

# Is the audit services market competitive following Arthur Andersen's collapse?

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## Abstract

This study investigates whether audit markets remain competitive in the wake of Arthur Andersen's demise and merger with Ernst & Young to create the Big Four. We conduct the study estimating audit fee models using Australian audit market data from both 2000 and 2003 to determine whether there is any evidence of cartel pricing either before, or subsequent to, the merger. In both years, we find evidence of a Big N price premium when estimating an audit fee model across all clients, and when we estimate the model separately across large and small client market segments. This evidence is consistent with product differentiation by Big N auditors and competitive markets.

**Key words:** Audit markets; Audit fees; Arthur Andersen's demise; Market competition; Self-selection bias; Big N accounting firms

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## 1. Introduction

Research examining audit firm mergers and the structure of the audit services market (e.g. Kaplan *et al.*, 1990; Baskerville and Hay, 2006) using market

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The paper has benefited from the comments of two anonymous referees, Kam Wah Lai, participants at the 2005 European Accounting Association Conference, 2005 Accounting and Finance Association of Australia and New Zealand Conference, 2006 American Accounting Association Auditing Section Mid-Year Conference, and colleagues at the University of Technology Sydney, in particular Boris Choy who provided valuable econometric guidance. Earlier versions of this paper have been circulated with the title 'Listed company auditor self selection bias and audit fee premiums: Is the audit services market competitive following Arthur Andersen's collapse?'

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concentration statistics has generated mixed interpretations on the competition effects of mergers. In contrast, audit pricing research has laid claim to the existence of competitive audit markets with brand name auditors delivering quality differentiated audits (e.g. Craswell *et al.*, 1995; Ferguson and Stokes, 2002; Ferguson *et al.*, 2003). The pricing studies<sup>1</sup> have exclusively adopted a variant of Simunic's (1980) audit fee regression, including an auditor size dummy variable to infer the existence of brand name premiums and the absence of cartel pricing and anticompetitive behaviour by the Big N.<sup>2</sup>

Although the pricing studies have consistently concluded that the audit services market remains competitive in the face of a series of significant structural changes through auditor mergers in the 1980s and 1990s, potentially the most serious threat to the claim of competitive markets is the recent and rapid demise of Arthur Andersen. In the USA, the US General Accounting Office (2003) concludes that the dissolution of Arthur Andersen means that increased market concentration among the Big N could significantly increase their market power. Past behaviour by the Big N (as revealed by earlier studies) might not be indicative of future behaviour and the US General Accounting Office called for further study of the effects of increasing market place consolidation on competition. The current study is directed at meeting that demand and it adopts Simunic's (1980) audit-pricing framework using the Australian setting around the Arthur Andersen dissolution.

Although Arthur Andersen was a global firm, the manner of its break-up varied around the world and led to different results in different countries. In Australia, around 75 per cent of Arthur Andersen's clients moved to Ernst & Young, along with the majority of the audit partners.<sup>3</sup> In contrast, in the USA, there has been a wider redistribution of ex-Arthur Andersen clients to other auditors with no single competing large audit firm gaining more than 32 per cent of ex-Arthur Andersen Fortune 500 clients (Scott, 2003).

The increased supplier concentration in Australia, together with the Big N auditors' apparent concentration on servicing large clients,<sup>4</sup> raises concerns of a lessening of competition in the audit market, particularly at the top end. These concerns were expressed in commentary and public policy debates over

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<sup>1</sup> Relevant studies that investigate auditor size and audit fees include Simunic (1980), Francis (1984), Francis and Stokes (1986), Palmrose (1986) and Francis and Simon (1987). For a review of audit pricing studies in countries other than the USA, refer to Walker and Johnson (1996).

<sup>2</sup> For ease of exposition, we use the term Big N to refer to the group of top tier auditors during all periods.

<sup>3</sup> Refer to Table 1, which we discuss in more detail below.

<sup>4</sup> Refer to Table 1, which we discuss in more detail below.

the competitiveness of audit markets both in Australia<sup>5</sup> and other jurisdictions.<sup>6</sup> Consistent with the public policy debate in Australia, the Australian Competition and Consumer Commission (ACCC) examined the issue and agreed that the merger raised concerns for competition in the audit market.<sup>7</sup> However, the commission's view was that their concentration thresholds would not be crossed in this market and they accordingly did not oppose the merger (ACCC, 2002).

In this study, we investigate the existence and extent of competitive pricing in the Australian audit services market both before and after Arthur Andersen's demise. Specifically, using data from both 2000 and 2003, we investigate whether there is any evidence of cartel pricing either before, or subsequent to, the merger. Because increased supplier concentration by itself is insufficient evidence of collusive pricing arrangements (Simunic, 1980) and concentration measures and thresholds are somewhat arbitrary,<sup>8</sup> we adopt Simunic's (1980) audit-pricing framework to investigate audit market competition.

We document evidence consistent with competitive audit services markets in both 2000 and 2003. In both years, Big N auditors earn audit fee premiums consistent with product differentiation. There is evidence of different audit pricing structures for Big N and non-Big N auditors with some evidence of variations in slope coefficients and intercepts for audit fee regressions across these auditor classifications. When we further investigate audit firm pricing behaviour in the large and small client segments of the market, respectively, we cannot find any evidence affecting the inferences that Big N auditors earn audit fee premiums and that the audit market is competitive. We provide evidence of Big N audit fee premiums in both small and large client market segments, although these premiums disappear in the extremely large (top 300) client segment in both years, consistent with Francis and Stokes (1986) and Carson *et al.* (2004). In addition, we investigate the possible effects of self-selection bias on our results (Ireland and Lennox, 2002; Chaney *et al.*, 2004, 2005). Our results are robust to testing for self-selection bias, although we note that our conclusions rely on robustness of the auditor selection model specification.

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<sup>5</sup> See for example articles in the Australian press: Boreham (2002), Editorial, 'Fat four would weaken audits' (2002), and Robertson (2002).

<sup>6</sup> See for example the following headlines: 'Andersen's plight saddles business with monopoly', *The Times* (Searjeant, 2002); 'Big four auditors face competition inquiry', *The Guardian* (Treanor & Inman, 2002); 'For and against – Breaking the monopoly', *Accountancy Age* (Editorial, 2002); 'Big four's dominance shows no let up amid calls for scrutiny', *Financial Times* (Tiesenhausen, 2004); 'Big four auditor too powerful, says EU: Accountancy firms could face action to end dominance', *The Guardian* (Gow, 2004).

<sup>7</sup> The ACCC is the body charged with the statutory responsibility of assessing merger effects on competition under the *Trade Practices Act 1974*.

<sup>8</sup> The market concentration measures and thresholds differ across jurisdictions; for details see ACCC's Australian Merger Guidelines, June 1999 (endnote 66, p. 81).

Our evidence supports the ACCC conclusion that although the demise of Arthur Andersen and the large movement of staff and clients to Ernst & Young in Australia could be viewed as a merger, competition in the audit services market did not disappear following these events. The evidence is not consistent with collusive pricing arrangements in 2003. Overall, our evidence supports the view that Big N auditors earn premiums for supplying higher quality products and there are scale diseconomies for non-Big N auditors in the very large client segment of the market.

The remainder of the present paper is organized as follows. Section 2 reviews the prior research for audit market competition and related audit fee literature. We also revisit and adapt Simunic's (1980) pricing framework in this section. Section 3 describes the data and Section 4 presents the results. Section 5 concludes the paper.

## 2. Prior research

### 2.1. Audit services market competition

Simunic (1980) constructs an economic model to test the effects of market structure upon the pricing of audit services and to investigate the audit fee determinants. He relates audit fees to potential third party losses, and the relative costs of utilizing audit services (Yardley *et al.*, 1992). He assumes that small audit clients are in a competitive audit services market because they are serviced by a large number of auditors. Large auditors dominate the large client segment of the market, with the marginal large auditor market share for such clients approaching 90 per cent (Simunic, 1980). The large client segment of the market is potentially less competitive than the small client segment, which is set as a competitive benchmark. The competition test is approached as a comparison of prices within the different client segments. His results suggest that there is no significant difference between large and small audit firm pricing, and he could not reject the hypothesis that price competition prevails throughout the audit market in favour of the alternative hypothesis that large auditors enjoy cartel pricing. Francis (1984) replicates the competition research in Australia with a different set of control variables. He concludes that large audit firms' prices are higher in both large and small client market segments, which implies that the audit services market is competitive and there is product differentiation by large auditors. Francis and Stokes (1986) argue that the conflicting conclusions of Simunic (1980) and Francis (1984) can be explained by the contrastable clientele size classifications in the previous two studies. By selecting two extreme categories, they compare the extremely large and extremely small segments of the Australian market and find evidence for large auditor price premiums for small clients but not for large clients. Their results suggest large accounting firm product differentiation across all client sizes and diseconomies of scale to the smaller auditors in the audits of large companies.

The price competition assumption has been widely adopted by most of the subsequent research, and the Big N fee premium has been interpreted as evidence of Big N product differentiation. However, few studies adopt the same basic form as Simunic's model (Walker and Johnson, 1996), and his segmented audit market assumption has received little recent attention (Carson *et al.*, 2004). Carson *et al.* (2004) is the most recent study that re-examines the competition issue with Australian data from 1995 to 1999, which is well before Arthur Andersen's demise. Their findings suggest a similar conclusion to the previous literature that higher fees are charged by large auditors in the small client segment and no fee premium is found in the very large client segment. As such, their findings establish the existence of competitive pricing in the Australian audit services market during the late 1990s.

## 2.2. Pricing framework specification

The prior studies suggest that the small client segment of the audit services market is more competitive than the large client segment. Table 1 presents descriptive data for the Australian audit services market from 2000 to 2003.<sup>9</sup> Panel A shows that there is a decline in the market share based on number of companies for the Big N from 64 per cent in 1998 to 60 per cent in 2003, while the market share based on audit fees rises very slightly from 91 per cent to 92 per cent over the same period.

Panel A of Table 1 also shows that Arthur Andersen had 84 Australian Stock Exchange-listed clients in 2001. Panel B shows the distribution of Arthur Andersen's clients to other auditors, with 63 of those clients (75 per cent) going to Ernst & Young. These clients represented 90 per cent (98 per cent) of Arthur Andersen's audit (other) fee revenue in 2001.

Panel C shows the Big N market shares for the 2000–2003 period classified by client size. It shows that there is greater competition in the small client segment than the large client segment. The Big N concentration has declined for smaller clients in the latter years, suggesting even greater competition in that segment, whereas in the larger client market segment the Big N auditors have increased their market share over the period.

The market share statistics and data showing the high proportion of ex-Arthur Andersen clients going to Ernst & Young in Table 1, *prima facie*, suggest an

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<sup>9</sup> For evidence of Big N market shares and audit pricing in different countries refer to: US market (e.g. Simunic, 1980; Palmrose, 1986; Francis and Simon, 1987), Australia (Francis, 1984; Francis and Stokes, 1986; Carson *et al.*, 2004), UK (Chen *et al.*, 1993; Brinn *et al.*, 1994; Ireland and Lennox, 2002; Chaney *et al.*, 2004), India (Simon *et al.*, 1986), Hong Kong, Malaysia and Singapore (Low *et al.*, 1990; Simon *et al.*, 1992; Lee, 1996; Gul, 1999), New Zealand (Firth, 1985; Johnson *et al.*, 1995), Canada (Anderson and Zeghal, 1994; Chung and Lindsay, 1988), Japan (Taylor, 1997), Pakistan (Simon and Taylor, 1997), South Korea (Taylor *et al.*, 1999), Bangladesh (Karim and Moizer, 1996), Finland (Niemi, 2002) and Nigeria (Taylor and Simon, 2003).

Table 1  
Descriptive statistics for the Australian audit services market

*Panel A: Audit services market 2000–2003*

	2003	2002	2001	2000
Number of companies	1 253	1 239	1 257	1 229
Total assets – sum (\$A billion)	1 880	2 014	1 969	1 790
Total assets – mean (\$A million)	1 501	1 624	1 567	1 460
Audit fees – sum (\$A million)	283	268	256	241
Audit fees – mean	226 003	216 770	203 752	196 470
Other fees paid to auditors – sum (\$A million)	279	358	351	379
Other fees paid to auditors – mean	223 373	289 574	279 165	308 069
Big N market share – (number of companies)	59.62%	62.95%	63.43%	63.79%
Big N market share – (audit fees)	92.22%	92.71%	92.34%	91.11%
Number of audit firms	94	90	92	91
Number of companies per audit firm				
Arthur Andersen	—	—	84	86
Ernst & Young	260	254	186	168
Deloitte	105	117	123	127
KPMG	176	179	182	177
PricewaterhouseCoopers	205	229	224	225
BDO	75	66	62	58
Pannell Kerr Foster	74	56	61	63
Grant Thornton	40	34	38	37
Other	318	304	299	288

*Panel B: Distribution of Arthur Andersen's clients in Australia in 2002*

	Number of Arthur Andersen's clients	Percentage of former Arthur Andersen's clients	Total assets (\$A million)	Audit fees (\$A million)	Percentage of former Arthur Andersen's clients' audit fees	Other fees (\$A million)	Percentage of former Arthur Andersen's clients' other fees
Pre-switching (2001)							
Arthur Andersen	84		171 000	35.3		63.44	
Post-switching (2002)							
Ernst & Young	63	75.00	150 000	34.53	89.88	61.64	98.37
Deloitte Touche Tohmatsu	1	1.19	0.48	1.17	3.05	0.04	0.06
KPMG	6	7.14	3 270	0.86	2.24	0.18	0.29
PricewaterhouseCoopers	1	1.19	0.96	1.42	3.70	0.59	0.94
Others	8	9.52	660	0.44	1.15	0.21	0.34
Delisted (2001)	5	5.95	690 <sup>a</sup>	0.34 <sup>a</sup>	NA	0.18 <sup>a</sup>	NA

<sup>a</sup> For the delisted firms, the amount of total assets, audit fees and other fees are those reported in 2001. NA, not applicable.

Table 1 (continued)

*Panel C: Big N concentration ratios by client size (2000–2003)*

Client size as measured by assets (\$A million)	Number of clients				Big N concentration by number of clients (%)				Big N concentration by audit fees (%)			
	2003	2002	2001	2000	2003	2002	2001	2000	2003	2002	2001	2000
Less than 2.5	162	129	111	77	32.10	40.31	47.75	50.65	39.44	50.46	56.40	53.86
2.5–5	126	134	121	101	41.27	44.78	45.45	54.46	50.25	54.41	56.75	62.04
5–10	174	162	178	170	41.95	47.53	49.44	47.65	54.92	55.54	55.14	54.32
10–20	171	179	182	188	54.39	56.98	54.95	50.53	61.33	64.22	60.75	55.50
20–50	175	193	207	209	61.71	60.62	56.04	55.50	69.39	68.08	62.23	55.77
50–100	106	103	112	139	66.04	74.76	74.11	71.94	76.21	82.97	77.24	78.31
100–250	113	117	124	117	76.11	75.21	75.81	74.36	80.70	83.61	82.72	79.71
250–1000	112	110	112	120	90.18	88.18	89.29	89.17	94.52	94.50	94.10	93.73
Greater than 1000	114	112	111	108	98.25	98.21	98.20	96.30	99.69	99.73	99.75	98.89
Total	1253	1239	1258	1229								

increased concentration of supply among the Big Four auditors, particularly at the higher end of the market. In turn, increased supplier concentration could increase the scope for cartel pricing arrangements in the market for audit services over this period, or at least reduce the opportunity for clients switching auditors, allowing some rent extraction. To investigate this issue, we adapt Simunic's (1980) pricing framework for investigating Big N audit pricing. The framework allows the pricing behaviour of Big N and non-Big N auditors in the large client segment to be compared with their pricing behaviour in the benchmark small client segment. Big N cartel pricing exists when Big N auditors charge higher fees than non-Big N auditors in the large client market segment but not in the small segment. However, product differentiation by Big N accounting firms and Big N economies of scale or non-Big N diseconomies of scale create complicated outcomes (Simunic, 1980).

Simunic (1980) characterizes the audit services market as a hedonic market where product differentiation is revealed by differences in pricing associated with differences in specific suppliers' characteristics. Big N firms, as a group, are likely to enjoy name recognition and provide high quality services, which might command a positive implicit price. Therefore, consistent higher fees charged by Big N accounting firms, which does not vary with the size of clients, could be interpreted as Big N product differentiation. In contrast, large audit firms could also realize scale economies sourcing from their size advantages, such as substantial staff knowledge, specialization, experience and economies in staff training, or economies in multiple office locations. These could result in a greater efficiency in the auditing process and a reduction of overall audit costs that could be passed onto the clients through lower audit fees. Therefore, Big N economies of scale could be captured in the pricing

framework with consistently lower Big N audit fees across different client segments. However, lower Big N audit fees in one single segment is characterized as diseconomies of scale to non-Big N firms because the scale economies should be broadly applicable to all production throughout the whole market (Francis and Stokes, 1986). Therefore, lower Big N audit fees in the large or small segment demonstrates the diseconomies to smaller auditors in providing their audit services to larger or smaller clients. Simunic (1980) notes that scale economies can exist in either monopolistic or competitive settings. Table 2 combines the effects of scale economies and diseconomies, product differentiation and competition to produce nine possible outcomes.

Table 2

Audit pricing framework (Big N versus non-Big N)\*

Large-client market	Small-client market		
	Big N > Non-Big N	Big N = Non-Big N	Big N < Non-Big N
Big N > Non-Big N	(1) Competition, and Big N product differentiation	(2) Big N cartel pricing	(3) Big N cartel pricing, and Big N scale economies
Big N = Non-Big N	(4) Competition, Big N product differentiation, and non-Big N scale diseconomies for large clients.	(5) Competition	(6) Big N cartel pricing, and Big N scale economies
Big N < Non-Big N	(7) Competition, Big N product differentiation, and non-Big N scale diseconomies for large clients.	(8) Competition, and non-Big N scale diseconomies for large clients	(9) Competition, and Big N scale economies

\* Adapted from Simunic (1980).

(1) Big N fee premiums in both markets indicate that the audit market is competitive. Consistently higher fees reflect the recognition of Big N product differentiation throughout the market. (2) Equivalent fees charged by all auditors in the small client market is consistent with the competitive assumption, and higher fees charged by Big N in the large client market is evidence of Big N cartel pricing. (3) (6) A Big N fee discount in the small client segment indicates scale economies for Big N audit firms as well competition in that segment of the market. The absence of the audit fee discount indicates the existence of cartel pricing by Big N auditors in the large client segment. (4) (7) A Big N fee premium in the small client segment reflects the recognition of Big N product differentiation. On the other hand, the equivalent or smaller fees charged by Big N in the large segment imply that the non-Big N auditors have diseconomies of scale. (5) Equivalent fees charged by all auditors throughout the market indicate that competition prevails throughout the market. (8) A Big N fee discount for large clients reflects the non-Big N auditors' scale diseconomies. Equivalent fees charged by all auditors in the small client segment indicate competition throughout the market. (9) Big N fee discounts throughout the market indicates that competition prevails throughout the market as well as scale economies favouring Big N auditors.



We make inferences about audit market competition based on the correspondence between evidence of differences between Big N and non-Big N pricing in small and large client segments. A finding of a Big N price premium in the large client segment, but not in the small (scenario 2 in Table 2), a Big N price premium in the large client segment and a discount in the small (scenario 3), or no Big N price premium in the large client segment and a Big N discount in the small (scenario 6) would be consistent with cartel pricing. Evidence consistent with any of the other scenarios would lead to a conclusion that competition in the Australian audit services market exists. We conduct the tests on data before and after Arthur Andersen's demise (2000 and 2003) to determine the scenario that applies in each year. We are able to assess the impact of the merger of Arthur Andersen with Ernst & Young on competition in the Australian audit services market by the change, if any, from one scenario to another.

### 3. Research design

#### 3.1. Audit fee model

We estimate the following audit fee model in the overall audit market and in each of the small and large client market segments:

$$\begin{aligned} \text{Ln } AF = & \beta_0 + \beta_1 \text{Ln } TA + \beta_2 \text{Ln } Sub + \beta_3 DE + \beta_4 Quick + \beta_5 Foreign + \beta_6 CATA \\ & + \beta_7 ROI + \beta_8 Loss + \beta_9 Opinion + \beta_{10} YE + \beta_{11} Big + \varepsilon \end{aligned} \quad (1)$$

The standard control variables and their predicted signs in the audit fee model are discussed in Ferguson *et al.* (2003) and their definitions are shown in Table 3.

The experimental variable of interest is *Big*, which captures fee effects from having a Big N accounting firm. The estimated coefficient on this variable for each of the large and small client market segments is interpreted against the scenarios in Table 2 to make inferences about competition in the market place.

#### 3.2. Data

The initial sample comprises all available Australian publicly listed companies for 2000 and 2003. Data are obtained from the Australian audit market database of the Capital Markets Cooperative Research Centre–University of Technology Sydney. We further exclude bank and insurance companies (Australian Stock Exchange code 16 and 17) for which some financial ratios are not well specified because of their unique account structures.<sup>10</sup> Consistent with

<sup>10</sup> In untabulated results available from the authors, inclusion of these firms does not affect our conclusions.

Table 3

Variable definition

<i>Ln AF</i>		= natural log of audit fees
<i>Ln TA</i>	+	= natural log of the clients' total assets at year end
<i>Ln Sub</i>	+	= natural log of the number of the clients' audited subsidiaries
<i>DE</i>	+	= ratio of clients' long-term debt to total assets at year end
<i>Quick</i>	–	= ratio of clients' current assets (less inventories) to current liabilities
<i>Foreign</i>	+	= proportion of the clients' subsidiaries that are foreign
<i>CATA</i>	+	= ratio of clients' current assets to total assets at year end
<i>ROI</i>	–	= ratio of clients' earnings before taxes to total assets
<i>Loss</i>	–	= 1 if there is a loss in any of the past 3 years, and 0 otherwise
<i>Opinion</i>	+	= 1 if a qualified opinion <sup>a</sup> , and 0 otherwise
<i>YE</i>	–	= 1 if non-June 30 year end, and 0 otherwise
<i>Big</i>	+/-	= 1 if audit firm is a Big N accounting firm, and 0 otherwise
$\epsilon$		= error term

<sup>a</sup> Qualified excludes opinions containing expressions of matters. We also ran estimations including such modifications as qualified opinions and the results are consistent with those reported in the main context.

prior studies discussed above, logarithm transformations are made to certain variables (*Ln AF*, *Ln TA* and *Ln Sub*). If a company has zero subsidiaries, it is re-coded as 1 before taking the natural log. In addition, extreme values in the variables, *Ln AF*, *Ln TA*, *Quick*, *DE* and *ROI*, are winsorized to a maximum value of mean  $\pm$  three standard deviations to ensure that the models are well specified and have statistical validity.<sup>11</sup>

## 4. Results

### 4.1. Descriptive statistics

Table 4 reports descriptive statistics (mean and median) for regression variables for the full sample and separately for the Big N-audited clients and the non-Big N-audited clients in 2000 and 2003.

Table 4 also reports the results of tests for differences in the variables for Big N and non-Big N auditors. In 2000, all variables except *Foreign*, *CATA* and *Opinion* vary between the auditor groups. Big N auditors' clients are larger and more complex, more profitable and pay higher audit fees. The pattern is very similar in 2003, although there is a greater propensity for non-Big N clients to receive qualified opinions. Both Big N and non-Big N clients are more likely to have a history of losses (*Loss*) in 2003 than in 2000. Non-Big N clients in 2003 are smaller, with fewer subsidiaries, and are more likely to receive a qualified

<sup>11</sup> The winsorizing does not affect our conclusions. The results without winsorizing are available from the authors.

Table 4  
Descriptive statistics for the sample of companies listed on the Australian share market (Australian Stock Exchange)

Variables	Sample: 2000							Sample: 2003						
	Total N = 1207		Non-Big N N = 444		Big N N = 763		<i>t</i> -statistic <sup>a</sup>	Total N = 1229		Non-Big N N = 504		Big N N = 725		<i>t</i> -statistic <sup>a</sup>
	Mean	Median	Mean	Median	Mean	Median		Mean	Median	Mean	Median	Mean	Median	
<i>Ln AF</i>	10.767	10.616	10.193	10.127	11.101	10.915	−11.817***	10.886	10.714	10.181	10.147	11.376	11.265	−16.914***
<i>Ln TA</i>	17.386	17.084	16.567	16.480	17.863	17.705	−11.205***	17.051	16.748	15.905	15.940	17.848	17.617	−15.631***
<i>Ln Sub</i>	1.705	1.386	1.439	1.386	1.860	1.609	−6.435***	1.575	1.609	1.199	1.099	1.837	1.792	−8.819***
<i>DE</i>	0.131	0.051	0.106	0.024	0.146	0.069	−3.899***	0.285	0.045	0.232	0.014	0.322	0.083	−0.589
<i>Quick</i>	7.383	1.278	9.146	1.730	6.357	1.173	2.725***	8.076	1.254	9.266	1.336	7.249	1.218	1.342
<i>Foreign</i>	0.177	0.000	0.164	0.000	0.185	0.000	−1.307	0.164	0.000	0.141	0.000	0.180	0.000	−2.514**
<i>CATA</i>	0.422	0.391	0.434	0.403	0.415	0.374	1.132	0.426	0.389	0.444	0.400	0.413	0.378	1.759*
<i>ROI</i>	−0.070	0.017	−0.097	−0.024	−0.055	0.043	−1.973**	−0.506	−0.023	−0.971	−0.090	−0.182	0.024	−0.900
<i>LOSS</i>	57.17%		68.24%		50.72%		6.0158***	69.10%		81.70%		60.30%		8.221***
<i>OPINION</i>	2.40%		2.93%		2.10%		0.9086	3.42%		5.95%		1.66%		4.103***
<i>YE</i>	18.56%		12.16%		22.28%		−4.3914***	15.90%		11.70%		18.80%		−3.341***
<i>BIG</i>	63.21%							58.99%						

\*, \*\* and \*\*\* denote significance at the 0.10, 0.05 and 0.01 levels (two-tailed), respectively.

<sup>a</sup> *t*-test on the equality of means between each variable for clients audited by non-Big N and Big N auditors. Refer to Table 3 for variable definitions.

opinion than non-Big N clients in 2000.<sup>12</sup> This pattern is consistent with non-Big N auditors gaining market share for smaller, less profitable and more risky clients in 2003 and is also consistent with the lower Big N concentration for smaller clients reported in Table 1.

#### 4.2. Audit fee regression results

Table 5 presents the estimations for the audit fee regression using the conventional ordinary least-squares (OLS) estimation method for 2000 and 2003. In columns 1 and 4 we replicate the approach in previous audit fee studies by including the auditor size dummy in the equation as an exogenous explainer of audit fees. To enable inferences to be drawn about any differences in pricing structures between Big N and non-Big N auditors in each year draw, we re-estimate the audit fee regressions for Big N and non-Big N client groups separately. These results are reported in columns 2 and 3 for 2000 and 5 and 6 for 2003.

In both years, the OLS regression including the auditor dummy (BIG) (columns 1 and 4) has an adjusted  $R^2$  comparable with prior studies (76 per cent) and a significant  $F$ -test result ( $p < 0.001$ ). The significantly positive coefficient on the auditor dummy indicates that Big N auditors charge audit fee premiums (26 and 43 per cent, respectively).<sup>13,14</sup> In addition, the coefficients on the control variables are generally consistent with standard expectations.

Splitting the sample in each year and running separate regressions (see columns 2 and 3 for 2000, and 5 and 6 for 2003) allow the slope coefficients as well as intercepts to vary across different audit groups. Most of the control variables are significant in the audit fee regressions for both groups of auditors in both years. The adjusted  $R^2$  for the non-Big N audit fee model is reduced to 56 per cent, whereas the Big N adjusted  $R^2$  remains around 78 per cent (all models are significant at  $p < 0.001$ ). It implies that different factors could be involved in determining the audit fees charged by different auditor groups in Australia.<sup>15</sup>

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<sup>12</sup> These test results across years are untabulated but available from the authors.

<sup>13</sup> The procedure described in Simon and Francis (1988, p. 263, footnote 7) and Craswell *et al.* (1995, p. 307) is used to calculate the magnitude of the percentage shift in audit fee regression model to infer the magnitude of changes in audit prices attributable to brand name reputation.

<sup>14</sup> Francis (1984) reports a coefficient of 0.153 for the auditor dummy; Craswell *et al.* (1995) report a coefficient of 0.269. Francis and Stokes (1986) report a significant result on Big 8 dummy (0.172) in the small client segment, while Carson *et al.* (2004) show evidence of significant Big 6/5 coefficients ranging from 0.137 to 0.319 from 1995 to 1999. Ferguson and Stokes (2002) document a significant Big 6 indicator (0.34) within industries without specialist auditors in 1992.

<sup>15</sup> Our results are different to the findings of Ireland and Lennox (2002) that there is no significant difference between the coefficients for Big 5 and non-Big 5 audit fee regressions. In addition, their adjusted  $R^2$  for the two regressions are similar to each other.

Table 5

Ordinary least-squares regression audit fee model: using *Big* dummy variable and sample split by auditor size

Sample: Model:	Expected sign	2000							2003						
		(1) Total		(2) Non-Big N		(3) Big N		Difference	(4) Total		(5) Non-Big N		(6) Big N		Difference
		Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic		Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	
<i>Ln TA</i>	+	0.362	22.07***	0.372	11.36***	0.354	18.60***	0.210	0.296	22.15***	0.248	11.30***	0.327	19.62***	6.270***
<i>Ln SUB</i>	+	0.374	16.36***	0.310	6.73***	0.395	15.21***	2.920*	0.376	19.25***	0.33	9.15***	0.377	16.24***	0.990
<i>DE</i>	+	0.503	3.78***	0.650	2.88***	0.420	2.56**	0.760	0.012	1.51	0.016	1.04	0.021	2.22**	0.100
<i>Quick</i>	–	–0.009	–7.77***	–0.010	–5.18***	–0.009	–5.43***	0.470	–0.007	–8.60***	–0.007	–5.98***	–0.006	–6.27***	0.010
<i>Foreign</i>	+	0.718	9.53***	0.614	4.78***	0.799	8.66***	1.240	0.463	6.10***	0.35	2.90***	0.538	5.60***	1.530
<i>CATA</i>	+	0.693	8.99***	0.534	4.17***	0.751	7.74***	1.460	0.73	10.54***	0.679	6.47***	0.761	8.33***	0.280
<i>ROI</i>	–	–0.302	–4.79***	–0.334	–2.97***	–0.268	–3.55***	0.180	0.000	0.38	–0.002	–1.29	0.005	2.19**	4.080**
<i>Loss</i>	–	–0.076	–1.49	–0.057	–0.66	–0.093	–1.49	0.110	–0.021	–0.41	–0.153	–1.75*	0.077	1.21	3.570*
<i>Opinion</i>	+	–0.095	–0.75	–0.315	–1.58	0.092	0.56	0.820	–0.015	–0.14	0.104	0.81	–0.376	–2.00**	1.850
<i>YE</i>	–	0.041	0.82	–0.208	–2.02**	0.133	2.34**	6.870***	0.043	0.82	–0.075	–0.81	0.080	1.26	1.460
<i>Big</i>	+/-	0.228	5.39***						0.361	8.60***					
<i>Constant</i>	?	3.298	11.66***	3.316	5.933***	3.575	10.49***	0.150	4.703	19.62***	5.676	14.61***	4.419	14.06***	4.670**
<i>N</i>		1229		504		725			1229		504		725		
Adjusted <i>R</i> <sup>2</sup>		0.765		0.5366		0.7798			0.765		0.5366		0.7798		
<i>F</i> -test		364.45	***	59.25	***	257.42	***		364.45	***	59.25	***	257.42	***	
Difference in slope coefficients ( $\chi^2$ )								31.08***							
Difference in constants ( $\chi^2$ )								4.670**							

\*, \*\* and \*\*\* denote significance at the 0.10, 0.05 and 0.01 levels (two-tailed), respectively.

Refer to Table 3 for variable definitions. In each row (except *Big*) the result of a Wald test of the difference in the coefficients is reported.At the foot of each panel is the  $\chi^2$  statistic and *p*-value from the Wald test of the hypothesis that all slope coefficients (with the exception of the intercept) are systematically the same across Big N and non-Big N auditors.

A test of the difference between the slope coefficients in the Big N and non-Big N regressions for each year, as reported at the foot of the table 5, allows us to reject the null hypothesis that all slope coefficients (excluding intercepts) are equal across the auditor groups in both years. In addition, tests between each pair of coefficients show that in 2000 Big N auditors would charge higher fees than non-Big N auditors to firms that have more subsidiaries and non-30 June year end. In 2003, Big N auditors charge higher fees to larger, more profitable firms and firms that experienced losses in years prior to 2003. Unlike in 2000, the significantly different constants suggest that in 2003 the non-Big N auditors charge a greater fixed fee component than the Big N auditors. Our findings lend some support to the proposition of Chaney *et al.* (2004) that both intercepts and slope coefficients of audit fee regressions are likely to vary across auditor groups. The results in Table 5 suggest that Big N and non-Big N auditors apply different audit fee structures to their clients.

Overall our findings for both 2000 and 2003 lend support to the conventional notion that Big N auditors charge higher fees than non-Big N auditors for listed companies. It suggests that public companies are prepared to pay a premium for choosing a Big N auditor. The next section interprets the implications of this finding for competition in the audit services market following the demise of Arthur Andersen.

#### 4.3. Competition testing results

To investigate audit market competition, we divide the Australian market in both 2000 and 2003 into large and small client groups based on the median of clients' total assets (\$A26 272 000 and \$A18 782 651, respectively). Approximately 50 (43) per cent of the companies in the small client group in 2000 (2003) are Big N clients, whereas this proportion reaches approximately 76 (75) per cent in the large client segment. We replicate the above tests in Section 4.2 in these two subsamples to investigate audit pricing in both years.

##### 4.3.1. Descriptive statistics

The descriptive data for both client segments are reported in Table 6 (Panel A for the year 2000 and Panel B for the year 2003).

In each panel of Table 6, we report tests of differences in means for each variable between non-Big N and Big N clients in each client size segment, and between small and large client segments. In 2000, all variables except *Opinion* differ between the client segments. In 2003, the variables that do not differ between small and large client segments are *DE* and *ROI*.<sup>16</sup> In general for both years, in addition to the size difference, small firms have higher quick ratios, more current assets, report more losses, and in 2003 are more likely to have a

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<sup>16</sup> The result on the *ROI* variable appears to be driven by a large standard deviation in the *ROI* variable in the small client segment in 2003.

Table 6  
Descriptive statistics for small and large client segments

Panel A: 2000 (large clients total assets greater than sample median \$A26 272 000)

Variables	Small clients							Large clients						
	Total N = 603		Non-Big N N = 300		Big N N = 303		Difference	Total N = 604		Non-Big N N = 144		Big N N = 460		Difference
	Mean	Median	Mean	Median	Mean	Median		Mean	Median	Mean	Median	Mean	Median	
Ln <i>AF</i>	9.915	9.903	9.766	9.770	10.062	9.998	-4.403***	11.617	11.472	11.081	11.140	11.785	11.626	-6.105***
Ln <i>TA</i>	15.784	15.921	15.795	15.891	15.773	15.957	0.283	18.986	18.557	18.174	17.984	19.240	18.940	-7.816***
Ln <i>Sub</i>	1.160	1.099	1.177	1.099	1.143	1.099	0.612	2.250	2.197	1.986	1.946	2.332	2.303	-3.063***
<i>DE</i>	0.062	0.003	0.071	0.004	0.052	0.003	1.718	0.201	0.176	0.180	0.133	0.208	0.189	-1.723*
<i>Quick</i>	12.219	2.860	12.427	2.732	12.013	2.998	0.231	2.555	1.005	2.310	1.070	2.632	0.991	-0.428
<i>Foreign</i>	0.156	0.000	0.155	0.000	0.156	0.000	-0.042	0.199	0.032	0.182	0.000	0.204	0.043	-0.865
<i>CATA</i>	0.482	0.444	0.458	0.417	0.506	0.495	-1.978**	0.361	0.327	0.382	0.354	0.354	0.319	1.143
<i>ROI</i>	-0.201	-0.093	-0.168	-0.087	-0.233	-0.106	1.749*	0.060	0.068	0.051	0.056	0.063	0.070	-1.261
<i>LOSS</i>	84.58%		83.67%		85.48%		-0.615	29.80%		36.11%		27.83%		1.900*
<i>OPINION</i>	2.99%		3.67%		2.31%		0.978	1.82%		1.39%		1.96%		-0.444
<i>YE</i>	14.26%		12.33%		16.17%		-1.348	22.85%		11.81%		26.30%		-3.650***
<i>BIG</i>	50.25%							76.16%						

Difference between small and large client segments

Variables	<i>t</i> -statistic	Variables	<i>t</i> -statistic	Variables	<i>t</i> -statistic
Ln <i>AF</i>	-27.905***	<i>Quick</i>	10.173***	<i>Loss</i>	23.068***
Ln <i>TA</i>	-44.212***	<i>Foreign</i>	-2.767***	<i>Opinion</i>	1.320
Ln <i>Sub</i>	-19.486***	<i>CATA</i>	7.587***	<i>YE</i>	-3.857***
<i>DE</i>	-15.505***	<i>ROI</i>	-13.575***	<i>Big</i>	-9.682***

Table 6 (continued)

Panel B: 2003 (large clients total assets greater than sample median \$A18 782 651)

Variables	Small clients							Large clients						
	Total N = 614		Non-Big N N = 352		Big N N = 262		Difference  t-statistic <sup>a</sup>	Total N = 615		Non-Big N N = 152		Big N N = 463		Difference  t-statistic <sup>a</sup>
	Mean	Median	Mean	Median	Mean	Median		Mean	Median	Mean	Median	Mean	Median	
Ln AF	10.065	10.058	9.846	9.798	10.360	10.355	−8.333***	11.705	11.625	10.956	10.915	11.951	11.864	−8.702***
Ln TA	15.221	15.511	15.045	15.334	15.458	15.699	−4.044***	18.878	18.515	17.897	17.680	19.200	18.944	−9.003***
Ln Sub	0.967	1.099	0.954	1.099	0.984	1.099	−0.428	2.183	2.197	1.765	1.946	2.320	2.398	−4.400
DE	0.366	0.002	0.254	0.001	0.517	0.004	−0.873	0.205	0.152	0.183	0.108	0.212	0.177	−1.140
Quick	10.821	1.936	11.089	1.765	10.460	2.311	0.268	5.336	1.055	5.043	1.044	5.432	1.060	−0.185
Foreign	0.129	0.000	0.131	0.000	0.126	0.000	0.210	0.199	0.046	0.166	0.000	0.210	0.063	−1.727*
CATA	0.471	0.444	0.456	0.432	0.491	0.456	−1.349	0.381	0.347	0.415	0.353	0.370	0.347	1.796*
ROI	−1.039	−0.246	−1.409	−0.233	−0.541	−0.258	−0.498	0.027	0.064	0.045	0.050	0.021	0.066	0.985
LOSS	95.11%		94.60%		95.80%		−0.681	43.09%		51.97%		40.17%		2.559**
OPINION	6.03%		7.67%		3.82%		1.987**	0.81%		1.97%		0.43%		1.839*
YE	10.75%		10.23%		11.45%		−0.483	20.98%		15.13%		22.89%		−2.043**
BIG	42.67%							75.28%						

Difference between small and large client segments

Variables	t-statistic	Variables	t-statistic	Variables	t-statistic
Ln AF	−26.722***	Quick	3.728***	Loss	23.852***
Ln TA	−43.639***	Foreign	−4.702***	Opinion	5.078***
Ln Sub	−18.796***	CATA	5.384***	YE	−4.951***
DE	1.080	ROI	−1.237	Big	−12.310***

\*, \*\* and \*\*\* denote significance at the 0.10, 0.05 and 0.01 levels (two-tailed), respectively.

<sup>a</sup>t-test on the equality of means between each variable for clients audited by non-Big N and Big N auditors. Refer to Table 3 for variable definitions.



qualified opinion. In both years most of the small clients' characteristics do not vary by auditor type. The exceptions are audit fees (both years), size and audit opinion (2003), and current assets and profitability in 2000. However, in the large client segment for both years the results of testing for differences between auditor types are similar to those reported for the total sample in Table 4.

#### 4.3.2. Audit fee regression results

Table 7 presents the results for the OLS regression with an auditor size dummy variable for the small and large client segments, and for separate regressions for Big N and non-Big N in each client size segment. The results for 2000 are presented in Panel A, and the results of 2003 in Panel B.

All regressions are statistically significant and the explanatory power is greater in the large client segment than the small client segment (adjusted  $R^2$  of over 70 per cent and 40 per cent, respectively). This is consistent with the results in Francis and Stokes (1986) and Carson *et al.* (2004), which indicate that the traditional audit fee model is not as well specified for the small client segment. The auditor size dummy is statistically significant in all regressions (model columns 1 and 4 in each panel), although its coefficient is larger in the small client segment than the large client segment. In 2000, the coefficient suggests a Big N premium of 32 per cent for small clients and 17 per cent for large clients. In 2003, the premiums are 49 per cent and 34 per cent, respectively. In both years, Big N auditors charge a premium to all clients, although the premium is greater in 2003 than 2000 and for small clients than large clients in both years. Consistent with the full sample, the results of estimating the OLS regressions separately for the Big N and non-Big N auditor groups in each segment suggest that the audit fee regressions have lower explanatory power for non-Big N clients than Big N clients, although the difference in explanatory power is most marked in the large client segment.

Table 7 also reports the results of testing the equality of slope coefficients for the Big N and non-Big N audit fee regressions in each client segment in each year. The null hypothesis is that all slope coefficients are equal across the auditor groups. In both years the null hypothesis cannot be rejected in either the small or large client segments at  $p < 0.05$ . The results indicate that similar pricing structures are applied to clients of the Big N and non-Big N auditor groups.

#### 4.3.3. Pricing behaviour

Simunic's (1980) pricing framework for investigating audit market competition requires pricing behaviour in the large and small client segments to be examined separately and the outcomes interpreted against the scenarios of Table 2. The results in Table 7 show that audit pricing behaviour by non-Big N and Big N auditors is the same (i.e. slope coefficients do not vary significantly) in both client segments in both years. In these cases, although the relative numbers of non-Big N and Big N

Table 7

Ordinary least-squares audit fee regression for small and large client segments: using *Big* dummy variable and sample split by auditor size

Panel A: 2000 (large clients total assets greater than sample median \$A26 272 000)

Sample: Model:	Expected sign	Small clients						Large clients					
		(1) Total		(2) Non-Big N		(3) Big N		(4) Total		(5) Non-Big N		(6) Big N	
		Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic	Coefficient	<i>t</i> -statistic
Ln <i>TA</i>	+	0.387	11.63***	0.357	6.87***	0.411	9.60***	0.360	14.37***	0.334	4.83***	0.357	13.04***
Ln <i>SUB</i>	+	0.224	5.50***	0.284	4.57***	0.177	3.32***	0.406	14.43***	0.296	4.17***	0.427	13.94***
<i>DE</i>	+	0.625	3.10***	0.750	2.68***	0.300	0.99	0.547	3.12***	0.483	1.20	0.574	2.92***
<i>Quick</i>	–	–0.008	–6.00***	–0.010	–4.87***	–0.006	–3.41***	–0.017	–4.92***	–0.014	–0.92	–0.018	–5.00***
<i>Foreign</i>	+	0.508	5.03***	0.436	2.89***	0.593	4.41***	0.886	8.08***	1.062	4.25***	0.853	6.88***
<i>CATA</i>	+	0.392	3.98***	0.411	2.72***	0.338	2.60**	1.005	8.23***	0.842	3.41***	1.036	7.22***
<i>ROI</i>	–	–0.351	–5.02***	–0.332	–2.75***	–0.394	–4.69***	0.336	1.04	0.767	1.00	0.255	0.71
<i>Loss</i>	–	–0.070	–0.85	0.048	0.41	–0.223	–1.97*	–0.024	–0.32	–0.112	–0.71	0.004	0.05
<i>Opinion</i>	+	–0.216	–1.38	–0.443	–2.05**	0.089	0.38	0.220	1.07	0.330	0.63	0.179	0.80
<i>YE</i>	–	–0.067	–0.87	–0.182	–1.48	0.059	0.62	0.110	1.69*	–0.289	–1.54	0.165	2.38**
<i>Big</i>	+/–	0.279	5.21***					0.156	2.35**				
Constant	?	3.208	5.94***	3.552	4.21***	3.248	4.66***	3.110	6.85	3.881	3.08***	3.240	6.30***
<i>N</i>		603		300		303		604		144		460	
Adjusted <i>R</i> <sup>2</sup>		0.3948		0.3699		0.3931		0.7231		0.4305		0.7517	
<i>F</i> -test		36.7***		18.56***		20.56***		144.12***		11.81***		139.93***	
Difference in slope coefficients ( $\chi^2$ )			15.91						8.36				

Table 7 (continued)

Panel B: 2003 (large clients total assets greater than sample median \$A18 782 651)

Sample: Model:	Expected sign	Small clients						Large clients					
		(1) Total		(2) Non-Big N		(3) Big N		(4)Total		(5) Non-Big N		(6) Big N	
		Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Ln TA	+	0.199	8.56***	0.178	5.77***	0.266	7.25***	0.385	16.43***	0.415	6.07***	0.386	14.91***
Ln SUB	+	0.255	7.92***	0.267	5.87***	0.234	5.25***	0.386	15.34***	0.394	6.54***	0.384	13.72***
DE	+	-0.001	-0.12	0.009	0.59	0.010	1.03	0.147	1.32*	-0.036	-0.17	0.184	1.29
Quick	-	-0.008	-8.21***	-0.007	-5.87***	-0.009	-5.87***	-0.004	-3.54**	-0.003	-0.87	-0.005	-3.55***
Foreign	+	0.398	3.81***	0.384	2.62**	0.407	2.74***	0.631	5.95***	0.595	2.68***	0.644	5.23***
CATA	+	0.589	6.56***	0.532	4.26***	0.634	4.93***	0.888	8.06***	0.813	3.80***	0.946	7.14***
ROI	-	0.001	0.49	-0.002	-1.27	0.004	2.20**	-0.035	-0.32	-0.056	-0.15	-0.014	-0.12
Loss	-	-0.145	-1.23	-0.300	-1.91*	0.113	0.62	0.040	0.64	0.000	0.00	0.065	0.88
Opinion	+	-0.139	-1.30	-0.014	-0.10	-0.444	-2.38**	0.213	0.69	0.852	1.76*	-0.365	-0.78
YE	-	-0.039	-0.48	-0.113	-1.00	0.023	0.19	0.096	1.44*	0.041	0.26	0.106	1.41
Big	+/-	0.396	7.70***					0.289	4.37***				
Constant	?	6.522	16.41***	6.991	13.32***	5.652	8.82***	2.864	6.72***	2.392	1.94**	3.101	6.32***
N		614		352		262		615		152		463	
Adjusted R <sup>2</sup>		0.4074		0.3165		0.3948		0.7414		0.4794		0.7470	
F-test		31***		17.26***		18.03***		161.06***		14.91***		137.38***	
Difference in slope coefficients ( $\chi^2$ )			16.95*						9.02				

\*, \*\* and \*\*\* denote significance at the 0.10, 0.05 and 0.01 levels (two-tailed), respectively.

Refer to Table 3 for variable definitions. In each row (except *Big*) the result of a Wald test of the difference in the coefficients is reported.

At the foot of each panel is the  $\chi^2$  statistic and *p*-value from the Wald test of the hypothesis that all slope coefficients (with the exception of the intercept) are systematically the same across Big N and non-Big N auditors.

auditors vary, the lack of differences in the slope coefficients indicate that the combined audit fee model with the inclusion of a Big N dummy variable is the appropriate fee model to apply. Therefore, we can rely on the results as reported in Table 7 that there are Big N audit fee premiums for all clients in 2000 and 2003.

As shown in Panel B of Table 7, the significance level achieved for the test of differences in slope coefficients for small clients in 2003 is  $p = 0.0755$ . To investigate auditor pricing behaviour further in this sample, the actual audit fees are compared with the expected alternate audit fees if the client had used a different size auditor. This method is based on that used in Chaney *et al.* (2004). The predicted alternative audit fees are computed by multiplying model parameters, estimated for the alternate auditor sample, with measures of explanatory variables for the clients. The test (untabulated) shows that small clients in 2003 would pay more if they chose Big N auditors in place of non-Big N auditors and less if they chose non-Big N auditors in place of Big N auditors. Therefore, by either focusing on the significance of the Big N dummy in the regression across both auditor types, or by taking into account differences in the slope coefficients of the regressions for Big N and non-Big N client groups, there is evidence of a price premium for Big N auditors in both client segments in both years.

The evidence of Big N audit premiums in both the small and large client segments of the market suggests that scenario (1) from Table 2 applies in both 2000 and 2003. This supports the existence of product differentiation in the services of Big N accounting firms. Under the Simunic (1980) framework, when clients voluntarily contract with a higher-priced auditor, it implies that a differentiated product is associated with that auditor. The results are also consistent with competitive markets existing in both years. The results suggest that there is no evidence of cartel pricing by Big N auditors either before or after the demise of Arthur Andersen. The reduction from 5 to 4 large auditors does not appear to have reduced competition in the Australian audit services market.

Our results also show that the Big N premium is not always captured by the use of a dummy auditor variable in the regression. In each year there are differences in slope coefficients between non-Big N and Big N auditors and in 2003, between the constants. After further controlling for client size by splitting the sample at median total assets, the Big N dummy captures the effect of different auditor pricing behaviour for all clients.

#### 4.4. Sensitivity tests

We conducted additional analysis to test the robustness of our main results. The detailed results are available from the authors and are summarised in this section.

##### 4.4.1. Self-selection bias

Recent studies using audit pricing models have questioned whether companies self-select their auditors, which could induce a self-selection bias in the

audit fee regression estimations and impact audit fee premiums estimates used as the basis for drawing inferences about market competition. We take into account the findings of such studies by Ireland and Lennox (2002), Chaney *et al.* (2004) and Chaney *et al.* (2005) that argue that auditor choice is likely to be endogenous, and it is probable that clients self-select their incumbent auditors based on firm characteristics, private information or other unobservable characteristics. Therefore, inclusion of an auditor indicator variable in an audit fee regression could be invalid because client firms are not randomly assigned to their audit firms.<sup>17</sup>

We develop an auditor choice model using a subset of variables from the audit fee model and prior year opinion ( $Opinion_{t-1}$ ).<sup>18</sup> Probit regression is used to predict auditor choice (Big N or non-Big N), and to calculate the inverse Mills ratio to be included as an independent variable in the audit fee model. Tests are conducted for the full sample and separately for large and small client segments for both 2000 and 2003, and we conclude that the results are robust for tests for self-selection bias.<sup>19,20</sup> These results are consistent with a competitive market outcome under Simunic's (1980) framework.

<sup>17</sup> Chaney *et al.* (2004) explain the effect of auditor self-selection on the audit fee model. The auditor selection equation could be written as:

$$Big_i = \gamma_0 + \gamma_1 Y_i + u_i \quad (1)$$

and the corresponding audit fee equations could be written as:

$$AF_{1i} = \beta_{10} + \beta_{11} X_i + e_{1i} \quad \text{if } Big_i = 1 \quad (2)$$

$$AF_{0i} = \beta_{00} + \beta_{01} X_i + e_{0i} \quad \text{if } Big_i = 0 \quad (3)$$

where  $AF_i$  is the audit fee;  $Big_i$  is the dummy variable that takes the value 1 if the auditor is Big N, and 0 otherwise.  $X_i$  and  $Y_i$  are the explanatory variables.  $e_{1i}$ ,  $e_{0i}$  and  $u_i$  are the error terms. The Heckman selection procedure first uses the auditor choice equation, equation (1), to calculate the inverse Mills ratios (IMR). Then, the IMR are included as independent variables in the audit fee models, equations (2) and (3), respectively, to allow for any self-selection bias arising from the auditor selection.

<sup>18</sup>  $Big = \alpha_1 + \alpha_2 \ln TA + \alpha_3 \ln Sub + \alpha_4 DE + \alpha_5 Quick + \alpha_6 Foreign + \alpha_7 CATA + \alpha_8 ROI + \alpha_9 Loss + Opinion_{t-1} + u$ , where  $Opinion_{t-1}$  coding 1 if the firm received a qualified audit opinion in year  $t - 1$ , and 0 otherwise.  $Opinion_{t-1}$  is also included in the audit fee model in the second stage of the self-selection model. Inclusion of this variable does not affect our conclusion.

<sup>19</sup> We run these tests using both a two-part and a two-stage approach. In the former, the statistical software (STATA) automatically generates the IMR and includes it in the audit fee model. However, it truncates the estimate of Rho (the correlation between the errors in the probit and OLS models) in some cases (where the estimate of Rho is greater than 1). The second approach involves obtaining the IMR from a probit model, then 'plugging' it into the OLS fee model. This avoids the truncation problem but our diagnostic tests reveal significant multicollinearity issues caused by including the IMR. It appears that because the auditor choice model is driven by client size, the IMR is likely to be correlated with the size variable in the audit fee model.

#### 4.4.2. Size non-linearities

We examine the potential for non-linearities in client size to affect our findings. We first re-run our analysis and find, consistent with Francis and Stokes (1986) and Carson *et al.* (2004), that by reducing our sample to the 300 largest and smallest clients, the Big N variable in the small client segment remains significant but is not significant in the large client segment in both years. This suggests no premium in the large client segment and is consistent with scenario (4) in Table 2. The result implies that in addition to competitive markets and product differentiation by Big N auditors, there are non-Big N scale diseconomies in serving large clients. However, the difference in slope coefficients between Big N and non-Big N auditors is significant in both years for large clients and for small clients in 2003. This suggests that the regression with a Big N variable does not capture the differences in pricing between Big N and non-Big N auditors for the largest clients.

As a further test we compare the actual audit fees paid by the largest 300 clients in 2000 with the expected alternate audit fees if the client had used a different size auditor and find that Big N (non-Big N) clients would pay higher fees if non-Big N (Big N) auditors were employed. We interpret this result as evidence that the choice of auditor in the extremely large client segment is cost-effective in 2000. In 2003, the test shows that if Big N clients chose non-Big N auditors, they would pay significantly lower fees but non-Big N clients would not pay different fees to Big N auditors. This result implies that in 2003 the Big N auditors charge a fee premium in the extremely large client segment, which is not captured by the *Big* dummy in the regression because of the existence of different audit fee structures (i.e. the different slope coefficients).

We vary the cut-off point between large and small clients and find that the Big N variable becomes significant in 2000 when large clients are defined as those with assets greater than \$A95 million (335 observations), and in 2003 when large clients are defined as those with assets greater than \$100 million (320 observations). The Big N capture 86 per cent of the sample (defined in client numbers) for these clients in 2000, and 88 per cent in 2003.

We also re-run our analysis using a client size dummy interaction with the auditor indicator variable consistent with Carson *et al.* (2004). Carson *et al.* use interaction terms to identify non-linearity in the relationship between log

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<sup>20</sup> We also run tests for the pooled sample and for the large and small client markets in both years consistent with the approach by Khurana and Raman (2004) that involves including the IMR from the relevant choice model along with the auditor indicator variable in the second stage fee model estimation across all Big N and non-Big N clients. The results show that the Big N earn a premium in the pooled sample and in each of the large and small client markets after controlling for the IMR variable, which is significant in the pooled, large and small client market segment in 2000 and the pooled and small client market segment in 2003. However, we detected multicollinearity problems in the pooled and small client market fee regressions that included the IMR variable.

of audit fees and log of client size that can potentially result in variables that are correlated with client size being significant in the audit fee model. Our results show the existence of a Big N premium for all sized clients and an additional premium for the largest 200 clients in 2003. We also re-run our analysis using the client size interaction model developed by Chaney *et al.* (2005) for the variables we had in common and we do not find evidence of selection bias.<sup>21</sup>

## 5. Conclusion

A significant body of empirical-based research into audit pricing has laid claim to the existence of additional audit value being delivered by brand name (Big N) auditors over non-brand name auditors and that the audit market is competitive. As recognized in a report by the US General Accounting Office (2003), the recent demise of Arthur Andersen has called into question whether audit markets remain competitive. In Australia, the majority of Arthur Andersen's clients moved to Ernst & Young along with the audit partners, which was viewed as a merger of the two audit firms. The Australian Competition and Consumer Commission concluded that the merger raised concerns for competition in the audit market but the commission's view was that their concentration thresholds would not be crossed in this market. Accordingly, they did not oppose the merger. Because increased supplier concentration by itself is insufficient evidence of collusive pricing arrangements (Simunic, 1980) and concentration measures and thresholds are somewhat arbitrary, we adopt Simunic's (1980) audit-pricing framework with the segmentation assumption (small and large client segments categorized by client size) to investigate whether before or subsequent to the merger any evidence of cartel pricing existed in the Australian audit market.

We find that Big N concentration is low in the small client market and high in the large client market in both years 2000 and 2003, consistent with Simunic's (1980) framework treating the small client segment as a competitive benchmark. In both years, we find evidence of a Big N price premium when estimating the audit fee model across all clients, and when we estimate the model separately across large and small clients. This evidence is consistent with product differentiation by Big N auditors and competitive markets. The higher premiums for the Big N in 2003 could suggest a lessening of competition from 2000 but this inference is mitigated by the Simunic (1980) design we have deployed to control for non-competitive effects. The evidence shows that both before and after Arthur Andersen's demise the Australian audit services market was competitive. Further tests reveal no evidence of a Big N price

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<sup>21</sup> However, our models, with the size non-linearity controls suggested by Chaney *et al.* (2005), did not appear to be well specified, which limits the ability to rely on any inferences drawn from the models. More generally, the difficulty in detecting statistically reliable interaction effects explaining variation in a dependent variable has been raised elsewhere (see McClelland and Judd, 1993).

premium for the very largest clients (clients in the top 300 in each year) in 2000, although there is some evidence of higher fees being charged to these clients by Big N auditors in 2003. This suggests that there are non-Big N scale diseconomies for the very largest clients prior to Arthur Andersen's demise, which do not persist to 2003.

Our results also show evidence of significant variation in slope coefficients for audit fee regressions across different auditor groups, which support the proposition of Chaney *et al.* (2004) that different audit fee structures are applied across different auditor groups beyond that captured by a Big N dummy. However, the differences in slope coefficients are not detected once the sample is split into small and large client segments. This suggests that a Big N dummy is sufficient to capture variation in auditor pricing behaviour for all clients. Therefore, we conclude that competition still prevails throughout the audit market after Arthur Andersen's demise with Big N product differentiation across the whole market.

Our results are robust to a number of additional tests, including testing for self-selection bias, although we note our conclusions rely on robustness of the auditor selection model specification. Although our model has significant explanatory power and we conduct some sensitivity tests on the choice of model variables, there is scope for improving the model particularly for the small client segment. Further investigation of client switching (and the fee outcomes) between Big N and across the non-Big N before and after Arthur Andersen's demise could also provide additional insights into competition in the audit market.<sup>22</sup>

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<sup>22</sup> As suggested by one of the reviewers.



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