The determinants of the UK Big Firm premium[&]

by

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24 April 2006

[&] Correspondence should be addressed to Dr Kevin McMeeking. Earlier drafts of this paper were presented at the 2001 British Accounting Association Conference, 2003 European Auditing Research Network Conference, 2004 European Accounting Association Conference and in seminars at Lancaster University, Exeter University and Bristol University. We are grateful for the helpful comments of seminar participants and in particular to David Gwilliam, Peter Moizer, Marleen Willekens, Stephen Young, Clive Lennox, Pelham Gore, Mark Tippett, Terry Cooke, Jere Francis, Kai-Uwe Marten, Paul Collier, Marieke Hartman-Frijlink, Aasmund Eilifsen, Richard Patterson and Ashni Singh. We are also indebted to Peter Moizer and the anonymous referees for their comments on earlier versions of the paper.

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Abstract

Our study attempts to determine whether, and if so why, the large auditing firms are able to earn a premium on their audit work in the UK. We start by confirming the apparent existence of a Big Firm premium during the period 1985-2002. We examine industry specialisation, non-audit service fee and monopoly pricing explanations for the premium. The results of our tests of industry specialization are mixed. There is little evidence that this premium is associated with industry specialization when specialists are defined at the national level. Significant premia are observed if specialization is defined at the city level, particularly if the auditor is the industry leader. However, when appropriate allowance is made for endogeneity, by modelling both audit and non-audit fees in a simultaneous equations framework, the Big Firm premium disappears. We find evidence to suggest that non-audit fees earned by auditors from their audit clients are positively related to the size of the audit fee and vice versa. Finally, when the sample is stratified by the size of audit client, we find no systematic evidence of anticompetitive pricing.

The determinants of the UK Big Firm premium

1. Introduction

A series of mergers and takeovers have radically changed the market for professional accounting services over the last twenty years. There were eight international UK firms in 1985 (Arthur Andersen, Arthur Young, Coopers and Lybrand, Ernst and Whinney, Deloitte Haskins and Sells, Peat Marwick, Price Waterhouse and Touche Ross). In 1986, Peat Marwick merged with KMG Thompson McLintock to form the firm that is known today as KPMG. The UK mergers in 1989 between Ernst and Whinney and Arthur Young and in 1990 between Deloitte, Haskins and Sells and Coopers and Lybrand (Touche Ross in the US) reduced the number of dominant firms to six. The merger between Price Waterhouse and Coopers and Lybrand in 1997 cut this number to five. Following the Enron debacle, the takeover of Andersen by Deloitte resulted in four Big Firms. Although these structural changes have contributed to increased concentration ratios in the audit market (Wolk et al., 2001), the effect on audit fees is unclear.

Several studies have provided evidence of the existence of a Big Firm audit fee premium in the US, Australia, Hong Kong and Malaysia.[1] However, the UK evidence is mixed. Studies by Taffler and Ramalinggam (1982), Chan et al. (1993), Pong and Whittington (1994) and Ezzamel et al. (1996) find the premium is significant, whereas Brinn et al. (1994), O'Sullivan (1998) and Ezzamel et al. (2002) do not. The purposes of the present study are twofold. One is to model the pricing of accounting services over a longer period (1985-2002) than in previous studies, one that encompasses notable contractions in the number of Big Firms. The other is to provide a systematic examination of the factors that might lead to higher audit fees being charged by Big Firms.

Our initial results are consistent with much earlier research in finding that Big Firms appear to earn a premium in the UK when due allowance is made for factors like the size, complexity and riskiness of a client's business. We also find evidence to suggest that the Big Firm premium is statistically significant from 1986 to 1998 but seems to fall away afterwards. The reasons for the decline are unclear.

One possibility is that the Big Firm premium is attributable to large audit firms devoting resources to developing industry expertise, making them better auditors in the industries in

[1] US studies include Palmrose (1986a,b), Francis and Simon (1987), Baber et al. (1987), Simon and Francis (1988), Turpen (1990), Beatty (1993) and Ward et al. (1994). Work dealing with Australia has been done by Francis (1984), Francis and Stokes (1986) and Butterworth and Houghton (1995). For similar findings covering Hong Kong and Malaysia, see Simon et al. (1992) and DeFond et al. (2000). An overall assessment of the international audit pricing literature is provided by Moizer (1997).

question. We explore this possibility much more exhaustively than in earlier studies, measuring industry specialization in a variety of ways and find that the results are mixed. If specialization is defined at the national level, we find that the Big Firm premium generally remains intact. Recent studies document that the industry leaders or industry specialists defined at the city-level enjoy a fee premium over other firms (DeFond et al., 2000; Ferguson et al., 2003; Francis et al., 2005). Using these definitions, we find evidence to suggest that the Big Firm premium could be attributable to industry specialization by auditors.

Another possibility we consider is that the Big Firm premium arises from big accounting firms being able to retain knowledge spillovers they obtain from providing consulting services to clients. We find that when income from non-audit services (NAS) provided to the audit client is included in the audit fee model, the coefficient on NAS is significant but the Big Firm premium seems to disappear. However, the picture changes when allowance is made for the possible endogeneity of audit and NAS by modelling both sources of audit firm revenue in a simultaneous equations framework. Whisenant et al. (2003) apart, prior research has not explicitly addressed this endogeneity issue. When allowance is made for endogeneity, we find that NAS is an increasing function of the audit fee and that audit fee is also increasing in NAS. From this we conclude that the audit and NAS fees could be jointly determined in a way that enhances the returns of audit firms: Big firms appear to charge a premium for their audit services as a result of the "one-stop shopping" they provide.

Finally, we carry out a number of additional tests to try to throw light on the competitiveness of the UK audit market. Following several high profile mergers, the Big Firms have increased their share of the audit market. Market concentration is particularly high for companies of above-average size, possibly because large audit firms have a technological advantage in auditing large clients. This raises the possibility that the Big Firm premium might be attributable to tacit or non-tacit price collusion in this segment (Sullivan (2002)). We examine the level of competition in the UK audit market by testing whether the size of the Big Firm premium differs across four sub-samples of clients stratified by size. Although the results indicate that accounting firms do not systematically engage in anticompetitive pricing, the Big Firm premium appears to be more prevalent for the lower size quartiles than the upper size quartiles. This result suggests that competition is strong in the market for prestigious clients but smaller companies must pay a premium to secure the services of a quality-differentiated firm.

The remainder of this study of the determinants of the Big Firm premium is organised in the following manner. Section 2 summarises the research, theoretical and methodological issues relating to quality differentiated audits. We address industry specialization in section 3, non-

audit services in section 4 and monopoly pricing in section 5. Our empirical results are reported in sections 6. A summary and our conclusions are presented in the final section.

2. Quality-Differentiated Audits

We begin our analysis of what constitutes the assumed Big Firm premium by considering quality differentiation. The three interrelated sources of demand for quality-differentiated audits are agency demand, information demand and insurance demand (Beattie and Fearnley, 1995). Agency demand, first detailed by Jensen and Meckling (1976), explains the demand for an audit in terms of a bonding mechanism that reduces the agency costs, such as the over-consumption of perks, that result from the self-interested actions of agents. The information demand addresses the circumstances when management might seek to use particularly creditable auditors in order to signal their own honesty and integrity (Dopuch and Simunic, 1980). The insurance demand for an audit refers to the avenue an audit opens up for investors and creditors to seek redress from the auditor for any losses they might suffer as a result of audit failures, with higher quality auditors having more insurance capacity. Differences in client circumstances lead to a demand for quality-differentiated audits.

The supply of quality-differentiated audits can be motivated by the theory of product differentiation (Simunic and Stein, 1987). Firms with greater expertise, credibility and audit quality will gain market share by "word of mouth" advertising (Mercer, 1992; Rogerson, 1983). Consumers use the quality of an earlier product as an indicator of present and future quality (Mercer, 1992; Shapiro, 1983). Firms have no incentive to reduce quality if consumers quickly become aware of the degradation of the product. Audits pose practical problems for the product differentiation theory because of the difficulties of discerning product quality. Audit quality is likely to be judged on the basis of observable supplier characteristics, such as the firm's size and name (Dopuch and Simunic, 1980). Reputable firms will produce high quality audits because consumers recognise and reward the investment (Klein and Leffler, 1981; Palmrose, 1986a)[2] unless the costs of such investments are the same for both high-quality and low-quality auditors, resulting in a "market for lemons" (Akerlof, 1970). The sheer scale of reputational investments can serve as a costly signal that might prevent such a pooling equilibrium. Rents can arise due to auditor start up costs and client switching costs and these serve as a "bond" on independence and audit quality (Francis and Wilson, 1988). Reputable firms have more incentives to produce

[2] Some examples of such investments include Price Waterhouse's Blue Chip Portfolio, the Coopers and Lybrand Audit Support System (CLASS), KPMG's Audit 2000 and Ernst and Young's Audit Innovation.

quality audits and maintain independence because they have large market shares (Craswell and Taylor, 1991) and the most specialised intangible assets at risk (Ritson et al., 1997), and they are able to extract economic rents as a result (DeAngelo, 1981).

Most audit pricing studies estimate cross-sectional models using a small sample of data. We test for quality differentiation (model 1) over a wider time frame than in previous studies and use the panel data method that captures the time-series aspect of our data and can help reduce multicollinearity, as well as control for omitted variables (Hsaio, 1986)[3]. We test whether the possession of a Big Firm brand name is a source of enhanced revenue in the audit market using the following generic model:

$$LAF = \alpha_0 + \beta_1 (\text{Controls}) + \beta_2 \text{ Brand} + \varepsilon . \quad (1)$$

The dependent variable, LAF, is the natural logarithm of audit fees and the experimental (test) variable, Brand, is an indicator variable set equal to one if the auditor is a Big Firm and zero otherwise. Controls are a vector of proxies for client size (assets or revenue), litigation risk (long term debt to assets, return on investment, current and quick ratios), complexity (domestic and foreign subsidiaries ratios) and the opportunity cost of audit labour (whether the financial year end falls in the busy period). These control variables have been used in other studies to capture the majority of the work-related variation in audit fees (e.g. Francis, 1984; Francis and Stokes, 1986; Palmrose, 1986; Francis and Simon, 1987; Simon and Francis, 1988; Simon et al., 1992; Beatty, 1993; Anderson and Zeghal, 1994; Brinn et al., 1994; Craswell et al., 1995; DeFond et al., 2000; Ferguson and Stokes, 2002; Ferguson et al., 2003). Based on that prior literature, we expect all these control variables to be positively associated with audit fees, with the exception of two risk proxies (Current Ratio and Return on Investment).

3. Industry Specialization

The Big Firm premium might also be explained by returns to industry specialist reputations. Audit firms promote themselves as industry specialists (Zeff and Fossum, 1967; Rhode et al., 1974; Danos and Eichenseher, 1981, 1982; Eichenseher and Danos, 1981), using the popular press and their websites to advertise their expertise in specific industries and to claim to provide a higher quality service and greater value (Berton, 1995; Dunn et al. 2000). DeAngelo (1981) defines quality as the auditor's ability to "discover errors or breaches in the accounting system and withstand client pressures to disclose selectively in the event a breach is discovered". The

[3] One audit pricing study that has used the panel data method is the analysis of the determinants of audit lags by Henderson and Kaplan (2000). We thank an anonymous reviewer for raising this issue.

quality differentiation claims made by the Big Firms can be viewed using agency and costly contracting theories (Jensen and Meckling, 1976 and Watts and Zimmerman, 1983, 1986) as service differentials that give rise to returns to brand name and industry specialization reputations. To the extent that their clients' control systems and financial statements are industry specific, industry specialization could lead to higher levels of audit performance and expertise beyond the generic level mandated by statute (Shockley and Holt, 1983; Palmrose, 1984; Bonner and Lewis, 1990; Ashton, 1991). Accounting firms might expect positive returns to their investment in specialization (Craswell et al., 1995) if audit clients benefit from significant reductions in the aforementioned industry-specific agency costs.

Theory about the influence of industry specialization on audit fees is inconclusive. Audit firms will only develop an industry specialist reputation if it increases the credibility of financial reporting and attracts clients. Industry specialization might do this if it creates knowledge of industry-specific audit risks that can be used on different audit assignments in the industry. The specialist knowledge could introduce production economies of scale into the audit process (O'Keefe et al., 1994), transforming the auditors involved into more efficient, lower-cost producers of audits (Eichenseher and Danos, 1981; Danos and Eichenseher, 1986; and Craswell et al., 1995). The resulting production economies of scale are passed on to clients if competitive pressures are such as to induce the industry specialists to charge lower relative audit fees (Palmrose, 1986a). The economies-of-scale argument could be strongest in the case of medium-sized audit firms if there is a clientele that demands the lowest priced audit available and if medium-sized firms are lower-cost service providers. Medium-sized firms might choose to specialise in order to generate economies of scale that will provide them with a cost advantage in this market sector and enable them to charge lower fees and gain market share (DeFond et al., 2000). This ambiguity could explain why prior research has been inconclusive (Krishnan and Yang, 1998).

Although empirical studies estimate the significance of brand name and industry-specialist returns, the design of appropriate tests for industry specialization is fraught with difficulty, little or no attention has been paid to industry size and the theoretical rationalisation is undeveloped. Industry specialist expertise is generated when a key individual, a group of people of differing ranks or a set of audit partners focus their training and experiences in the field of interest and invest significant resources in the study of legal regulations, production processes and market behaviour of key players. Audit firms will invest resources in the creation of an industry specialist reputation if there are sufficient clients willing to pay higher fees that will cover this additional investment. It could be uneconomical for any auditor to develop expertise

in small sectors, whereas several firms might find it worthwhile to specialise in large sectors. Recent research suggests that industry expertise could be developed at the city level rather than on a national scale (Ferguson et al., 2003)[4] and that the industry leader might earn a fee premium over other firms (DeFond et al., 2000; Francis et al., 2005). We build our research design on the notion that industry size matters and partition across industry sectors before defining both city-based and national-level specialists.

Most prior studies test for specialization as a differentiating feature *between* auditors[5] using a simple measure of specialization derived from the audit firm's share of the market in a particular industry (Pearson and Trompeter, 1994; Craswell et al., 1995; Palmrose, 1986a; Craswell and Taylor, 1991). However, a single market-based measure of industry specialization does not provide for a robust test and introduces a bias towards large accounting firms (Krishnan, 2001). Australian studies report both significant (Craswell et al., 1995) and insignificant industry-specialist returns (Ferguson and Stokes, 2002). US writers find that industry specialization does not have a significant effect on audit fees (Palmrose, 1986a; Pearson and Trompeter, 1994). In Hong Kong, industry specialization has a significant positive impact on the fees charged by the international accounting firms but a significant negative impact on the fees charged by their smaller counterparts (DeFond et al., 2000). These disparate results reflect the inconclusive state of theory, differences in auditing regimes in different countries, unusual descriptive statistics[6] and different research methodologies.

We address some of these measurement issues with design enhancements. We test whether the Big Firm premium could be explained by returns to industry specialist reputations by capturing investment in industry specialist expertise using multiple measures of the auditor's share of the sales revenue and audit fees of clients in an industry (Krishnan and Yang, 1998). We do this in a number of ways.

First, to facilitate comparison with prior work, we follow Craswell et al. (1995) and DeFond et al. (2000) and define specialists in terms of a dichotomous measure of the auditor's share of the audit fees of clients in an industry (DDF). We then extend this line of thought by further defining specialism in three different ways: (i) a dichotomous measure of the auditor's

[4] Ferguson et al., (2003: 429) observe an average premium of 24 percent if the auditor is both the city-specific leader and one of the two leading national firms in the industry. This premium disappears if the two leading national firms are not city leaders.

[5] The extant literature has viewed industry specialization premium as a differentiating feature amongst the (usually) Big Firms. This study investigates a different question - whether the Big Firms premium can be attributed to returns to industry specialist reputations. We thank an anonymous referee for raising this point.

[6] Krishnan (2001) attributes these disparities to "different bases …[that] yield different rankings of specialists". The mean acid test ratio found by Craswell et al. 1995 (5.828) and the peculiar mean current and quick ratios reported by DeFond et al. 2000 (0.447 and 2.157) cast doubt about the generalisability of their results.

share of the client's sales revenue in an industry (DDR); (ii) a continuous measure of the auditor's share of the audit fees of clients in an industry (CDF), and (iii) a continuous measure of the auditor's share of the sales revenue of clients in an industry (CDR). We test whether small firms devote a substantial percentage of their resources to one industry, using both continuous and dichotomous measures of the audit firm's share of their portfolio in an industry. We adopt the specialist definition which focuses on dichotomous measures of the audit firm's share of the audit fees of clients in their portfolio within an industry (DAF) and dichotomous measures of the audit firm's share of the sales revenue of clients in their portfolio in an industry (DAR). We extend this line of argument by defining specialists using a continuous measure of the audit firm's share of the audit fees of clients in their portfolio in an industry (CAF) and a continuous measure of the audit firm's share of the sales revenue of clients in their portfolio in an industry (CAR). Finally, perceptions of industry specialization are estimated using a dichotomous dummy that indicated whether the audit firm has promoted itself as a specialist in the industry (DFP). Details of the methods used to estimate DDF, DDR, CDF, CDR, DAF, DAR, CAF, CAR and DFP industry specialists are contained in the Appendix.

We use these multiple definitions at both the national and city level to test whether industry specialization might be a source of enhanced revenue in the audit market and whether firms with a brand name can enhance their audit revenues through industry specialization. We extend Palmrose (1986a) by testing for returns to brand name, non-Big Firm industry specialization and Big Firm industry specialization reputations in a single OLS regression (model 2). By expanding model (1) to form model (2), we can jointly test for non-Big Firm and Big Firm industry specialization:

$$LAF = \alpha_0 + \beta_1(\text{Controls}) + \beta_2\ \text{Brand} + \beta_3\ \text{NBFSpec} + \beta_4\ \text{BF Spec} + \varepsilon. \qquad (2)$$

where:

NBFSpec = auditor indicator variable, 1 indicates a Non-Big Firm specialist, 0 otherwise,

BFSpec = auditor indicator variable, 1 indicates a Big Firm specialist, 0 otherwise.

We follow this by replicating the basic design of Craswell et al. (1995), creating sub-samples of specialist and non-specialist auditor client industries (models 1 and 3). Model 1 is used to estimate brand name returns in non-specialist industries and then again by removing the specialist auditors in industries where such specialists exist. Model 3 computes industry specialization returns by excluding the small and medium sized non-specialists and comparing specialist fees with Big Firm non-specialist fees:

$$LAF = \alpha_0 + \beta_1\ (\text{Controls}) + \beta_2\ \text{Spec} + \varepsilon. \qquad (3)$$

where Spec is an auditor indicator variable, set equal to one if the audit firm is an industry specialist, and zero otherwise,

4. Non-Audit Services

The Big Firm premium might be explained in terms of interdependence between the fees charged by auditors for audit and non-audit services. One rationale for the joint provision of audit and NAS by accounting firms is the existence of economies of scope generated by the two services in association with "knowledge spillovers" (Simunic, 1984; Antle et al., 1997; Whisenant et al., 2003). Knowledge spillovers are a form of external economy "arising from providing audits and NAS as joint products" (Abdel-khalik, 1990, 296). These could be generated if "the total costs of one firm jointly performing both non-auditing and auditing services are less than the sum of the costs when each service is performed by a different firm" (DeBerg et al., 1991: 20). If NAS can be purchased from the incumbent auditor, a client's search and other transactions costs should also be reduced (Simunic, 1984). While the provision of NAS could threaten audit independence (and hence audit quality), joint provision is likely to be more cost-efficient (Simunic, 1984). Moreover, most of the existing empirical papers document a positive association between audit and NAS fees when a simple OLS model is used (Simunic, 1984; Simon, 1985; Abdel-Khalik, 1990; Turpen, 1990; Barkess and Simnett, 1994; Butterworth and Houghton, 1995; Ezzamel et al., 1996; Firth, 1997; Craswell and Francis 1999; Ezzamel et al., 2002; Firth, 2002). This raises concerns as to whether it is appropriate to treat assurance services and other services provided by audit firms as though they are independent (Simunic, 1984; Beck et al., 1988; Abdel-Khalik, 1990; Bartlett, 1993; Davis et al., 1993; Lowenstein, 2002; Malkiel, 2002).

A number of explanations have been offered for the observed positive association between audit and NAS fees. Simunic (1984) and Firth (2002) argue that the joint supply of audit and NAS reduces the price per unit of audit services; so assuming that demand for audit services is price-elastic, clients demand more audit services leading to an increase in total audit fees. This strongly suggests that the relationship between the fees for audit and NAS work should be modelled simultaneously, rather than treating NAS as exogenous, as has been done in prior work. It is important to note in this regard that clients in difficulty might demand more NAS, which might in turn lead to a higher audit fee because of the greater risk or work involved (Simunic, 1984). Alternatively, some client-specific events might generate a demand for consultancy services and necessitate additional auditing (Ezzamel et al., 2002; and Firth, 2002). Firth (2002) contends that mergers and acquisitions, share issues, new accounting and

information systems, new CEOs and corporate restructurings might require additional audit and NAS work. Furthermore, Solomon (1989) argues that NAS might lead to a change in the client's organisation that increases the demand for audit services, the NAS market could be uncompetitive, or audit partners might capture part of the NAS fee for themselves. Accounting firms have promoted themselves as global or 'one stop' service providers. Brand name firms capable of providing NAS as well as audit might have a marketing advantage over other auditors in terms of the provision of all of the additional services that are demanded by a client. Concerns have been expressed that the audit service has become increasingly marginalised in the quest for more profitable NAS work, leading to the possibility that the price for audit work declines as NAS business increases (Zeff, 1998; Jeppesen, 1998).

These factors suggest that the measurement of any Big Firm premium needs to take account of the potential endogeneity of NAS. Whisenant et al. (2003) argue that to the extent that audit and NAS fees are jointly determined, the residuals will be correlated and single-equation estimations violate the independent error term assumption of OLS. However, although there are clear a priori reasons to expect audit and NAS fees to be endogenous and the literature on audit and NAS pricing suggests that the services are interrelated, Whisenant et al. (2003) is the only published study that incorporates simultaneous equation models into the pricing of accounting services. We remedy this deficiency by testing for endogeneity and investigating the extent any simultaneous equation bias affects inferences by estimating the fee relationship using both OLS (model 4) and simultaneous equation (models 4 and 5):

$$LAF = \alpha_0 + \beta_1 (\text{Controls}) + \beta_2 \text{Brand} + \beta_3 \text{LNAS} + \varepsilon. \quad (4)$$

$$LNAS = \alpha_0 + \beta_1 (\text{Controls}) + \beta_2 \text{Brand} + \beta_3 \text{LAF} + \varepsilon. \quad (5)$$

where LNAS is the natural logarithm of NAS fees (£'000).

5. Monopoly Pricing

Evidence that the Big Firm premium could be attributable to monopoly pricing would have significant implications for regulatory bodies, accounting firms and audit clients. Critics contend that the Big Firms have used their dominant market position to create entry barriers and thereby charge excessive fees. For example, Gist and Michaels (1995) call for a change in the structure of the market, stating: "it is obvious that some form of intervention is necessary as the market and free enterprise system cannot be relied upon to remedy the oligopolistic or monopolistic abuses in the profession". These concerns have troubled researchers for many years (Stigler, 1968: 30; Gist and Michaels, 1995: 233; Romeo, 1999: 62) but have grown more strident in the light of the Enron debacle and the resultant reduction to a Big Four. Although concentration

ratios have increased (e.g. Eichenseher and Danos, 1981; Danos and Eichenseher, 1986; Hogan and Jeter, 1999; and Wolk et al., 2001), no systematic evidence of market abuse has appeared in the literature[7]. Consistent with this, the Monopolies and Mergers Commission and the Office of Fair Trading in the UK and the Department of Justice in the USA did not oppose the recent mergers of major accounting firms. The American evidence is that competition was largely unaffected by the mergers in 1989-1990 (Minyard and Tabor, 1991; Tonge and Wootton, 1991) and there has been no evidence of anti-competitive behaviour (Simunic, 1980; Lee, 1996; and Sullivan, 2002). The Office of Fair Trading (2001) appointed an independent body - the Law and Economics Consultant Group (LECG) - to assess competition in the architecture, law and accountancy professions. Their survey noted the high concentration levels but stated: "LECG …have not found evidence of cartel activity among the professions examined." Likewise, academic research has not uncovered evidence of an anticompetitive market (DeAngelo, 1981; Francis and Simon, 1987; Simon and Francis, 1988; Roberts et al., 1990; Turpen, 1990; Pearson and Trompeter, 1994; and Craswell and Francis, 1999). One explanation for this disparity of opinion is that some segments of the market could be more competitive than others (Simunic 1980). We analyse the effect of increasing concentration levels on audit pricing by estimating the Big Firm premium (model 1) across four quartiles of clients partitioned by total assets.

6. Data Collection

The sample comprises UK firms for the period 1985-2002. Variable definitions and sources of data used to measure them are set out in Table 1. We collected total assets, debt, earnings before interest and tax, financial year end, quick ratio, current ratio, operating profit, share issue and industry listing code data from the Standard and Poor's Global Vantage and Thomson Analytics Worldscope databases. We collected audit and NAS fee data (mandated for years ending on or after 30 September 1992) from the Datastream International, Extel Company Research and Thomson Analytics Worldscope databases. Subsidiary and auditor identity data were collated by hand from hard copies of the published financial statements and the International Stock Exchange yearbook. Financial clients were removed because the very different nature of their business makes interpretation of their financial statements and ratios problematic and their different regulatory environments might result in different costs for their auditors relative to those of industrials.

[7] High concentration ratios are usually explained as a form of product differentiation and concerns over market power "should be treated with scepticism" (Craswell and Taylor, 1991: 74).

-Insert Table 1 about here-

We trimmed the sample to eliminate extreme observations in the first and last percentiles of total assets, total debt, operating profit, earnings before interest and tax, audit fees and NAS fees. However, the key results are not materially different if the outliers are Winsorised or included in the sample. These procedures produced a panel of 180 clients covering the period 1985-2002, giving 180×18 = 3,240 firm-year observations.

Consistent with other studies, the audit fee and NAS variables are expressed in logarithmic form in order to reduce their skewness and to prevent the largest clients from unduly influencing the results. The size proxy is similarly transformed, and a square root transformation was applied to the complexity variable (the number of UK subsidiaries). As can be seen from Table 2, the assets, audit and NAS fee variables are well behaved after transformation. The mean and median Current and Quick ratios are similar to the figures the financial statement literature might lead one to expect, unlike the mean acid test ratio (5.828) found by Craswell et al. (1995) and the mean current and quick ratios (0.447 and 2.157) quoted by DeFond et al. (2000). Untabulated analyses reveal that the LAF, LNAS and LTA variables increased over the period, suggesting that clients grew in size and paid higher fees. The concentration ratio rose from 62.4% in 1985 to 86.6% in 2002, indicating a trend by clients to switch to Big Firm auditors. Untabulated correlation coefficient estimates are all below the critical value (0.8) suggested by Judge et al. (1988: 868). We computed variance inflation factors (VIF's) for the only correlations of any magnitude (Current with Quick and LTA with Sub), but since the VIF's were well below the conventional cut-off point of 10 (Hair et al., 1998: 193), we conclude that our results are not likely to be materially affected by multicollinearity amongst the explanatory variables.

- Insert Table 2 about here -

7. Results

To make the results section concise and interpretable, we tabulate annual and panel regression results and Fama McBeth (1973) t-statistics for the areas of greatest interest. Since there is some evidence of heteroskedasticity, t-values are based on corrected standard errors using the White (1980) procedure. Coefficients that are significant at the five percent level or better are shown in bold type.

7.1 Quality Differentiation Tests

The results of the yearly Big Firm premium estimation (model 1) are documented in Table 3. Almost all of the control variables display the predicted sign, with LTA, Sub, Current and Foreign providing the most explanatory power. Consistent with many prior studies, the coefficient on the Brand variable is significant in most years – in all years between 1986 and 1998, but not in 1985 and not after 1998.

The magnitude of the Big Firm premium can be estimated from these results in the following manner. Denote the expected value of Big Firm audit fees as

$$\log AF_{big} = E[LAF] = \alpha_0 + \beta_1 E[Controls] \tag{6}$$

and the expected value of non-Big firm audit fees as

$$\log AF_{small} = E[LAF] = \alpha_0 + \beta_1 E[Controls]. \tag{7}$$

Defining the Big Firm premium as the proportionate increase in fees associated with engaging a major firm as the auditor, due allowance being made for work-related differences in fees, it follows from equations (6) and (7) that (after undoing the logarithmic transformation) the premium can be derived from the estimate of the Brand coefficient as

$$\frac{AF_{big} - AF_{small}}{AF_{small}} = e^{\beta_2} - 1. \tag{8}$$

Using equation (8), annual estimates of the Big Firm premium are given in the final column of Table 3. We set the premium equal to zero in the years when the Brand coefficient was not statistically significant. It can be seen from the table that the Big Firm premium estimates generally fluctuated in the range 15-20% over the period 1985-1996, except for 1985 (0%) and 1987 (26%). The Big Firm premium increased abruptly to 30.2% in 1997 and 33.9% in 1998, after which it became indistinguishable from zero.

- Insert Table 3 about here –

Table 4 documents the results for a pooled time- and firm-fixed-effects model that contains the previous control variables, the Brand dummy and a Brand-year interaction variable for each of the years 1986-2002 inclusive. A fixed-effects model has the advantage of controlling for firm-specific omitted factors that might confound the results in the annual cross-sectional regressions. The fixed-effects estimation allows one to see how the premium varies through time vis-à-vis the benchmark year (1985). The Brand coefficient is significant and positive,

indicating the existence of a Big Firm premium in 1985. This contrasts with the annual regression results reported in Table 3, where the Brand coefficient was not significant in that year[8]. The Brand-year interaction variables had significant positive coefficients in the years 1987, 1992, 1994, 1997 and 1998, indicating that the premium was larger in those years than in 1985. These findings might suggest (but see below) that the PricewaterhouseCoopers merger enabled the Big Firms to increase audit fees in the years 1997 and 1998. Over the last four years of the sample period, the audit fee premium falls back to the 1985 level in the fixed effect model and is insignificant in the annual estimations. This reduction in the premium might be attributable to the high profile scandals or the considerable regulatory and political upheaval in the market for professional services. However, since these explanations are not grounded in academic theory, we do not seek to explain how the sources of the Big Firms premium have evolved over time in this paper.

-Insert Table 4 about here –

An indication of the economic significance of these results is shown in the Premium column in Table 4. As before, the magnitudes of the Big Firm premia are computed by reference to equation (8) and indicate the percentage difference in audit fees with and without the audit being carried out by one of the major firms. Again, when the relevant Brand coefficient was not statistically significant, the premium is set equal to zero. The premium was 21.2% in 1985, which is pretty much the average level reported for the annual regressions in Table 3. The premium increased by only about one percent in some of the later years, and it never fell from the 1985 level, suggesting that too much should not be made of the likely effects of the mergers and scandals on fee levels. Whatever is the source of the Big Firm premium, it appears to have been a temporally stable phenomenon. We turn now to consider some of those factors.

7.2 Brand Name and Industry Specialization Tests

The brand name and industry specialization OLS estimates (models 2-3) appear in Tables 5 and 6. The variable Spec refers to whether or not the auditor meets our definition of being a specialist in the client's industry. The NBFSpec and BFSpec variables capture a Non-Big Firm

[8] Why this is so is not entirely clear. We conjecture that the difference is due to the fixed effects model having a stronger explanatory power than the annual regressions because of its greater number of degrees of freedom, coupled with its controls for possibly confounding unmodelled firm-and-year factors. This would account for why the fixed effects model is able to pick up the brand name effect in 1985 that the annual estimation just fails to do at the ten percent level.

or a Big Firm that is an industry specialist. In the case of the DDF and DDR definitions of industry specialization, the industry must pass a size criterion (contain at least 30 companies) and be important to the firm in terms of its share of industry audit fees or the extent to which it is reliant on the industry for revenue, respectively. The DAR and DAF definitions focus on how big a proportion of the auditor's business comes from the client's industry. These are researcher-derived measures of industry specialization. In contrast, DFP refers to whether the auditor promotes itself as a specialist in that particular industry. The CDF and CDR definitions are continuous measures of the extent to which the firm is reliant on the industry for audit fees and revenue, respectively. CAR and CAF are researcher-derived measures of the concentration of the auditor's business from the client's industry.[9] Control variables are included in the regressions but are not reported because the coefficients are similar in magnitude to those reported in tables 3 and 4. As discussed in section 3, we jointly estimate brand name and specialization returns (Brand, NBFSpec and BFSpec in model 2) for the Palmrose (1986a) replications. For the Craswell et al. (1995) methodology, we create sub-samples of specialist and non-specialist auditors and estimate returns to brand name (model 1) separately from industry specialization returns (Spec in model 3). Since brand is invariably significant, only the statistically significant Spec variables are tabulated.

Our analysis shows that returns are generally not significant for industry specialists defined at the national level. The results in Table 5 indicate significant returns when specialization is defined by reference to a firm's share of the industry's clients and audit fees (DDF). However, the other ways of defining specialization all fail to yield significant results. The coefficient on Brand is significant but the coefficients on NBFSpec and BFSpec are almost invariably insignificant, suggesting that it is not simply a return to national-level industry specialist reputations. The results in Table 6 show that returns could be significant if industry specialization is defined at the city-level.[10] We observe significant results when specialization is defined by reference to a firm's share of the industry clients, fees and revenues (i.e., DDF and

[9] All the regressions include Brand, which is the Big Firm indicator variable, and one of nine ways of defining an industry (DDF, DAF, DDR, DAR, DFP, CDF, CAF, CDR and CAR). Both Big Firms and medium sized ones register DDF, DAF and DAR industry specializations throughout the period, but medium sized firms fail to meet the DDR and DFP criteria in a number of years. To avoid collinearity problems and to facilitate consistent comparison of the results across time, BFspec is included in all of the DDF, DAF and DAR regressions but is not reported for the other estimations. However, the results in the years that medium sized firms meet the DDR and DFP criteria are not dissimilar to those reported.

[10] This is consistent with the behavioural study carried out by Simnett and Wright (2005) in a Big 4 firm into the knowledge required by auditors specialising in the insurance industry. They found that on-the-job experience was the most prevalent method of audit personnel gaining industry specialist knowledge. If the tacit knowledge of individual auditors is the most important source of industry expertise, this will generally reside at the city office level rather than be spread equally across all of a firm's offices.

DDR), share of the auditor's business that comes from the client's industry (DAF) and its importance to the firm's revenues (i.e., CAR). The other ways of defining specialization fail to yield significant results. Moreover, additional untabulated results indicate that the returns to city-level industry specialization are greater if the specialist is restricted to the market leader.

-Insert Tables 5 and 6 about here-

The implications of our findings are that the Big Firm premium could be attributable to brand names, cannot be credited to national-level industry specialist returns, but might be driven by city-level industry specialist returns. The evidence that returns to industry specialisation are significant at the city level but insignificant at the national level differs from existing research that suggests that industry expertise is rewarded if the auditor is both the city-specific leader and one of the two leading national firms in the industry (Ferguson et al., 2003) or if the auditor is the industry leader (DeFond et al., 2000; Francis et al., 2005). Our mixed results are not surprising given that firms could expect to receive returns on investments in industry specialist expertise whilst competitive pressures could force firms to pass on at least part of the benefits of specialization to clients in the form of lower order charges. Moreover, our results have been rigorously tested using a larger number of definitions of an industry specialist and a larger panel of data than extant studies. Why our results differ from the prior work is not entirely clear. We conjecture that the difference is due to industry, cultural and regulatory differences between the UK and other countries and/or the slightly different research design used.

7.3 Knowledge Spillovers Tests

One possible explanation for the Big Firm premium is that it stems from the major firms being able to retain knowledge spillovers. This might arise if the Big Firms are able to generate more audit revenue, due allowance being made for cross-sectional variations in the drivers of audit work, because of operational audit efficiencies they obtain from providing consulting services to

those clients.[11] Preliminary evidence indicating that this might be happening is provided by an untabulated univariate analysis of the data that shows that a larger amount (in terms of money value) of NAS fees is generated by Big Firms when the clients are complex and diversified in their operations than is obtained by non-Big Firms from simple, undiversified clients. This finding must be treated with caution as it might be due to audits of the former being more costly to undertake. We therefore fit both OLS and two-stage simultaneous equation regressions (models 4 and 5) for the years when NAS fee data are available. The OLS model treats NAS as an exogenous determinant of audit fees whereas the simultaneous equations model allows us to explore whether the endogeneity of NAS is an issue that has to be taken into account in determining the impact of NAS on audit fees.

The results of the relationships between audit fees, brand name and NAS are presented in Table 7. The same control variables were included in both the OLS and the 2SLS specifications as were employed in the earlier regressions. We predict that very similar factors that explain the magnitude of audit fees will also drive NAS - namely, client size, risk, profitability and complexity[12]. However, while there is reason to believe that clients with financial year-ends that fall within the peak period December-March impose greater marginal costs on auditors than those with other year-ends, the same does not seem likely to be the case with non-audit assignments. Since the demand for NAS seems unlikely to be heavily influenced by the client's financial reporting cycle, we include the same exogenous variables in the LNAS 2SLS equation, except we exclude the YE variable. The OLS results imply that the audit revenue elasticity with respect to non-audit revenue is 0.138; in other words, an increase in NAS fees of one pound will generate extra audit fees of about fourteen pence. However, we find convincing evidence (at the $p<4\%$ and $p<3\%$ levels, respectively) that audit and NAS fees are interrelated using the Hausman (1978) exogeneity test, suggesting these results need to be treated with caution. When LNAS is estimated as an endogenous variable by fitting a simultaneous equations model, it

[11] The unobservability of the costs involved in conducting audits means we are unable to say anything about who captures any Big Firm premium. If Big Firms pay higher salaries then the premium will be shared between the partners and the more junior audit staff.

[12] Ezzamel et al. (2002) and Firth (2002) argue that some company specific events generate a demand for consultancy services and also require extra auditing. We have carried out untabulated sensitivity checks which show that the results of our OLS and simultaneous equation models are not materially different when dummy and interaction variables to control for mergers, share issues, the installation of information systems, a new chief executive officer and restructuring processes are added. However, one must treat the significant audit-NAS relationship and the insignificant event effects with care. Dummies and interaction terms were constructed using backdated newspaper and microfiche reports. This analysis was undertaken retrospectively and produced a small number of events for the early years of the sample. The lack of variability in the dummy variables in the early years could mitigate against more positive results. Furthermore, there is suggestive evidence of a bias towards larger companies because they receive a relatively greater share of the total press coverage. The latter factor might be important if company specific events that require significantly greater levels of audit effort for small clients are unreported in the national press. We thank an anonymous referee for raising these issues.

remains a significant factor. If we focus on the two-stage results, the audit revenue elasticity with respect to non-audit revenue is 0.151; in other words, an increase in NAS fees of one pound will generate extra audit fees of 15 pence. The relationship is much stronger when we consider the impact of audit fee income on non-audit fee revenue. There is clear evidence to suggest that NAS revenue is a positive function of the level of audit fee income. Moreover, the quantitative impact of the LAF coefficient is much greater, an increase in audit revenue from a client of one pound generating additional non-audit income of 93 pence.

- Insert Table 7 about here -

The Table 7 results indicate that the Big Firm premium coefficient is not statistically significant after controlling for NAS, suggesting Big Firms charge the same price as a small audit firm. This is contrary to the result shown in the earlier tables, when no control was included for NAS. Taken together, these results imply that the Big Firm premium could be partially attributable to the failure to control for NAS. When allowance is made for the endogeneity of NAS, the significance of the Big Firm premium declines substantially. However, one must interpret this result with a degree of caution because the extent to which NAS might proxy for other omitted variables is unclear. We do not investigate this issue in this paper but believe that the relationship between NAS and other variables is a valuable avenue for further research.

7.4 Monopoly Pricing Tests

Our models contain control variables for the size of a client that should be the prime factor in the determination of the price of an audit. However, size might affect audit fee income in more complex ways than is captured by the simple linear specification used in this and earlier studies. For example, a Big Firm might be able to charge more than its smaller brethren for auditing a large client because the client's market is more concentrated. We address this possibility by re-running model 1 for sub-samples partitioned according to the size of the clients. Size partitioning across the panel of data is problematic because clients move between quartiles over the sample period. We therefore present the results of annual estimations in Table 8. The brand name premium is significant for clients from the first quartiles in 1987, 1988, 1994, 1995, 1997-2000 and 2002. For the second quartile, significant brand name returns are reported in 1989-1991, 1993, 1997, 1998 and 2001. A significant brand name coefficient is observed in 1985 and 1992 for the third quartile and in 1987 and 1998 for the fourth quartile. The significant negative

brand name coefficient in 2002 for the fourth quartile suggests that the international firms charged significantly *lower* fees than their smaller counterparts. The reasons for this are unclear; we conjecture it could be due to price competition for the prestigious blue chip clients that were audited by Andersen in the wake of the Enron and WorldCom fiascos. For robustness, we estimated a panel regression across the sub-samples of clients that did *not* move between quartiles but the results were not materially different from those reported above. These mixed results imply that there is no evidence of systematic anticompetitive pricing and the demand for the quality-differentiated services of a reputable accounting firm is greatest for small clients, consistent with product differentiation (Anderson and Zeghal, 1994).

- Insert Table 8 about here –

7.5 Sensitivity Analysis

The sensitivity of the results reported in Tables 3-8 have been tested in a variety of ways. Our checks suggest the models are well specified from an econometric perspective. There is no evidence that hetroskedasticity is a problem. Likewise, variable exclusion, consideration of a different model and prior beliefs about variable estimates (Gujarati 1999) suggest that the results are not contaminated by multicollinearity.

Since the annual regression results could be sensitive to firm-specific events not captured by our control variables, we also estimated fixed-effects regressions with dummies for audit firms. An important feature of this procedure is that the Brand variable is substituted with separate variables for each of the large-, medium- and small-sized firms. Consistent with the Big Firm premium evidence reported earlier, we find that the coefficients on the medium and small firms are significantly lower than the Big Firm coefficients. We also sequentially exclude individual accounting firms from the estimate of model 1 and find results that are consistent with our earlier analysis. We find no evidence to suggest that any one particular firm is driving the findings reported in this paper.

In addition to the steps outlined in above, model structure has been further assessed by using different proxies for client size, complexity, risk, brand name and industry specialization, without the results being materially affected. We flex our industry specialization definitions by using steeper 20% and 30% hurdle rates. Although there are fewer specialists, the unreported results are not materially different. Likewise, we test the sensitivity of the results reported in tables 5 and 6 by excluding each firm and industry sequentially to see if any were driving the results. The results were substantially the same.

Functional form has further been examined by considering the possibility that brand name, size, risk and NAS might interact in complex ways. Audit firms might be able to generate more NAS business when the client is particularly large or risky. Big Firms might be particularly well placed to provide NAS and their ability to provide such additional services might lead to larger audit fees. We include various two-way interactions of auditor type, client size, client risk and NAS revenue, but the untabulated results do not support the view that the Big Firms charge more the greater the size or risk of the client.

We acknowledge that our research design could be sensitive to the assumption that auditor choice is an exogenous variable. Recent studies argue that clients are not randomly assigned to audit firms.[13] We control for selection bias using the methodology detailed by Maddala (1983). In the first stage, we estimate an auditor choice probit model to compute inverse Mill's ratios (IMR). Following Ireland and Lennox (2002), we believe that the choice of audit firm will depend mostly on whether the client is large (LTA) and has diverse overseas operations (Foreign). We extend this work by testing whether clients are also drawn to an audit firm that can provide additional consultancy services (LNAS). Let y_i^* denote the unobservable utility of the Big versus non-Big Auditor choice defined by the relationship

$$y_i^* = \gamma_0 + \gamma_1 LTA_i + \gamma_2 Foreign_i + \gamma_3 LNAS_i + v_i \tag{9}$$

where y_i =1 if y_i^* >0 and y_i = 0 otherwise.

The results of our estimation of the auditor choice equation (9) are presented in column (1) of Table 9. All of the explanatory variables exhibit the expected sign and are statistically significant (p<0.001). These findings imply that clients characterized as relatively larger (LTA_i), with many overseas subsidiaries ($Foreign_i$) or requiring additional consultancy services ($LNAS_i$) are more likely to hire a large audit firm than a small audit firm.

The next step is to separately state audit fee models for large and small firms as follows

$$LAF_{1i} = \beta_{10} + \beta'_{11} Controls_i + u_{1i} \tag{10}$$

$$LAF_{0i} = \beta_{00} + \beta'_{01} Controls_i + u_{0i} \tag{11}$$

where for client i $Controls_i$ is the same vector of proxies for client size, risk, complexity and the opportunity cost of audit labour as used in equation (1) and LAF_{1i} and LAF_{0i} are the natural

[13] Ireland and Lennox (2002) find that self-selection among 1,543 listed UK clients is significant and the Big Firm premium is twice as large when selectivity is taken into account. Chaney et al. (2004) observe a Big Firm premium for 15,255 private UK clients that disappears after controlling for self-selection bias. Furthermore, clients choosing Big Firm auditors would have faced higher fees had they chosen a non Big Firm auditor.

logarithm of the audit fees paid to a large or small audit firm. For each client i, their choice of a large or small firm determines whether LAF_{1i} or LAF_{0i} is observed. Unlike equation (1), equations (10) and (11) allow the coefficients on the control variables to differ for large and small firms (i.e. $\beta'_{11} \neq \beta'_{01}$). The results of the large and small audit firm demand equations (10 and 11) are presented in columns (2) and (3) of Table 9 respectively. The coefficients on the control variables are generally consistent with our expectations. The estimate of the Big Firm premium ($\exp^{\hat{\beta}_{10}} - \exp^{\hat{\beta}_{00}}$ = 14 percent) is similar to the mean of the premia reported in Table 3.

In the final stage, we control for self-selection bias by estimating audit fee models for large and small firms

$$LAF_{1i} = \beta_{10} + \beta'_{11} Controls_i + \sigma_{1u}\lambda_{1i} + e_{1i} \quad (12)$$

$$LAF_{01i} = \beta_{00} + \beta'_{01} Controls_i + \sigma_{0u}\lambda_{0i} + e_{0i} \quad (13)$$

where $\sigma_{1u}\lambda_{1i} = E[u_{1i} | y_i = 1]$ and $\sigma_{0u}\lambda_{0i} = E[u_{0i} | y_i = 0]$ control for selection. The IMR (λ_{1i} and λ_{1i}) results from equation (9) are used to allow for selection bias in equations (12) and (13). We present the results of these estimations in columns (4) and (5) of Table 9. The coefficients on the control variables are generally consistent with our earlier work and the estimate of the Big Firm premium increases to 23 percent. The significance of the IMR indicates the importance of controlling for selectivity. Consistent with Ireland and Lennox (2002), these results imply that studies that fail to control for self-selection bias could underestimate the size of the Big Firm premium. The question of whether the Big Firm premium determinants are affected by self-selection bias is left for further work.

-Insert Table 9 about here-

8. Summary and Conclusions

Prior research on audit pricing has found evidence consistent with the claim that the largest audit firms charging a premium for their services in a number of countries. However, the evidence concerning the UK has been mixed, with some studies reporting a premium and others failing to do so. Our study has two distinguishing features. We start by confirming over a greater time period than hitherto the finding in prior research that the Big Firms appear to earn an audit fee premium, when due allowance is made for factors like the size, complexity and riskiness of a client's business. We add to this earlier work by finding that the premium has eroded in recent years.

The major contribution of the paper is to examine whether this Big Firm premium is associated with omitted factors. We test for these factors using a large panel of data taken from a wider time frame than the extant literature and by providing a number of research design improvements. This is the first study to find that the Big Firm premium might be associated with the provision of NAS to UK audit clients, when proper allowance is made for the fact that the pricing of an audit can be affected by non-audit services, and vice versa. We also examine the possible role of industry specialization, using a much wider number and variety of measures than have been employed in previous studies. We find that the Big Firm premium cannot be attributed to specialization at the national level, although there is some evidence of significant returns if specialization is defined at the city level. Finally we consider whether the Big Firms are colluding over price in the highly concentrated large audit client market. When we partition by client size, we find that Big Firm returns are more significant in the small client sector, consistent with product differentiation rather than abuse of monopoly power.

Our study has a number of limitations. The UK is an excellent test site for examining the relationship between the pricing of audit and non-audit services provided to audit clients because both types of fee have been publicly disclosed for some time. However, the amount the auditor receives for non-audit services is not disaggregated into component parts (e.g. special investigations, tax advice, corporate recovery, mergers and acquisitions and other management advisory services). Changes in various countries concerning the non-audit work that auditors can do for their audit clients could make it possible to narrow down the focus in future investigations.

A second limitation is the essentially ad hoc nature of the audit and non-audit pricing models used in this and other studies. A better theoretical understanding of the audit production function and determinants of NAS fees could enable sharper tests to be made by researchers, assuming suitable empirical proxies can be identified.

Consistent with much of the prior literature, a third limitation is that the models used in this study initially assume that auditor choice is exogenous. Our models show that the Big Firm premium increased after controlling for self-selection bias. This study has been unable to ascertain the extent to which the determinants of the Big Firm premium are affected by self-selection bias. We believe that this could be a fruitful avenue for further work.

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Appendix

The prior literature defines industry specialization using a dichotomous measure of the auditors' sales or fees in an industry, hereinafter DAI (Palmrose, 1986a; Craswell et al., 1995 and DeFond et al., 2000). The present study extends this prior work in four ways. First, we compute continuous and dichotomous measures of specialization to try to capture complexities stemming from firms choosing to invest different amounts in the development of specialist expertise (Krishnan and Yang, 1998). Second, since small firms might devote significant amounts of their resources to one particular industry, we define specialization in terms of the audit firm's share of their portfolio in an industry, hereinafter AFSI, and the audit firm's perceived areas of industry specialization (as advertised on websites and in corporate literature), hereinafter AFP. Third, for robustness we estimate three (10%, 20% and 30%) hurdle rates of specialization. Finally, we define specialization at both the city-level and national-level (Ferguson et al., 2003). In total, we use nine specialist measures. These measures are derived from the following variables:

$SALES_{jik}$ = sales of company j in industry i audited by firm k,

$FEES_{jik}$ = audit fees of auditor k from company j in industry I,

$CLIENT_{jik}$ = 1 if company j is in industry i and is audited by auditor k; 0 otherwise

K_i = number of (listed) companies in industry i.

Five of the specialist measures are dichotomous indicator variables:

1. A DAI specialist variable, DDR, that takes the value of 1 if the following two conditions hold: (i) the industry contains at least 30 clients and (ii) the aggregate share number of the sales of the audit firm's clients in an industry exceed α = 10% (20%) of the industry's sales revenue. Otherwise DDR is set equal to zero. More precisely:

   If $\{(K_i \geq 30) \cap (SALESSHARE_{ik} > \alpha)\}, DDR_{ik} = 1;$ otherwise $DDR_{ik} = 0,$

   where K_i is the number of companies in industry i and

$$SALESSHARE_{ik} = \sum_{j=1}^{J} \left(\frac{SALES_{jik}}{\sum_{k=1}^{K} \sum_{j=1}^{J} SALES_{jik}} \right).$$

   DDR is intended to capture settings where becoming an industry specialist might be a rational goal for an audit firm (condition one) and where the audit firm's clients have a significant share of the economic activity in that industry (condition two).

2. A fee-based DAI specialist variable, DDF, that takes the value of 1 if the following two conditions hold: (i) the industry contains at least 30 clients and (ii) the audit firm's share

of the audit fees paid by the industry exceeds α = 10% (20%). DDF = 0 otherwise. More precisely

If $\{(K_i \geq 30) \cap (FEESSHARE_{ik} > \alpha)\}, DFR_{ik} = 1; \text{otherwise } DFR_{ik} = 0$, where:

$$FEESSHARE_{ik} = \sum_{j=1}^{J} \left(\frac{FEES_{jik}}{\sum_{k=1}^{K} \sum_{j=1}^{J} FEES_{jik}} \right).$$

DDF is intended to capture settings where becoming an industry specialist might be a rational goal for an audit firm (condition one) and where the auditor has a substantial share of the audit income generated by the industry (condition two).

3. A revenue-based AFSI specialist variable, DAR, that takes a value of 1 if the following two conditions hold: (i) at least α = 20% (30%) of the number of the firm's clients and (ii) α = 20% (30%) of the value of the auditors' clients' revenue is from the industry. DAR = 0 otherwise. More precisely:

   If $\{(\%CLIENT_{ik} \geq \alpha) \cap (\%SALESCLIENT_{ik} > \alpha)\}, DAR_{jk} = 1; \text{otherwise } DAR_j = 0$,

   where

$$\%CLIENT_{ik} = \sum_{j=1}^{J} \left(\frac{CLIENT_{jik}}{\sum_{i=1}^{I} \sum_{j=1}^{J} CLIENT_{jik}} \right).$$

$$\%SALESCLIENT_{ik} = \sum_{j=1}^{J} \left(\frac{SALES_{jik}}{\sum_{i=1}^{I} \sum_{j=1}^{J} SALES_{jik}} \right).$$

   DAR is intended to capture settings where the auditor has a large share of its clients from the industry (condition one) and the clients are economically significant (condition two).

4. A fee-based AFSI specialist variable, DAF, that takes a value of 1 if the following two conditions hold: (i) at least α = 20% (30%) of the number of the firm's clients and (ii) α = 20% (30%) of the value of the firm's fees are from the industry. DAF = 0 otherwise. More precisely:

   If $\{(\%CLIENT_{ik} \geq \alpha) \cap (\%FEESCLIENT_{ik} > \alpha)\}, DAR_{jk} = 1; \text{otherwise } DAR_j = 0$,

   where

$$\%CLIENT_{ik} = \sum_{j=1}^{J} \left(\frac{CLIENT_{jik}}{\sum_{i=1}^{I}\sum_{j=1}^{J} CLIENT_{jik}} \right).$$

$$\%FEESCLIENT_{ik} = \sum_{j=1}^{J} \left(\frac{FEES_{jik}}{\sum_{i=1}^{I}\sum_{j=1}^{J} FEES_{jik}} \right).$$

DAF is intended to capture settings where the auditor has a large share of both its clients (condition one) and its audit fee income (condition two) from the industry.

5. An AFP specialist variable, DFP, that takes a value of 1 if the firm promotes itself as a specialist in this industry. DFP = 0 otherwise.

We also use four corresponding continuous variables of industry specialism:

1. A revenue-based measure of DAI specialist, CDR: the ratio of the accounting firm's revenue within an industry to the total amount of revenue earned by firms in that industry. CDR is a continuous measure based on the share of the total sales revenue of that industry attributable to the auditor's clients:

$$SALESSHARE_{ik} = \sum_{j=1}^{J} \left(\frac{SALES_{jik}}{\sum_{k=1}^{K}\sum_{j=1}^{J} SALES_{jik}} \right).$$

2. A fee-based measure of DAI specialist, CDF: the ratio of the accounting firm's audit fees within an industry to the total amount of audit fees paid by firms in that industry. CDF is a continuous measure based on the auditor's share of the total audit fees paid by companies in that industry:

$$FEESSHARE_{ik} = \sum_{j=1}^{J} \left(\frac{FEES_{jik}}{\sum_{k=1}^{K}\sum_{j=1}^{J} FEES_{jik}} \right).$$

3. A revenue-based measure of AFSI specialist, CAR: the ratio of the accounting firm's revenue within an industry to the total amount of revenue earned by the firm's portfolio of clients. CAR is a continuous measure based on the share of the total sales revenue of that industry attributable to the auditor's clients:

$$SALESCLIENT_{ik} = \sum_{j=1}^{J} \left(\frac{SALES_{jik}}{\sum_{i=1}^{I} \sum_{j=1}^{J} SALES_{jik}} \right).$$

4. A revenue-based measure of AFSI specialist, CAF: the ratio of the accounting firm's audit fees within an industry to the total amount of audit fees paid by firms in their total portfolio of clients. CAF is a continuous measure based on the proportion of its fees that are derived from the industry:

$$FEESCLIENT_{ik} = \sum_{j=1}^{J} \left(\frac{FEES_{jik}}{\sum_{i=1}^{I} \sum_{j=1}^{J} FEES_{jik}} \right).$$

Table 1

Summary of the data collection procedure and model specification

	Raw Variable	Transformed Variable	Data Source
Dependent variable	Audit fees (£'000)	Natural log of audit fees (LAF)	Datastream
Dependent variable	NAS fees (£'000)	Natural log of NAS fees (from 1992)	Extel
Size proxy	Total assets (£'M)	Natural log of total assets (LTA)	Global Vantage and Worldscope
Risk proxy	Long term debt (£'M)	Long term debt to total assets (DTA)	Global Vantage and Worldscope
Risk proxy	Earnings before interest and tax (£'M)	Return on investment (ROI)	Global Vantage and Worldscope
Risk proxy	Operating profit (£'M)	Dichotomous variable (Loss) = 1 if an operating loss in any of the prior three years; 0 otherwise	Global Vantage and Worldscope
Risk proxy	Net current assets	Current Ratio (Current)	Global Vantage and Worldscope
Risk proxy	Liquid resources	Quick Ratio (Quick)	Global Vantage and Worldscope
Complexity	UK subsidiaries	Square root of the number of subsidiaries (Sub)	Stock Exchange Yearbook
Complexity	Overseas subsidiaries	Foreign subsidiaries to total number of subsidiaries (Foreign)	Stock Exchange Yearbook
Busy period	Financial year end	Dichotomous variable (YE) = 1 if fiscal year end between December and March; 0 otherwise	Global Vantage and Worldscope
Audit quality	Auditor identity	Dichotomous variable (Brand) = 1 if auditor is a Big Firm; 0 otherwise	Stock Exchange Yearbook

Table 2

Descriptive Statistics

	Mean	Median	St. dev.	Min	Max
LAF	5.005	4.854	1.261	2.267	9.341
LTA	11.730	11.574	1.674	5.872	18.846
Sub	3.573	3.265	1.889	0.000	14.000
Current	1.592	1.412	0.847	0.015	8.987
Quick	0.966	0.851	0.772	0.012	8.864
DTA	0.132	0.074	0.195	0	3.612
ROI	0.106	0.109	0.123	-1.345	0.692
Foreign	0.254	0.188	0.270	0.000	1.000
YE	0.687	1.000	0.464	0.000	1.000
Loss	0.158	0.000	0.354	0.000	1.000
Brand	0.771	1.000	0.409	0.000	1.000
LNAS	4.479	4.412	1.553	0.000	9.116

LAF = natural logarithm of audit fees; LTA= natural logarithm of total assets (£'000); Sub = square root of the number of subsidiaries; Current = ratio of current assets to current liabilities; Quick = ratio of current assets less stock to current liabilities; DTA = ratio of long-term debt to total assets; ROI = ratio of earnings before interest and tax to total assets; Foreign = proportion of subsidiaries that are foreign operations; YE = 1 if fiscal year end between December and March inclusive, 0 otherwise; Loss = 1 if operating loss reported in prior 3 years, 0 otherwise; Brand = 1 if Big Firm auditor, 0 otherwise; LNAS = natural logarithm of non-audit fees.

Table 3

Annual Big Firm premium regressions

$$LAF = \alpha_0 + \beta_1 \text{ LTA} + \beta_2 \text{ Sub} + \beta_3 \text{ Current} + \beta_4 \text{ Quick} + \beta_5 \text{ DTA} + \beta_6 \text{ ROI} + \beta_7 \text{ YE} + \beta_8 \text{ Foreign} + \beta_9 \text{ Loss} + \beta_{10} \text{ Brand} + \varepsilon$$

	Intercept ?	LTA +	Sub +	Current -	Quick +	DTA +	ROI -	Foreign +	YE +	Loss +	Brand +	F-stat	R^2	Premium %
1985	**-3.283**	**0.619**	**0.186**	-0.030	**0.308**	0.469	-0.708	0.204	0.104	0.107	0.138	127.81[a]	0.82	**0**
	(8.86)	(18.21)	(7.25)	(0.27)	(2.13)	(0.47)	(1.43)	(1.21)	(1.13)	(1.14)	(1.55)			
1986	**-2.741**	**0.565**	**0.212**	-0.113	0.058	0.436	-0.369	**0.343**	0.015	0.012	**0.174**	139.46[a]	0.81	**19.0**
	(7.63)	(17.18)	(8.05)	(1.11)	(0.51)	(0.75)	(0.74)	(2.39)	(0.16)	(0.12)	(1.99)			
1987	**-2.101**	**0.494**	**0.237**	**0.011**	0.030	0.474	-0.191	**0.374**	0.039	0.088	**0.231**	116.55[a]	0.80	**26.0**
	(6.33)	(16.24)	(9.46)	(0.12)	(0.27)	(0.88)	(0.32)	(2.34)	(0.48)	(0.69)	(2.92)			
1988	**-2.625**	**0.556**	**0.237**	-0.059	0.020	0.363	-0.014	**0.318**	0.075	0.063	**0.148**	141.97[a]	0.80	**16.0**
	(9.17)	(21.85)	(11.10)	(0.76)	(0.21)	(0.87)	(0.03)	(2.27)	(1.06)	(0.53)	(2.10)			
1989	**-2.510**	**0.563**	**0.209**	-0.120	0.070	0.497	-0.379	0.235	0.118	0.142	**0.148**	132.75[a]	0.80	**16.0**
	(8.20)	(20.86)	(9.68)	(1.79)	(0.83)	(1.35)	(0.84)	(1.57)	(1.64)	(1.07)	(1.97)			
1990	**-1.441**	**0.469**	**0.238**	**-0.119**	**0.030**	0.222	-0.027	**0.346**	0.074	-0.006	**0.139**	143.21[a]	0.81	**14.9**
	(5.10)	(18.51)	(11.71)	(1.98)	(0.35)	(0.75)	(0.06)	(2.61)	(1.11)	(0.04)	(2.03)			
1991	**-0.949**	**0.428**	**0.253**	**-0.186**	0.071	0.229	-0.299	**0.439**	0.112	0.060	**0.162**	154.50[a]	0.80	**17.8**
	(3.72)	(18.41)	(13.14)	(2.86)	(0.85)	(0.91)	(0.85)	(3.59)	(1.82)	(0.57)	(2.46)			

Table 3 (continued)

	Intercept ?	LTA +	Sub +	Current -	Quick +	DTA +	ROI -	Foreign +	YE +	Loss +	Brand +	F- stat	R^2	Premium %
1992	**-0.683**	**0.396**	**0.253**	-0.081	-0.002	0.349	-0.241	**0.522**	0.098	0.057	**0.185**	141.44[a]	0.80	**20.3**
	(2.79)	(17.32)	(12.56)	(1.15)	(0.01)	(1.45)	(0.84)	(4.28)	(1.56)	(0.61)	(2.70)			
1993	**-0.919**	**0.426**	**0.242**	**-0.175**	0.087	0.456	-0.119	**0.555**	0.025	0.137	**0.146**	177.37[a]	0.83	**15.7**
	(4.00)	(19.76)	(13.00)	(2.84)	(1.21)	(1.94)	(0.61)	(4.81)	(0.41)	(1.74)	(2.08)			
1994	**-0.856**	**0.431**	**0.227**	**-0.180**	0.046	0.103	**-0.508**	**0.663**	0.063	0.037	**0.183**	157.40[a]	0.81	**20.1**
	(3.65)	(19.68)	(12.32)	(3.28)	(0.69)	(0.47)	(2.04)	(5.91)	(1.03)	(0.45)	(2.60)			
1995	**-0.952**	**0.425**	**0.224**	**-0.134**	0.052	0.098	**-0.526**	**0.655**	**0.115**	0.001	**0.168**	178.99[a]	0.84	**18.3**
	(4.52)	(21.00)	(13.00)	(2.54)	(0.82)	(0.87)	(2.78)	(6.45)	(2.05)	(0.04)	(2.46)			
1996	**-0.882**	**0.401**	**0.214**	**-0.103**	0.043	0.090	**-0.511**	**0.685**	0.098	0.014	**0.179**	163.24[a]	0.82	**19.6**
	(3.82)	(18.60)	(12.14)	(2.14)	(0.64)	(0.81)	(2.43)	(6.97)	(1.75)	(0.19)	(2.51)			
1997	-0.553	**0.391**	**0.230**	**-0.246**	0.137	0.041	-0.294	**0.759**	0.148	0.048	**0.264**	126.82[a]	0.79	**30.2**
	(1.48)	(11.62)	(7.86)	(3.61)	(1.48)	(1.06)	(0.75)	(4.44)	(1.55)	(0.60)	(2.61)			
1998	**-0.844**	**0.418**	**0.215**	**-0.226**	0.143	0.044	-0.201	**0.576**	0.136	0.043	**0.292**	115.13[a]	0.84	**33.9**
	(2.75)	(14.56)	(8.88)	(4.03)	(1.76)	(0.41)	(0.69)	(4.25)	(1.47)	(0.48)	(2.88)			
1999	**-0.846**	**0.436**	**0.187**	**-0.090**	0.042	0.320	**-0.603**	**0.853**	0.001	-0.082	0.153	135.35[a]	0.85	**0**
	(2.95)	(17.03)	(8.38)	(2.03)	(0.58)	(1.83)	(2.30)	(6.34)	(0.02)	(0.76)	(1.78)			
2000	**-0.921**	**0.423**	**0.186**	**-0.105**	0.026	**0.051**	-0.378	**0.791**	0.047	**0.419**	0.178	114.88[a]	0.81	**0**
	(2.80)	(14.04)	(6.80)	(2.09)	(0.31)	(4.12)	(1.12)	(5.27)	(0.47)	(2.90)	(1.68)			

Table 3 (continued)

	Intercept	LTA	Sub	Current	Quick	DTA	ROI	Foreign	YE	Loss	Brand	F-stat	R^2	Premium
	?	**+**	**+**	**-**	**+**	**+**	**-**	**+**	**+**	**+**	**+**			**%**
2001	**-1.309**	**0.496**	**0.124**	**-0.292**	0.233	-0.032	-0.285	**0.793**	0.102	0.166	0.145	145.98[a]	0.85	**0**
	(3.01)	(13.54)	(3.65)	(2.95)	(1.93)	(0.10)	(0.97)	(3.90)	(0.78)	(0.67)	(1.21)			
2002	**-1.236**	**0.461**	**0.144**	**-0.134**	0.136	0.195	-0.384	**0.792**	**0.188**	0.156	0.072	138.22[a]	0.80	**0**
	(3.61)	(15.36)	(5.20)	(2.28)	(1.43)	(0.68)	(1.26)	(5.02)	(1.98)	(1.14)	(0.62)			

[a] significant at the 1% level.

The coefficients shown in bold are significant at the 5% level or lower. The first row shows the parameter estimate and the second row the t statistic (two-tailed) for each variable. The dependent variable is the natural logarithm of audit fees. The models are estimated using a dataset of 180 clients across 18 years (3,240 firm-year observations). LTA= natural logarithm of total assets (£'000); Sub = square root of the number of subsidiaries; Current = ratio of current assets to current liabilities; Quick = ratio of current assets less stock to current liabilities; DTA = ratio of long-term debt to total assets; ROI = ratio of earnings before interest and tax to total assets; Foreign = proportion of subsidiaries that are foreign operations; YE = 1 if fiscal year end between December and March inclusive, 0 otherwise; Loss = 1 if operating loss reported in prior 3 years, 0 otherwise; Brand = 1 if Big Firm auditor, 0 otherwise.

Premium = $(e^{\beta_{10}} - 1) \times 100.$ Premium is set equal to zero if Brand coefficient is not significant at the 5% level

Table 4
Big Firm Premium Time- and Firm- Fixed Effects regression

$LAF = \alpha_0 + \beta_1$ (Controls) $+ \beta_2$ Brand $+ \beta_3$ Brand86 $+ \beta_4$ Brand87 $+ \beta_5$ Brand88 $+ \beta_6$ Brand89 $+ \beta_7$ Brand90 $+ \beta_8$ Brand91 $+ \beta_9$ Brand92 $+ \beta_{10}$ Brand93 $+ \beta_{11}$ Brand94 $+ \beta_{12}$ Brand95 $+ \beta_{13}$ Brand96 $+ \beta_{14}$ Brand97 $+ \beta_{15}$ Brand98 $+ \beta_{16}$ Brand99 $+ \beta_{17}$ Brand00 $+ \beta_{18}$ Brand01 $+ \beta_{19}$ Brand02 $+ \varepsilon$

		Panel			Panel	Premium			Panel	ΔPremium
Intercept	?	**-1.526**	**Brand**	+	**0.192**	**21.2**	**Brand95**	?	0.006	0
		(18.72)			(7.42)	ΔPremium			(1.54)	
LTA	+	**0.474**	**Brand86**	?	0.003	**0**	**Brand96**	?	**0.008**	**0.8**
		(63.56)			(0.71)				(2.28)	
Sub	+	**0.229**	**Brand87**	?	**0.007**	**0.7**	**Brand97**	?	**0.012**	**1.2**
		(36.48)			(2.07)				(3.02)	
Current	-	**-0.122**	**Brand88**	?	0.001	**0**	**Brand98**	?	**0.013**	**1.3**
		(5.84)			(0.47)				(3.14)	
Quick	+	**0.056**	**Brand89**	?	0.001	**0**	**Brand99**	?	0.003	0
		(2.27)			(0.14)				(0.72)	
DTA	+	0.135	**Brand90**	?	0.006	**0**	**Brand00**	?	0.004	0
		(1.75)			(1.58)				(1.04)	
ROI	-	**-0.372**	**Brand91**	?	0.005	**0**	**Brand01**	?	0.003	0
		(4.34)			(1.26)				(0.76)	
Foreign	+	**0.452**	**Brand92**	?	**0.011**	**1.1**	**Brand02**	?	-0.001	0
		(11.52)			(2.81)				(0.30)	
YE	+	**0.070**	**Brand93**	?	0.002	**0**				
		(3.41)			(0.58)		**N**		3240	
Loss	+	0.001	**Brand94**	?	**0.010**	**1.0**	**F**		772.28[a]	
		(0.75)			(2.53)		**R^2**		0.82	

[a] significant at the 1% level. The coefficients shown in bold are significant at the 5% level or lower. The first row shows the parameter estimate and the second row the t statistic (two-tailed) for each variable. The dependent variable is the natural logarithm of audit fees.

LTA= natural logarithm of total assets (£'000); Sub = square root of the number of subsidiaries; Current = ratio of current assets to current liabilities; Quick = ratio of current assets less stock to current liabilities; DTA = ratio of long-term debt to total assets; ROI = ratio of earnings before interest and tax to total assets; Foreign = proportion of subsidiaries that are foreign operations; YE = 1 if fiscal year end between December and March inclusive, 0 otherwise; Loss = 1 if operating loss reported in prior 3 years, 0 otherwise; Brand = 1 if Big Firm auditor, 0 otherwise; Brand86 = 1 if Big Firm auditor in the year 1986, 0 otherwise; Brand87 = 1 if Big Firm auditor in the year 1987, 0 otherwise; Brand88 = 1 if Big Firm auditor in the year 1988, 0 otherwise; Brand89 = 1 if Big Firm auditor in the year 1989, 0 otherwise; Brand90 = 1 if Big Firm auditor in the year 1990, 0 otherwise; Brand91 = 1 if Big Firm auditor in the year 1991, 0 otherwise; Brand92 = 1 if Big Firm auditor in the year 1992, 0 otherwise; Brand93 = 1 if Big Firm auditor in the year 1993, 0 otherwise; Brand94 = 1 if Big Firm auditor in the year 1994, 0 otherwise; Brand95 = 1 if Big Firm auditor in the year 1995, 0 otherwise; Brand96 = 1 if Big Firm auditor in the year 1996, 0 otherwise; Brand97 = 1 if Big Firm auditor in the year 1997, 0 otherwise; Brand98 = 1 if Big Firm auditor in the year 1998, 0 otherwise; Brand99 = 1 if Big Firm auditor in the year 1999, 0 otherwise; Brand00 = 1 if Big Firm auditor in the year 2000, 0 otherwise; Brand01 = 1 if Big Firm auditor in the year 2001, 0 otherwise; Brand02 = 1 if Big Firm auditor in the year 2002, 0 otherwise.

Premium = $(e^{\beta_2} - 1) \times 100$. Premium is set equal to zero if Brand coefficient is not significant at the 5% level. ΔPremium is the Big Firm – year interaction. This is the change in the Premium relative to the 1985 level.

Table 5
Brand name and national industry specialization panel regressions

$$LAF = \alpha_0 + \beta_1(\text{Controls}) + \beta_2\ \text{Brand} + \beta_3\ \text{NBFSpec} + \beta_4\ \text{BF Spec} + \varepsilon.$$

$$LAF = \alpha_0 + \beta_1\ (\text{Controls}) + \beta_2\ \text{Spec} + \varepsilon.$$

	Brand +	**NBFSpec +**	**BFSpec +**	**Spec +**	**F**	**R^2**
DDF	**0.123**	**0.061**	0.038		826.6[a]	0.82
	(5.81)	(2.36)	(1.23)			
DDF				**0.063**	793.3[a]	0.79
				(2.27)		
DDR	**0.142**		-0.029		771.1[a]	0.80
	(6.41)		(0.87)			
DDR				0.029	673.2[a]	0.76
				(0.83)		
DAF	**0.141**	0.021	0.024		774.5[a]	0.80
	(6.38)	(0.77)	(0.83)			
DAF				0.031	678.9[a]	0.77
				(0.94)		
DAR	**0.148**	0.050	0.031		796.9[a]	0.81
	(6.51)	(1.87)	(1.07)			
DAR				0.024	678.4[a]	0.79
				(0.57)		
DFP	**0.144**		-0.024		747.9[a]	0.81
	(6.43)		(0.76)			
DFP				0.054	698.4[a]	0.81
				(1.17)		
CDF	**0.147**		0.028		674.6[a]	0.78
	(6.48)		(0.91)			
CDR	**0.140**		0.014		687.9[a]	0.77
	(6.32)		(0.34)			
CAF	**0.138**		-0.009		642.5[a]	0.76
	(6.27)		(0.15)			
CAR	**0.142**		-0.015		678.6[a]	0.77
	(6.40)		(0.14)			

[a] significant at the 1% level. The coefficients shown in bold are significant at the 5% level or lower. The dependent variable is the natural logarithm of audit fees.

The same control variables as appear in table 3 are included in the LAF regressions, but for conciseness are not reported. The first row shows the parameter estimate and the second row the t statistic (two-tailed) for each variable. Brand = 1 if Big Firms auditor = 1, 0 otherwise; NBFSpec = Non Big Firms industry specialization variable; BFSpec= Big Firms industry specialist variable; Spec = dichotomous industry specialization variable. The definitions of industry specialist are explained in detail in the Appendix.
DDR takes the value of 1 if: (i) the industry contains at least 30 clients and (ii) the number of clients in an industry and the firm's share of the revenue both exceed 10% (20%), 0 otherwise. DDF takes the value of 1 if: (i) the industry contains at least 30 clients and (ii) the number of clients in an industry and the firm's share of the fees both exceed 10% (20%), 0 otherwise. DAR takes a value of 1 if: (i) at least 20% (30%) of the number of the firm's clients and (ii) 20% (30%) of the value of the firm's revenue is from the industry, 0 otherwise. DAF takes a value of 1 if: (i) at least 20% (30%) of the number of the firm's clients and (ii) 20% (30%) of the value of the firm's fees are from the industry, 0 otherwise. DFP takes a value of 1 if the firm promotes itself as a specialist in this industry 0 otherwise. CDR is a continuous measure of the firm's share of revenue in an industry. CDF is a continuous measure of the firm's share of the audit fees in an industry. CAR is a continuous measure of the share of the firm's revenue from the industry. CDF is a continuous measure of the share of the firm's audit fees from the industry

Table 6
Brand name and city level industry specialization panel regressions

$$LAF = \alpha_0 + \beta_1(\text{Controls}) + \beta_2\ \text{Brand} + \beta_3\ \text{NBFSpec} + \beta_4\ \text{BF Spec} + \varepsilon.$$

$$LAF = \alpha_0 + \beta_1\ (\text{Controls}) + \beta_2\ \text{Spec} + \varepsilon.$$

	Brand +	NBFSpec +	BFSpec +	Spec +	F	R^2
DDF	**0.130**	**0.072**	**0.058**		884.3[a]	0.84
	(6.20)	(2.50)	(2.03)			
DDF				**0.084**	754.2[a]	0.80
				(2.59)		
DDR	**0.142**		**0.059**		854.1[a]	0.82
	(6.41)		(2.07)			
DDR				0.031	707.9[a]	0.79
				(1.20)		
DAF	**0.137**	0.038	**0.054**		865.5[a]	0.82
	(6.32)	(1.34)	(2.01)			
DAF				**0.062**	748.9[a]	0.79
				(2.16)		
DAR	**0.132**	0.039	0.031		861.7[a]	0.82
	(6.28)	(1.37)	(1.27)			
DAR				0.020	694.2[a]	0.79
				(0.97)		
DFP	**0.144**		0.003		807.9[a]	0.81
	(6.43)		(0.21)			
DFP				0.004	670.1[a]	0.77
				(0.17)		
CDF	**0.141**		0.018		817.2[a]	0.80
	(6.38)		(0.81)			
CDR	**0.147**		0.014		816.2[a]	0.80
	(6.49)		(0.78)			
CAF	**0.148**		0.043		832.5[a]	0.81
	(6.45)		(1.44)			
CAR	**0.142**		**0.056**		858.6[a]	0.82
	(6.41)		(2.05)			

[a] significant at the 1% level. The coefficients shown in bold are significant at the 5% level or lower. The dependent variable is the natural logarithm of audit fees.

The same control variables as appear in table 3 are included in the LAF regressions, but for conciseness are not reported. The first row shows the parameter estimate and the second row the t statistic (two-tailed) for each variable. Brand = 1 if Big Firms auditor = 1, 0 otherwise; NBFSpec = Non Big Firms industry specialization variable; BFSpec= Big Firms industry specialist variable; Spec = dichotomous industry specialization variable. The definitions of industry specialist are explained in detail in the Appendix. DDR takes the value of 1 if: (i) the industry contains at least 30 clients and (ii) the number of clients in an industry and the firm's share of the revenue both exceed 10% (20%), 0 otherwise. DDF takes the value of 1 if: (i) the industry contains at least 30 clients and (ii) the number of clients in an industry and the firm's share of the fees both exceed 10% (20%), 0 otherwise. DAR takes a value of 1 if: (i) at least 20% (30%) of the number of the firm's clients and (ii) 20% (30%) of the value of the firm's revenue is from the industry, 0 otherwise. DAF takes a value of 1 if: (i) at least 20% (30%) of the number of the firm's clients and (ii) 20% (30%) of the value of the firm's fees are from the industry, 0 otherwise. DFP takes a value of 1 if the firm promotes itself as a specialist in this industry 0 otherwise. CDR is a continuous measure of the firm's share of revenue in an industry. CDF is a continuous measure of the firm's share of the audit fees in an industry. CAR is a continuous measure of the share of the firm's revenue from the industry. CDF is a continuous measure of the share of the firm's audit fees from the industry

Table 7
Brand name and knowledge spillovers
OLS and simultaneous equations models

$$LAF = \alpha_0 + \beta_1 (\text{Controls}) + \beta_2 \text{Brand} + \beta_3 \text{LNAS} + \varepsilon.$$

$$LNAS = \alpha_0 + \beta_1 (\text{Controls}) + \beta_2 \text{LAF} + \varepsilon.$$

Dependent variable	OLS LAF	2SLS LAF	2SLS LNAS
Intercept	**-1.280**	**-1.302**	**-1.438**
	(15.55)	(15.98)	(18.87)
LTA	**0.419**	**0.438**	**0.389**
	(58.19)	(61.24)	(53.18)
Sub	**0.214**	**0.216**	**0.224**
	(33.39)	(34.69)	(31.08)
Current	**-0.106**	**-0.124**	-0.046
	(5.39)	(5.97)	(1.52)
Quick	**0.051**	**0.056**	0.028
	(2.24)	(2.28)	(1.23)
DTA	0.147	0.131	**0.179**
	(1.86)	(1.59)	(2.16)
ROI	**-0.384**	**-0.388**	**-0.303**
	(4.41)	(4.51)	(3.26)
Foreign	**0.456**	**0.466**	**0.354**
	(11.60)	(12.08)	(9.73)
YE	**0.061**	0.028	
	(2.97)	(1.24)	
Loss	0.011	0.009	-0.009
	(0.80)	(0.70)	(0.67)
Brand	0.071	0.093	0.079
	(1.01)	(1.55)	(1.07)
LNAS	**0.138**	**0.151**	
	(3.97)	(4.67)	
LAF			**0.886**
			(12.89)
F	603.21[a]	862.14[a]	317.24[a]
R^2	0.82	0.84	0.77

a significant at the 1% level.
The coefficients shown in bold are significant at the 5% level or lower.
The first row in each panel shows the parameter estimate and the second row the t statistic (two-tailed) for each variable.
LTA= natural logarithm of total assets (£'000); Sub = square root of the number of subsidiaries; Current = ratio of current assets to current liabilities; Quick = ratio of current assets less stock to current liabilities; DTA = ratio of long-term debt to total assets; ROI = ratio of earnings before interest and tax to total assets; Foreign = proportion of subsidiaries that are foreign operations; YE = 1 if fiscal year end between December and March inclusive, 0 otherwise; Loss = 1 if operating loss reported in prior 3 years, 0 otherwise; Brand = 1 if Big Firm auditor, 0 otherwise; LAF = natural logarithm of audit fees. LNAS = natural logarithm of non-audit service fees.

Table 8
OLS regressions partitioned by client size

$$LAF = \alpha_0 + \beta_1(\text{Controls}) + \beta_2\ \text{Brand} + \varepsilon.$$

	Smallest quartile		**Second quartile**		**Third quartile**		**Largest quartile**	
	Brand (t-stat)	Adj R^2 (F stat)	Brand (t-stat)	Adj R^2 (F stat)	Brand (t-stat)	Adj R^2 (F stat)	Brand (t-stat)	Adj R^2 (F stat)
1985	0.006	0.74	0.214	0.59	**0.382**	0.67	-0.164	0.54
	(0.04)		(1.36)		(2.34)		(0.69)	
1986	0.116	0.53	0.192	0.58	0.275	0.54	-0.023	0.55
	(0.68)		(1.36)		(1.37)		(0.09)	
1987	**0.274**	0.46	0.215	0.54	0.145	0.49	**0.542**	0.50
	(1.99)		(1.61)		(0.90)		(2.00)	
1988	**0.301**	0.53	0.010	0.65	0.076	0.50	**0.468**	0.51
	(2.21)		(0.11)		(0.37)		(2.04)	
1989	0.111	0.53	**0.204**	0.64	0.052	0.41	0.247	0.41
	(0.98)		(1.99)		(0.32)		(1.04)	
1990	0.041	0.63	**0.210**	0.60	0.161	0.46	0.398	0.46
	(0.45)		(2.01)		(0.97)		(1.67)	
1991	0.012	0.58	**0.202**	0.66	0.165	0.55	0.334	0.45
	(0.13)		(1.98)		(1.10)		(1.40)	
1992	0.069	0.58	0.115	0.66	**0.436**	0.52	0.381	0.50
	(0.81)		(1.07)		(2.95)		(1.39)	
1993	0.033	0.61	**0.373**	0.60	0.123	0.58	0.258	0.43
	(0.37)		(3.13)		(0.83)		(1.14)	
1994	**0.176**	0.67	0.218	0.54	0.236	0.57	0.284	0.51
	(1.97)		(1.87)		(1.53)		(1.49)	
1995	**0.181**	0.70	0.137	0.60	0.282	0.59	0.208	0.47
	(2.07)		(1.23)		(1.75)		(1.54)	
1996	0.165	0.57	0.124	0.46	0.125	0.64	0.058	0.70
	(1.81)		(0.95)		(0.80)		(0.31)	
1997	**0.431**	0.60	**0.287**	0.53	0.147	0.54	0.185	0.69
	(3.20)		(2.17)		(1.24)		(1.31)	
1998	**0.431**	0.58	**0.315**	0.67	0.207	0.51	-0.162	0.75
	(3.20)		(2.34)		(1.60)		(0.81)	
1999	**0.365**	0.52	0.122	0.45	0.165	0.66	-0.207	0.74
	(2.65)		(0.91)		(1.21)		(1.58)	
2000	**0.237**	0.50	0.187	0.44	0.091	0.70	-0.215	0.69
	(2.08)		(1.85)		(0.55)		(1.64)	
2001	0.134	0.57	**0.462**	0.53	0.158	0.67	-0.159	0.69
	(0.68)		(3.98)		(1.03)		(0.79)	
2002	**0.378**	0.49	0.246	0.46	0.132	0.64	**-0.409**	0.76
	(2.46)		(1.87)		(0.87)		(2.92)	

[a] significant at the 1% level. The coefficients shown in bold are significant at the 5% level or lower.

The dependent variable is the natural logarithm of audit fees.

The same control variables as appear in table 3 are included in the regressions, but for conciseness are not reported.

The first row shows the parameter estimate and the second row the t statistic (two-tailed) for each variable.Brand = 1 if Big Firm auditor, 0 otherwise.

Table 9
Evaluating the Effects of Selection Bias on Audit Fees

$$y_i^* = \gamma_0 + \gamma_1 LTA_i + \gamma_2 Foreign_i + \gamma_3 LNAS_i + v_{ii}$$

$$LAF_{1i} = \beta_{10} + \beta'_{11} Controls_i + \sigma_{1u}\lambda_{1i} + e_{1i}$$

$$LAF_{01i} = \beta_{00} + \beta'_{01} Controls_i + \sigma_{0u}\lambda_{0i} + e_{0i}$$

		(1) y_i^*		(2) LAF_{1i}	(3) LAF_{0i}	(4) LAF_{1i}	(5) LAF_{0i}
Intercept	?	**-0.790**	?	**-0.625**	**-0.934**	-0.527	**-1.007**
				(2.03)	(3.34)	(1.55)	(3.42)
		(0.001)		(0.044)	(0.001)	(0.082)	(0.001)
LTA	+	**0.128**	+	**0.430**	**0.421**	**0.393**	**0.408**
				(16.02)	(13.79)	(15.72)	(14.24)
		(0.001)		(0.001)	(0.001)	(0.001)	(0.001)
Sub			+	**0.191**	**0.205**	**0.222**	**0.263**
				(8.12)	(7.67)	(8.87)	(9.07)
				(0.001)	(0.001)	(0.001)	(0.001)
Current			-	**-0.250**	-0.121	**-0.264**	-0.087
				(3.19)	(1.02)	(3.31)	(0.78)
				(0.001)	(0.321)	(0.001)	(0.473)
Quick			+	**0.196**	0.145	0.187	0.076
				(2.03)	(1.12)	(1.90)	(0.51)
				(0.046)	(0.304)	(0.066)	(0.610)
DTA			+	0.284	0.076	**0.303**	0.081
				(1.53)	(0.64)	(2.03)	(0.72)
				(0.127)	(0.522)	(0.047)	(0.508)
ROI			-	**-0.810**	-0.001	**-0.790**	-0.020
				(2.44)	(0.07)	(2.28)	(0.19)
				(0.001)	(0.946)	(0.001)	(0.904)
Foreign	+	**0.264**	+	**0.787**	**0.525**	**0.787**	**0.528**
				(5.41)	(2.01)	(5.41)	(2.06)
		(0.001)		(0.001)	(0.049)	(0.001)	(0.038)
YE			+	0.022	0.017	0.027	0.009
				(0.29)	(0.19)	(0.34)	(0.07)
				(0.769)	(0.834)	(0.760)	(0.893)
Loss			+	0.129	0.023	0.097	0.46
				(1.13)	(0.23)	(0.94)	(0.38)
				(0.260)	(0.821)	(0.406)	(0.796)
LNAS	+	**0.245**	+				
		(0.001)					
λ_{1i}			?			**-0.779**	
						(6.01)	
						(0.001)	
λ_{0i}			?				0.102
							(1.12)
							(0.291)
R^2				**0.85**	**0.83**	**0.85**	**0.83**

The coefficients shown in bold are significant at the 5% level or lower. The first row shows the parameter estimate, the second row the t statistic (two-tailed) and the third row the p value.
LTA= natural logarithm of total assets (£'000); Sub = square root of the number of subsidiaries; Current = ratio of current assets to current liabilities; Quick = ratio of current assets less stock to current liabilities; DTA = ratio of long-term debt to total assets; ROI = ratio of earnings before interest and tax to total assets; Foreign = proportion of subsidiaries that are foreign operations; YE = 1 if fiscal year end between December and March inclusive, 0 otherwise; Loss = 1 if operating loss reported in prior 3 years, 0 otherwise; LNAS = natural logarithm of non-audit service fees; λ_{1i} and λ_{0i} are the Inverse Mills Ratios used to control for selection bias for large and small audit firms respectively.