Self-Selection of Auditors
and Audit Pricing in Private Firms

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Abstract

Prior research has examined audit pricing for publicly held firms and provided some evidence of a Big 8 premium in pricing. We investigate audit pricing among private firms, and provide evidence that private firms do not pay such a premium on average. The relatively greater degree of dispersion in auditor choice (between Big 5 and non-Big 5 auditors) in our large sample of privately held audit clients allows us to predict the auditor choice for each firm and to control for potential self-selection. We reject the null hypothesis that clients are randomly allocated across Big 5 and non-Big 5 auditors. Using standard OLS regressions, we document a Big 5 premium; however this premium vanishes once we control for self-selection bias. Moreover, we find that client firms choosing Big 5 auditors generally would have faced higher fees had they chosen non-Big 5 auditors, given their firm-specific characteristics. Our results are consistent with audit markets for private firms being segmented along cost-effective lines. Further, our results suggest that auditees in our setting do not, on average, view Big 5 auditors as superior in terms of the perceived quality of the services provided to a degree significant enough to warrant a fee premium.
I. INTRODUCTION

The industrial organization of the public accounting profession has been a topic of considerable interest to both researchers and regulators since the 1970s. Important dimensions involve the issues of product differentiation and the effects of competition on audit pricing. Starting with Simunic (1980), several researchers have examined whether the audit market is segmented, whether such segmentation affects audit pricing, and along what dimensions audit markets are segmented. While it is generally acknowledged that audit markets are segmented into at least two categories, large and small auditors, disagreements remain on the other two issues. In this study we compare audit fees across the two auditor groups in a unique setting with the aim of gleaning some new insights into audit pricing, how audit markets work, and along what dimensions the clientele are segmented into Big 5 and non-Big 5 auditees.

In this paper, we focus on a sample of privately held U.K. audit clients. We believe private firms provide an excellent setting to identify and evaluate new dimensions, such as the cost of providing audit services, along which audit markets could potentially be segmented. This setting is particularly appropriate to examine how the Big 5 auditor advantage (if there is one) is viewed when firms face little or no capital-market pressures to hire a “brand-name” auditor. Unlike samples of U.S. listed firms, where over 80% of the clients hire Big 5 auditors, our sample includes fairly equal numbers of clients choosing Big 5 and non-Big 5 auditors. In a setting where there is no threat of anything approaching monopoly power by the larger auditors, clients will pay a premium to obtain the services of a Big 5 auditor only if they believe the quality offered (benefits received) to be superior to an extent sufficient to justify such a premium.

Further, private firms are a significant portion of the UK economy and of the market for audit services. For example, private firms constituted 99.9% of all private non-agricultural entities in 1993 Europe (Mulhern 1995). Over 90% of registered U.K. companies are private (Companies House,
U.K.), and, in our sample of firms, we find that over 50% of the audit fees received by U.K. auditors are attributable to private firms. Several recent studies also rely upon the unique or differing attributes of private firms to improve our understanding of issues in financial accounting literature (e.g., Ball and Shivakumar, 2002; Beatty, Ke and Petroni, 2002; and Beaver, McNichols and Nelson, 2002). Our study is positioned along similar lines.

We expect private firms to have significantly different demand and supply functions for audits as compared to listed firms. There are several reasons why a Big 5 fee premium might not be observed among private firms. For example, Big 5 fee premiums may not be observed for these firms if such a fee premium is primarily related to litigation risks, as the risks of litigation are in general low for private firms. Similarly, private firms are more closely held than listed firms, and their shareholders take a more active role in management, on average. This closer relationship may reduce agency conflicts as well as the demand for financial statements as a monitoring mechanism (Fama and Jensen, 1983). Hence, private firms may not be willing to pay a higher audit fee to obtain the services of a Big 5 auditor.

On the other hand, there are several equally convincing reasons why Big 5 fee premiums might be observed among private firms. First, accounting information may actually play a more important role in the evaluation of managerial performance at private firms for the very reason that these firms lack market measures of firm value. To the extent that the information generated by the accounting system is used to determine personnel and compensation decisions (Blackwell, Brickley, and Weisbach, 1994), the quality of financial statements becomes particularly relevant for private held firms lacking other (market-based) measures. Many private firms are not entirely run by owner/managers, in which case agency conflicts continue to create the need for monitoring of management (Ang, Cole, and Lin, 2000). In addition to the potential usefulness of high quality reporting in monitoring and compensation decisions,
private firms concerned about obtaining financing at the lowest possible cost may believe that Big 5 auditors will facilitate that goal (Beatty, 1989).

Also, a private firm may wish to cultivate a relationship with a Big 5 auditor to establish a credible measure of value in view of the possibility of going public in the future or of being targeted for acquisition. Further, privately held clients may believe that a Big 5 auditor can provide superior tax expertise or advisory services. Finally, auditor choice may also be influenced by the quality of non-audit services provided by the auditor. Thus, private firms may attach value to the superior reputation of Big 5 auditors if they believe that the reputation reflects enhanced quality. Given opposing arguments for (and against) the existence of a Big 5 fee premium among private firms, we empirically investigate this issue.¹

Apart from examining audit pricing in private firms, the paper also addresses econometric issues in the literature. Despite the large number of studies examining audit fee issues, relatively few econometric advances have been made in this area of research. Notable exceptions include Copley, Gaver and Gaver (1995) and Ireland and Lennox (2001). Most studies of audit pricing include a dummy variable for the actual auditor choice in the audit fee regressions. However, as suggested by Copley, Gaver and Gaver (1995) and Ireland and Lennox (2001), the actual auditor choice is likely to be endogenous in these regressions. Since client firms are not randomly assigned to audit firms, it is probable that firms self-select into Big 5 and non-Big 5 auditees based on firm characteristics, private information, or other unobservable characteristics. We adopt the classical econometric selection model (Heckman, 1978; Lee, 1979) to address potential bias in the standard OLS regressions due to self-selection.

¹ Still another possibility is that Big 5 auditors may charge lower fees as the result of economies of scale (Simunic, 1980; Francis and Stokes, 1986). However, economies of scale are likely to extend to all large clients, irrespective of whether the firm is privately held or publicly listed.
In addition, most prior studies restrict the slope coefficients in audit fee regressions to be the same across Big 5 and non-Big 5 clients, allowing only the intercept to vary between the two groups. In contrast, we argue that slope coefficients are likely to differ across auditor groups, and we test the empirical validity of this conjecture. More specifically, we suggest that auditors structure their business in a manner appropriate for their specific client segments, with Big 5 auditors investing more in technology, training and facilities and, as a result, carrying out audits more efficiently for large, relatively complex clients. The costs of these investments result in a relatively high fixed component of audit fees, which may be unattractive (and costly) for small and less complex clients. Thus, we predict that the intercept in audit fee regressions is higher for Big 5 clients, but that the slope coefficients on variables associated with increased levels of audit effort or risk are generally smaller.

Using the two-stage Heckman approach to test for self-selection, we reject a null hypothesis that clients are randomly allocated across Big 5 and non-Big 5 auditors. After controlling for self-selection, we find no evidence of a Big 5 auditor fee premium. On average, client firms in our sample choose auditors that minimize their audit fees. Client-firms that choose Big 5 auditors generally would have faced higher fees had they gone to a non-Big 5 auditor, given their firm-specific characteristics. Further, we find that the slope coefficients in audit fee regressions differ significantly across Big 5 and non-Big 5 auditors, suggesting that Big 5 auditors have a different fee structure from non-Big 5 auditors. Consistent with our arguments on audit market segmentation, the intercept for Big 5 auditors is larger than that for non-Big 5 auditors, while the slope coefficients on proxies for size and complexity tend to be smaller.

Our paper makes several contributions to the literature. First, we show that a Big 5 premium is not observed in a setting where firms do not feel compelled by market pressures to hire a brand-name
auditor but face a more balanced choice. Second, we explore the possibility that the market for audit services is segmented along cost-efficient lines and present evidence consistent with this argument.

Third, we propose and demonstrate an approach for addressing self-selection issues in the audit fee literature, which may be applied in a number of settings relevant to accounting research where choice variables are included in the research design.

The remainder of the paper is organized as follows. Section 2 presents the model specification, Section 3 describes the data and results, and Section 4 concludes the paper.

II. MODEL SPECIFICATION

Overview

Most studies examining the existence (or non-existence) of a Big 5 auditor fee premium estimate the following OLS regression:

\[ F_i = \beta' X_i + \gamma \text{Big } 5_i + \epsilon_i, \]  

where, \( F_i \) is the audit fee; Big 5 is a dummy variable that takes the value 1 if the actual auditor is one of the Big 5 auditors, and 0 otherwise. The remaining explanatory variables (\( X_i \)) capture other client and auditor characteristics that affect fees. A significant positive coefficient for \( \gamma \) in the above model is generally interpreted as evidence consistent with the existence of a Big 5 auditor fee premium. This approach, although straightforward, relies on at least two implicit assumptions. First, the regression assumes that the incremental costs of choosing a Big 5 auditor are constant across all firms, which justifies the use of a dummy variable to capture pricing differences across auditor types. This assumption can be restrictive, as it does not

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2 This, however, does not necessarily imply that capital-market pressures drive the Big 5 fee premium documented in prior studies for listed firms.

3 The above model, as well as the other models discussed in this section, is an application of the treatment effects model where the benefit or cost associated with a particular treatment (defined broadly to include any choice or decision) is evaluated. A central problem in this evaluation literature is the estimation of counterfactuals, which is the expected outcome under the alternative treatment state. The econometric issues relating to these models are
allow for interactive effects between auditor type and firm characteristics and ignores differences in the demand for Big 5 auditors. Second, the model implicitly assumes that auditors are randomly allocated to client firms, which rationalizes the inclusion of Big 5 as an exogenous variable in the regression. This paper examines the validity of these assumptions for our sample of private client-firms.

**Self-Selection in Auditor Choice**

Theoretical studies (Trueman and Titman, 1986; Datar, et al., 1991) present signaling models to explore the self-selection of auditors by clients, and it is widely accepted in principle that clients self select their auditors. From an econometric perspective, self-selection introduces a bias in the standard OLS regressions. To address this point more formally, consider the following equations:

**Auditor choice equation:**

\[ \text{Big } 5_i^* = \alpha / Z_i + u_i \]  

Big 5 = 1 if Big 5^* > 0  

Big 5 = 0 if Big 5^* ≤ 0

**Audit-fee equation:**

\[ F_{0i} = \beta_0 / X_i + \varepsilon_{0i} \] if Big 5 = 0  

\[ F_{1i} = \beta_1 / X_i + \varepsilon_{1i} \] if Big 5 = 1

where \( X_i \) and \( Z_i \) are vectors of exogenous variables and the error terms, \( u_i, \varepsilon_{0i}, \varepsilon_{1i} \), are assumed to be normally distributed with mean zero and variance-covariance matrix given by:

\[
\text{Covariance}(\varepsilon_{0i}, \varepsilon_{1i}, u_i) = 
\begin{bmatrix}
\sigma_{00} & \sigma_{01} & \sigma_{0u} \\
\sigma_{01} & \sigma_{11} & \sigma_{1u} \\
\sigma_{0u} & \sigma_{1u} & \sigma_{uu}
\end{bmatrix}
\]

extensively examined in the program evaluations literature, and our discussions here draw heavily upon this literature (e.g., Heckman, Lalonde and Smith (1999), Moffitt (1991) and Maddala (Chapter 9, 1983)).
This self-selection model, which is based on Lee (1979), is quite general in that it allows for simultaneity in the auditor choice and audit-fee equations, as well as for self-selection. The model also allows slope coefficients and the error terms in the fee equations to vary across auditor types.\textsuperscript{4,5}

Allowing slope coefficients to differ across auditor groups is important in our setting as our arguments related to market segmentation imply that the intercept in the fee regressions should be higher for Big 5 clientele, while the slope coefficients on complexity, size and audit risks should generally be lower.

Standard OLS regressions of the self-selection model are potentially mis-specified. To show this, we take the conditional expectations of the residuals in equations (3) and (4).

\[
E(\varepsilon_0 \mid \text{Big 5}=0) = E(\varepsilon_\alpha \mid u_i \leq -\alpha' Z_i) = -\sigma_{0u} \left[ \frac{\phi(-\alpha' Z_i)}{\Phi(-\alpha' Z_i)} \right] \equiv \sigma_{0u} \lambda_{0i},
\]

\[
E(\varepsilon_1 \mid \text{Big 5}=1) = E(\varepsilon_\alpha \mid u_i > -\alpha' Z_i) = \sigma_{1u} \left[ \frac{\phi(-\alpha' Z_i)}{1 - \Phi(-\alpha' Z_i)} \right] \equiv \sigma_{1u} \lambda_{1i}.
\]

The functions \( \phi \) and \( \Phi \) are the standard normal probability density function and the cumulative distribution function, respectively; \( \sigma_{0u} \) and \( \sigma_{1u} \) are the covariances of the residuals from the non-Big 5 and Big 5 audit-fee equations, respectively, and the residuals from the auditor-choice equation. In the above equations, if \( \sigma_{0u} \neq 0 \) or \( \sigma_{1u} \neq 0 \), then the conditional expectations are non-zero, causing standard OLS regression to be mis-specified.\textsuperscript{6} Moreover, in this case, OLS regressions yield biased estimates for

\textsuperscript{4} The standard simultaneous equations model for Big 5 auditor choice and total audit fees as implemented in Copley, Gaver and Gaver (1995) can be viewed as a special case of the above self-selection model (Heckman 1978; Lee 1979). Relative to the self-selection model, the standard simultaneous equations model makes the following additional assumptions: (a) the marginal fees for choosing Big 5 auditors (i.e., fee differential across Big 5 and non-Big 5 auditors) are observable and (b) the coefficients and the error terms in the fee equations are restricted to be the same across Big 5 and non-Big 5 auditors.

\textsuperscript{5} Ireland and Lennox (2001) estimate a similar self-selection model, but focus only on differences in intercepts and ignore differences in slope coefficients across the Big 5 and non-Big 5 samples.

\textsuperscript{6} Testing whether \( \sigma_{0u} = 0 \) and \( \sigma_{1u} = 0 \) is, in fact, the test for self-selection (see Madala (1983) pg. 259).
the primary parameter of interest, namely the average benefit or cost of auditor choice. To see this, note that the average benefit or cost of auditor choice is given by:

For non-Big 5 clients:  \[
F_0 - E(F_i | \text{Big 5} = 0) = \overline{F_0} - \beta_1 \overline{X} - \sigma_{1u} \overline{\lambda_0}
\]

For Big 5 clients:  \[
F_1 - E(F_0 | \text{Big 5} = 1) = \overline{F_1} - \beta_0 \overline{X} - \sigma_{0u} \overline{\lambda_1}
\]

where a bar over a variable denotes its cross-sectional average.\(^7\) If \(\sigma_{0u}\) is positive, then the fee differential estimated from OLS regressions will be biased upward for Big 5 clients as \(\overline{\lambda_1} > 0\). Similarly, if \(\sigma_{1u}\) is positive, then the fee differential estimated from OLS regressions will be biased downward for non-Big 5 clients, as \(\overline{\lambda_{1u}} < 0\).

**Implementation and identification**

Using the two-stage procedure of Heckman (1979) and Lee (1979), we estimate the self-selection model. In the first stage, consistent estimates for \(\alpha\) are obtained from a probit regression of the dummy variable, Big 5, on \(Z_i\). These estimates are used to compute the inverse Mills ratios (IMR), \(\lambda_{0i}\) and \(\lambda_{1i}\). Then, in the second stage, the audit fee equation is estimated by OLS with the inverse Mills ratio included as an additional explanatory variable. Our self-selection model is given as:

**Probit Regression:**  \[\text{Big 5} = \alpha_1 + \alpha_2 \text{Size}_i + \alpha_3 \text{Aturn}_i + \alpha_4 \text{DA}_i + \alpha_5 \text{Curr}_i + \alpha_6 \text{Quick}_i + \alpha_7 \text{ROA}_i + \alpha_8 \text{ROA*Loss}_i + \alpha_9 \text{Export}_i + u_i\]  

**OLS regression:**  \[\text{Lfee}_i = \beta_{j1} \text{Size}_i + \beta_{j2} \text{Atturn}_i + \beta_{j3} \text{Export}_i + \beta_{j4} \text{Cur}_i + \beta_{j5} \text{DA}_i + \beta_{j6} \text{ROA}_i + \beta_{j7} \text{ROA*Loss}_i + \beta_{j8} \text{Yrend}_i + \beta_{j9} \text{Yrend*} + \beta_{j10} \text{Size}_i + \beta_{j11} \text{London_dum}_i + \beta_{j12} \text{Abs_excep}_i + \beta_{j13} \text{Abs_excep}_i + \beta_{j14} \text{Abs_excep}_i + \epsilon_{ji}\]

where:

\(^7\) In equations (5) and (6), all variables and firm characteristics that determine fees, including \(\lambda_j\) (j=0,1), are obtained from a particular auditor type. However, the parameters (\(\beta_j\) and \(\sigma_{ju}\), j=0 or 1) are obtained from the alternative auditor type.
\( j \) = 0 for non-Big 5 client firms; 1 for Big 5 client firms.

Lfee \(_{i}\) = Logarithm of audit fees

Big 5 \(_i\) = 1 if firm \( i \) chose a Big 5 auditor in year \( t \); 0 otherwise.

Size \(_{i}\) = Logarithm of end of year total assets

Aturn \(_{i}\) = Asset turnover, calculated as sales divided by total assets

Export \(_{i}\) = Sales outside United Kingdom divided by total sales

Curr \(_{i}\) = Current assets divided by total assets

DA \(_i\) (Debt-Asset ratio) = Long-term debt divided by total assets

Quick (quick ratio) = Current assets minus inventory divided by current liabilities

ROA \(_i\) = Earnings before interest and taxes divided by total assets

Loss \(_i\) = 1 if the firm incurred a loss in the previous year; 0 otherwise

Yrend \(_i\) = 1 if the firm’s year-end occurs in either December or March

London_dum \(_i\) = 1 if the auditor is located in London; 0 otherwise.

Abs_excep = Absolute value of exceptional or extraordinary items included in earnings during the year, divided by total assets

The coefficients, \( \beta_{0,0} \) and \( \beta_{0,1} \), are the estimates for \( \sigma_{0u} \) and \( \sigma_{1u} \), which are the covariances of the residuals from the non-Big 5 or Big 5 audit-fee equation and the residuals from the auditor-choice equation.

The motivation for, and predictions of, our explanatory variables follow. Consistent with previous studies, we hypothesize that auditee size, complexity and risk affect both fees and the choice of the audit firm. We initially discuss the explanatory variables used in the second-stage audit fee regressions, followed by a discussion of the association between the variables and auditor choice (first-stage regression). The predicted signs for the variables are presented in Tables 3 and 4.

We use the logarithm of total assets and asset turnover (sales divided by total assets to attenuate collinearity with total assets) to control for audit effort. To control for audit risk, we include variables for financial structure and profitability of the client firm. Following Francis (1984), quick ratio and leverage are included to measure the short-term and long-term financial structures of the client firm. Since the relationship between ROA (our measure of profitability) and fees is likely to be more important for loss-making firms than for profitable firms as litigation claims largely follow losses, we allow the coefficient on ROA to differ across profit and loss-making firms. The audits of receivables and inventory require specific audit procedures because these items are viewed as relatively high-risk assets; to capture this,
we include current assets as a percentage of total assets as an additional explanatory variable in the regressions. We also include the fraction of sales earned from exports.

The self-selection model allows the slope coefficients and the intercept in the audit fee regression to vary across Big 5 and non-Big 5 clients. This is important since our arguments on market segmentation predict differences in cost functions across these client firms. Specifically, if Big 5 auditors invest more in technology, training, etc., then the intercept in the fee regression of Big 5 clients will be larger, reflecting the Big 5 auditors’ compensation for their increased investments. However, this larger investment will allow Big 5 auditors to conduct audits more efficiently, particularly for large, risky and relatively complex clients. In such a case, we expect the slope coefficients on variables associated with audit effort or risk to be smaller for these clients.

The self-selection model can be estimated only if it satisfies the identification condition, which requires the vectors $X_i$ and $Z_i$ to have elements that are not common. However, the probit regression (10) is identified even in the absence of any exogenous variables in $Z_i$ because of its non-linearity (see Wills and Rosen, 1979). To identify the audit fee equation (11), we include the following variables in the audit fee equation and not in the auditor choice equation: (a) $Y_{rend}$, a dummy variable equal to 1 if year-end is either March or December and 0, otherwise, (b) $London_{dum}$, a dummy variable that takes the value 1 if the auditor office is located in London and 0 otherwise, and (c) $Abs_{excep}$, the absolute value of exceptional or extraordinary items included in earnings (scaled by total assets).

The year-end dummy variable is included to control for off-peak pricing. However, since larger clients are often continuously audited throughout the year, the incremental workload around fiscal year-ends may be relatively lower for these firms; thus we allow the year-end coefficient to vary with client size. Following Ireland and Lennox (2001), we include a dummy for London audit offices to control for the relatively higher overhead costs that these auditors are likely to face. Finally, we include the absolute
value of exceptional or extraordinary items in earnings to control for both incremental audit risks and audit work related to these items.

For our first stage (auditor choice) regression, we include the same variables with the exceptions noted above. We expect larger companies to be more likely to hire Big 5 audit firms for various reasons, including the perception that larger auditors are better equipped to handle the audit efficiently. Firms with high asset turnover may be either more or less likely to prefer a large auditor, as this variable may capture transaction complexity or, alternatively, may reflect a lessened necessity to audit large dollar volumes of assets per dollar of sales.

Agency costs tend to be higher in highly leveraged clients, and such firms may prefer to hire auditors of “superior” reputation to reduce agency costs. Also, to the extent that Big 5 auditors have generally wider experience and arguably better-trained personnel, they may be able to audit riskier clients more efficiently. We also expect firms with relatively heavy export activity to prefer Big 5 auditors because larger auditors are better equipped to handle the geographical dispersion and complexity of such audits. We include profitability measures to consider the possibility that auditor choice might be influenced by firm profitability or the presence of a recent loss.

III. INSTITUTIONAL DETAILS, DATA AND RESULTS

Institutional Background and Data

All limited liability companies in the U.K. can be classified as either public companies or private companies. All limited liability firms are required by the U.K. Companies Act to submit a copy of their full financial statements annually to the Companies House. The financial statements must be prepared in accordance with U.K. GAAP irrespective of whether the firm is public or private. However, small and medium sized companies are required to submit only abridged versions of their financial statements to the
Companies House. During our sample period, financial statements submitted to the Companies House must be audited unless annual sales are less than £350,000. Tax laws do not discriminate between public and private companies and, hence, are unlikely to give rise to any differences across these firms.

The data source for this study is the “Financial Analysis Made Easy” (FAME) database supplied by Bureau Van Dijk. This database provides accounting data on over 100,000 private British companies for fiscal years ending after January 1989. Since data availability is limited in initial years, we restrict our sample period to the five-year period 1994-1998. The database includes only companies that either have annual turnover in excess of £750,000, pre-tax profits greater than £45,000 or shareholders’ funds greater than £750,000. Further, we exclude firms with less than £1 million in total assets, since many of the variables, including audit fees, are rounded to the nearest thousand and their inclusion could introduce significant noise in the analyses. Finally, banks, insurance and other financial institutions are excluded from the FAME database. We eliminate firms that changed organization type during our sample period (i.e., converted from private to listed or listed to private), as well as any firm-year in which the fiscal year was not exactly twelve months. In addition, we screened out observations for which book value of total assets changed by over 30% from the prior year, as these were often firm-years in which a major acquisition, restructuring or divestment occurred. Our final sample consists of a yearly median of 15,255 (mean of 15,484) private firm observations.

Descriptive Statistics

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8 Small sized companies have (i) sales turnover of not more than £2.8 million, (ii) total assets (book value) of not more than £1.4 million and (iii) average number of employees of not more than 50 for the last two years. Medium sized companies are larger than small companies and have (i) annual sales revenue of not more than £11.2 million, (ii) total assets (book value) of not more than £5.6 million and (iii) an average number of employees of not more than 250 for the last two years.

9 Fiscal years are converted into calendar years using the same approach as COMPUSTAT; that is, fiscal years ending before May 31\textsuperscript{st} are treated as belonging to the previous calendar year, while those ending on or after June 1\textsuperscript{st} are classified as belonging to the same calendar year as the year in which the financial statements are prepared.

10 Our results remain unchanged whether we include or exclude these observations.
Table 1 reports descriptive information for our sample of firms. We present the mean and standard deviation for each variable used in our regressions, first for all audit clients and then separately for auditees of Big 5 and non-Big 5 auditors. The audit fee for the average Big 5 client is £24,153 (≈US $38,645), while the audit fee for the average non-Big 5 client is £11,365 (US $18,184). Means and medians were virtually identical for our sample, so we present only the means of the yearly data. We test for differences between Big 5 and non-Big 5 clients using a t-test, and the medians of the yearly t-tests are presented in the last column of Table 1. As shown in this column, all but two of the variables (ROA and Quick) are significantly different for Big 5 and non-Big 5 auditees.

The mean of total assets for firms in our sample is £24.3 million (US $38.9 million). In comparison, Francis and Simon (1987) report average total assets of US $30 million for their sample of 220 US listed firms, while Chan et al. (1993) report average total assets of £233 million for their sample of 985 UK quoted firms. For Big 5 auditees, the mean is £41.8 million (US $66.9 million), while for non-Big 5 auditees it is £6.8 million (US $10.9 million). For the average Big 5 auditee, 17.6% of their sales come from sales to other countries (exports). This compares to about 10.7% exports for non-Big 5 clients in our sample. The average leverage, defined as the ratio of long-term debt to total assets (DA), is about 12.0% for Big 5 auditees and 10.1% for the non-Big 5 clientele. The quick ratio and the ratio of current assets to total assets are higher for clients of Big 5 auditors (although not statistically different for the quick ratio). In addition, the mean return on assets (ROA) is not statistically different for Big 5 and non-Big 5 auditees in our sample. Among Big 5 clients, average earnings are negative about 23% of the time (Loss). This figure decreases to about 18.5% for non-Big 5 clients. Big 5 clients have December or March year-ends 69% of the time, while only 54% of non-Big 5 clients have peak year-ends. Big 5 clients have London-based auditors 39.4% of the time, and non-Big 5 clients have auditors
from London 43.5% of the time. Finally, the absolute value of exceptional or extraordinary items reported in earnings averaged 0.8% of total assets for Big 5 clients but only 0.6% for non-Big 5 clients.

Table 2 presents the correlations among the variables used in estimating our models. As seen in this table, the correlation between audit fees and client size is 70%, and the correlation between client size and the choice of a Big 5 auditor is 35%. As expected, the correlation between return on assets and the presence of a loss in the prior year is quite high (-71%). Other notable correlations include those between export activity and the variables for firm size (21%), audit fees (28%), and the choice of a Big 5 auditor (15%).

Model Estimation

Auditor-choice regression results

Table 3 presents the results of our estimation of the probit regression described in equation (10). In predicting auditor choice, all of our explanatory variables are statistically significant in each year of our sample, with the exception of the quick ratio, which is significant in only one of the five years at p<0.10. We find that firms characterized as relatively larger and more highly levered, with a larger portion of assets represented by current assets and with greater foreign involvement, are more likely to choose Big 5 auditors.

To assess the accuracy of our stage one classification, we chose a cut-off level of 50%; i.e., if the probability of choosing a Big 5 auditor is greater than 50%, we assume the firm would make that choice. Based on this cut-off, our classification is accurate, on average, 68.5% of the time. Also note that approximately half the firms in our sample chose Big 5 auditors each year, with a slightly downward trend in more recent years (ranging from a high of 51.8% in 1994 to a low of 48.6% in 1998).11

11 The proportion of Big 5 auditors increases monotonically across size deciles for our sample, from a low of 28% for the smallest decile of firms to a high of 87% for the largest decile, on average.
**Audit fee regression results**

Tables 4 and 5 present the estimates from the regression of audit fees on the explanatory variables. For comparison with prior studies, Table 4 presents the results based on single-stage estimation with the actual auditor choice (BIG 5) variable included, while Table 5 presents the two-stage regression results using the self-selection model.\textsuperscript{12} Since the dependent variable in this regression (i.e. Lfee) is highly serially correlated, we do not estimate equation (2) as a panel regression.\textsuperscript{13} We instead estimate equation (2) on an annual basis and present the means and medians from these annual cross-sectional regressions. Further our results are generally quite consistent across years so we do not report individual yearly results.

For the single-stage estimation presented in Table 4, there are 15,255 private firms in the median year with data available for the regressions. For the median year, the regression model explains 57\% of the cross-sectional variation in audit fees. This adjusted R-square is comparable to the R-squares reported in earlier studies for listed firms.\textsuperscript{14} Further, we find that when the actual auditor choice variable is included as a dummy variable in the regression, the coefficient on auditor choice is significantly positive. The mean coefficient of 0.061 on the Big 5 dummy variable suggests that, on average, Big 5

\textsuperscript{12} The t-statistics reported throughout the paper are based on heteroskedasticity-consistent standard errors. Further, for the self-selection model, the standard errors are corrected to account for the fact that an explanatory variable is an estimate from another statistical model. The t-values are based on the method proposed by Greene (1981) to estimate consistent standard errors.

\textsuperscript{13} For the same reason, we do not rely on the Fama-Macbeth t-statistic (which assumes observations are serially uncorrelated) as a control for potential cross-correlation in the annual regressions.

\textsuperscript{14} For example, Simunic (1980) reports adjusted R-squares from an audit fee regression model of 51\% for large clients and 28\% for small clients, on average. Francis and Stokes (1986) report adjusted R-squares of 76\% for their large client sample and 45\% for their small client sample.
fears are 6.3% higher than non-Big 5 fees.\textsuperscript{15} The coefficients on the control variables are generally consistent with our expectations.\textsuperscript{16} We discuss the control variables in more detail in subsequent tables.

In Table 5, we present our estimation of regression equation (11), which is estimated separately for Big 5 and non-Big 5 auditees. This specification includes the inverse Mill’s ratio (IMR) from stage one (\(\lambda_{it0} \text{ or } \lambda_{it1}\)), which controls for potential self-selection bias in the second stage. The significance of the coefficients on the IMR suggests the importance of controlling for self-selection bias. Further, by estimating the regressions separately for Big 5 and non-Big 5 auditors, our approach allows the slope coefficients to vary across the two groups.

We initially consider the significance of our control variables, as presented in Panel A of Table 5. The signs (and significance) of the coefficients are the same in most cases for Big 5 and non-Big 5 auditee samples. The coefficient on leverage (DA) is statistically insignificant. However, the coefficient on the quick ratio, a measure of short-term financial risk, is significantly negative (-0.002 and -0.009 for Big 5 and non-Big 5 samples, respectively). The coefficient on return on assets (ROA) is significantly negative, consistent with lower fees for more profitable firms, for the Big 5 sample. However, the coefficient on ROA*Loss is not significant. For non-Big 5 clients, the opposite is true; i.e., the coefficient on return on assets is not significant while the coefficient on ROA*Loss is significantly negative, suggesting that non-Big 5 auditors do not charge higher fees for less profitable clients except in the presence of a prior year loss.

\textsuperscript{15} The economic interpretation for the coefficient on Big 5 dummy is based on the method described in Simon and Francis (1988, p. 263, fn. 7).

\textsuperscript{16} Comparing the coefficients in Table 4 with those reported in Chan et al. (1993) for a sample of 985 UK listed companies from 1989, among variables that are comparable, we observe that the intercept is larger, the coefficient on profitability more negative, and the coefficient on the Big 5 dummy more positive for the listed firms in their sample. The coefficient on client size is similar across the two studies. Although the results in these two studies are not directly comparable because of differences in model specification, the above differences in coefficients are consistent with listed firms facing higher audit fees relative to private firms.
The coefficient on the dummy variable for year-end as well as the coefficient on size*year-end are statistically insignificant for both the Big 5 and the non-Big 5 clients. We find a positive, statistically significant coefficient on our London office variable. Finally the coefficient on the abs_excep variable is significantly positive, consistent with an expectation that fees are higher when extraordinary or exceptional gains or losses are reported in earnings. In general, the results from the above regressions show that the variables suggested in prior studies as important in explaining the audit fees of listed companies are relevant for private firms as well.

The coefficients on $\lambda_0$ and on $\lambda_1$ are significant for both the Big 5 and non-Big 5 auditee samples, suggesting that OLS regressions that ignore self-selection will yield biased results. We address this bias directly in the next section.

The mean and median statistics from a joint F-test of whether the slope coefficients (excluding intercept) are significantly different between Big 5 and non-Big 5 client groups are reported in panel B of Table 5. The coefficients are significantly different in every year 1994 through 1998 at less than the 1% level. These results reject empirical specifications that require slope coefficients to be the same across Big 5 and non-Big 5 auditors. In comparing the individual slope coefficients between Big 5 and non-Big 5 client groups, we find that the coefficients for nine of the fourteen explanatory variables (including the intercept) differ significantly between the groups. We find significant differences for coefficients on our variables for size, asset turnover, current ratio, quick ratio, ROA, ROA*Loss, and the London office variable. Of these, the only slope coefficient that is significantly larger in absolute value in the Big 5 client regressions is asset turnover. We speculate that non-Big 5 auditors may focus their efforts and expertise on auditing companies with higher asset turnover; thus the increment charged for this particular variable is less for non-Big 5 than for Big 5 auditors. The generally larger coefficients on non-Big 5 variables (and significantly lower intercept) are consistent with our expectation that non-Big 5 auditors charge larger
increments for measures reflecting increased audit complexity (but a smaller fixed component). This notion is further developed in subsequent paragraphs.

Given the evidence of self-selection bias (and differences in slope coefficients), we evaluate the existence of a Big 5 auditor fee premium in our sample by computing the difference between the actual audit fee paid and the fee that the firm would have paid, on average, had the alternative choice on auditor-type been made [E(Alternate fee)]. As mentioned previously, we follow Chapter 9 of Maddala (1983) and Heckman, Lalonde and Smith (1999), both of which provide detailed discussions of self-selection bias and evaluation problems that require estimation of counterfactuals. We compute this difference in each year and report the mean and median in the last row of Panel A. We present the comparative data first for firms actually choosing Big 5 auditors, and then for firms choosing non-Big 5 auditors. The differences are negative in every year, suggesting that if Big 5 auditees had chosen non-Big 5 auditors, their audit fees would have been higher. The difference is statistically significant in every year 1994 through 1998 (not reported). Similarly, in the final comparison of Table 5, Panel A, we find that if non-Big 5 auditees had chosen to hire Big 5 auditors, their fees [E(Alternate fee)] would also have been significantly higher on average than the actual fees paid.

These results suggest that firms, on average, self-select an auditor type that minimizes their audit fees. Explanations for a Big 5 auditor fee premium that are based on superior reputation or deeper pockets of Big 5 auditors imply that firms choosing Big 5 auditors pay higher fees than the amount they would have paid had they chosen a non-Big 5 auditor. However, our results indicate just the opposite and do not support the view that, on average, Big 5 auditors charge more than that which would have been charged by non-Big 5 auditors, given the firms' characteristics.
Our findings are consistent with audit markets being differentiated along dimensions other than reputation or deep-pockets. More specifically, auditors appear to structure their businesses in a manner that appeals to specific client segments. For instance, Big 5 auditors invest more in technology, training and facilities, enabling them to carry out audits more efficiently for large, relatively complex clients. However, the fixed costs of these investments may not be attractive to small clients in general. These arguments are supported with the larger intercepts and smaller slope coefficients observed for Big 5 client-firms. Overall, the results are consistent with firms self-selecting the most cost-effective auditor given their firm-specific characteristics.

**Robustness Tests**

As stated previously, our methodology enables us to deal with two distinct econometric concerns: potential self-selection bias and the possibility that the slope coefficients on the various control variables differ across Big 5 and non-Big 5 auditor groups. Our first robustness test is structured to ascertain whether allowing for slope coefficients to differ between the two client groups would suffice to explain the difference between the traditional OLS regression results presented in Table 4 and our two-stage results presented in Table 5.

We re-estimate the OLS regression as shown in Table 4, but now separately for the Big 5 and non-Big 5 auditor groups. The F-test for a null hypothesis that all slope coefficients are equal across the auditor-groups is rejected in every year. Using the coefficients from these regressions, we next calculate a comparison of actual and expected (alternative) fees based on this specification for our sample of Big 5 clients to see if a Big 5 premium exists. Table 6 presents the benefit or cost of choosing...
a Big 5 auditor, based on this specification, relative to the fees that the firms would have faced if a non-
Big 5 auditor were chosen instead. In Panel A of Table 6, we see evidence of a Big 5 auditor premium
when all Big 5 auditor clients are included. Therefore, it is not merely the failure to control for
differences in slope coefficients between the samples that explains the difference in results between a
single-stage OLS estimation and a self-selection adjusted analysis.

Adjusted for self-selection bias, our results suggest that the unobserved, or surprise, element in
auditor choice plays an important role in the audit fee regressions. To test this prediction more directly,
we next estimate the above OLS regressions for samples of firms where the predicted auditor choice
agrees with (differs from) the actual auditor choice. For this analysis, firms are predicted to choose a
Big 5 auditor (non-Big 5 auditor) if the estimated probability from probit regression equation (10) is
greater (lower) than 0.5.

The rationale behind these regressions is that for firms whose auditor choice is predicted from
observable characteristics, the surprise element in auditor choice is likely to be small and relatively
unimportant in audit pricing. For this sample, the self-selection bias in the OLS regressions, if any, is
expected to be small. Hence, if the Big 5 fee premium reported in Panel A of Table 6 arises from the
surprise element in the self-selection model (i.e., $\lambda_0$ and $\lambda_1$), then we expect these firms not to bear a Big
5 fee premium. In contrast, the self-selection bias is relatively more important for firms where the
predicted auditor choice differs from the actual choice, and so we expect to see a Big 5 fee premium for
this sample.

Panel B of Table 6 presents the results for firms making predicted choices, while Panel C
presents the results for firms making unexpected choices (based on our stage one model and a 50% cut-
off prediction). As observed in Table 2, over two-thirds of our sample firms fall into the category of
firms making expected auditor choices. For these firms, the OLS regressions do not provide any
evidence of a Big 5 auditor fee premium. In fact, the average difference between the Big 5 auditor fee and the expected fee if they had chosen a non-Big 5 auditor is −0.025 (t-stat= -2.05) for these firms. This negative difference is consistent with our earlier findings that client-firms in general choose auditors that minimize their audit fees. However, a Big 5 auditor fee premium is observed for firms making unexpected choices (difference between actual and alternative fee of 0.058, on average, with a t-stat of 5.21). These results are consistent with our earlier findings based on the Heckman approach and indicate that self-selection resulting from unobservable characteristics significantly biases the OLS estimation of Big 5 auditor fee premiums.

Finally, we examine the sensitivity of our results to non-linearities in the relationship between audit fees and the explanatory variables by repeating the analyses using rank regressions. Also, we sort our sample firms into size tertials and repeat the tests. These modifications do not affect our conclusions. We find no evidence of a Big 5-auditor fee premium for any of the size tertials.

IV. CONCLUSION

We investigate audit pricing among private firms in the context of both demand-side and supply-side factors affecting the pricing of audit services. The predominance of private companies in the economy makes a study of their auditor choice decision and audit fee determination interesting in its own right. But more importantly, as suggested by prior studies (Ball and Shivakumar, 2002; Beatty, Ke and Petroni, 2002), important differences exist between private and listed firms, suggesting that findings documented in the audit pricing literature for listed firms may not necessarily extend to private firms. Our results are consistent with the notion that auditees, when not compelled by market pressures to choose a Big 5 auditor, choose the lowest-cost auditor available; further, our results suggest that clients in our setting, on average, do not view Big 5 auditors as superior in terms of the perceived quality of services provided to a degree sufficient to justify a fee premium.
The paper also addresses econometric issues in the literature for audit pricing. The relatively greater degree of dispersion in auditor choice (between Big 5 and non-Big 5 auditors) in our large sample of privately held UK audit clients offers us the opportunity to estimate the predicted auditor choice for each firm and then to use information from this first-stage regression in our fee analysis. In addition, most prior studies restrict the slope coefficients in audit fee regressions to be the same across Big 5 and non-Big 5 clients, allowing only the intercept to vary across the two groups. These studies often implicitly assume that biases arising from self-selection of auditors by client firms are relatively unimportant. This paper examines the validity of these assumptions for our sample of private client firms.

Using the two-stage Heckman approach, we find no evidence of a Big 5-auditor fee premium. However, we do find evidence consistent with firms choosing auditors that minimize their audit fees. We suggest that auditors structure their businesses in a manner appropriate for specific client segments. For instance, Big 5 auditors invest more in technology, training and facilities, enabling them to carry out audits more efficiently for large, relatively complex clients. However, the fixed costs of these investments may not be attractive to small clients in general. Consequently, private firms self-select, on average, the most cost-effective auditor types, given their firm-specific characteristics.

Finally we note that this paper examines only the direct costs associated with the selection of a particular auditor type. Since we are unable to measure the indirect effects of auditor choices (such as cost of capital, cost of litigation, etc.), we cannot conclude that private firms necessarily benefit in terms of total costs, but only in terms of audit fees. We leave this issue for future research.
References


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All means are the average of the yearly means for each variable for the years 1994 through 1998, and the standard deviation is the average of the yearly standard deviations over the same period.

**Variable Definitions:**

- **Big 5** = 1 if the firm chooses a Big 5 auditor, 0 otherwise
- **Export** = Sales outside United Kingdom divided by total sales
- **Size** = Logarithm of end of year total assets
- **DA (Debt-Asset ratio)** = Long-term debt divided by total assets
- **Curr** = Current assets divided by total assets
- **Quick (quick ratio)** = Current assets minus inventory divided by current liabilities
- **Lfee** = Logarithm of the auditor’s fee
- **Aturn** = Sales divided by total assets
- **ROA** = Earnings before interest and taxes divided by total assets
- **Loss** = 1 if the firm incurred a loss in the previous year, 0 otherwise
- **Yrend** = 1 if the firm’s year ended in either December or March, 0 otherwise
- **London_dum** = 1 if the auditor is located in London, 0 otherwise.
- **Abs_excep** = Absolute value of exceptional or extraordinary items included in earnings during the year, divided by total assets
Table 2
Spearman cross-correlations

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For each of years 1994 to 1998, the Spearman cross-correlations are estimated across firms in the sample. The mean correlations across years are presented in the table. The variables are defined in Table 1.
Table 3
Demand Equation Estimated by Year

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<tr>
<td>Intercept</td>
<td>-4.336</td>
<td>-4.069</td>
<td>-4.014</td>
<td>-4.245</td>
<td>-4.659</td>
<td>-4.695</td>
</tr>
<tr>
<td>Size</td>
<td>+</td>
<td>0.443</td>
<td>0.421</td>
<td>0.416</td>
<td>0.438</td>
<td>0.470</td>
</tr>
<tr>
<td>Aturn</td>
<td>-</td>
<td>-0.049</td>
<td>-0.034</td>
<td>-0.054</td>
<td>-0.061</td>
<td>-0.055</td>
</tr>
<tr>
<td>DA</td>
<td>+</td>
<td>0.181</td>
<td>0.060</td>
<td>0.146</td>
<td>0.131</td>
<td>0.283</td>
</tr>
<tr>
<td>Curr</td>
<td>+</td>
<td>0.621</td>
<td>0.001</td>
<td>0.587</td>
<td>0.578</td>
<td>0.668</td>
</tr>
<tr>
<td>Quick</td>
<td>+</td>
<td>0.002</td>
<td>0.004</td>
<td>0.004</td>
<td>0.004</td>
<td>0.668</td>
</tr>
<tr>
<td>ROA</td>
<td>?</td>
<td>1.882</td>
<td>1.549</td>
<td>1.743</td>
<td>2.176</td>
<td>1.913</td>
</tr>
<tr>
<td>Export</td>
<td>+</td>
<td>0.355</td>
<td>0.239</td>
<td>0.286</td>
<td>0.250</td>
<td>0.431</td>
</tr>
</tbody>
</table>

N = 15,484
% Correctly Classified = 68.5
% Using Big 5 = 50.1

The probit-equation estimated is:

$$ \text{Big 5}_t = \beta_1 + \beta_2 \text{Size}_t + \beta_3 \text{Aturn}_t + \beta_4 \text{DA}_t + \beta_5 \text{Curr}_t + \beta_6 \text{Quick}_t + \beta_7 \text{ROA}_t + \beta_8 \text{ROA*Loss}_t + \beta_9 \text{Export}_t + \mu_t $$

where Big 5 = 1 if firm i chose a Big 5 auditor in year t; 0 otherwise, Size = Logarithm of end of year total assets, Aturn = Sales/total assets, DA (Debt-Asset ratio) = Long-term debt divided by total assets. Curr = Current assets divided by total assets, Quick (quick ratio) = Current assets minus inventory divided by current liabilities, ROA = Earnings before interest and taxes divided by total assets, Loss = 1 if the firm incurred a loss in the previous year, 0 otherwise and Export = Sales outside United Kingdom divided by total sales.
Table 4
Single-Stage Audit Fee OLS Regression Coefficients
(Using Big 5 Dummy Variable)

<table>
<thead>
<tr>
<th></th>
<th>Hyp. Sign</th>
<th>Mean Coefficient</th>
<th>Mean t value</th>
<th>Median Coefficient</th>
<th>Median t-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td></td>
<td>-2.698</td>
<td>-43.21</td>
<td>-2.713</td>
<td>-42.89</td>
</tr>
<tr>
<td>Big 5</td>
<td>?</td>
<td>0.061</td>
<td>5.62</td>
<td>0.062</td>
<td>5.53</td>
</tr>
<tr>
<td>Size</td>
<td>+</td>
<td>0.541</td>
<td>75.46</td>
<td>0.544</td>
<td>74.79</td>
</tr>
<tr>
<td>Atturn</td>
<td>+</td>
<td>0.072</td>
<td>20.02</td>
<td>0.073</td>
<td>20.74</td>
</tr>
<tr>
<td>Export</td>
<td>+</td>
<td>0.300</td>
<td>14.27</td>
<td>0.293</td>
<td>13.86</td>
</tr>
<tr>
<td>Curr</td>
<td>+</td>
<td>0.257</td>
<td>11.79</td>
<td>0.248</td>
<td>11.42</td>
</tr>
<tr>
<td>DA</td>
<td>?</td>
<td>-0.048</td>
<td>-2.22</td>
<td>-0.051</td>
<td>-2.33</td>
</tr>
<tr>
<td>Quick</td>
<td>-</td>
<td>-0.002</td>
<td>-8.22</td>
<td>-0.001</td>
<td>-8.64</td>
</tr>
<tr>
<td>ROA</td>
<td>-</td>
<td>-0.236</td>
<td>-3.63</td>
<td>-0.205</td>
<td>-3.55</td>
</tr>
<tr>
<td>ROA*Loss</td>
<td>-</td>
<td>-0.279</td>
<td>-2.84</td>
<td>-0.217</td>
<td>-2.17</td>
</tr>
<tr>
<td>Yrend</td>
<td>+</td>
<td>0.119</td>
<td>1.67</td>
<td>0.116</td>
<td>1.61</td>
</tr>
<tr>
<td>Yrend*Size</td>
<td>-</td>
<td>-0.017</td>
<td>-2.09</td>
<td>-0.015</td>
<td>-1.84</td>
</tr>
<tr>
<td>London_dum</td>
<td>+</td>
<td>0.079</td>
<td>7.73</td>
<td>0.071</td>
<td>7.22</td>
</tr>
<tr>
<td>Abs_excep</td>
<td>+</td>
<td>0.300</td>
<td>3.03</td>
<td>0.340</td>
<td>3.47</td>
</tr>
<tr>
<td>Adj. R-square</td>
<td></td>
<td>0.565</td>
<td>0.568</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The regression estimated is:

\[
\text{Lfee}_{it} = \beta_1 + \beta_2 \text{Big 5}_{it} + \beta_3 \text{Size}_{it} + \beta_4 \text{Atturn}_{it} + \beta_5 \text{Export}_{it} + \beta_6 \text{Curr}_{it} + \beta_7 \text{DA}_{it} + \beta_8 \text{Quick}_{it} + \beta_9 \text{ROA}_{it} + \beta_{10} \text{ROA*Loss}_{it} + \beta_{11} \text{Yrend}_{it} + \beta_{12} \text{Yrend*Size}_{it} + \beta_{13} \text{London_dum}_{it} + \beta_{14} \text{Abs_excep}_{it} + \mu_t
\]

Separate yearly regressions are estimated for years 1994 to 1998, and the mean and median values across the regressions are presented.

where:
- Big 5 = 1 if the firm chooses a Big 5 auditor, 0 otherwise
- Export = Sales outside United Kingdom divided by total sales
- Size = Logarithm of end of year total assets
- DA (Debt-Asset ratio) = Long-term debt divided by total assets
- Curr = Current assets divided by total assets
- Quick (quick ratio) = Current assets minus inventory divided by current liabilities
- Lfee = Logarithm of the auditor’s fee
- Atturn = Sales divided by total assets
- ROA = Earnings before interest and taxes divided by total assets
- Loss = 1 if the firm incurred a loss in the previous year, 0 otherwise
- Yrend = 1 if the firm’s year ended in either December or March, 0 otherwise
- London_dum = 1 if the auditor is located in London, 0 otherwise.
- Abs_excep = Absolute value of exceptional or extraordinary items included in earnings during the year, divided by total assets
Table 5
Two-Stage Audit Fees Regressions (Controlling for Self-Selection)

Panel A: Regressions for Big 5 and Non-Big 5 Firms

<table>
<thead>
<tr>
<th>Hyp. Sign</th>
<th>Big 5 Firms</th>
<th>Non-Big 5 Firms</th>
<th>t-stat for diff. in coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>Intercept</td>
<td>-1.971</td>
<td>-7.32</td>
<td>-2.010</td>
</tr>
<tr>
<td>Size</td>
<td>+ 0.481</td>
<td>22.71</td>
<td>0.483</td>
</tr>
<tr>
<td>Aturn</td>
<td>+ 0.098</td>
<td>15.57</td>
<td>0.115</td>
</tr>
<tr>
<td>Export</td>
<td>+ 0.309</td>
<td>9.56</td>
<td>0.304</td>
</tr>
<tr>
<td>Curr</td>
<td>+ 0.215</td>
<td>4.86</td>
<td>0.197</td>
</tr>
<tr>
<td>DA</td>
<td>-0.049</td>
<td>-1.71</td>
<td>-0.040</td>
</tr>
<tr>
<td>Quick</td>
<td>-0.002</td>
<td>-6.73</td>
<td>-0.001</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.387</td>
<td>-3.64</td>
<td>-0.374</td>
</tr>
<tr>
<td>ROA*Loss</td>
<td>-0.016</td>
<td>-0.01</td>
<td>0.053</td>
</tr>
<tr>
<td>Yrend</td>
<td>+ 0.009</td>
<td>-0.09</td>
<td>0.022</td>
</tr>
<tr>
<td>Yrend*SIZE</td>
<td>-0.004</td>
<td>-0.31</td>
<td>-0.007</td>
</tr>
<tr>
<td>London_dum</td>
<td>+ 0.038</td>
<td>2.58</td>
<td>0.040</td>
</tr>
<tr>
<td>Abs_excep</td>
<td>+ 0.234</td>
<td>2.43</td>
<td>0.352</td>
</tr>
<tr>
<td>Lambda (λ)</td>
<td>-0.167</td>
<td>-2.25</td>
<td>-0.184</td>
</tr>
<tr>
<td>Adj-R-square</td>
<td>0.57</td>
<td>0.57</td>
<td>0.46</td>
</tr>
<tr>
<td>Actual Fee -E(Alt.Fee)</td>
<td>-0.82</td>
<td>-220.18</td>
<td>-0.94</td>
</tr>
</tbody>
</table>
Table 5 (contd)

Panel B: F test for Differences in Slope Coefficients between Big 5 and Non-Big 5

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-Value</td>
<td>12.03</td>
<td>10.31</td>
</tr>
<tr>
<td>Pr.&gt;F</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Panel A reports estimates from the following regression:
\[
\text{Lfee}_i = \beta_1 + \beta_2 \text{Size}_i + \beta_3 \text{Atum}_i + \beta_4 \text{Export}_i + \beta_5 \text{Curr}_i + \beta_6 \text{DA}_i + \beta_7 \text{Quick}_i + \beta_8 \text{ROA}_i + \beta_9 \text{ROA}_i \times \text{Loss}_i + \beta_{10} \text{Yrend}_i + \beta_{11} \text{Yrend}_i \times \text{Size}_i + \beta_{12} \text{London_dum}_i + \beta_{13} \text{Abs_excep}_i + \beta_4 \lambda_i + \epsilon_i
\]

where \(\lambda\) is the inverse-Mills ratio. The rest of the variables are defined in Table 4. The t-statistics are based on the method proposed by Greene (1981) to estimate consistent standard errors when using the Heckman approach. The mean and median values of the coefficients and t-statistics from yearly regressions are presented for the Big 5 and the non-Big 5 firms in the first six columns. In the last two columns, the mean and median t-statistics from testing the null hypothesis that the individual coefficients are the same for Big 5 and non-Big 5-auditors are presented. Panel B reports mean and median statistics from a joint F-test that all slope coefficients (with the exception of intercept) in the yearly regressions are the same across Big 5 and non-Big 5 auditors.
### Table 6
Treatment Effects of Big 5 Auditors

<table>
<thead>
<tr>
<th>Panel</th>
<th>Actual Fee– E(Alt. fee)</th>
<th>Mean Values</th>
<th>Median Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Difference in Fees</td>
<td>t-stat</td>
</tr>
<tr>
<td><strong>Panel A: All Firms</strong></td>
<td></td>
<td>0.040</td>
<td>4.45</td>
</tr>
<tr>
<td><strong>Panel B: Firms making predicted choices</strong></td>
<td></td>
<td>-0.025</td>
<td>-2.05</td>
</tr>
<tr>
<td><strong>Panel C: Firms making unexpected choices</strong></td>
<td></td>
<td>0.053</td>
<td>4.82</td>
</tr>
</tbody>
</table>

The table presents the mean and median values and the associated t-statistics, from yearly computation of the treatment effects. Each year, the treatment effect is measured for Big 5-auditees as the difference in average actual fees paid by these firms and the fees that they would have paid had they selected the alternative auditor-type, E(Alt. fee).

E(Alt. fee) is computed by multiplying model parameters, estimated for Non-big-auditors sample, with averages of explanatory variables for Big-auditees. The audit-fee model used to estimate the parameters is:

\[
\text{Lfee}_i = \beta_1 + \beta_2 \text{Size}_i + \beta_3 \text{Aturn}_i + \beta_4 \text{Export}_i + \beta_5 \text{Curr}_i + \beta_6 \text{DA}_i + \beta_7 \text{Quick}_i + \beta_8 \text{ROA}_i + \beta_9 \text{ROA}_i \times \text{Loss}_i + \beta_{10} \text{Yrend}_i + \beta_{11} \text{Yrend}_i \times \text{Size}_i + \beta_{12} \text{London dum}_i + \mu_i
\]

where the variables are defined in Table 4.

Panel A reports results from using all firms in the sample, while Panels B and C report results for sub-samples of firms. Panel B repeats the analyses for the sub-sample of firms whose choice of auditor-type is consistent with the predicted auditor-type, while Panel C repeats the analyses for firms whose auditor-choice is not consistent with the predicted auditor type. Firms are classified as making predicted (unexpected) auditor-choice if the auditor type predicted from probit model reported in Table 3 agrees with (differs from) the actual auditor choice. A firm is predicted to choose a Big 5 (non-Big 5) auditor if the estimated probability from the probit model is greater (less) than 0.5.