The Large Audit Firm Fee Premium: A Case of Selectivity Bias?

JEN C. IRELAND*
CLIVE S. LENNOX**

Audit fee studies often find large (Big 5) audit firms earn significantly higher fees than small (non–Big 5) firms, but they treat auditor choice as exogenous. In contrast, this paper takes into account that companies are not randomly assigned to audit firms. We find the effects of auditor selection bias on audit fees are statistically and economically significant. Consistent with the predictions of analytical research, our results suggest large (small) audit firms experience advantageous (adverse) selection in attracting high (low) quality companies. Our results indicate the premium earned by large audit firms is more than twice as large when selectivity effects are taken into account (53.4% compared to 19.2%).

1. Introduction

There have been several empirical studies of the determinants of audit fees, many of which include among the explanatory variables a dummy for audit firm size (see Moizer [1997] for a review of the audit fee literature). In a competitive audit market, a fee differential between audit firms represents a return to higher quality. It is therefore important to estimate the premium charged by large audit firms in order to assess the quality differential between large and small auditors. We find the approach of previous audit fee studies significantly underestimates the size of the large audit firm fee premium.

As Moizer (1997) notes, audit fee studies reach different conclusions about the existence and size of premiums. Fee premiums have been found in Australia, New Zealand, the United Kingdom, Hong Kong, Singapore, and India, with estimates ranging from 16.5 to 36.0 percent (Francis [1984]; Francis and Stokes [1986]; Craswell et al. [1995]; Firth [1985]; Johnson et al. [1995]; Chan et al. [1993]; Pong and Whittington [1994]; DeFond et al. [2000]; Gul [1999]; Lee [1996]; Simon et al. [1992]; Simon et al. [1986]). Audit fee studies in other countries find conflicting results. In the United States, Simunic (1980) finds no premium whereas Palmrose

*University of Bristol
**Hong Kong University of Science and Technology
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(1986) and Simon and Francis (1988) find premiums of 16–17 percent. In Canada, Chung and Lindsay (1988) find no premium while Anderson and Zeghal (1994) find premiums for small clients only. Other studies find no premiums in Malaysia (Simon et al. [1992]), Norway (Firth [1997]), the Netherlands (Langendijk [1997]), and South Africa (Simon [1995]). All these studies test for a fee premium by including among the explanatory variables a dummy for audit firm size. However, it is invalid to treat the auditor size dummy as exogenous because companies are not randomly assigned to audit firms. Although we observe the fees companies pay to their chosen audit firms, we do not observe the fees they would have paid to audit firms of alternative size.

This paper controls for the effects of auditor selection on the estimated fee premium using a two-stage model. In the first stage, we model UK companies' selection of audit firms. In the second stage, we estimate audit fee models in order to determine the effects of selectivity on the estimated premium. Our estimated fee premium before controlling for selectivity is 19.2 percent, similar to the 24 percent premium estimated by Pong and Whittington (1994) for the United Kingdom. However, the estimated premium is more than twice as large (53.4%) when we account for auditor selection. If selectivity effects are ignored the estimated premium is biased downwards because large auditors' clients pay lower fees than randomly selected clients would pay to large auditors. This is consistent with high quality companies selecting large audit firms and paying lower fees because they require less audit work (Titman and Trueman [1986]; Thornton and Moore [1993]).

Extant theory and empirical research suggest it is appropriate to treat auditor choice as endogenous, as we do in this paper. Titman and Trueman (1986) and Datar et al. (1991) present signalling models in which high quality companies prefer more accurate auditors. Empirical studies of auditor choice start from the premise that companies choose whether to hire large or small audit firms (Francis and Wilson [1988]; Johnson and Lys [1990]; DeFond [1992]; Firth and Smith [1992]). The endogenous treatment of auditor choice in these papers contrasts with its exogenous treatment in extant audit fee research.

In addition to estimating the effects of auditor selection bias, our paper differs from prior research in two respects. First, we include some variables in the auditor choice model but exclude them from the audit fee model in order to provide power for our selectivity tests. The variables we use are the proportion of board members who are nonexecutives and board members' affiliations with audit firms. Although previous auditor choice studies do not include these variables, we find they are significantly associated with audit firm size. In particular, a company is more likely to select a large audit firm when the board consists of a high proportion of nonexecutives and when board members are affiliated with large audit firms. Second, the selectivity adjustment is sensitive to departures from the assumption that audit fee residuals are normally distributed (Maddala [1983]). We find log transformations do not result in normally distributed residuals whereas rank transformations do. We therefore use rank-transformations whereas most audit fee studies (which do not rely so heavily on the normality assumption) use log transformations.

Section 2 details the economic intuition underlying selectivity bias and describes the auditor selection and audit fee models estimated in the paper. Section 3 outlines the data and Section 4 evaluates the impact on audit fees of audit firm size and selectivity bias.

2. Model Specification

2.1 Estimating the Large Audit Firm Fee Premium

2.1.1 IGNORING AUDITOR SELECTION EFFECTS

Previous studies examine the determinants of audit fees (AF_i) by assuming a model of the following form:

$$\text{AF}_i = \beta_0 + \beta_1' X_i + \beta_2' Z_i + \beta_3 \text{AUD}_i + u_i. \tag{1}$$

The X_i variables capture the effects of client characteristics on audit fees, while the Z_i variables capture the effects of auditor characteristics other than size. The effects of audit firm size are captured using a dummy variable (AUD_i), which equals one if company *i* selects a Big 5 auditor and equals zero if company *i* selects a non–Big 5 auditor. Studies often find positive and statistically significant coefficients on audit firm size ($\hat{\beta}_3 > 0$) and conclude there is a large audit firm fee premium. However, $\hat{\beta}_3$ is potentially a biased estimate of the premium since AUD_i is endogenous. In particular, clients choose whether to hire large or small audit firms. We find $\hat{\beta}_3$ in equation (1) significantly understates the true size of the large audit firm fee premium ($\hat{\beta}_3 < \beta_3$).

Equation (1) hypothesizes that audit firms of different sizes charge different fees. Under laboratory conditions, we would test this hypothesis by comparing the fees that all companies would pay to both large and small audit firms. In practice, however, we only observe the fees companies are charged by their selected audit firms. We do not observe the fees companies would pay if they selected audit firms of different size classes.

In order to understand the economic intuition for why auditor selection biases the estimated premium, it is important to understand that client characteristics affect both fees and audit firm choice. Some client characteristics are readily observable and can be directly controlled for. For example, large companies tend to hire large audit firms and also tend to pay high audit fees. If observable factors such as client size are included in the set of X_i variables (eq. [1]), they will not cause $\hat{\beta}_3$ to be biased. Although we can directly control for many client characteristics, characteristics that are not observable to the academic researcher may affect both fees and auditor choice and thereby cause bias.

In order to see how auditor selection biases the estimated premium, consider eq. (2), which is an auditor choice probit model.

$$\text{AUD}_i^* = \gamma_0 + \gamma_1' X_i + \gamma_2' Y_i + v_i, \tag{2}$$

where

$$\text{AUD}_i = 1 \text{ if } \text{AUD}_i^* > 0$$
$$\text{AUD}_i = 0 \text{ otherwise}$$

In eqs. (1) and (2), the X_i variables affect both audit fees and auditor selection. In contrast, the Z_i and Y_i variables affect only audit fees and auditor selection, respectively. If unobservable client characteristics affect both auditor choice (v_i) and audit fees (u_i), then $E(u_i v_i) \neq 0$. This implies $E(u_i \text{AUD}_i) \neq 0$ and so $\hat{\beta}_3 \neq \beta_3$. In other words, the fee premium in eq. (1) is estimated with bias if AUD_i is endogenous.

We can sign the expected direction of the bias if we make assumptions about how unobserved client characteristics affect auditor choice (v_i) and audit fees (u_i). The quality of internal accounting controls and management integrity are potentially important characteristics that are unobservable to the researcher. These quality characteristics bias the estimated premium if they simultaneously affect auditor choice and audit fees. Analytical studies indicate high-quality companies are more likely to hire large audit firms and are more likely to pay low audit fees. Titman and Trueman (1986) show high-quality companies are more likely to hire large audit firms for signaling reasons. Similarly, Thornton and Moore (1993) argue that companies with strong internal controls are more likely to choose high-quality auditors. Thornton and Moore (1993) predict that audit fees are negatively associated with internal control strength, which is consistent with auditors doing less substantive testing when internal controls are strong. Statement of Auditing Standards 400 states "where tests of control provide satisfactory evidence as to the effectiveness of accounting and internal control systems, the extent of relevant substantive procedures may be reduced" (Auditing Practices Board [1995]).

According to these arguments, high quality companies are simultaneously more likely to hire large audit firms and pay lower audit fees [$E(u_i v_i) < 0$]. From eqs. (1) and (2), $E(u_i v_i) < 0$ implies $E(u_i \text{AUD}_i) < 0$ and so $\hat{\beta}_3 < \beta_3$. In this case, a comparison of fees paid by large and small auditors' clients biases downward the estimated fee premium in eq. (1).

2.1.2 CONTROLLING FOR AUDITOR SELECTION EFFECTS

We employ the two-step procedure of Heckman (1979) to control for selection effects. First, we estimate a probit auditor selection model and use the results to generate inverse Mills ratios (these are discussed later in the paper). Next, we include the inverse Mills ratios in audit fee regressions for large and small auditors' clients in order to correct for selectivity bias. Our results show the estimated fee premium is significantly biased downward if the inverse Mills ratios are omitted from the regressions.

To simplify notation, the auditor selection model (eq. [2]) is written as

$$\text{AUD}_i^* = \gamma_0 + \gamma_1' X_i + \gamma_2' Y_i + v_i \equiv \gamma' W_i + v_i, \tag{3}$$

where $\gamma' \equiv [\gamma_0{:}\gamma_1'{:}\gamma_2']$ and $W_i \equiv [1{:}X_i{:}Y_i]$.

The audit fee models for large and small audit auditors' clients are

$$\mathrm{AF}_{1i} = \beta_{10} + \beta_{11}'X_i + \beta_{12}'Z_i + u_{1i}, \tag{4}$$

$$\mathrm{AF}_{0i} = \beta_{00} + \beta_{01}'X_i + \beta_{02}'Z_i + u_{0i}, \tag{5}$$

where AF_{1i} and AF_{0i} are the fees company i would pay to large or small audit firms, respectively. Recall that only one of AF_{1i} and AF_{0i} is observed for each company i, depending on whether the company chooses a large or small auditor. Our selectivity corrections (discussed later) control for the fact that we do not observe the fees companies would have paid if they had chosen audit firms of alternative size. From eqs. (4) and (5), our estimate of the large audit firm fee premium is $\hat{\beta}_{10} - \hat{\beta}_{00}$. If there is a large audit firm fee premium, the intercept in eq. (4) is bigger than the intercept in eq. (5) (i.e., $\hat{\beta}_{10} > \hat{\beta}_{00}$).

Unlike eq. (1) and most previous studies, eqs. (4) and (5) do not impose the restriction that the coefficients on the X_i and Z_i variables are the same for large and small audit firms (i.e., we do not impose the restriction that $\beta_{11}' = \beta_{01}'$ and $\beta_{12}' = \beta_{02}'$).[1] We assume the error terms in eqs. (4), (5) and (3) (u_{1i},u_{0i}, and v_i) have a trivariate normal distribution, with mean vector zero and covariance matrix:

$$\Omega = \begin{bmatrix} \sigma_1^2 & \sigma_{10} & \sigma_{1v} \\ \sigma_{10} & \sigma_0^2 & \sigma_{0v} \\ \sigma_{1v} & \sigma_{0v} & \sigma_v^2 \end{bmatrix}.$$

We show why simple regressions of eqs. (4) and (5) can result in selectivity bias by taking conditional expectations:

$$E[\mathrm{AF}_{1i} \mid \mathrm{AUD}_i = 1] = \beta_{10} + \beta_{11}'X_i + \beta_{12}'Z_i + E[\mathrm{u}_{1i} \mid \mathrm{AUD}_i = 1],$$
$$E[\mathrm{AF}_{0i} \mid \mathrm{AUD}_i = 0] = \beta_{00} + \beta_{01}'X_i + \beta_{02}'Z_i + E[u_{0i} \mid \mathrm{AUD}_i = 0].$$

If auditor choice is systematically correlated with audit fees, the conditional means for audit fees and error terms are not equal to their unconditional means:

$$E[\mathrm{AF}_{1i} \mid \mathrm{AUD}_i = 1] \neq E[\mathrm{AF}_{1i}] \Leftrightarrow E[u_{1i} \mid \mathrm{AUD}_i = 1] \neq E[u_{1i}] = 0,$$
$$E[\mathrm{AF}_{0i} \mid \mathrm{AUD}_i = 0] \neq E[\mathrm{AF}_{0i}] \Leftrightarrow E[u_{0i} \mid \mathrm{AUD}_i = 0] \neq E[u_{0i}] = 0.$$

In this case, large (small) auditors' clients pay different fees on average than randomly selected companies would pay to large (small) auditors. Equations (4) and (5) result in a biased estimate of the large audit firm fee premium ($\hat{\beta}_{10} - \hat{\beta}_{00}$) if

$$E[\mathrm{AF}_{1i} \mid \mathrm{AUD}_i = 1] - E[\mathrm{AF}_{0i} \mid \mathrm{AUD}_i = 0] \neq E[\mathrm{AF}_{1i}] - E[\mathrm{AF}_{0i}],$$

or equivalently, if

1. An exception is Pong and Whittington (1994) who control for coefficient differences by including interaction terms between the auditor size dummy and the other explanatory variables. However, Pong and Whittington (1994) do not control for auditor selection effects.

$$E[u_{1i} \mid \text{AUD}_i = 1] - E[u_{0i} \mid \text{AUD}_i = 0] \neq 0.$$

We control for the effects of selection bias by estimating the following fee models for large and small audit firms:

$$\text{AF}_{1i} = \beta_{10} + \beta'_{11}X_i + \beta'_{12}Z_i + \sigma_{1u}\lambda_{1i} + e_{1i}, \tag{6}$$

$$\text{AF}_{0i} = \beta_{00} + \beta'_{01}X_i + \beta'_{02}Z_i + \sigma_{0u}\lambda_{0i} + e_{0i}, \tag{7}$$

where

$$\sigma_{1u}\lambda_{1i} \equiv \sigma_{1u}\frac{\phi(\gamma' W_i)}{\Phi(\gamma' W_i)} = E[u_{1i} \mid \text{AUD}_i = 1],$$

$$\sigma_{0u}\lambda_{0i} \equiv \sigma_{0u}\frac{\phi(\gamma' W_i)}{1 - \Phi(\gamma' W_i)} = E[u_{0i} \mid \text{AUD}_i = 0],$$

$$\sigma_{1u} \equiv \frac{\sigma_1^2 - \sigma_{10}}{\sigma_i}, \ \sigma_{0u} \equiv \frac{\sigma_0^2 - \sigma_{10}}{\sigma_i}, \text{ and } \sigma_i^2 \equiv \text{var}(u_{1i} - u_{0i}).$$

The functions ϕ and Φ are the standard normal probability density function and the cumulative distribution function, respectively. The key difference between eqs. (4) and (5) and eqs. (6) and (7) is the latter include inverse Mills ratios (λ_{1i} and λ_{0i}) in order to control for the effects of auditor selection.

In the first stage, we construct inverse Mills ratios (λ_{1i} and λ_{0i}) using the results from the auditor choice model (eq. [3]). In the second stage, we estimate audit fee models which include the inverse Mills ratios in eqs. (6) and (7). As a result, the conditional and unconditional expected error terms in eqs. (6) and (7) equal zero:

$$E[e_{1i} \mid \text{AUD}_i = 1] = E[e_{1i}] = E[e_{0i} \mid \text{AUD}_i = 0] = E[e_{0i}] = 0.$$

The estimated large audit firm fee premium ($\hat{\beta}_{10} - \hat{\beta}_{00}$) in eqs. (6) and (7) is unbiased, since

$$E[e_{1i} \mid \text{AUD}_i = 1] - E[e_{0i} \mid \text{AUD}_i = 0] = 0.$$

We can now explain the economic intuition underlying the signs of the coefficients on the Mills ratios. We hypothesize that large auditors' clients are of higher than average quality and therefore pay lower than average fees (Titman and Trueman [1986]; Thornton and Moore [1993]). If large auditors' clients pay lower fees than randomly selected companies would pay to large auditors:

$$E[\text{AF}_{1i} \mid \text{AUD}_i = 1] < E[\text{AF}_{1i}] \Leftrightarrow \sigma_{1u}\lambda_{1i} = E[u_{1i} \mid \text{AUD}_i = 1] < E[e_{1i}] = 0.$$

Similarly, we hypothesize that small auditors' clients are of lower than average quality and therefore pay higher than average fees. If small auditors' clients pay higher fees than randomly selected companies would pay to small auditors:

$$E[\text{AF}_{0i} \mid \text{AUD}_i = 0] > E[\text{AF}_{0i}] \Leftrightarrow \sigma_{0u}\lambda_{0i} = E[u_{0i} \mid \text{AUD}_i = 0] > E[e_{0i}] = 0.$$

TABLE 1

Variable Definitions

Panel A: Variables (X_i) in both the auditor selection and audit fee models	
ASS_i	Assets employed (£000)
SA_i	Sales turnover (£000)
SIC_i	Number of SIC codes
DS_i	Number of domestic (United Kingdom) subsidiaries
OS_i	Number of overseas subsidiaries
$LOSS_i$	= 1 if the company made a loss during the past 3 years = 0 otherwise
G_i	$\frac{\text{Preference capital + subordinated debt + loan capital + short-term borrowings}}{\text{Capital employed + short-term borrowing − intangibles}}$
$BUSY_i$	= 1 if year-end is between December 1 and March 31 = 0 otherwise
Panel B: Variables (Y_i) in the auditor selection models only	
NX_i	$\frac{\text{Number of nonexecutive directors}}{\text{Number of directors}}$
LAF_i	= 1 if the influential director is affiliated with a large audit firm = 0 otherwise
SAF_i	= 1 if the influential director is affiliated with a small audit firm = 0 otherwise
Panel C: Variable (Z_i) in the audit fee models only	
LON_i	= 1 if the audit office is located in London = 0 otherwise

Since the inverse Mills ratios (λ_{1i} and λ_{0i}) are both positive by definition, the two conditions above can be restated as $\sigma_{1u} < 0$ and $\sigma_{0u} > 0$, respectively. This means the coefficients on the inverse Mills ratios should be negative for large auditors' clients and positive for small auditors' clients.

2.2 The Explanatory Variables (X_i, Y_i, and Z_i)

Table 1 defines the explanatory variables (X_i, Y_i, and Z_i) that we use in the auditor choice and audit fee models.

2.2.1 VARIABLES (X_i) INCLUDED IN BOTH THE AUDITOR CHOICE AND AUDIT FEE MODELS

From prior research we expect auditee size, complexity and risk affect both fees and auditor selection (e.g., Pong and Whittington [1994]). Previous studies use either assets (e.g., Craswell et al. [1995]) or sales turnover (e.g., Chan et al. [1993]) or both (Pong and Whittington [1994]) to control for client size. We use both assets (ASS_i) and sales (SA_i), as each represents a different dimension of size (Pong and Whittington [1994]). Fees likely reflect both turnover and assets, as audit work involves the examination of both transactions during the year (reported in the profit and loss account and cash flow statement) and year-end balances (reported in the balance sheet). We expect large companies hire large audit firms more often than small audit firms and large companies pay higher fees.

A more complex or more risky auditee requires more audit work. Risk and complexity are in some ways closely linked as a more complex auditee poses higher risk, although risk may also arise from other sources.[2] Again, there are several dimensions of complexity and risk that may be measured. One complexity measure is the number of business areas in which the auditee operates. We capture this using the number of clients' main SIC (Standard Industry Classification) codes (SIC_i). The existence of subsidiary companies increases complexity as consolidated accounts must be audited. Hence, we include among our explanatory variables the number of subsidiary companies located in the United Kingdom (DS_i) and overseas (OS_i).

Gearing (G_i) is included as a risk measure, as companies often fail through cash flow problems and binding bond covenants. Profitability is another measure of auditee risk. As in previous studies, we define a loss dummy ($LOSS_i$) equal to one if the company makes a loss in the past three years. We hypothesize these risk variables are positively associated with audit fees. On the other hand, the hypothesized relation between client risk and auditor size is ambiguous. More risky companies may hire large audit firms in order to reduce agency costs (Francis and Wilson [1988]; DeFond [1992]). On the other hand, large audit firms may be reluctant to accept high-risk clients because of the potential damage to their reputations or because of the threat of litigation (Krishnan and Krishnan [1997]).

We also include a dummy ($BUSY_i$) for the so-called "busy period" of accounting firms, namely client year-ends falling between December 1 and March 31, inclusive.

2.2.2 VARIABLES (Y_i) INCLUDED IN THE AUDITOR SELECTION MODELS ONLY

In order to identify the effects of selectivity bias (as captured by the $\sigma_{1u}\lambda_{1i}$ and $\sigma_{0u}\lambda_{0i}$ terms), it is important to include some variables in the auditor choice model, but to exclude them from the audit fee models. The Y_i variables that fulfill this role are defined in Table 1.

We hypothesize audit firm size is positively associated with the proportion of directors who are nonexecutives (NX_i) for at least two reasons. First, nonexecutive directors may have stronger preferences than executives for high quality (large)

2. One example would be the integrity of management.

audit firms. Second, companies with high demand for monitoring may have greater incentives to appoint nonexecutive directors and hire large audit firms.

We hypothesize auditor choice also depends on directors' personal affiliations with audit firms. We expect companies hire large (small) audit firms more often when directors disclose that they previously worked for large (small) auditors. Our affiliation variables equal one if the company is affiliated with a large (LAF_i) or small (SAF_i) audit firm, respectively; otherwise they equal zero. Corporate affiliations with audit firms are discussed in more detail in Section 3.1.

2.2.3 VARIABLE (Z_i) INCLUDED IN THE AUDIT FEE MODELS ONLY

We include an audit office location variable in the audit fee models but exclude it from the auditor choice models. The location variable (LON_i) equals one if the audit office is located in London and zero otherwise. Prior research shows London offices charge higher audit fees compared to offices located outside of London (Chan et al. [1993]). We therefore control for the effects of audit office location on audit fees.[3]

3. Data

3.1 Data Sources

Our initial sample consists of 1,543 companies registered with a UK stock exchange. Data are taken from annual reports with year-ends between March 1, 1997 and February 28, 1998, and each company appears only once in the sample. We use the PricewaterhouseCoopers Corporate Register (PCR) to identify company auditors, audit office locations, company directors and corporate affiliations with audit firms. The PCR provides information on directors' career histories and their professional qualifications.

In deciding whether companies are affiliated with audit firms, we attempt to identify for each company the director who has the strongest boardroom influence over audit appointments. We generally assume finance directors are most influential as they have closest contact with audit firms. If a finance director discloses that he or she previously worked for a large (small) audit firm, we expect the company will be more likely to hire a large (small) audit firm. When a director discloses past employments with both large and small audit firms, we assume the affiliation is with the most recent audit firm.

In approximately 10 percent of sample companies, finance directors are not

3. In order to estimate the effects of auditor selection bias, it is not necessary to include a variable in the audit fee model but exclude it from the auditor choice model. Not surprisingly therefore, our selectivity results are robust to dropping audit office location.

identified. In such cases we adopt the following rules for choosing the most influential directors:

1. We choose the company secretary, if (a) the company secretary is a qualified accountant or (b) neither the company secretary nor the CEO nor the chairman are qualified accountants. We rank the company secretary above the CEO and chairman in terms of influence, because the posts of company secretary and finance director are often carried out by the same person.
2. We choose the CEO, if (a) the CEO is a qualified accountant and the company secretary is either not qualified or not identified or (b) neither the CEO nor chairman are qualified accountants and the company secretary is not identified.
3. We choose the company chairman, if (a) the chairman is a qualified accountant and neither the CEO nor company secretary are qualified or (b) neither the CEO nor company secretary are identified.

These rules enable us to identify an influential director for each company. Since directors frequently do not disclose full career histories in the PCR, it is likely that some directors previously worked for audit firms but do not disclose this, perhaps because the employment was a long time ago or because it was for a relatively short period. We do not believe this lack of disclosure presents a serious problem since directors may disclose past audit employments more readily when personal affiliations are particularly strong.[4]

Information on SIC codes and subsidiaries is collected from Extel. Data on audit fees, assets, sales, profits, gearing and directors (executive or nonexecutive) are from Datastream. Because of missing Datastream data for 217 companies, the final sample consists of 1,326 observations.

3.2 Descriptive Statistics

Table 2 reports descriptive statistics for the dependent and explanatory variables. Audit fees (AF_i) range from a minimum of £2,000 to a maximum of £9.6m, with mean and median values of £243,000 and £73,000 respectively. Large audit firms (AUD_i) are chosen by 76 percent of sample companies and 43 percent of companies are audited by offices located in London (LON_i).

The mean values for assets (ASS_i) and sales (SA_i) are £343m and £519m, respectively. The means for these size variables are much larger than their medians (£28m and £61m, respectively) as there are relatively few very large companies. The number of main SIC codes (SIC_i) ranges from one to ten and there is also a considerable range in the number of domestic (DS_i) and overseas subsidiaries (OS_i).

4. We have no reason to believe that measurement error is correlated with auditor choice, so we feel that bias is unlikely to be a problem. A potentially more important problem is that measurement error may increase coefficient standard errors. However, our affiliation variables have statistically significant effects on auditor choice, indicating that lack of precision is not a serious problem.

TABLE 2

Descriptive Statistics

Variable	Mean	Median	Minimum	Maximum
AF_i	243	73	2	9,600
AUD_i	0.76	1	0	1
LON_i	0.43	0	0	1
ASS_i	343,585	28,431	−13,579	42,400,000
SA_i	519,499	60,647	0	56,666,666
SIC_i	2.96	2	1	10
DS_i	5.73	4	0	53
OS_i	4.25	1	0	96
$LOSS_i$	0.22	0	0	1
G_i	33.38	27.15	−4,552	3,020
$BUSY_i$	0.48	0	0	1
NX_i	0.30	0.3	0	0.8
LAF_i	0.25	0	0	1
SAF_i	0.05	0	0	1

Note: See Table 1 for variable definitions. The AF_i, ASS_i, and SA_i variables are in £000s.

Only 22 percent of companies make accounting losses ($LOSS_i$) in one or more of the past three years and there is considerable variation in gearing levels (G_i). Nearly half of the companies (48%) have year-ends in the four-month busy period ($BUSY_i$). The average proportion of directors who are nonexecutives (NX_i) is 30 percent and ranges from zero to 80 percent.

Affiliations with large audit firms (LAF_i) are disclosed by 25 percent of influential directors and affiliations with small audit firms (SAF_i) are disclosed by a further 5 percent. The remaining 70 percent either did not previously work for audit firms or do not disclose past audit employments. As explained above, these directors are categorized as having no affiliations with audit firms.

3.3 Rank Transformations

The means and medians reported in Table 2 reveal skewness in the audit fee (AF_i), company size (ASS_i and SA_i), complexity (SIC_i, DS_i, and OS_i) and gearing (G_i) variables. Two statistical problems faced by previous audit fee studies are skewness and outlying observations. Some researchers control for the former problem using log transformations (e.g., Francis and Simon [1987]; Simon and Francis [1988]; Chan et al. [1993]; Craswell et al. [1995]). Outlying observations have generally been confronted by trimming or truncating sample distributions.

More recently, Kane and Meade (1998) show rank transformations perform better in resolving both these problems. The procedure involves replacing each observation with its rank within the sample and then dividing each observation by

TABLE 3

Descriptive Statistics for the Clients of Large and Small Audit Firms

Variable	Large Audit Firms ($AUD_i = 1$) Mean	Large Audit Firms ($AUD_i = 1$) Median	Small Audit Firms ($AUD_i = 0$) Mean	Small Audit Firms ($AUD_i = 0$) Median
$R(AF_i)$	0.5692**	0.6059**	0.2994	0.2495
$R(ASS_i)$	0.5411**	0.5588**	0.3081	0.2723
$R(SA_i)$	0.5789**	0.6058**	0.3430	0.2997
$R(SIC_i)$	0.5302*	0.6243**	0.4838	0.4057
$R(DS_i)$	0.5049**	0.4915**	0.4083	0.3969
$R(OS_i)$	0.5455**	0.5678**	0.4029	0.2567
$LOSS_i$	0.2024**	0	0.2716	0
$R(G_i)$	0.5042**	0.4993**	0.4449	0.4269
$BUSY_i$	0.4985**	0	0.4026	0
NX_i	0.3061**	0.3077**	0.2702	0.2857
LAF_i	0.2774**	0	0.1565	0
SAF_i	0.0306**	0	0.1022	0
LON_i	0.4087**	0	0.5144	1
Observations	1,013		313	

Note: The $R(AF_i)$, $R(ASS_i)$, $R(SA_i)$, $R(SIC_i)$, $R(DS_i)$, $R(OS_i)$, and $R(G_i)$ variables are rank-transformations of AF_i, ASS_i, SA_i, SIC_i, DS_i, OS_i, and G_i. See Table 1 for variable definitions. ** (*) Significant difference between large and small auditors' clients at the 1% (5%) levels.

$N + 1$ (where N is the number of observations). Thus, the ranked variables are uniformly distributed between zero and one.[5]

We replace the audit fee (AF_i), company size (ASS_i and SA_i), complexity (SIC_i, DS_i, and OS_i), and gearing (G_i) variables with their rank-transformed equivalents ($R[AF_i]$, $R[ASS_i]$, $R[SA_i]$, $R[SIC_i]$, $R[DS_i]$, $R[OS_i]$, and $R[G_i]$). Table 3 partitions the sample into 1,013 clients of large audit firms and 313 clients of small

5. Kane and Meade (1998) show rank transformations generally perform better than log or square root transformations in resolving outlier and skewness problems. They find rank transformations contain information that is obfuscated by untransformed variables or alternative transformations. Moreover, simulation studies indicate little loss of efficiency when rank transformations are applied to normally distributed variables (Conover and Iman [1980]; Iman and Conover [1979]). Rank transformations have previously been used in event studies (Beaver et al. [1979]; Cheng et al. [1992]) and accounting disclosure studies (Lang and Lundholm [1996]; Wallace et al. [1994]; Wallace and Naser [1995]). In unreported results, we test whether alternative specifications result in better audit fee models. We find log transformations do not satisfactorily remove the estimation problems associated with highly skewed variables, particularly nonnormality. In addition, we wish to avoid the loss of information associated with sample trimming and truncation when dealing with outliers. Consistent with Kane and Meade (1998), we find rank transformations result in residuals which conform more closely to OLS assumptions. The residuals are normally distributed, spherical and uncorrelated with the explanatory variables.

audit firms and reports descriptive statistics for the rank-transformed and other variables (LOSS_i, BUSY_i, NX_i, LAF_i, LAF_i, LON_i).

The audit fee ($R[\mathrm{AF}_i]$) variable confirms that large auditors' clients pay significantly higher fees than small auditors' clients. The company size ($R[\mathrm{ASS}_i]$ and $R[\mathrm{SA}_i]$) and complexity ($R[\mathrm{SIC}_i]$, $R[\mathrm{DS}_i]$, $R[\mathrm{OS}_i]$) variables show large auditors' clients are significantly larger and more complex than small auditors' clients. The loss dummy (LOSS_i) and gearing ($R[\mathrm{G}_i]$) show large auditors' clients are more profitable and more highly geared than small auditors' clients.

The association between large audit firms and the proportion of directors who are nonexecutives (NX_i) is positive and significant. This is consistent with auditors and boards performing complementary monitoring activities and with nonexecutives preferring large audit firms. Companies hire large audit firms more often when influential directors are affiliated with large audit firms (LAF_i). Similarly, companies hire large audit firms less often when directors are affiliated with small audit firms (SAF_i).

4. Estimation Results

4.1 An Overview

In this section, we evaluate the effects of auditor selection bias on the size of the large audit firm fee premium. First, we replicate the approach of previous studies by treating auditor choice as exogenous as in the following model:

$$R(\mathrm{AF}_i) = \beta_0 + \beta_1' X_i + \beta_2' Z_i + \beta_3 \mathrm{AUD}_i + u_i.$$

Consistent with extant research, we find a significant positive coefficient on the auditor size dummy ($\hat{\beta}_3 > 0$).

Next, we estimate an auditor selection model

$$\mathrm{AUD}_i^* = \gamma_0 + \gamma_1' X_i + \gamma_2' Y_i + v_i \equiv \gamma' W_i + v_i,$$

and use the results to construct inverse Mills ratios ($\hat{\lambda}_{1i}$ and $\hat{\lambda}_{0i}$):

$$\hat{\lambda}_{1i} \equiv \frac{\phi(\hat{\gamma}' W_i)}{\Phi(\hat{\gamma}' W_i)} \text{ and } \hat{\lambda}_{0i} \equiv \frac{\phi(\hat{\gamma}' W_i)}{1 - \Phi(\hat{\gamma}' W_i)}.$$

Next, we estimate audit fee models for the clients of large and small audit firms and evaluate the effects of selection bias.

$$R(\mathrm{AF}_{1i}) = \beta_{10} + \beta_{11}' X_i + \beta_{12}' Z_i + \sigma_{1u} \hat{\lambda}_{1i} + e_{1i},$$
$$R(\mathrm{AF}_{0i}) = \beta_{00} + \beta_{01}' X_i + \beta_{02}' Z_i + \sigma_{0u} \hat{\lambda}_{0i} + e_{0i}.$$

When we allow for selectivity effects, we find the estimated fee premium is significantly larger than when selectivity is ignored (i.e., $\hat{\beta}_{10} - \hat{\beta}_{00} > \hat{\beta}_3 > 0$). Moreover, we find the coefficients on the inverse Mills ratios are significantly negative for large auditors' clients ($\hat{\sigma}_{1u} < 0$) and weakly positive for small auditors'

TABLE 4

Audit Fee Models Ignoring Selectivity Effects

	Expected Sign	$R(\mathrm{AF}_i)$	$R(\mathrm{AF}_{1i})$	$R(\mathrm{AF}_{0i})$
$R(\mathrm{ASS}_i)$	+	0.16	0.15	0.17
		(6.28)**	(5.35)**	(3.25)**
$R(SA_i)$	+	0.59	0.60	0.57
		(21.93)**	(19.79)**	(9.33)**
$R(\mathrm{SIC}_i)$	+	0.06	0.05	0.05
		(4.96)**	(4.02)**	(2.22)*
$R(DS_i)$	+	0.09	0.07	0.18
		(6.97)**	(4.69)**	(5.95)**
$R(\mathrm{OS}_i)$	+	0.23	0.24	0.19
		(17.76)**	(17.02)**	(5.99)**
LOSS_i	+	0.04	0.05	0.02
		(5.22)**	(5.11)**	(1.59)
$R(G_i)$	+	0.05	0.06	0.05
		(4.76)**	(4.03)**	(2.60)**
BUSY_i	+	0.01	0.02	0.01
		(2.33)*	(2.39)*	(0.37)
LON_i	+	0.05	0.05	0.04
		(7.89)**	(6.75)**	(3.72)**
AUD_i	+	0.05		
		(6.80)**		
Constant	?	−0.18	−0.12	−0.18
		(−18.45)**	(−9.69)**	(−9.77)**
Observations		1,326	1,013	313
R^2		86.6%	84.7%	82.4%

Note: Column 1 includes audit firm size as a dummy variable (eq. [1]). Columns 2 and 3 are estimated separately for large and small auditors' clients (eqs. [4] and [5]). *t* statistics are given in parentheses. ** (*) Significant at the 1% (5%) levels. See Tables 1 and 3 for variable definitions.

clients ($\hat{\sigma}_{0u} \geq 0$). These results are consistent with selectivity effects being caused by unobserved quality differences between large and small auditors' clients.

4.2 The Large Audit Firm Fee Premium Ignoring Selectivity

Table 4 reports the results from audit fee regressions when the effects of auditor selection are ignored. Column 1 replicates the approach of previous studies by including auditor size (AUD_i) as an exogenous predictor of audit fees (eq. [1]). Columns 2 and 3 estimate audit fee regressions separately for large and small auditors' clients (eqs. [4] and [5]) but do not control for selectivity.

The results in column 1 are consistent with those reported in prior audit fee studies. The coefficient on auditor size is positive ($\hat{\beta}_3 = 0.05$) and statistically significant. Therefore, large auditors' clients pay higher fees than small auditors' clients after controlling for observed client characteristics (X_i) and audit office location (Z_i). The estimated premium ($\hat{\beta}_{10} - \hat{\beta}_{00}$) in columns 2 and 3 is 0.06 (= −0.12 − [−0.18]), which is not significantly different from the 0.05 estimate in column 1. The insignificant difference is unsurprising as the fee regressions in Table 4 treat auditor choice as exogenous. We use the 0.06 estimate to calculate the median premium when selectivity effects are ignored. Since the median firm lies in the 50th centile and ranked audit fees are uniformly distributed between zero and one, the median premium is simply the difference in fees paid by companies in the 47th (= 0.5 − 0.03) and 53rd (= 0.5 + 0.03) centiles. Companies in the 47th and 53rd centiles pay fees of £65,000 and £79,000 respectively, giving a median premium of £14,000. As a percentage of median fees (£73,000) the premium is 19.2 percent, similar to the 24 percent premium estimated by Pong and Whittington (1994).

The signs of the coefficients in columns 2 and 3 are the same for large and small audit firms and, in general, there are no significant differences between coefficient estimates ($\beta'_{11} = \beta'_{01}$ and $\beta'_{12} = \beta'_{02}$). The only exception is the domestic subsidiaries variable (R([DS$_i$]), which has a significantly smaller impact on the fees of large auditors' clients (0.07) than on the fees of small auditors' clients (0.18). This is possibly due to large audit firms having more offices and therefore lower transport costs compared to small audit firms.

As expected, there is a significant positive relation between company size (R[ASS$_i$] and R[SA$_i$]) and audit fees. In addition, audit fees are positively associated with client complexity as measured by the number of SIC codes (R[SIC$_i$]) and the number of domestic (R[DS$_i$]) and overseas (R[OS$_i$]) subsidiaries. High-risk companies are charged higher fees, as shown by the significant positive coefficients on the loss dummy (LOSS$_i$) and gearing (R[G_i]). Audit fees are also higher during the busy season (BUSY$_i$) and when audit offices are located in London (LON$_i$).

4.3. Evaluating the Effects of Selection Bias on Audit Fees

Table 5 reports the effects of selectivity using the two-stage approach. In the first stage, we estimate auditor selection models (columns 1 and 2). In the second stage, we estimate audit fee regressions for large and small auditors' clients taking into account selectivity effects (columns 3 and 4).[6] Columns 1 and 2 correspond to eq. (3), while columns 3 and 4 correspond to eqs. (6) and (7).

In columns 1 and 2, the coefficient estimates for the auditor choice models are mostly consistent with prior expectations.[7] The coefficients on the company size variables (R[ASS$_i$] and R[SA$_i$]) show large companies hire large audit firms more often than small audit firms. Companies also hire large audit firms more often when they have subsidiaries located overseas (R[OS$_i$]). Affiliations between audit firms and influential directors (LAF$_i$ and SAF$_i$) are important in explaining auditor choice.

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6. To assess the validity of the auditor choice models, we generate simulated residuals and find no evidence of heteroscedasticity or omitted variables problems (Gourieroux et al. [1987]).

7. The R^2s in columns 1 and 2 are the pseudo R^2s that one obtains from probit models.

TABLE 5

Evaluating the Effects of Auditor Selection Bias on Audit Fees

	Expected Sign	AUD_i^*	AUD_i^*	Expected Sign	$R(AF_{1i})$	$R(AF_{0i})$
$R(ASS_i)$	+	0.73	0.72	+	0.12	0.15
		(2.65)**	(2.65)**		(4.07)**	(2.62)**
$R(SA_i)$	+	1.66	1.49	+	0.54	0.53
		(5.36)**	(5.22)**		(15.82)**	(7.60)**
$R(SIC_i)$	+	−0.23		+	0.05	0.06
		(−1.38)			(4.20)**	(2.29)*
$R(DS_i)$	+	−0.28		+	0.07	0.18
		(−1.55)			(4.60)**	(5.93)**
$R(OS_i)$	+	0.53	0.50	+	0.22	0.18
		(2.84)**	(2.72)**		(14.77)**	(5.64)**
$LOSS_i$	?	0.37	0.37	+	0.04	0.01
		(3.47)**	(3.50)**		(3.15)**	(0.78)
$R(G_i)$	?	0.08		+	0.06	0.05
		(0.52)			(4.12)**	(2.62)**
$BUSY_i$	?	0.07		+	0.02	0.01
		(0.80)			(2.46)*	(0.35)
LON_i				+	0.05	0.04
					(6.92)**	(3.77)**
LAF_i	+	0.29	0.29			
		(2.78)**	(2.76)**			
SAF_i	−	−0.55	−0.56			
		(−3.07)**	(3.13)**			
NX_i	+	2.17	2.19			
		(3.99)**	(4.02)**			
$\hat{\lambda}_{1i}$				−	−0.09	
					(−3.02)**	
$\hat{\lambda}_{0i}$				+		0.04
						(1.19)
Constant	?	−1.19	−1.27	?	−0.03	−0.19
		(−5.85)**	(−6.61)**		(−0.96)	(−9.08)**
Observations		1,326	1,326		1,013	313
R^2		18.9%	18.5%		84.8%	82.5%

Note: Columns 1 and 2 are probit auditor choice models (eq. [3]). Columns 3 and 4 are audit fee regressions for large and small auditors' clients (eqs. [6] and [7]). z and t statistics are given in parentheses. ** (*) Significant at the 1% (5%) levels. See Tables 1 and 3 for variable definitions.

Companies hire large (small) audit firms more often when directors disclose past employments with large (small) audit firms. Audit firm size is positively associated with the proportion of directors who are nonexecutives (NX_i). The remaining explanatory variables ($R[SIC_i]$, $R[DS_i]$, $R[G_i]$, and $BUSY_i$) do not significantly affect auditor choice and are omitted from column 2.

We use the results in column 2 to construct the inverse Mills ratios ($\hat{\lambda}_{1i}$ and $\hat{\lambda}_{0i}$), which are included in columns 3 and 4 in order to control for selectivity effects. Column 3 (eq. [6]) is estimated for large auditors' clients while column 4 (eq. [7]) is estimated for small auditors' clients. After controlling for selectivity, the estimated fee premium ($\hat{\beta}_{10} - \hat{\beta}_{00}$) is 0.16 (= −0.03 − [−0.19]). The difference between the estimated premia in Tables 4 and 5 (0.06 and 0.16) is statistically significant at the 1% level. The effect of selectivity on the fee premium is also significant from an economic point of view. We use the 0.16 estimate to calculate the median premium taking into account selectivity effects. Companies in the 42nd (0.5 − 0.08) and 58th (0.5 + 0.08) centiles pay fees of £52,000 and £91,000 respectively, giving a median premium of £39,000. As a percentage of median fees (£73,000) the premium is 53.4 percent. We conclude the large audit firm fee premium is more than twice as large when one controls for auditor selection bias (53.4% compared to 19.2%).

The effects of selectivity can also be seen from the coefficients on the inverse Mills ratios ($\hat{\lambda}_{1i}$ and $\hat{\lambda}_{0i}$). The coefficient for large auditors' clients in column 3 is negative and statistically significant ($\hat{\sigma}_{1u} < 0$). This means large auditors' clients pay lower fees than randomly selected companies would pay to large auditors (i.e., $\hat{\sigma}_{1u}\hat{\lambda}_{1i} = E[u_{1i} \mid \text{AUD}_i = 1] < 0 \Leftrightarrow E[\text{AF}_{1i} \mid \text{AUD}_i = 1] < E[\text{AF}_{1i}]$). The coefficient for small auditors' clients in column 4 is positive but not statistically significant ($\hat{\sigma}_{1u} \geq 0$). This means small auditors' clients pay fees that are at least as high as randomly selected companies would pay to small auditors (i.e., $\hat{\sigma}_{0u}\hat{\lambda}_{0i} = E[u_{0i} \mid \text{AUD}_i = 0] \geq 0 \Leftrightarrow E[\text{AF}_{0i} \mid \text{AUD}_i = 0] \geq E[\text{AF}_{0i}]$). These results are consistent with selectivity effects being caused by unobserved quality differences between large and small auditors' clients. In particular, high-quality companies tend to hire large audit firms and pay lower audit fees than randomly selected companies would pay.

5. Conclusions

After controlling for client characteristics, studies often find large audit firms earn significantly higher fees than small audit firms. However, extant research on audit fees treats auditor choice as exogenous. In contrast, this paper takes into account that companies are not randomly assigned to audit firms. We examine the large audit firm fee premium when auditor choice is treated as endogenous.

We find the effects of auditor selection on audit fees are statistically and economically significant. The premium earned by large audit firms is more than twice as large when selectivity bias is taken into account (53.4% compared to 19.2%). The importance of selectivity effects should not be too surprising given the predictions of analytical research. Theory suggests high quality companies are more likely to hire large audit firms and are more likely to pay low fees (Titman and Trueman [1986]; Thornton and Moore [1993]). Our results indicate large auditors attract clients that are of higher than average quality and require less than average audit effort. Previous fee studies significantly underestimate the returns attributable to higher audit quality, because they ignore the advantageous (adverse) selection effects experienced by large (small) auditors. A task for future research is to estimate the effects of selectivity in countries where no large audit firm fee premiums have been found.

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