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Who are Industry Specialist Auditors?

Like JIANG*, Anne JENY-CAZAVAN* and Sophie AUDOUSSET-COULIER**

* ESSEC Business School, ** John Molson School of Business, Concordia University

Résumé : L'objectif de cette recherche est d'analyser les effets de l'utilisation de définitions et de mesures multiples du concept de spécialisation sectorielle des auditeurs dans la recherche empirique en audit. Les auditeurs spécialistes d'un secteur industriel sont supposés produire un audit de meilleure qualité ce qui a entraîné le développement de mesures de la spécialisation sectorielle. Notre analyse démontre que l'utilisation de différentes définitions et mesures conduit à des classements non homogènes. Ainsi, selon la méthode utilisée, un même cabinet d'audit pourra être qualifié de « spécialiste » ou non d'un secteur industriel donné. Nous montrons également que l'absence de cohérence de ces définitions et mesures remet en question la significativité et la magnitude des résultats obtenus lorsqu'une mesure de spécialisation sectorielle des auditeurs est utilisée comme déterminant des honoraires d'audit, par exemple. Ce résultat a des implications méthodologiques pour les recherches empiriques en audit qui utilisent des mesures de spécialisation sectorielle des auditeurs.

Mots clés : Spécialisation sectorielle des auditeurs, honoraires d'audit

Abstract : The purpose of this paper is to analyze the effects of using several definitions and several measurements of auditor industry specialization in the empirical audit research. Industry specialist auditors are supposed to be able to provide better quality audits therefore, auditor industry specialization measures have been developed and used in the empirical audit research. In a first step, we empirically test whether different definitions of auditor industry specialist result in consistent designations of audit firms as specialists of a given industry and find that inconsistent industry specialist definitions lead to inconsistent designation of audit firms as industry specialists. In a second step, we test and demonstrate that these different auditor industry designations lead to inconsistent results in terms of magnitude and significance regarding the fee premium paid to auditor industry specialists. Such evidence raises an issue of whether the findings in prior studies are subject to measurement errors of audit industry specialists

Keywords : Auditor industry specialists, audit fees

Corresponding Author

Anne JENY-CAZAVAN

Accounting department

ESSEC Business School

Ave Bernard Hirsch, B.P. 50105

95021 Cergy-Pontoise Cedex, FRANCE

e-mail: cazavan@essec.edu

1. Introduction

Audit firms characteristics and their influence on audit quality and audit pricing is a major interest for accounting researchers. Besides the dichotomy between Big firms and Non-Big firms, the main source of variation that has been tested is the variation in industry expertise (Francis, 2011). Despite the fact the auditor industry specialization has been tested several times from different perspectives in the literature, the results can be seen as mixed (Francis, 2011). We argue that the mixed results can partially be attributable to the diversified approaches used to measure and to designate auditor industry specialists. In this paper, we empirically test this conjecture. We compare different measurements of auditor industry specialization in order to investigate if they produce different auditor industry specialist designations, and to test whether the different designations, if they exist, result in diversified impacts of auditor industry specialization when this variable is used in audit quality and audit pricing empirical research models.

Who are industry specialist auditors? A survey of the websites of Big 4 audit firms shows that all Big 4 auditors promote themselves as industry specialists in almost all and every industry. However, in academic research, auditor industry specialization is analyzed through the composition of the auditor's clientele because auditors who devote resources to develop special industry knowledge will tend to have larger market shares and will be able to split the knowledge-developing costs and achieve economy of scales. Gramling and Stone (2001) demonstrate that in industry k , market shares of auditor firm i is measured as the total audit fees earned by auditor firm i in industry k deflated by the total audit fees generated by all the clients in the industry k . Because until recently, the information of audit fees was not publicly available, researchers used a variety of proxies to calculate auditor industry market shares. Those proxies are based on client firms' size (assets or sales revenues), or on the number of clients that an auditor has in one industry. Besides the different calculations of auditor industry market shares, the criteria applied to assign auditor industry specialists are diversified as well due to different definitions of auditor industry specialists. For instance, some researchers define auditor industry specialists as the one that possess the largest market share in a given industry (relative measure) whereas others define specialists as the ones that possess a market share in a given industry that exceeds certain cutoff levels (absolute measure). The diversity of proxies used to measure auditor market shares and the inconsistent criteria adopted to assign auditor industry specialists render the empirical results hard to interpret. Since the audit fees are now publicly disclosed for listed firms, it raises the issue of whether the empirical results still hold when auditors' market shares are calculated with audit fees instead of with proxies of audit fees. Our research attempts to shed light on this issue and adopts a two step methodology. We have first conducted an analysis of the different methods used in the literature to measure industry specialization and we have found seven different measurements of the auditors' industry market shares and two criterions to designate industry specialists (based on

relative market shares or on absolute market shares). We have then used these fourteen different industry specialization measures to investigate if they produce different industry specialist assignments..In a second step, we have used alternatively the industry specialization assignments produced by the fourteen measurement methods in an audit fees determinants model to further test whether the different auditor industry specialist designations have differentiated impacts on audit pricing. We have compared the significance and the magnitude of the coefficients of the auditor industry specialist variable in our audit fee determinants model.

Our results show that with the same assignment criterion, different proxies used to calculate industry market shares result in different designations of auditor industry specialists. Moreover, our regression results show that not all dummy variables of auditor industry specialist are significant. Finally, coefficients comparisons illustrate that there exist significant differences between some pairs of coefficients, meaning that the magnitude of effect that different auditor industry specialist designations have on audit fees are significantly different. Our results can be one explanation of the mixed empirical results that try to test the effect of auditor industry expertise. The paper contributes to the literature by empirically showing that when different proxies are used to measure market shares, even with the same assignment criterion, the designations of auditor industry specialist vary significantly. Furthermore, the measurement discrepancies can be large enough to influence the statistical results when auditor industry specialist is tested as an independent variable that influence audit pricing.

The remainder of the paper is organized as follows. Literature review and hypotheses development are in section 2, followed by data description in section 3. Section 4 provides detailed information about the research design and the empirical results are stated in section 5. Section 6 concludes the paper.

2. Literature Review and Hypotheses Development

2.1. Audit quality and auditor industry specialization: prior evidence

Auditor industry specialization is a major topic in auditing literature. The importance of industry specialized auditors is attributable to the research findings that auditor industry expertise is associated with better auditor performance and higher audit quality. For better auditor performance, researchers argue that industry specialized auditors produce more accurate and efficient audit. For instance, Solomon and Shields (1999) use an experiment and show that industry specialist auditors have a greater quantity of and more accurate knowledge of financial statement non-error factors for their industries of specialization relative to other industries. Low (2004) examines the effects of industry specialization on auditors' risk assessment and audit-planning decisions and finds that industry knowledge improves audit risk assessment and influences the perceived quality of audit-planning decisions.

The research of the association between auditor industry specialization and audit quality is extensive. One stream of literature argues that auditor industry expertise will help constrain earnings management thereby increasing earnings quality. For example, Balsam et al. (2003) find that clients of industry specialist auditors have lower DCA and higher ERC¹ than clients of non-specialist auditors, suggesting that auditor industry specialization improves earnings quality. Similarly, Krishnan (2003) also supports the argument by showing that earnings management proxied by client's level of absolute discretionary accruals is lower for clients audited by industry specialist.

Another stream of research takes a more broad view and tests whether auditor industry specialization increases the overall client disclosure quality and reduces the frequency of fraudulent financial reporting. Dunn and Mayhew (2004) document a positive relation between industry specialist audit firms and analysts' rankings of disclosure quality in unregulated industries. However, the relation does not exist in regulated industries. Carcello and Nagy (2004) reports a negative relationship between auditor industry specialization and financial fraud, but such negative relationship is weaker for larger clients because larger clients have more bargaining power and it is more difficult for an auditor to possess industry expertise due to clients' complex operating in more than one industry. Overall prior empirical evidence shows that auditor industry specialization seems to be positively associated with different proxies of audit quality. Nevertheless, as Francis (2011) claimed "more research is needed to understand the source of industry expertise and its relation to global, country-level, and office-specific operations of large accounting firms".

Furthermore, some researchers focus their analysis on the effect that industry specialized auditors have on audit pricing. For example, Casterella et al. (2004) find that a fee premium exists for industry specialist auditors in the small client segment but audit fees decrease as a company becomes increasingly larger relative to the auditor's industry clientele, suggesting that larger clients have stronger bargaining power and this power offset the fee premium effect. Huang et al. (2007) test whether the results of Casterella et al. (2004) will still hold for the post-SOX periods and they find that in the post-SOX period (i.e., 2003 and 2004) the negative association between audit fees and client size extends to both small and large client segments.

In addition, some studies adopt another strategy to test the moderating effect that industry specialized auditors may have on already tested relationships. Gul et al. (2009) investigate whether auditor industry specialization influences the observed positive relationship between auditor tenure and earnings quality and find that the relationship is significantly weakened for firms that are audited by industry specialists. Lim and Tan (2008) examines whether the relation between the provision of non-audit services and the impairment of audit quality is conditional on auditor specialization. Contrast to widely held claim that non-audit service impairs audit quality, the author find that there is no significant relationship between non-audit service and decreased audit quality. Rather, the results show that for clients who are audited by industry specialists, an increased level of non-audit service is positively associated with the incidence of issuing going-concern opinions. Knechel et al. (2007) hypothesize that if capital market

¹DCA refers to discretionary accruals and ERC refers to earnings response coefficient.

considers industry specialized auditors as suppliers of high audit quality services, it will value the high quality and will react to auditor switches. Their findings suggest that within Big 4 auditors, market react positively when firms switch from a non-specialist Big 4 auditor to a specialist Big 4 auditor, consistent with market perceiving industry specialization to be valuable after controlling for the effects of brand name. However, the effect of switches between non-Big 4 and Big 4 specialists are somewhat ambiguous.

2.2. A lack of consistent definition and measurement of Auditor

Industry Specialization

Although studies on auditor industry specialization are extensive, definition and designation of industry specialized auditor are not clearly agreed upon by researchers. Regarding the definition, most research follows Palmrose (1986) who defines auditor industry specialists to include the largest supplier in each industry, as well as the second and third largest suppliers in the industry in which readily observable differences existed between the second and the third or between the third and the remaining suppliers. This definition basically takes the within-industry market share approach in which an auditor is considered to be industry specialists if it possesses a significant part of the market shares in that industry. The rationale for defining specialists on the basis of market share is that auditors who devote resources to develop special industry knowledge to become industry specialists will tend to have as large market shares as possible in order to split the knowledge-developing costs and achieve economy of scales. An alternative definition of auditor industry specialization emphasizes auditor firm individually and focuses on the relative distribution of audit services across the various industries for each audit firms. This within-firm portfolio share approach defines audit firms as specialists in those industries which consist of the largest portfolio shares for the audit firms. The rationale for this kind of designation is that industries with largest portfolio shares generate most revenues for the audit firms because presumably they have devoted the most resources into developing industry-specific knowledge even if they do not have leading market shares. Additionally, Neal and Riley (2004) develop a weighted-market share approach² which combines the two previous approaches. Finally, some researchers adopt a straightforward self-proclaimed approach in which audit firms are considered industry specialists if they promote their particular industry specialization at their websites. Table 1 summarizes the approaches that previous empirical papers applied to measure industry specialized auditors. The table shows that the within industry market share approach dominates the literature.

²In this approach, a firm's market share is weighted by its portfolio share. For example, if a firm has a market share of 30% in industry k and industry k accounts for a portfolio share of 2%, the weighted market share is 0.6%. A firm is designated as industry specialist if its weighted market share exceeds the cutoff ratio which is calculated as:

$$\left(\frac{1}{N_{firms}} * 1.2 \right) * \left(\frac{1}{N_{industries}} \right)$$

[Insert Table 1 here]

Regardless of the consensus that larger market shares indicate better industry knowledge, the calculation of auditor market share is not unified in the literature. Gramling and Stone (2001) identified that the market shares of auditor firm i in the industry k ³ is measured as the total audit fees earned by auditor firm i in industry k deflated by the total audit fees generated by all the clients in the industry k . However, because until recently information on audit fees was not publicly available, researchers often replaced audit fees with (i) client size which is proxied by client assets and sales revenues and (ii) the number of clients. In addition to the variety of proxies utilized to measure market shares, the assignment criteria for auditor industry specialist are also complicated. Industry specialist auditors are selected according to a relative level of market shares or to an absolute level of market shares. For relative level, specialists are selected as the ones having the largest market shares, or the first two largest market shares, or the first three largest market shares. For absolute level, specialists are selected when their market shares are 20% greater than those if the audit firms were to split the industry evenly among them. Some researchers adopt a more rigid approach and identify specialist as the one with largest market share which should also be at least 10% higher than the second one (i.e., the dominance).

2.3. Hypotheses development

The diversity of proxies used to measure auditor market shares and the inconsistent criteria adopted to assign auditor industry specialist render the empirical results hard to interpret. Now that audit fees are publicly disclosed, it raises the question of whether the empirical results still hold when market shares are calculated with audit fees based measures instead of with other proxies of audit fees. Our research attempts to shed light on this issue by comparing the designations of auditor industry specialist across various industry specialist measurements.

We hypothesize that different measurement proxies produce inconsistent results of auditor industry specialist designations

H1: The use of different proxies to measure auditor industry market shares produces inconsistent auditor industry specialist assignments.

Moreover, if the assignment results are inconsistent, the auditor industry specialists resulting from different measurements will produce dissimilar impacts when auditor industry specialization is used as an independent variable in empirical models. To empirically test this conjecture, we use an audit fee model and make the hypothesis that auditor industry specialists resulting from different measurements will have

³ Most existing research uses two-, three-, or four-digit SIC code to assign companies to different industries.

different impacts on audit fees.

H2: The use of different measurements proxies to identify auditor industry specialists produces inconsistent impacts on audit fees.

3. Data

This study selects all Canadian companies with financial data available in Compustat for the fiscal year 2007. We restrict the sample to industrial firms and exclude banks and financial institutions (all firms with SIC codes 6000-6999). From this list of non-financial companies we have downloaded the Annual information Forms (AIF) available on SEDAR to collect manually⁴ audit related data reported in their AIF (audit fees and auditor names). Our final sample for the auditor industry specialization measurements and audit fees estimation model has 824 observations for the year 2007.

The 824 companies are assigned to 20 industries based on their four-digit SIC. Table 2 presents composition of the sample by industries. It shows that the largest industry is Metal and Coal Mining which has 211 observations (26% of the total sample), followed by the industry of Oil and Gas Extraction which has 151 observations (18% of the total sample).

[Insert Table 2 here]

There are six main audit firms in the Canadian audit market. Those six audit firms are the BIG4 audit firms, namely Deloitte & Touche (DTT), Ernst & Young (EY), KPMG, and PricewaterhouseCoopers (PWC), and two other international audit networks which are Grant Thornton (GT) and BDO Dunwoody (BDO). Besides these six audit firms, other small audit firms also provides services in the Canadian market. Table 3 shows the distribution of sample companies' auditors. Table 3 Panel A separates the sample by BIG4 auditors versus NonBIG4 auditors and shows that the majority of sample companies are audited by BIG4 auditors (83%). Table 3 Panel B provides information of the number of sample companies that are audited by each audit firms. Because each small audit firm only takes very small proportion of market shares and are not comparable to the six major players, we aggregate other small audit firms as one category (Other). It shows that KPMG has the largest market share, followed by PWC, DTT and EY.

[Insert Table 3 here]

⁴ Detailed audit fee data (with a split between legal audit fees, and non-audit fees) are not available in databases for Canadian companies. Compustat provides "total fees" (= audit fees + non-audit fees) for a list of Canadian companies, and Audit Analytics only includes Canadian firms listed on a U.S. stock market.

4. Research Design

4.1. Calculation of Auditor Industry Market Shares

Our research focuses on within industry market share approach because this approach is the most often used measurement in the literature. Table 1 shows that all previous empirical papers applied this approach, even if they sometimes complement their analyses with other approaches. We think that the variability offered by the different proxies and assignments in the market share approach is sufficient to test whether different auditor industry specialization measures lead to consistent or inconsistent results. Using only market share approach enables us also to keep the measurement concept constant. According to Gramling and Stone (2001), within industry market shares of auditor firm i in the industry k is measured as the total audit fees earned by auditor firm i in industry k deflated by the total audit fees generated by all the clients in the industry k . For the purpose of comparison, we select audit fee based measures (audit fees and total fees) as well as the other proxies used in the literature to measure auditor industry market shares. In a survey of prior studies, we find that client size, i.e., assets and sales revenues, are the most often used proxies. Moreover, the number of clients is also frequently employed as another proxy. In addition, because non-audit services may have an impact on auditor's development of industry expertise, we also use total fees (i.e., audit fees plus non-audit fees) as another measure. Following Gramling and Stone (2001), the formula used to calculate auditor industry market shares is:

$$MS_{ik} = \frac{\sum_{j=1}^{J_{ik}} X_{ijk}}{\sum_{i=1}^{I_k} \sum_{j=1}^{J_{ik}} X_{ijk}} \quad (1)$$

Where:

MS_{ik} = market share of audit firm i for industry k

X_{ijk} = audit fees, total fees (audit fees + non-audit fees), total assets, total sales, number of clients of firm j audited by audit firm i in industry k , respectively

i = auditor

k = industry

j = client

With this calculating formula and five different values of variable X , we obtain five different market shares for each auditor in each industry.

Gramling and Stone (2001) also suggest that the relationship of audit fees and client size may not be linear. They show that based on Danos and Eichenseher (1982), audit fees tend to vary linearly with the square root of client size. Some recent papers actually take this proposition into account and use square root of client size instead of client size itself. Accordingly, we also include another formula for calculating

market shares.

$$MS_{ik} = \frac{\sum_{j=1}^{J_{ik}} \sqrt{X_{ijk}}}{\sum_{i=1}^{I_k} \sum_{j=1}^{J_{ik}} \sqrt{X_{ijk}}} \quad (2)$$

Where:

X_{ik} = total assets or total sales of audit firm i in industry k

The other variables are the same as those in equation (1)

With this calculating formula and the two values of variable X, we obtain two other market shares for each auditor in each industry. In sum, we use audit fees, total fees, total assets, sales revenues, number of clients, square root of assets and square root of salesto calculate auditor industry market shares, resulting in seven different market shares calculations for each auditor in each industry.

4.2. Criteria for assigning auditor industry specialist

After the calculation of market shares, we adopt two criteria to assign auditor industry specialists. According to Palmrose (1986), auditor industry specialists include the largest supplier in each industry, as well as the second and third largest suppliers in the industry in which readily observable differences existed between the second and the third or between the third and the remaining suppliers. In line with this definition, the first criterion (Criterion 1) for assigning industry specialist is based on the largest market shares. That is, auditor with the largest market shares is selected as the industry specialist in that industry. This assignment approach results in one auditor industry specialist per industry. The second assignment criterion (Criterion 2) is to assign industry specialists as the ones which serve market shares 20% greater than if the audit firms were to split the industry evenly among them, i.e., market share larger than 1 deflated by the number of audit firms in the industry. This assignment approach may result in several auditor industry specialists in one industry. In our study, we take the six major audit firms as the major players while aggregating other small audit firms as one category. In this sense, none of the small audit firms is considered a single player in the market. As a result, for criterion 2 the cutoff ratio is calculated as $(1/6) * (1+20\%)$ which equals to 20%. In short, assignment criterion 2 can be expressed as industry market shares larger than 20%.

4.3. Statistical model to test hypotheses

In order to test hypothesis H1, we first calculate the seven market shares of each auditor in each industry. Then we apply assignment criterion 1 and criterion 2 respectively to designate auditor industry specialists for each industry. This results in seven designations for each industry in each criterion. We compare descriptively

whether with the same assignment criterion, the resulting auditor industry specialists are the same for the different measurement proxies in each industry.

To test hypothesis H2, we run the analysis at the firm level. We create dummy variables $ISpec_{ij}$ to indicate whether a firm is audited by industry specialist, where i refers to the assignment criterion and j refers to the variables used to calculate auditor industry marketshares. For assignment criterion 1, since there are seven designations based on different market share calculation, we create seven dummy variables named from $ISpec11$ to $ISpec17$. Those dummy variables equals to 1 if a firm is audited by the industry specialized auditor and 0 otherwise. For assignment criterion 2, we do the same time and create 7 dummy variables named from $ISpec21$ to $ISpec27$.

To test whether different auditor industry specialist designations produce similar statistical results on the relationship between audit industry specialization and audit fees, we regress audit fees on different $ISpec_{ij}$ and compare whether the coefficients of different $ISpec_{ij}$ are the same. We adopt a within assignment criterion approach. That is, for each assignment criterion, we do the regression seven times using seven different $ISpec_{ij}$ each time. The first analysis is to see whether all $ISpec_{ij}$ are significant in the regression. Second, we combine the regression estimates in pairs as seemingly unrelated estimates and analyze whether the coefficients of $ISpec_{ij}$ are the same. The regression model in our test is:

$$\begin{aligned} LnAUDFEE = & a_0 + a_1 LnASSETS + a_2 BIG4 + a_3 INVREC + a_4 ROA + a_5 LOSS \\ & + a_6 MINING + a_7 CROSSLIST + a_8 wLEV + a_9 ISSUE + a_{10} ISpec_{ij} + \varepsilon \end{aligned} \quad (3)$$

i = criterion

j = variable used to calculate auditor industry market shares

All the variables are defined in the appendix A

Audit fees ($LnAUDFEE$) correspond to the fees (log) paid by companies to their auditors for the audit of the year-end financial statements.

We control for client size ($LnASSETS$), because the demand for audit services is likely to increase with firm size, leading to a positive association between firm size and audit fees. Size is measured as the logarithm of total assets. Audit fees are likely to increase with the complexity of clients' business operations. Following past literature, we include the variable $INVREC$ (measured by the proportion of inventories and accounts receivable in the total assets) to proxy for client complexity. All the coefficients of the aforementioned variables are expected to be positive (Simunic 1980; Choi et al. 2010). Prior research also showed a positive association between clients' riskiness and audit fees (Simunic and Stein 1996) and a negative association with client's profitability. Then we include $LOSS$ (if the firm has experienced losses during the current or previous period), LEV (leverage), and ROA (return on assets) to proxy for a client's risk characteristics.

In order to capture the effect of audit quality differentiation on audit fees, we include $BIG4$. A positive coefficient of $BIG4$ means the existence of fee premiums for high-quality auditors belonging to a $BIG4$ international auditing network. To control

for audit demand effects, we include ISSUE (if the firm has issued new long term debt or common equity representing more than 5% of the total assets). Firms involved in equity and debt offerings (Reynolds et al. 2004) are in a greater need of audit services. Considering the specific characteristics of our Canadian sample, we control for the impacts of the cross-listing on a US stock market (CROSSLIST).as previous literature (Seetharaman et al. 2002, Choi et al. 2010) has shown that audit fees increase when the litigation risk is higher. Finally, we include one industry indicator variable (MINING) to control for industry differences.

5. ResearchResults

5.1 Descriptive statistics

Table 4 presents the descriptive statistics of the variables, showing that our sample covers a wide range of companies. The mean assets of sample companies is 1070 thousands (\$CAN), with standard deviation of 3681 thousands. The mean audit fees are 488 thousands, with standard deviation of 1149 thousands. On average, sales revenues generated by sample companies in 2007 were 699 thousands. Proportion of inventory and receivables relative to total assets ranges from 2% to 87%, and the mean ratio is 17%. However, the mean of LOSS shows that about 53% of sample companies reported loss in 2007, consistent with the negative mean ROA. In addition, 23% of the sample firms crosslist in US exchange and more than half of them issued new debt or equity that is more than 5% of the lag total assets in 2007.

[Insert Table 4 here]

Table 5 is the correlation matrix of the variables used in our statistical model. All ISpecij are significantly correlated to each other, but their correlations with other firm-specific variables are somehow different. For instance, all ISpecij significantly correlate to LnAUDFEE except for ISpec15 and ISpec25, indicating that the number of clients may not be appropriate in terms of proxy of audit fees. In addition, ISpec25 does not significantly correlate to BIG4, whereas other ISpecij do. In contrast, only ISpec25 significantly correlates to ROA, LOSS, and ISSUE, whereas others do not. This result indicates that ISpec25 are quite different from other ISpecij. Furthermore, even within the same assignment criterion, there are discrepancies among different ISpecij. For example, for assignment criterion 1, only ISpec11 significantly correlates to INVREC and MINING. For assignment criterion 2, ISpec24 and ISpec25 correlate CROSSLIST significantly, whereas others do not. In sum, the correlation matrix shows that designations of auditor industry specialists resulted from different market share measurements and specialist assignment criteria are different in terms of their correlations with other firm characteristics.

[Insert Table 5 here]

5.2. Results of auditor industry specialists designation

Table 6 summarizes designation results of auditor industry specialist. Panel A presents the results for criterion 1 and Panel B presents the results for criterion 2. In both criteria, industry specialized auditors are Big 4 audit firms. Nevertheless, as shown by Panel A, in criterion 1 the seven measurements of industry market shares do not yield exactly the same industry specialist assignment results. For instance, for Industry 4 (i.e., industry of Food and kindred Products) DTT is assigned as the industry specialized auditor by method 1, 2 and 7, whereas KPMG is assigned as specialist by method 3 and 6. Moreover, in the same industry, method 4 designates EY as the industry specialized auditor but in method 5 the auditor industry specialist becomes PWC. The results descriptively show that even with the same assignment criterion, using different proxies to calculate industry market shares yields inconsistent industry specialized auditors. Similarly, in Panel B, the assignment results of criterion 2 are not consistent as well. For instance, in Industry 1 (i.e., industry of Metal and Coal Mining), PWC and DTT are selected as industry specialized auditors by method 1, 2 and 6. However, in method 3, 4 and 7 three auditors, namely PWC, DTT and KPMG, are assigned as industry specialists. More differently, in method 5, only PWC is designated as auditor industry specialist. In sum, the two tables descriptively show that within the same assignment criterion, different measurements of auditor industry market shares result in different designations of auditor industry specialists, supporting hypothesis 1.

[Insert Table 6 here]

5.3. Results of comparing the effects of different auditor industry specialists designation on audit pricing

To test whether different ISpecij of criterion 1 have the same effect on audit fees, we run the regression of our audit fees pricing model (3), seven times by adding different ISpecij of criterion 1 (i.e., ISpec11 to ISpec17) each time. The regression results are shown in Table 7. We name each regression model according to the ISpec that is included in the model. For example, if ISpec11 is included, the regression model is named MODEL11. As shown in the table, R-squares of all seven regressions are around 0.72 which is satisfactorily high. F-tests are significant for all models. However, not all ISpecij are significant. The coefficient of ISpec12 is significant at 0.05 level with t-statistic of 1.99 ($p=0.046$), while coefficients of ISpec13 and ISpec14 are significant at 0.1 level with t-statistic of 1.72 ($p=0.086$) and 1.83 ($p=0.068$) respectively. ISpecij in other models are not significant. The results support hypothesis 2, suggesting that when the assignment criterion is the largest market shares, the resulting auditor industry specialists from different industry market shares measurements have dissimilar impact on audit fees in terms of significance.

[Insert Table 7 here]

To further test hypothesis 2, we redo the test using criterion 2. That is, we run the regression again seven times by including ISpec21 to ISpec27 each time. The regression results are shown in Table 8. It shows that only the coefficients of ISpec21 and ISpec23 are significant at 0.1 level with t-statistic of 1.71 ($p=0.088$) and 1.92 ($p=0.056$) respectively. However, coefficients of ISpecij are not significant in other models. This result again support hypothesis 2.

[Insert Table 8 here]

Correlation matrix shows that some ISpecij are significantly correlated to other control variables, casting doubt that our estimates may be biased because of multicollinearity. We test the level of multicollinearity in each model and the results are reported in Appendix B. The mean VIFs of each model are low, suggesting that there no severe multicollinearity problem in our tests.

In the next step, we explore the difference in effect magnitude of ISpecij. That is, we test whether the coefficients of different ISpecij from the same assignment criterion are statistically the same. To operationalize the comparison, regression estimates of each model in the same criterion are combined as seemingly unrelated estimates in pairs and the coefficients of ISpecij are tested in pairs. Comparison results for models in criterion 1 and criterion 2 are shown in Table 9, panels A and B, respectively. In Table 9, panel A, coefficients of ISpec11 to ISpec17 are compared in pairs. The table shows that some pairs of ISpec coefficients are significantly different. For instance, chi-square statistic of comparison between coefficients of ISpec12 and ISpec15 is 6.39 ($p=0.0115$), demonstrating that these two coefficients are significantly different at 5% level. Similarly, difference between coefficients of ISpec13 and ISpec16 is also significantly at 5% level. Moreover, differences between coefficients of ISpec13 and ISpec16, and between coefficients of ISpec14 and ISpec15 are significantly different at 1% level. In addition, coefficients of ISpec14 and ISpec16, coefficients of ISpec14 and ISpec17, and coefficients of ISpec15 and ISpec17 are significantly different in pairs at 10% level.

[Insert Table 9 here]

Table 9, panel B summarizes the coefficient comparison results for ISpec in criterion 2 (i.e., compare ISpec21 to ISpec27 in pairs). It shows that coefficient of ISpec25 is significantly different from coefficients of other ISpec. The difference is significant at 1% level between ISpec25 and ISpec21, between ISpec25 and 22, between ISpec25 and ISpec23, between ISpec25 and ISpec24, and between ISpec25 and ISpec26. The difference between the coefficients of ISpec25 and ISpec27 is significant at 5% level. Additionally, coefficients of ISpec23 and ISpec27 are significantly different at 1% level.

In sum, the results show that the impact that different auditor industry specialist designations has on audit fees are not the same. Applying the same regression, we find that with assignment criterion as largest market shares, ISpecij measured from sales, audit fees and total fees are significant.

However, with assignment criterion as market share larger than:

$$\frac{1}{N_{firms}} * 1.2 \text{ (i.e., in our research, the ratio is } (1/6) * 1.2 = 0.2),$$

ISpecij measured from assets and audit fees in are significant at 10% level. Furthermore, when combining the regression estimates as seemingly unrelated estimates to test the difference in effect magnitude of different ISpecij, some coefficient pairs are statistically significant from each other.

6. Conclusion

In this paper, we empirically test whether different measurements of auditor industry specialist results in the same designations of industry specialized auditors for Canadian listed companies. Adopting a within industry market shares approach, we find that with the same industry specialist assignment criterion, different proxies and formulas used to calculate auditor industry market shares produce different industry specialized auditors. Moreover, the firm-level regression of audit fees on different auditor industry designations shows that auditor industry specialist does not always have significant effect on audit fees. When regression estimates are combined as seemingly unrelated estimates and the coefficients of ISpecij are compared in pairs within the same assignment criterion, the difference between some ISpecij coefficients pairs become statistically significant. Our results provide empirical evidence that the effect significance and effect magnitude of different auditor industry specialist measurements on audit fees can be different due to the diversity of market shares calculations. Such evidence, in turn, raises an issue of whether the findings in prior studies are subject to measurement errors of audit industry specialists.

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Table 1: Summary of measurements used by empirical papers

Article	Market share	Portfolio share	Weighted market share	Self-proclaimed
Palmrose (1986)	X			
Hogan and Jeter (1999)	X			x
Balsam et al. (2003)	X			
Krishnan (2003)	X	x		
Dunn (2004)	X			
Carcello and Nagy (2004)	X			
Casterella et al. (2004)	X			
Cairney and Young (2006)	X	x	x	
Huang et al. (2007)	X			
Kwon et al. (2007)	X			
Knechel et al. (2007)	X			
Lim (2008)	X			
Cahan et al. (2008)	X		x	
Gul et al. (2009)	X			

Table 2: Sample Industries

	Industry	# of Firms	Proportion
1	Metal and Coal Mining	211	26%
2	Oil and Gas extraction	151	18%
3	Nonmetallic Minerals	15	2%
4	Food and kindred products	22	3%
5	Wood products	13	2%
6	Paper products, printing and publishing	17	2%
7	Chemical products	55	7%
8	Rubber and misc. Plastic products	10	1%
9	Metal products	15	2%
10	Industrial equipment	16	2%

	Industry	# of Firms	Proportion
11	Electric and electronic equipment	39	5%
12	Transportation equipment	15	2%
13	Instruments and related products	20	2%
14	Transportation services	25	3%
15	Communication services	17	2%
16	Utilities	36	4%
17	Wholesale	21	3%
18	Retail	36	4%
19	Business services	64	8%
20	Other services	26	3%
	Total	824	100%

Table 3: Sample Audit Firms

Panel A: BIG4 vs. Non-BIG4

	# of Obs.	Proportion
BIG4	681	83%
NonBIG4	143	17%

Panel B: Individual Audit Firms

Audit Firm	# of Obs.	Proportion
Deloitte & Touche	143	17.4%
Ernst & Young	131	16.0%
KPMG	209	25.3%
PwC	198	24.0%
Grant Thornton	28	3.4%
BDO Dunwoody	25	3.0%
Other Small Firms	90	10.9%

Table 4: Descriptive Statistics of Variables

Variable	N	mean	sd	min	p25	p50	p75	max
AUDFEE	824	487.6319	1149.271	10	85.2355	177.625	370.61	16200
LnAUDFEE	824	5.301822	1.196639	2.302585	4.445414	5.179668	5.915139	9.692766
ASSETS	824	1070.348	3681.337	1.815	41.7705	126.038	506.8155	46974
LnASSETS	824	5.052315	1.844952	0.5960855	3.732181	4.83658	6.228145	10.75735
TOTALFEE	824	699.0464	1540.485	14.684	140.579	287.25	602.465	20800
NETINC	824	50.26852	286.9952	-969.2	-8.7685	-0.632	15.2965	4057
SALES	824	655.2688	2426.581	0	1.6525	49.2275	256.63	32815
BIG4	824	0.8264563	0.3789466	0	1	1	1	1
INVREC	824	0.1679687	0.1862845	0	0.0243688	0.0881206	0.2648053	0.8734282
ROA	824	-0.0847158	0.3371057	-2.903605	-0.1160116	-0.0082595	0.0572314	2.47734
LOSS	824	0.526699	0.4995899	0	0	1	1	1
MINING	824	0.256068	0.4367249	0	0	0	1	1
CROSSLIST	824	0.2281553	0.4198981	0	0	0	0	1
wLEV	824	0.372784	0.2529987	0.0092233	0.173249	0.3433774	0.5262196	1.302034
ISSUE	824	0.5364078	0.4989756	0	0	1	1	1

Table 5: Variable Correlations

	LnAUDFEE	LnASSETS	BIG4	INVREC	ROA	LOSS	MINING	CROSSLIST	wLEV	ISSUE
LnAUDFEE	1									
LnASSETS	0.7609*	1								
BIG4	0.3198*	0.3015*	1							
INVREC	0.1849*	-0.0714*	-0.0252	1						
ROA	0.1721*	0.3605*	0.0606	0.0706*	1					
LOSS	-0.3499*	-0.4278*	-0.1648*	-0.1790*	-0.4903*	1				
MINING	-0.2777*	-0.1666*	-0.2010*	-0.3616*	-0.0521	0.2721*	1			
CROSSLIST	0.2735*	0.1276*	-0.0258	-0.0875*	-0.1111*	0.0346	0.1316*	1		
wLEV	0.4171*	0.2255*	0.0724*	0.3645*	-0.1070*	-0.1354*	-0.3869*	0.0785*	1	
ISSUE	-0.1681*	0.0001	-0.1176*	-0.2119*	0.1830*	-0.0770*	0.2332*	0.0125	-0.2571*	1
ISpec11	0.1433*	0.1624*	0.2680*	-0.0943*	0.0019	-0.009	0.0908*	0.0271	0.0045	-0.0092
ISpec12	0.1158*	0.1049*	0.2757*	-0.0608	0.0311	0.0091	0.075	-0.0194	-0.0094	-0.0246
ISpec13	0.1303*	0.1075*	0.3068*	-0.0252	0.0435	0.0036	0.0163	0.0051	-0.0035	-0.0462
ISpec14	0.1300*	0.1086*	0.3007*	-0.05	0.0395	0.0126	0.0272	0.0215	-0.0079	-0.0426
ISpec15	0.0482	0.0421	0.3173*	0.0146	0.0244	0.0279	-0.0022	-0.0118	0.0076	-0.0427
ISpec16	0.1062*	0.1154*	0.3129*	-0.058	0.02	0.0105	0.0054	0.02	-0.0166	-0.0237
ISpec17	0.1242*	0.1212*	0.3033*	-0.0555	0.0164	-0.0116	0.0225	0.0423	-0.0038	-0.0192
ISpec21	0.2320*	0.2255*	0.4905*	-0.0674	0.0413	-0.0572	-0.1041*	-0.008	0.0643	-0.0538
ISpec22	0.2331*	0.2261*	0.4549*	-0.0319	0.0545	-0.0555	-0.0597	0.0155	0.0747*	-0.0457
ISpec23	0.2270*	0.2313*	0.5139*	-0.1192*	0.044	-0.0135	0.0698*	0.0598	0.0085	-0.0108
ISpec24	0.2413*	0.2418*	0.5454*	-0.0889*	0.04	-0.0266	0.0357	0.0693*	0.0353	-0.0251
ISpec25	-0.0055	0.1288*	-0.0495	0.3805*	0.4281*	0.6055*	0.5436*	0.7076*	0.6301*	0.5604*
ISpec26	0.2451*	0.2353*	0.5126*	-0.027	0.0515	-0.0598	-0.1303*	-0.0145	0.1144*	-0.0425
ISpec27	0.2552*	0.2609*	0.5413*	-0.0521	0.0548	-0.0632	0.04	0.0674	0.0808*	-0.0369

Table 5: Variable Correlations (continued)

ISpec11	ISpec12	ISpec13	ISpec14	ISpec15	ISpec16	ISpec17	ISpec21	ISpec22	ISpec23	ISpec24	ISpec25	ISpec26	ISpec27
1													
0.7325*	1												
0.2953*	0.4411*	1											
0.3145*	0.5096*	0.9058*	1										
0.2080*	0.4111*	0.7425*	0.6990*	1									
0.4200*	0.3502*	0.7832*	0.6883*	0.6911*	1								
0.5024*	0.4793*	0.7377*	0.8075*	0.6630*	0.8391*	1							
0.5463*	0.5621*	0.6149*	0.5812*	0.4805*	0.6379*	0.6183*	1						
0.5891*	0.6060*	0.6376*	0.6292*	0.4951*	0.6252*	0.6667*	0.8690*	1					
0.4542*	0.4702*	0.5705*	0.5638*	0.4921*	0.5721*	0.5690*	0.7782*	0.7827*	1				
0.3783*	0.4498*	0.5625*	0.5513*	0.5554*	0.5737*	0.5347*	0.7364*	0.7109*	0.8827*	1			
0.6658*	0.5922*	0.5597*	0.6545*	0.7076*	0.6301*	0.5604*	0.6658*	0.5922*	0.5597*	0.6545*	1		
0.5004*	0.5157*	0.5615*	0.5546*	0.5615*	0.5841*	0.5704*	0.9128*	0.8191*	0.7812*	0.7416*	0.7232*	1	
0.4951*	0.5093*	0.5295*	0.5448*	0.4967*	0.5146*	0.5603*	0.7483*	0.8257*	0.8701*	0.8776*	0.5772*	0.7687*	1

Table 6: Summary of Auditor Industry Specialists

Panel A: Assignment Criterion 1: Largest Market Share

Industry	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6	Method 7
1	PWC	PWC	PWC	PWC	PWC	PWC	PWC
2	PWC	PWC	KPMG	KPMG	KPMG	KPMG	KPMG
3	KPMG	KPMG	KPMG	KPMG	PWC	PWC	KPMG
4	DTT	DTT	KPMG	EY	PWC	KPMG	DTT
5	PWC	PWC	KPMG	KPMG	KPMG	KPMG	KPMG
6	DTT	KPMG	DTT	KPMG	None	DTT	KPMG
7	KPMG	EY	EY	EY	EY	KPMG	KPMG
8	PWC	PWC	EY	EY	DTT	PWC	DTT
9	KPMG	KPMG	KPMG	KPMG	KPMG	KPMG	KPMG
10	EY	EY	EY	EY	EY	KPMG	EY
11	EY	EY	KPMG	KPMG	KPMG	KPMG	KPMG
12	EY	EY	EY	EY	DTT	EY	EY
13	PWC	PWC	KPMG	KPMG	EY	KPMG	KPMG
14	PWC	PWC	PWC	PWC	EY	PWC	PWC
15	DTT	DTT	DTT	DTT	DTT	DTT	DTT
16	PWC	PWC	KPMG	KPMG	PWC	PWC	PWC
17	DTT	DTT	DTT	DTT	DTT	DTT	DTT
18	KPMG	KPMG	DTT	KPMG	DTT	DTT	KPMG
19	PWC	KPMG	KPMG	KPMG	KPMG	KPMG	KPMG
20	EY	DTT	EY	EY	PWC	EY	EY

Variables used in each method:

Method 1: assets

Method 2: sales

Method 3: audit fees

Method 4: total fees

Method 5: Number of clients

Method 6: square root of asset

Method 7: square root of sales

Panel B: Assignment Criterion 2: Market Share > 20%

Industry	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6	Method 7
1	PWC, DTT	PWC, DTT	PWC, DTT, KPMG	PWC, DTT, KPMG	PWC	PWC, DTT	PWC, DTT, KPMG
2	PWC, KPMG	PWC, KPMG	KPMG, PWC	KPMG, PWC	KPMG, PWC	KPMG, PWC	KPMG, PWC
3	KPMG, PWC	KPMG	KPMG, PWC	KPMG, PWC	PWC	PWC, KPMG	KPMG
4	DTT, KPMG	DTT	None	EY, KPMG, PWC	PWC, KPMG	None	DTT, PWC, EY
5	PWC, KPMG	PWC, KPMG	KPMG, PWC	KPMG, PWC	KPMG, PWC	KPMG, PWC	KPMG, PWC
6	DTT, KPMG	KPMG, DTT, PWC	DTT, KPMG, PWC	KPMG, DTT, PWC	None	DTT, KPMG	KPMG, DTT, PWC
7	KPMG, EY	EY, KPMG	EY, KPMG	EY, KPMG	EY, KPMG	KPMG, EY	KPMG, EY
8	PWC, DTT	PWC, KPMG, DTT	EY, DTT, KPMG	EY, DTT, PWC	DTT	PWC, DTT, KPMG	DTT, PWC, KPMG
9	KPMG, EY	KPMG, EY	KPMG, EY	KPMG, EY	KPMG	KPMG, EY	KPMG, EY
10	EY, KPMG	EY, KPMG, DTT	EY, KPMG, DTT	EY, KPMG, DTT	EY, KPMG, DTT	KPMG, EY	EY, KPMG, DTT
11	EY, KPMG, PWC	EY, KPMG	KPMG, PWC	KPMG, PWC	KPMG	KPMG, EY, PWC	KPMG, EY
12	EY	EY	EY	EY	DTT, PWC	EY, DTT, PWC	EY, KPMG
13	PWC, KPMG	PWC, KPMG	KPMG, PWC	KPMG, EY, PWC	EY	KPMG, PWC	KPMG, PWC
14	PWC, KPMG	PWC, KPMG	PWC, EY	PWC, EY, KPMG	EY, KPMG, PWC	PWC, KPMG, EY	PWC, KPMG, EY
15	DTT, KPMG	DTT, KPMG	DTT, KPMG	DTT, KPMG	DTT, KPMG	DTT, KPMG	DTT, KPMG
16	PWC, KPMG, EY	PWC, KPMG	KPMG, PWC, EY	KPMG, PWC, EY	PWC, EY, KPMG	PWC, EY, KPMG	PWC, EY, KPMG
17	DTT	DTT	DTT	DTT	DTT, KPMG	DTT	DTT
18	KPMG, DTT	KPMG, DTT	DTT, KPMG	KPMG, DTT	DTT, PWC	DTT, KPMG	KPMG, DTT
19	PWC, DTT, KPMG	KPMG, PWC	KPMG, PWC	KPMG	KPMG, DTT	KPMG, PWC, DTT	KPMG, PWC
20	EY, DTT	DTT, EY	EY, DTT	EY, DTT, PWC	PWC, EY	EY, DTT, PWC	EY, DTT, PWC

Variables used in each method:

Method 1: assets

Method 2: sales

Method 3: audit fees

Method 4: total fees

Method 5: Number of clients

Method 6: square root of asset

Method 7: square root of sales

Table 7: Regression Results of Criterion 1

	MODEL 11		MODEL 12		MODEL 13		MODEL 14		MODEL 15		MODEL16		MODEL 17	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
LnASSETS	0.452	29.58	0.453	29.79	0.453	29.82	0.453	29.82	0.454	29.81	0.454	29.79	0.454	29.79
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
BIG4	0.282	4.33	0.263	4.02	0.265	4.02	0.263	4.00	0.316	4.73	0.293	4.44	0.284	4.31
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
INVREC	1.161	8.28	1.159	8.29	1.153	8.24	1.159	8.28	1.163	8.29	1.158	8.26	1.158	8.26
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
ROA	-0.214	-2.62	-0.221	-2.71	-0.223	-2.73	-0.224	-2.74	-0.213	-2.60	-0.217	-2.65	-0.217	-2.65
		(0.009)		(0.007)		(0.006)		(0.006)		(0.010)		(0.008)		(0.008)
LOSS	-0.043	-0.77	-0.048	-0.85	-0.049	-0.86	-0.049	-0.88	-0.039	-0.68	-0.043	-0.77	-0.044	-0.78
		(0.439)		(0.397)		(0.388)		(0.380)		(0.494)		(0.444)		(0.438)
MINING	-0.099	-1.62	-0.106	-1.74	-0.098	-1.62	-0.099	-1.62	-0.088	-1.45	-0.091	-1.50	-0.094	-1.54
		(0.105)		(0.082)		(0.106)		(0.105)		(0.148)		(0.133)		(0.123)
CROSSLIST	0.545	9.90	0.549	9.98	0.544	9.90	0.543	9.87	0.545	9.89	0.544	9.88	0.543	9.86
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
wLEV	0.622	5.85	0.620	5.84	0.625	5.89	0.624	5.88	0.625	5.88	0.625	5.88	0.625	5.88
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
ISSUE	-0.167	-3.47	-0.166	-3.44	-0.165	-3.43	-0.165	-3.43	-0.168	-3.48	-0.167	-3.48	-0.167	-3.48
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
ISpec	0.055	1.02	0.105	1.99	0.087	1.72	0.093	1.83	-0.040	-0.79	0.013	0.26	0.038	0.75
		(0.308)		(0.046)		(0.086)		(0.068)		(0.432)		(0.794)		(0.451)
_cons	2.338	20.38	2.341	20.50	2.336	20.46	2.336	20.47	2.323	20.34	2.328	20.36	2.331	20.39
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)

Table 7: Regression Results of Criterion 1 (continued)

	MODEL 11	MODEL 12	MODEL 13	MODEL 14	MODEL 15	MODEL16	MODEL 17
Num of obs	824	824	824	824	824	824	824
F(10, 813)	209.55	210.60	210.23	210.37	209.40	209.20	209.38
Prob> F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.7205	0.7215	0.7211	0.7213	0.7203	0.7201	0.7203
Adj R-squared	0.7170	0.7181	0.7177	0.7178	0.7169	0.7167	0.7169

p-value in parentheses

ISpec is calculated based on variables:

Model 11: Assets

Model 12: Sales

Model 13: Audit fees

Model 14: Total fees

Model 15: Number of clients

Model 16: Square root of assets

Model 17: Square root of sales

Table 8: Regression Results of Criterion 2

	MODEL 21		MODEL 22		MODEL 23		MODEL 24		MODEL 25		MODEL 26		MODEL 27	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
LnASSETS	0.452	29.63 (0.000)	0.452	29.60 (0.000)	0.451	29.52 (0.000)	0.452	29.550 (0.000)	0.454	29.89 (0.000)	0.452	29.65 (0.000)	0.453	29.59 (0.000)
BIG4	0.245	3.48 (0.001)	0.259	3.74 (0.000)	0.227	3.12 (0.002)	0.246	3.300 (0.001)	0.344	4.98 (0.000)	0.257	3.59 (0.000)	0.277	3.72 (0.000)
INVREC	1.171	8.36 (0.000)	1.158	8.27 (0.000)	1.166	8.33 (0.000)	1.159	8.280 (0.000)	1.145	8.17 (0.000)	1.162	8.30 (0.000)	1.156	8.25 (0.000)
ROA	-0.219	-2.68 (0.008)	-0.220	-2.69 (0.007)	-0.221	-2.71 (0.007)	-0.219	-2.680 (0.008)	-0.212	-2.60 (0.009)	-0.220	-2.69 (0.007)	-0.217	-2.66 (0.008)
LOSS	-0.048	-0.86 (0.392)	-0.047	-0.84 (0.403)	-0.051	-0.92 (0.360)	-0.049	-0.860 (0.389)	-0.035	-0.63 (0.530)	-0.048	-0.86 (0.393)	-0.044	-0.78 (0.438)
MINING	-0.089	-1.47 (0.143)	-0.094	-1.55 (0.121)	-0.110	-1.80 (0.073)	-0.103	-1.680 (0.094)	-0.102	-1.68 (0.094)	-0.089	-1.47 (0.142)	-0.097	-1.57 (0.116)
CROSSLIST	0.546	9.93 (0.000)	0.544	9.89 (0.000)	0.541	9.83 (0.000)	0.541	9.810 (0.000)	0.545	9.92 (0.000)	0.546	9.92 (0.000)	0.543	9.85 (0.000)
wLEV	0.618	5.82 (0.000)	0.617	5.81 (0.000)	0.617	5.81 (0.000)	0.618	5.810 (0.000)	0.639	6.00 (0.000)	0.613	5.75 (0.000)	0.619	5.80 (0.000)
ISSUE	-0.168	-3.49 (0.001)	-0.168	-3.49 (0.001)	-0.169	-3.52 (0.000)	-0.169	-3.510 (0.000)	-0.164	-3.41 (0.001)	-0.170	-3.53 (0.000)	-0.168	-3.48 (0.001)
ISpec	0.088	1.71 (0.088)	0.068	1.34 (0.179)	0.103	1.92 (0.056)	0.073	1.330 (0.186)	-0.081	-1.60 (0.110)	0.065	1.23 (0.220)	0.030	0.54 (0.587)
_cons	2.338	20.47 (0.000)	2.341	20.42 (0.000)	2.356	20.48 (0.000)	2.348	20.370 (0.000)	2.322	20.35 (0.000)	2.340	20.41 (0.000)	2.337	20.20 (0.000)

Table 8: Regression Results of Criterion 2 (continued)

	MODEL21	MODEL 22	MODEL 23	MODEL 24	MODEL 25	MODEL 26	MODEL 27
Num of obs	824	824	824	824	824	824	824
F(10, 813)	210.22	209.82	210.49	209.80	210.09	209.71	209.28
Prob> F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.7211	0.7207	0.7214	0.7207	0.7210	0.7206	0.7202
Adj R-squared	0.7177	0.7173	0.7179	0.7173	0.7176	0.7172	0.7168

p-value in parentheses

ISpec is calculated based on variables:

Model 21: Assets

Model 22: Sales

Model 23: Audit fees

Model 24: Total fees

Model 25: Number of clients

Model 26: Square root of assets

Model 27: Square root of sales

Table 9 :Results of Ispec Coefficient Comparison

Panel A : ISpec Coefficients Comparison–Criterion 1

	MODEL11	MODEL12	MODEL13	MODEL14	MODEL15	MODEL16
MODEL12	1.71 (0.1915)					
MODEL13	0.25 (0.6164)	0.10 (0.7517)				
MODEL14	0.36 (0.5505)	0.05 (0.8300)	0.12 (0.7321)			
MODEL15	1.97 (0.1600)	6.39 (0.0115)	10.47 (0.0012)	10.58 (0.0011)		
MODEL16	0.52 (0.4724)	2.15 (0.1428)	3.97 (0.0463)	3.71 (0.0541)	1.71 (0.1904)	
MODEL17	0.09 (0.7655)	1.34 (0.2463)	1.77 (0.1836)	2.90 (0.0888)	3.31 (0.0689)	0.86 (0.3530)

Chi-square test, p-value in parentheses

Panel B : ISpec Coefficients Comparison–Criterion 2

	MODEL21	MODEL22	MODEL23	MODEL24	MODEL25	MODEL26
MODEL22	0.44 (0.5072)					
MODEL23	0.13 (0.7198)	0.74 (0.3886)				
MODEL24	0.09 (0.7595)	0.02 (0.9012)	1.43 (0.2318)			
MODEL25	17.21 (0.0000)	10.36 (0.0013)	11.48 (0.0007)	9.06 (0.0026)		
MODEL26	1.45 (0.2283)	0.01 (0.9311)	0.78 (0.3767)	0.03 (0.8624)	14.46 (0.0001)	
MODEL27	1.38 (0.2397)	0.95 (0.3299)	5.41 (0.0020)	1.99 (0.1583)	4.07 (0.0435)	0.54 (0.4645)

Chi-square test, p-value in parentheses

Appendix A: Variable Descriptions

Variable	Description	Calculation
LnAUDFEE	Natural logarithm of audit fees	Natural logarithm of audit fees
LnASSETS	Natural logarithm of assets	Natural logarithm of assets
BIG4	Whether a firm is audited by Big 4 auditors	Equals to 1 if a firm is audited by Big 4 auditors; 0 otherwise
INVREC	Proportion of inventory and receivables relative to total assets	(inventory + receivables) / total assets
ROA	Return on Assets	net income / total assets
LOSS	Whether a firm reported loss in year 2007	Equals to 1 if net income is less than 0; 0 otherwise
MINING	Whether a firm is in the Metal and Coal Mining industry	Equals to 1 if a firm belongs to Mining industry (four-digit SIC code with the beginning two-digit 10 and 12); 0 otherwise
CROSSLIST	Whether a firm crosslists in US exchange	Equals to 1 if EXCHG variable in Compustat is larger than 10; 0 otherwise
wLEV	Leverage ratio, winsorized at 99%	Leverage ratio = total liabilities / total assets
ISSUE	Whether a firm issue new debt or equity that is more than 5% of the lag total assets	Equals to 1 if (change in long-term debt + change in common equity) is larger than 5% of the lag total assets; 0 otherwise
ISpecij	Whether a firm is audited by industry specialized auditor(s) i: criteria: 1= largest market share; 2= market share > 20% j: variables used to calculate industry market share: 1=assets 5=number of clients 2=sales 6= square root of assets 3=audit fees 7=square root of sales 4=total fees	Equals to 1 if a firm is audited by industry specialized auditor(s); 0 otherwise

Appendix B: Test of Multicollinearity

Panel A: Test of Multicollinearity: Regressions Model 11 to Model 17

	Model 11		Model 12		Model 13		Model 14		Model 15		Model 16		Model 17	
	VIF	R-Square	VIF	R-square	VIF	R-square	VIF	R-square	VIF	R-square	VIF	R-square	VIF	R-square
LnASSETS	1.62	0.3816	1.60	0.3759	1.60	0.3753	1.60	0.3753	1.60	0.3752	1.60	0.3759	1.60	0.3758
BIG4	1.24	0.1910	1.25	0.2010	1.27	0.2129	1.27	0.2102	1.30	0.2294	1.27	0.2134	1.26	0.2092
INVREC	1.38	0.2778	1.38	0.2774	1.38	0.2776	1.38	0.2774	1.39	0.2789	1.38	0.2774	1.38	0.2774
ROA	1.54	0.3517	1.54	0.3517	1.54	0.3527	1.55	0.3528	1.55	0.3532	1.54	0.3514	1.54	0.3512
LOSS	1.60	0.3741	1.60	0.3752	1.60	0.3766	1.60	0.3769	1.61	0.3777	1.60	0.3766	1.60	0.3745
MINING	1.45	0.3106	1.45	0.3081	1.43	0.3002	1.43	0.3002	1.43	0.2990	1.42	0.2978	1.43	0.2997
CROSSLIST	1.09	0.0791	1.09	0.0803	1.09	0.0790	1.09	0.0792	1.09	0.0790	1.09	0.0792	1.09	0.0800
wLEV	1.47	0.3192	1.47	0.3191	1.47	0.3188	1.47	0.3188	1.47	0.3189	1.47	0.3190	1.47	0.3188
ISSUE	1.17	0.1470	1.17	0.1473	1.17	0.1476	1.17	0.1477	1.17	0.1470	1.17	0.1469	1.17	0.1469
ISpec	1.12	0.1081	1.11	0.0997	1.12	0.1068	1.12	0.1056	1.13	0.1156	1.12	0.1088	1.12	0.1034
Mean VIF	1.37		1.37		1.37		1.37		1.37		1.37		1.37	
Max VIF	1.62		1.60		1.60		1.60		1.60		1.60		1.60	

Panel B: Test of Multicollinearity: Regressions Model 21 to Model 27

	Model 21		Model 22		Model 23		Model 24		Model 25		Model 26		Model 27	
	VIF	R-Square	VIF	R-square	VIF	R-square	VIF	R-square	VIF	R-square	VIF	R-square	VIF	R-square
LnASSETS	1.61	0.3793	1.61	0.3806	1.62	0.3819	1.62	0.3819	1.6	0.3746	1.61	0.3792	1.62	0.3826
BIG4	1.45	0.3087	1.4	0.2881	1.56	0.3589	1.62	0.3832	1.4	0.284	1.49	0.33	1.61	0.3798
INVREC	1.39	0.2798	1.38	0.2774	1.39	0.2781	1.38	0.2774	1.39	0.2796	1.38	0.2779	1.38	0.2777
ROA	1.54	0.3513	1.54	0.3517	1.54	0.3518	1.54	0.3515	1.54	0.3517	1.54	0.3519	1.54	0.3516
LOSS	1.6	0.3762	1.6	0.3765	1.61	0.3785	1.61	0.3784	1.61	0.3772	1.61	0.3786	1.6	0.3754
MINING	1.42	0.2969	1.42	0.2979	1.46	0.3161	1.45	0.3125	1.44	0.3065	1.42	0.297	1.48	0.3232
CROSSLIST	1.09	0.0792	1.09	0.079	1.09	0.0802	1.09	0.0815	1.09	0.079	1.09	0.0794	1.09	0.0807
wLEV	1.47	0.3196	1.47	0.3204	1.47	0.3197	1.47	0.3202	1.48	0.324	1.48	0.3236	1.48	0.3246
ISSUE	1.17	0.147	1.17	0.147	1.17	0.1472	1.17	0.1473	1.17	0.1486	1.17	0.1484	1.17	0.147
ISpec	1.34	0.2541	1.29	0.2228	1.46	0.3138	1.51	0.3382	1.29	0.2258	1.39	0.2817	1.52	0.3412
Mean VIF	1.41		1.40		1.44		1.45		1.40		1.42		1.45	
Max VIF	1.61		1.61		1.62		1.62		1.60		1.61		1.62	