditor in the MSA-Industry market, and $i \in$ auditor a in MSA-Industry indicates client i is audited by auditor a in the MSA-Industry market, and $i \in$ MSA-Industry indicates client i is audited by an auditor in the MSA-Industry market, and $DIFFERENCE_{at}$ is the value of DIFFERENCE for auditor a in fiscal year t.

Table 5
Abnormal accruals and DIFFERENCE in an MSA-industry market.

VARIABLES	(1) Absolute Abnormal Accrual	(2) Positive Abnormal Accrual	(3) Negative Abnormal Accrual
DIFFERENCE	-0.006	-0.002	0.009
	(−1.33)	(−0.53)	(1.43)
LTA	-0.020***	-0.019***	0.019***
	(−7.85)	(−10.13)	(3.81)
LTA^2	0.001***	0.001***	-0.001***
	(6.55)	(6.58)	(−2.81)
CATA	0.028***	0.034***	-0.027***
	(5.28)	(6.25)	(−4.15)
QUICK	-0.002***	-0.001	0.002***
	(−4.83)	(−1.59)	(3.66)
LEV	0.033***	0.017***	-0.040***
	(8.91)	(4.73)	(−6.93)
ROI	-0.080***	-0.106***	0.068***
	(−6.57)	(−10.26)	(3.86)
LOSS	0.016***	-0.019***	-0.048***
	(2.70)	(−7.32)	(−4.86)
BIG	-0.002	-0.003	0.001
	(−0.91)	(−1.45)	(0.34)
Constant	0.091***	0.192***	-0.668***
	(3.52)	(22.62)	(−19.37)
Observations	22,918	12,520	10,398
Adjusted R^2	0.188	0.223	0.220
MSA FE	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

This table presents regression results on the relationship between abnormal accruals and DIFFERENCE. The following model is used to estimate abnormal accruals by year and by two-digit SIC code, scaling by total assets: $TOTAL\_ACCRUALS_{i,t} = \alpha_0 + \alpha_1 LTA_{i,t} + \alpha_2(\Delta SALES_{i,t} - \Delta REC_{i,t}) + \alpha_3 PPE_{i,t} + \alpha_4 ROI_{i,t} + \varepsilon_{i,t}$, where for firm i and fiscal year t, *TOTAL_ACCRUALS* equals net income before extraordinary items minus operating cash flows from continuing operations/total assets; $\Delta SALES$ equals change in sales in latest two years/total assets; ΔREC equals change in accounts receivable in the latest two years/total assets; *PPE* equals net property, plant, and equipment/total assets; *ROI* is return on investments; and $\varepsilon_{i,t}$ equals the estimated abnormal accrual for firm i and fiscal year t. The dependent variable in Column (1) is absolute value of abnormal accruals. The dependent variables in Columns (2) and (3) are positive abnormal accruals and negative abnormal accruals, respectively. Note that the sample size is slightly reduced because we estimate the abnormal accruals with more than ten observations in a year and industry combination. LTA^2 is the square of log total assets. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively, using two-tailed tests. t-statistics determined by clustered standard errors in both company and year are presented in parentheses.

DIFFERENCE captures the competitive disadvantage of an audit firm relative to the largest audit firm in an MSA-Industry market, and we expect its coefficient to be negative. For example, if Ernst & Young (EY) is the dominant audit firm of wineries headquartered in the San Francisco Bay Area MSA, then the variable DIFFERENCE captures the transaction cost (pricing) disadvantage of all other incumbent audit firms of San Francisco Bay Area winery clients. Note that the variable DIFFERENCE is not a measure of differential pricing by the dominant audit firm(s) in a market relative to all other firms, but a measure of the pricing power of each specific audit firm in a market relative to the largest audit firm. This measure can therefore distinguish between the two conceptual "views" concerning the nature of audit fee premiums charged by dominant audit firms, namely, are they payments for higher audit quality or some form of economic rent (quasi-rents or monopoly rents)? If audit fees decrease as the relative size of a supplier decreases, then the declining fee premium either measures market power (our interpretation) or there are multiple audit quality levels available in markets *and these quality levels correspond to the market shares of audit firms*. That is, the largest supplier sells the highest quality level, the second largest supplier sells the second-highest level, and so forth down to the lowest-quality level sold by the smallest supplier. A differential audit quality interpretation of the variable DIFFERENCE is implausible as there is no economic reason why varying audit quality levels offered for sale and the market shares of the suppliers of these differential quality levels should be correlated.[8]

To test Hypothesis 2, we construct the following MSA-specific competition variable:

$$MSA\_DIFFERENCE_{at} = \frac{\sum_{i\in \text{ dominant auditor in MSA}} AF_{it} - \sum_{i\in \text{ auditor } a \text{ in MSA}} AF_{it}}{\sum_{i\in \text{ MSA}} AF_{it}},$$

[8] We also directly test the relation between DIFFERENCE and audit quality proxied by abnormal accruals, and the results presented in Table 5 do not suggest that larger auditors have higher quality.

where $i \in$ dominant auditor in MSA indicates client i is audited by the dominant auditor in the MSA market and $i \in$ auditor a in MSA indicates client i is audited by auditor a in the MSA market, and $i \in$ MSA indicates client i is audited by an auditor in the MSA market, and $MSA\_DIFFERENCE_{at}$ is the value of MSA_DIFFERENCE for auditor a in fiscal year t.

The variable MSA_DIFFERENCE captures the competitive disadvantage of other audit firms relative to the largest audit firm in an MSA market by assuming that the transaction costs are fully determined by operational scale in an MSA market, and that the industry of the client is essentially irrelevant. Continuing our example above, if industry expertise does not play a significant role in auditor local competition, the variable MSA_DIFFERENCE captures the transaction cost (pricing) disadvantage of all other incumbent audit firms of San Francisco Bay Area clients relative to EY if EY is the dominant audit firm in the San Francisco Bay Area MSA. Hypothesis 2 predicts that MSA_DIFFERENCE has a lower explanatory power for audit fees than DIFFERENCE.

To test Hypothesis 3, we construct variables that capture possible additional competitive pressure from the largest audit firm in an MSA-Industry market due to its resources outside this market. We define other operations outside the MSA-Industry market progressively, including operations in the same MSA but other industries, operations in the same industry but in all other MSAs, and finally all operations outside the MSA. We create three variables to identify whether the dominant auditor in an MSA-Industry market also has dominant other operations in the respective domains. We use MSA_DOM to indicate an MSA-Industry leader who also has the largest other operations in the MSA. Thus, this variable equals one if the MSA-Industry leader also has the largest other operations in the MSA, and zero otherwise. We use IND_DOM to indicate that an MSA-Industry leader also has the largest other operations in the same industry but outside of the MSA. This variable therefore equals one if the MSA-Industry market leader has the largest operations in the industry but outside the MSA, and zero otherwise. Finally, we use NATION_DOM to indicate that an MSA-Industry leader also has the largest overall operations outside the MSA. This variable equals one if the MSA-Industry market leader has the largest overall operations outside the MSA, and zero otherwise.

We measure whether the MSA-Industry leader's dominance in other operations has an impact on the competitive pressure exerted on other audit firms using interaction variables constructed between DIFFERENCE and the outside dominance variables, as follows.

$$MSA\_DOM\_DIFF = DIFFERENCE^{*}\ MSA\_DOM$$

$$IND\_DOM\_DIFF = DIFFERENCE^{*}\ IND\_\mathrm{DOM}$$

$$NATION\_DOM\_DIFF = DIFFERENCE^{*}\ NATION\_DOM$$

The basic idea motivating these variables is that the competitive pressure from the largest audit firm in an MSA-Industry market (DIFFERENCE) is further increased if the largest audit firm also has the largest production capacities outside the market. That is, the effect of DIFFERENCE on the audit fees is enhanced if the dominant audit firm is also the leader outside the MSA-Industry market.

Continuing our example, if EY is not only the dominant audit firm of wineries headquartered in Bay area, but also the dominant audit firm of all other types of Bay Area clients (MSA_DOM_DIFF = DIFFERENCE) then this may confer a further cost advantage to EY in potentially taking over the winery clients of other audit firms. If this is true, then the estimated coefficient on MSA_DOM_DIFF will be negative. Furthermore, if EY is the dominant audit firm of winery clients throughout the United States (IND_DOM_DIFF = DIFFERENCE) then this fact may also enhance EY's cost (pricing) advantage related to Bay Area winery clients. Finally, if EY has the largest operations outside the San Francisco Bay Area regardless of client industry (NATION_DOM_DIFF = DIFFERENCE) then this may also reduce the transaction costs and therefore the threat of potential takeover of Bay Area winery clients of other audit firms. Hypothesis 3 predicts that the coefficients on these three interaction variables will be negative. To control for possible cross-market differences, we also include the variables MSA_DOM, IND_DOM, and NATION_DOM in the regression.

4.3. Control variables

The common control variables included in the audit fee model are based on numerous previous studies, such as Dao et al. (2012); Ferguson et al. (2003); Fung et al. (2012); Hanlon et al. (2012); Hay et al. (2006); NW; and Simunic (1980). We control for client size (LTA), complexity (LBSEG, LGSEG, FOREIGN), and bankruptcy risk (CATA, QUICK, LEV, ROI, LOSS).[9] With the exception of QUICK and ROI we expect the coefficients on these variables to be positive. We expect the coefficients of QUICK and ROI to be negative. Following Francis et al. (2005) and Fung et al. (2012), we include audit opinion (OPINION), which is a client-risk measure and may also measure the need for additional work, and a variable indicating a December fiscal year-end (YE), which may also capture a difference in audit costs, hence fees. Extant literature has shown that Big N audit firms earn fee premiums (Hay et al., 2006) and thus we also control for Big audit firms (BIG) in the regression. We expect positive coefficients for OPINION, YE, and BIG. Finally, indicators for year, industry effects, and MSA effects (e.g., to control for different cost levels across MSAs) are included in all tests.

[9] QUICK, CATA, LEV and ROI are winsorized at the 0.005 level in both tails of their respective distributions.

Two additional control variables, SPECIALIST and DISTANCE, are also included. Following the specialist literature, we define SPECIALIST as an indicator variable that equals one if an audit firm has the highest market share in a local client-industry (MSA-Industry) market and the market share is not lower than 30%, and zero otherwise. As defined in NW, DISTANCE is the smallest absolute fee market share difference between the incumbent auditor and its closest competitor in an MSA-Industry market. The literature shows that these two variables have a positive association with audit fees. All variable definitions are presented in Appendix A.

5. Data and results

5.1. Sample and data

The sample is selected from the Audit Analytics and Compustat databases. Panel A of Table 1 presents the sample-screening procedures. We start with 99,800 observations with audit fee and incumbent audit firm city location data for 2000–2011 on Audit Analytics.[10] Audit Analytics identifies the geographical city (not the MSA) from audit reports attached to the Form 10-K filings. We use the U.S. Census Bureau's MSA cross-map to categorize cities into MSAs.[11] We then merge this data with the Compustat variables. We lose 37,304 observations in the merging process. We then exclude companies in the financial sector because the audit fee model for these firms is different from other industries due to their special characteristics (Fields et al., 2004; Kanagaretnam et al., 2010).[12] Furthermore, 5,166 observations do not have values for all control variables. To focus on the issues of interest in this study, we exclude audit markets that have only one active audit firm.[13] Recall that the transaction costs and resulting rents and quasi-rents in the pricing model describe continuing audit engagements, leading us to exclude 5,223 observations with one or two years of auditor tenure. The final sample consists of 26,876 firm-year observations with 5,831 MSA-Industry market-years and a mean (median) of 4.6 (3) observations in a market-year.

Descriptive statistics for all variables are reported in Panel B of Table 1, and the correlations between variables are reported in Panel C of Table 1. Note that the variables relating to NW listed after DISTANCE in Panel B of Table 1 are defined and explained later in the paper. The data presented in these tables are comparable to those reported in previous studies (e.g., Fung et al., 2012).

Our main test variable, DIFFERENCE, has an average value of 0.233, which implies that, in all MSA-Industry markets, the market share as defined by fees of the largest audit firms is about 23.3% higher than all audit firms on average. This value is similar to the variable DISTANCE in NW that suggests the average market share difference between two nearest neighbors is about 23.9%. Note that the value of DIFFERENCE assigned to the largest (as defined by fees) audit firm in an MSA-Industry market is zero, while in NW the value of DISTANCE for the largest audit firm is always the difference between the market share of the largest and the second-largest audit firms.

Table 1 Panel C presents Spearman correlations. DIFFERENCE and SPECIALIST are highly correlated ($\rho = -0.88$).[14] Furthermore, DIFFERENCE is also correlated with several other measures of market power. For example, the correlation between DIFFERENCE and MSA_DIFFERENCE is 0.45, consistent with a significant number of MSA markets being dominated by a few industries. DIFFERENCE is also highly correlated with MSA_DOM_DIFF, IND_DOM_DIFF, and NATION_DOM_DIFF, because these dominance variables are interaction terms with DIFFERENCE.

The correlation between DIFFERENCE and DISTANCE is −0.53. This negative correlation is the result of the opposite correlations of DIFFERENCE and DISTANCE with the size of the incumbent auditor in the sample. Since DIFFERENCE is the size difference between the MSA-Industry leader and the incumbent auditor, DIFFERENCE increases as the size of the incumbent auditor decreases. In contrast, DISTANCE is the size difference between the incumbent auditor and the auditor who is closest in size to the incumbent auditor. Although the definition of DISTANCE does not itself predict the relation between DISTANCE and the size of the incumbent auditor, empirically the size difference between the two closest neighbors is smaller for smaller auditors. Thus, the value of DISTANCE decreases as the incumbent audit firm gets smaller, while the value of DIFFERENCE increases as the incumbent auditor gets smaller.

[10] We started preparing the data in early 2013 for this study and 2011 was the last year the data was available at the time. The coverage of Audit Analytics mainly starts from 2000.

[11] The U.S. Census Bureau's MSA cross-map is available at: https://www.census.gov/programs-surveys/metro-micro.html.

[12] We rerun our tests by including the financial firms in calculating the dominance variables (MSA_DIFFERENCE, MSA_DOM_DIFF, NATION_DOM_DIFF, MSA_DOM, and NATION_DOM). The results are similar but slightly weaker. A possible explanation is that the audits of financial industry clients may require substantially different expertise from other industries and the impact of this part of the operation is not likely to influence the transaction costs of auditor change in other industries. Therefore, excluding financial firms from our sample is appropriate.

[13] Similar results are obtained when audit markets with only two or fewer audit firms are excluded.

[14] By definition, SPECIALIST and DIFFERENCE must be highly correlated. SPECIALIST is a measure of the largest auditor's dominance relative to all other auditors while treating all other auditors equally. SPECIALIST captures the average fee premium between the largest auditor and all other auditors. In contrast, DIFFERENCE captures the differences between the SPECIALIST and all other auditors individually. Our test that excludes all specialists (Table 2 Column (2)) addresses the multicollinearity issue between SPECIALIST and DIFFERENCE. We conclude our results are not affected by multicollinearity.

5.2. Results

Column (1) of Table 2 reports the multivariate results from estimating Eq. (1) with DIFFERENCE as the test variable for Hypothesis 1.[15] The estimated coefficient on DIFFERENCE is negative (as hypothesized) and statistically significant. This suggests that smaller audit firms have limited pricing power relative to larger competitor firms. The coefficient – 0.340 means that in proportion an incumbent audit firm is charging $1 - exp(-0.340^{*}DIFFERENCE)$ less than what the largest audit firm charges, ceteris paribus. Given that the average DIFFERENCE in our sample is 0.233, the largest audit firm is charging about 7.6% more than the audit firm with a DIFFERENCE of 0.233. Therefore, the variable DIFFERENCE shows a significant economic impact of an incumbent auditor's competitive position on audit fees.

We conduct two tests to investigate whether the differential fees captured by our competition measure, DIFFERENCE, reflect the fee premium of quality-differentiated specialists relative to non-specialists, and whether the classification of specialists and non-specialists is dichotomous. In the first test, we exclude the dominant audit firm (specialist) in each audit market. If the remaining audit firms that are non-specialists have similar quality or competitive power, the coefficient on DIFFERENCE should *not* be significant. In the second test, we add an indicator variable, SPECIALIST, together with DIFFERENCE in our regression model. We expect that this variable will fully capture the effect of DIFFERENCE if there are only two types of audit firms in a market (i.e., specialist vs. non-specialists) and the coefficient on SPECIALIST should be positive.

Column (2) of Table 2 presents the results of our main analysis when all specialists and their clients are excluded from the sample. The overall regression results using these non-specialist observations are similar to those obtained using the full sample, and the estimated coefficient of the variable DIFFERENCE remains statistically significant (– 0.331, $t = -9.49$). Column (3) reports results with DIFFERENCE excluded from the regression while the variable SPECIALIST is included. The results show that the estimated coefficient on SPECIALIST is positive and statistically significant, consistent with "specialist" results normally reported in the literature. Finally, column (4) of Table 2 reports full sample results when SPECIALIST is included in the audit fee model along with DIFFERENCE and the control variables. The coefficient on DIFFERENCE is – 0.343 and significant at the 1% level, which is very similar to the coefficients on DIFFERENCE in Columns (1) and (2). In contrast, the estimated coefficient on SPECIALIST is insignificant and essentially zero. These results suggest that the variable SPECIALIST is not a good measure of the relative market power of the dominant audit firm relative to every other audit firm in an MSA-Industry market, and probably does not capture a quality-differentiation price premium.

All estimated coefficients on the control variables in the regressions are statistically significant and have the expected signs. The coefficient on LTA is expected to be about 0.5 when U.S. data is used in estimating the audit fee model (Simunic, 1980), and its value is approximately 0.47. Also, as expected, the regression model has high explanatory power (adjusted $R^2 = 0.866$). The adjusted R^2 is 0.863 when both SPECIALIST and DIFFERENCE are excluded (not tabulated). The R^2 is 0.864 in column (3) with SPECIALIST and R^2 is 0.866 in column (1) when DIFFERENCE is also included. Thus, the audit fee model using DIFFERENCE has higher explanatory power than with SPECIALIST.[16]

To mitigate potential concern that the effects of DIFFERENCE are driven by the extreme values of DIFFERENCE, we partition the non-zero DIFFERENCE into quintiles based on the values of DIFFERENCE and substitute the single continuous variable with five indicator variables representing each quintile with an equal number of observations. We find consistent and significantly negative coefficients on these indicator variables and the coefficients increase in size monotonically as the values of DIFFERENCE in the quintiles are higher (the coefficients for the quintiles from lowest to the highest values of DIFFERENCE are −0.043, −0.059, −0.126, −0.178, and −0.254). This result supports our conjecture that the fee premium is a continuous function of market power. Overall, our results show that the relative size of an audit firm in a market is an important, previously unrecognized determinant of audit fees, and that, ceteris paribus, audit fees are not uniform across suppliers.[17]

Table 3 presents the test results for Hypothesis 2. In Column (1) we include only the variable MSA_DIFFERENCE. The coefficient on MSA_DIFFERENCE is – 0.193 ($t = -4.32$), suggesting that the variable captures significant fee differences among different sized audit firms in an MSA market. However, when the variable DIFFERENCE is also included, the magnitude of the coefficient on MSA_DIFFERENCE is reduced significantly (– 0.060, $t = -1.47$), while the coefficient on DIFFERENCE is more than five times larger (– 0.333, $t = -11.21$). This result is consistent with Hypothesis 2, confirming that the main focus of

[15] Gow et al. (2010) show that in accounting cross-sectional studies, the serial correlations of accounting variables are likely to be by firm and year. In this paper, we cluster the standard errors for the main regressions over both the company and year to account for correlations among different companies in the same year and different years in the same company (Petersen, 2009; Cameron, Gelbach, and Miller, 2011). We use the program prepared by M.A. Petersen for calculating the two-dimensional clustered standard errors, which is available at http://www.kellogg.northwestern.edu/faculty/petersen/htm/papers/se/se_programming.htm. As robustness tests, we also cluster the standard errors over companies and auditors, respectively. These estimations render the same conclusions as documented in this paper.

[16] We tested the incremental contribution to R^2 of each variable in the model by comparing the change in R^2 after excluding the variable from the full regression. The test suggests that the size of the client is the primary determinant of the audit fees and most of the other variables, including DIFFERENCE, are lesser but statistically significant determinants. DIFFERENCE has a greater impact on R^2 than the variables SPECIALIST, LEV, ROI, OPINION, YE and LOSS, and a similar impact as LBSEG, LGSEG. Combined with its economically significant impact on fees, the variable DIFFERENCE explains significant fee differentiation among audit firms and therefore helps us understand how audit markets operate.

[17] To test whether our main test results are driven by the relatively small number of Non-Big N observations, we repeat our Table 2 tests on the sample with a Big N auditor and obtain similar results.

competition is within an MSA-Industry market, not simply a geographic MSA market. Therefore, industry expertise has a significant impact on competition for clients.

Table 4 shows the test results for Hypothesis 3. Column (1) includes SPECIALIST, DIFFERENCE, and MSA_DOM_DIFF as test variables. Column (2) adds IND_DOM_DIFF and Column (3) adds NATION_DOM_DIFF. We find that the largest audit firm in an MSA-Industry market can enhance its competitive pressure on the other audit firms in that market if it also enjoys dominant positions outside the MSA-Industry market. Specifically, the coefficient on MSA_DOM_DIFF in Column (1) is – 0.078 and significant at the 1% level, which can be translated as a further 1.8% reduction in fees for an incumbent audit firm with the average DIFFERENCE (i.e., 0.233). When IND_DOM_DIFF (Column (2)) and NATION_DOM_DIFF (Column (3)) are included in the model, their coefficients are negative but not significant.[18] The results in Column (3) indicate that, for an auditor with average DIFFERENCE, a 6.6% fee difference occurs directly from the MSA-Industry leader pressure and a further 1.5% fee difference occurs if the leader also dominates other MSA-Industry markets in the MSA. In other words, operations external to the MSA-Industry market produce an incremental fee differential, which is 22.7% (=1.5%/6.6%) of the fee differential associated with competition within the MSA-Industry. Thus, audit firms' other operations play an economically meaningful role.

Overall, these results suggest that audit firm dominance and the relative disadvantage of non-dominant audit firms is largely a local MSA, client-industry phenomenon, with the size of an audit firm's other operations in the MSA playing a lesser - but still significant role - in the determination of the transaction costs of audit firm change and audit pricing.

As noted earlier, our hypothesis tests provide a basis for distinguishing between two underlying conceptual reasons why audit fees in a local market are highest for the dominant audit firm. We argue that audit fees increase because of differences in supplier pricing power. However, the auditor specialization/ quality differentiation literature that originates with Craswell et al. (1995) interprets the differences as a premium (discount) for higher (lower) audit quality. For the results of our hypothesis tests to be consistent with a "quality differentiation" story, there must be multiple levels of auditor specialization and industry expertise sold in local client-industry-defined markets, and the lower an audit firm's market share, the lower must be its level of audit quality. To our knowledge, no one has argued that this rather unlikely situation is, in fact, the case.

To provide evidence directly supporting our argument that the negative relation between audit fees and DIFFERENCE is not caused by lower audit quality (i.e., smaller operational size implies lower quality for the audit firm), we conduct three tests to evaluate the relation between abnormal accruals, our proxy for audit quality, and DIFFERENCE. Specifically, we regress absolute abnormal accruals, positive abnormal accruals and negative accruals, respectively, on DIFFERENCE and control variables.[19,20]

Table 5 reports the results. Column (1) is the regression for the absolute value of abnormal accruals. The coefficient on DIFFERENCE is insignificant. Similarly, the coefficient estimates on DIFFERENCE in Column (2) for positive abnormal accruals and Column (3) for negative abnormal accruals are also insignificant. If abnormal accruals are a measure of audit quality, the results presented in Table 5 suggest that there is little evidence that DIFFERENCE is associated with lower audit quality.

We also investigate whether auditor turnover is increasing in DIFFERENCE which could confound the negative relation between audit fees and DIFFERENCE. Our analysis (not tabulated) shows that audit firm switching is determined by client size, number of operating segments, type of audit firm's opinion, and whether the client experiences a loss. We do not find any evidence that DIFFERECE is associated with audit firm switching, which is consistent with entry deterring, limit pricing by audit firms. This mitigates the concern that the negative relation between audit fees and DIFFERENCE is confounded by audit firm switching.

5.3. Comparing our DIFFERENCE with DISTANCE in NW

NW investigate a non-cooperative oligopoly model of the audit market where clients and suppliers are located in a product-characteristics space (which could include physical space as in Hotelling, 1929) and the supplier located "closest" to a client enjoys a cost advantage in supplying the audit service relative to competitors. Holding audit quality constant, a client is motivated to purchase an audit from the cheapest supplier, who prices the audit at the cost of the closest competitor firm (the second closest supplier to the client).

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[18] It is interesting to note that Column (3) shows that NATION_DOM is significant at 1% with a coefficient of 0.06. Recall NATION_DOM is an indicator variable equal to one for an MSA-Industry market if the market leader has the largest operations outside the MSA, and zero otherwise. This result suggests that the audit fees charged in an MSA-Industry market are 6% (exp(0.06)-1) higher if the leader in the market is also the national leader. The non-dominant auditors also benefit from the higher benchmark fees in the market, although they do not receive the full benefits due to relatively greater competitive disadvantage to the dominant auditor.

[19] Based on Dechow, Sloan, and Sweeney (1995) and Kothari, Leone, and Wasley (2005), we use the following model to estimate abnormal accruals by year and by two-digit SIC code, scaling by total assets: $TOTAL\_ACCRUALS_{i,t} = \alpha_0 + \alpha_1 LTA_{i,t} + \alpha_2(\Delta SALES_{i,t} - \Delta REC_{i,t}) + \alpha_3 PPE_{i,t} + \alpha_4 ROI_{i,t} + \varepsilon_{i,t}$, where for firm i and fiscal year t, *TOTAL_ACCRUALS* equals net income before extraordinary items minus operating cash flows from continuing operations/total assets; $\Delta SALES$ equals change in sales in latest two years/total assets; ΔREC equals change in accounts receivable in the latest two years/total assets; *PPE* equals net property, plant, and equipment/total assets; *ROI* is return on investments; and $\varepsilon_{i,t}$ equals the estimated abnormal accrual for firm i and fiscal year t. Estimating abnormal accruals without *ROI* provides similar results.

[20] The control variables are similar to those used in the literature (see Lawrence et al., 2011). We include LTA^2 to control for the nonlinear effect of firm size and the results on our test variables are not affected if LTA^2 is not included.

Table 6
Audit fees and DISTANCE in an MSA-industry market.

VARIABLES	(1) LAF	(2) LAF
DISTANCE	0.153*	0.201**
	(1.84)	(2.23)
PORTFOLIO	1.021***	1.764***
	(3.57)	(3.46)
PORTFOLIO_DISTANCE		-1.368
		(−1.57)
HERFINDAHL	-0.350***	-0.314***
	(−2.89)	(−2.59)
LTA	0.509***	0.508***
	(40.91)	(41.13)
LBSEG	0.121***	0.122***
	(5.06)	(5.09)
FOREIGN	0.150***	0.147***
	(8.87)	(8.71)
CATA	0.552***	0.550***
	(6.07)	(6.07)
QUICK	-0.050***	-0.050***
	(−8.03)	(−8.02)
LEV	-0.091	-0.088
	(−1.22)	(−1.20)
ROI	-0.408***	-0.406***
	(−3.56)	(−3.54)
LOSS	0.128***	0.128***
	(3.19)	(3.19)
YE	0.043	0.044
	(1.36)	(1.38)
SWITCH	-0.301***	-0.303***
	(−3.68)	(−3.71)
INDUSTRY_NATION	-1.195	-1.597
	(−0.18)	(−0.25)
Constant	10.238***	10.176***
	(55.65)	(54.14)
Observations	2,602	2,602
Adjusted R^2	0.737	0.737
Industry FE	YES	YES
Year FE	YES	YES

This table replicates Table 6 of NW. The sample is from year 2005 and 2006 and only Big 4 observations are included. PORTFOLIO_DISTANCE is the interaction of variables PORTFOLIO and DISTANCE. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively, using two-tailed tests. t-statistics determined by clustered standard errors in company are presented in parentheses.

While the spatial model of auditor competition is conceptually appealing, operationalizing the notions of "space" and "distance" to test the pricing implications of the model is a challenge. NW define distance in space by the difference in market shares of suppliers, where markets are defined the same way as in our paper (i.e., client industries in U.S. MSAs), and market shares are also measured the same way (specific audit firm's aggregate audit fees relative to total audit fees in a market). They argue that the greatest pricing pressure comes from the supplier whose market share is "closest" (i.e., most similar in value) to the incumbent audit firm. They use the absolute value of this difference to compute a variable called DISTANCE and find that it has a statistically significant positive coefficient. That is, the greater the DISTANCE the greater the pricing power of the incumbent audit firm.

We argue that the greatest pricing pressure in a market comes from the largest audit firm in the market - not from smaller firms - and we believe that the variable DISTANCE may not measure competitive pressure on the incumbent audit firm correctly. If the incumbent firm is a small firm, the greater the distance to its closest competitor (larger firm), the lower the fee it can charge. We believe that the positive coefficient on DISTANCE observed in NW is mainly driven by the larger firms' dominance. Since the largest audit firm's nearest neighbor is always the second largest auditor, the DISTANCE effect in NW mainly captures the fee difference between the largest audit firm and the second-largest audit firm, as shown in their Table 7.

Thus, it is interesting to determine whether NW's reported findings are robust if DISTANCE to a smaller neighbor is distinguished from that to a larger neighbor, and how DIFFERENCE, our competition measure, affects the estimation of the impact of DISTANCE on audit fees. We start by replicating NW following their sample selection process and regression model specifications.[21] The variables DISTANCE, PORTFOLIO (the proportion of revenues an audit firm generates in an MSA-Industry market relative to its total client revenues earned in an MSA), PORTFOLIO_DISTANCE (i.e., interaction of variables DISTANCE

[21] Using our full sample yields similar results (not tabulated). The sample size is small in NW for several reasons, including that the data is from two years, the auditors are only Big 4, and each market must have at least two Big 4 auditors.

Table 7
Audit fees and directional DISTANCE in an MSA-industry market.

VARIABLES	(1) LAF	(2) LAF
DISTANCE_smaller	0.286***	0.456***
	(3.31)	(4.58)
DISTANCE_larger	-0.189**	-0.194*
	(−2.26)	(−1.88)
PORTFOLIO	0.492	1.816***
	(1.57)	(4.92)
PORTFOLIO_DISTANCE_smaller		-3.020***
		(−3.63)
PORTFOLIO_DISTANCE_larger		2.799
		(1.04)
HERFINDAHL	-0.304***	-0.254**
	(−2.60)	(−2.25)
LTA	0.499***	0.494***
	(39.34)	(39.41)
LBSEG	0.126***	0.126***
	(5.31)	(5.30)
FOREIGN	0.149***	0.145***
	(8.90)	(8.64)
CATA	0.538***	0.523***
	(5.96)	(5.86)
QUICK	-0.049***	-0.049***
	(−8.02)	(−7.98)
LEV	-0.092	-0.084
	(−1.29)	(−1.18)
ROI	-0.395***	-0.386***
	(−3.46)	(−3.39)
LOSS	0.117***	0.114***
	(2.96)	(2.91)
YE	0.045	0.042
	(1.42)	(1.35)
SWITCH	-0.303***	-0.309***
	(−3.73)	(−3.79)
INDUSTRY_NATION	-0.434	-2.061
	(−0.07)	(−0.32)
Constant	10.393***	10.368***
	(52.34)	(53.41)
Observations	2602	2602
Adjusted R^2	0.741	0.744
Industry FE	YES	YES
Year FE	YES	YES

This table presents results on the impact of directional DISTANCE on audit fees. The sample is from year 2005 and 2006 and only Big 4 observations are included. PORTFOLIO_DISTANCE_smaller is PORTFOLIO × DISTANCE_smaller. PORTFOLIO_DISTANCE_larger is the interaction of variables PORTFOLIO and DISTANCE_larger. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively, using two-tailed tests. t-statistics determined by clustered standard errors in company are presented in parentheses.

and PORTFOLIO), INDUSTRY_NATION (the proportion of revenues an audit firm generates from an SIC industry relative to its total client revenues earned nationwide), and HERFINDAHL are included in the regression.

Table 6 shows that we obtain results similar to those in Table 6 of NW. The coefficient on DISTANCE is positive and statistically significant in both columns. Since DISTANCE in NW is measured in absolute value, except for the largest and the smallest audit firms, the nearest neighbor of an audit firm may be larger or smaller than the incumbent audit firm. This means that the competitive pressure from either direction is regarded as equal if the DISTANCE is the same. This is not consistent with our argument that the competitive pressure from the largest audit firm dominates the pressure from the smaller audit firms. NW suggest that PORTFOLIO measures the focus of an audit office's operation in an industry. For a given-sized operation in an MSA-Industry market, the higher the proportion the industry operation represents of the total MSA operation, the more attention the audit firm pays to its competitive ability in the MSA-Industry market, which leads to greater efficiency. Results in Table 6 confirm the effects of PORTFOLIO on audit fees are indeed positive.

The analysis reported in Table 7 investigates the validity of the DISTANCE measure by distinguishing whether DISTANCE is measured relative to a smaller neighbor (DISTANCE_smaller) or to a larger neighbor (DISTANCE_larger). Consistent with our expectation, the results show that if the DISTANCE is to a smaller neighbor, the audit firm charges higher fees, and if the DISTANCE is to a larger neighbor, the audit firm charges lower fees. Therefore, DISTANCE defined in NW is not a proper measure for competition because it can capture a competitive advantage (to a smaller neighbor) or competitive pressure (from a larger neighbor). Table 7 Column (2) adds two interaction terms, PORTFOLIO interacting with DISTANCE_smaller and PORFOLIO interacting with DISTANCE_larger, to the regression model presented in Column (1). We find that the coefficient

Table 8
Audit Fees and both DISTANCE and DIFFERENCE in an MSA-industry market.

VARIABLES	(1) LAF	(2) LAF	(3) LAF
DISTANCE	0.021	0.056	0.067
	(0.24)	(0.59)	(0.70)
DIFFERENCE	-0.375***	-0.367***	-0.460***
	(−5.57)	(−5.43)	(−6.03)
PORTFOLIO	0.454	0.973*	0.833
	(1.47)	(1.88)	(1.61)
PORTFOLIO_DISTANCE		-0.935	-0.609
		(−1.05)	(−0.68)
PORTFOLIO_DIFFERENCE			6.976***
			(2.79)
HERFINDAHL	-0.110	-0.091	-0.092
	(−0.84)	(−0.69)	(−0.70)
LAT	0.500***	0.500***	0.496***
	(39.98)	(40.13)	(39.63)
LBSEG	0.122***	0.123***	0.121***
	(5.15)	(5.17)	(5.12)
FOREIGN	0.149***	0.147***	0.145***
	(8.89)	(8.78)	(8.66)
CATA	0.551***	0.549***	0.540***
	(6.12)	(6.11)	(6.04)
QUICK	-0.050***	-0.050***	-0.050***
	(−8.09)	(−8.09)	(−8.06)
LEV	-0.091	-0.090	-0.088
	(−1.27)	(−1.25)	(−1.22)
ROI	-0.402***	-0.400***	-0.394***
	(−3.49)	(−3.48)	(−3.43)
LOSS	0.129***	0.128***	0.126***
	(3.25)	(3.25)	(3.21)
YE	0.042	0.042	0.038
	(1.32)	(1.33)	(1.22)
SWITCH	-0.305***	-0.306***	-0.307***
	(−3.76)	(−3.78)	(−3.79)
INDUSTRY_NATION	0.375	0.070	-1.217
	(0.06)	(0.01)	(−0.19)
Constant	10.150***	10.110***	10.142***
	(55.70)	(54.50)	(54.50)
Observations	2602	2602	2602
Adjusted R^2	0.741	0.741	0.742
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

This table presents results on the impact of DISTANCE on audit fees when DIFFERENCE is included. The sample is from year 2005 and 2006 and only Big 4 observations are included. PORTFOLIO_DISTANCE is the interaction of variables PORTFOLIO and DISTANCE. PORTFOLIO_DIFFERENCE is PORTFOLIO × DIFFERENCE. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively, using two-tailed tests. t-statistics determined by clustered standard errors in company are presented in parentheses.

on the interaction between PORTFOLIO and DISTANCE_smaller is significantly negative, suggesting that PORTFOLIO is more important to smaller firms; that is, the larger auditor's fee is reduced if the smaller auditor has higher PORTFOLIO.

Finally, Table 8 presents the results when DIFFERENCE, our measure for competition, is added to the regression model. We find that DIFFERENCE is consistently negative and significant while DISTANCE is insignificant, consistent with our argument that DIFFERENCE better captures the competitive positions of auditors in a local market.

6. Conclusions

Based on a theory of transaction costs associated with audit firm change, we hypothesize and find that audit fees decrease as the size difference between the dominant audit firm in a market and an incumbent audit firm increases. We develop a measure of audit firms' competitive positions, termed DIFFERENCE, which is the size difference between the largest auditor's operations in a market and the size of an incumbent audit firm's operations. We show that DIFFERENCE can consistently capture audit-firm-specific competition in the market, better than NW's DISTANCE measure. We also investigate the boundaries of local audit markets and find evidence that competition occurs mainly at the MSA-Industry level, rather than at the MSA level. However, the dominant firm's competitive position in an MSA-Industry market is strengthened by the size of its operations outside the MSA-Industry market.

Our analyses suggest that variations in the transaction costs of changing audit firms for the clients of incumbent audit firms are an important, hitherto undocumented determinant of the pricing of audit services. This is not too surprising

since these transaction costs of changing auditors are an important element of DeAngelo's (1981) multi-period audit pricing model. While the implications of that model have been used to investigate the phenomenon of "lowball" pricing in the first (early) period(s) of an audit engagement, to our knowledge, no one has investigated the implications of the model for the pricing of continuing audit engagements where the level of transaction costs determines the level of quasi-rents (and perhaps monopoly rents) an auditor can incorporate into audit fees.

Finally, our arguments and evidence challenge the usual view that fee premiums charged by the largest audit firms in local markets are due to their high audit quality. Our results suggest that such premiums likely result from greater market power, rather than quality differentiation. This study does not claim that all audit firms in a market supply the same quality, and whether or not there are systematic industry-specific audit quality differences across audit firms remains an open question. One possibility is that audit firms that have market power in a particular context may also perform a higher-quality audit *in that context,* since a client's threat to terminate an audit relationship if the auditor "looks too hard" or fails to report as the client wishes is less credible (not credible) if the client has few (no) alternative supplier choices. In other words, these audit firms have bargaining power over the clients. Thus, higher market power could be correlated with both a higher audit fee and a higher-quality audit. However, such higher audit quality and higher audit fee would be *client-specific* and would depend on the competitive context. We leave the investigation of this interesting possibility to future research.

Appendix A. Variable definitions

Dependant variable	
LAF	= natural log of audit fees of client *i*
Variables of interest	
DIFFERENCE	= (The difference of the total audit fees in an MSA-Industry market between the largest audit firm in the market and the incumbent auditor of client *i*) ÷ Total audit fees in the MSA-Industry market. An MSA-Industry market is defined as a two-digit SIC industry in a U.S. Metropolitan Statistical Area (MSA, U.S. Census Bureau definition)
MSA_DIFFERENCE	= (The difference of the total audit fees in an MSA market between the largest audit firm in the market and the incumbent auditor of client *i*) ÷ Total audit fees in the MSA market
MSA_DOM_DIFF	= DIFFERENCE for an MSA-Industry market if the market leader also has the largest other operations in the MSA, and zero otherwise
IND_DOM_DIFF	= DIFFERENCE for an MSA-Industry market if the market leader has the largest industry operations outside the MSA, and zero otherwise
NATION_DOM_DIFF	= DIFFERENCE for an MSA-Industry market if the market leader has the largest operations outside the MSA, and zero otherwise
Control variables	
LTA	= natural log of total assets
LBSEG	= natural log of the number of unique business segments
LGSEG	= natural log of the number of unique geographic segments
CATA	= ratio of current assets to total assets
QUICK	= ratio of current assets excluding inventory to current liabilities
LEV	= ratio of long-term debt to total assets
ROI	= ratio of earnings before interest and tax to total assets
FOREIGN	= an indicator variable that equals one if revenue from foreign operations is reported, and zero otherwise
OPINION	= an indicator variable that equals one for a going-concern audit report, and zero otherwise
YE	= an indicator variable that equals one for December 31 year-end, and zero otherwise
LOSS	= an indicator variable that equals one if there is a loss in the current year, and zero otherwise
BIG	= an indicator variable that equals one for Big N auditors, and zero otherwise
SPECIALIST	= an indicator variable that equals one if the auditor is the largest in the MSA-Industry market, and zero otherwise
DISTANCE	= smallest absolute fee market share difference between the incumbent audit firm and its closest competitor in an MSA-Industry market
DISTANCE_smaller	= DISTANCE if the nearest neighbor is smaller than the incumbent audit firm, and zero if the nearest neighbor is larger than the incumbent audit firm
DISTANCE_larger	= DISTANCE if the nearest neighbor is larger than the incumbent audit firm, and zero if the nearest neighbor is smaller than the incumbent audit firm
PORTFOLIO	= the relative revenue share an audit firm generates in a two-digit SIC industry relative to the total revenue generated by an audit firm in an MSA
INDUSTRY_NATION	= fees an audit firm generates in a two-digit SIC industry as a percentage of the total fees generated by an audit firm nationwide
HERFINDAHL	= Herfindahl concentration index per MSA-Industry audit market, where the Herfindahl index is calculated as the sum of s_i^2, where *i* is an audit office in an MSA-Industry market and s is market share in the market based on audit fees
MSA_DOM	= an indicator variable that equals one for an MSA-Industry market if the market leader also has the largest other operations in the MSA, and zero otherwise
IND_DOM	= an indicator variable that equals one for an MSA-Industry market if the market leader has the largest client-industry operations outside the MSA, and zero otherwise
NATION_DOM	= an indicator variable that equals one for an MSA-Industry market if the market leader has the largest operations outside the MSA, and zero otherwise

Appendix B. DeAngelo's (1981) Audit pricing model

The model describes an audit firm's net present value or profit (π) from a client engagement as a function of the initial year's audit fee (F_1), normal annual production costs (A), first period start-up costs (K), a recurring audit fee in the second and subsequent years (F), and a discount rate (r), where:

$$\pi = (F_1 - A - K) + \frac{F - A}{r} \tag{B.1}$$

In addition, the recurring audit fee, F, is limited by a client's ability to change audit firms to secure a lower fee while incurring the costs of changing audit firms, denoted CS, such that:

$$F + \frac{F}{r} \leq A + K + \frac{A}{r} + CS \tag{B.2}$$

This implies that the entry-deterring (audit-firm-change deterring) audit fee in the second and subsequent years can be written as:

$$F = A + \frac{r(CS + K)}{1 + r} \tag{B.3}$$

The transaction costs of audit firm change are ($CS + K > 0$).

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