Quality Determines Performance: Evidence from International Audit Firms in Taiwan

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Abstract: This study investigates the operating performance of Taiwanese international audit firms in different market structures under the control of audit quality. Market structures are defined as three time periods by the number of international audit firms in the auditing industry. Empirical results indicate that the operating performance of international firms is better than that of non-international firms in the three time periods. This suggests that higher audit quality brings about superior operating performance. Next, international firms have better operating performance in the more equal but concentrated market structures after mergers of international firms. This further confirms that international audit firm mergers upgrade audit quality and thereby improve operating performance. To the best of our knowledge, few prior studies directly investigate the operating performance of international audit firms. With the empirical results this study contributes knowledge to related literatures and brings managerial implications to the practitioners.

Key words: International audit firms, market structures, operating performance, knowledge, audit quality, performance

INTRODUCTION

Long-term cooperation between US and Taiwanese auditing industries has created a similar audit market structure in both countries. Taiwanese international audit firms became affiliates or members of the US international firms 5 decades ago. In the past two decades, the US international firms are often referred to as the Big 4-6. In addition to the international firm affiliations, many non-international local firms are associated with other US firms such as BDO, Grant Thornton and Baker Tilly International. Prior studies report that international audit firms provide higher audit quality because they are expected to be more independent. This is because their larger client base subjects these firms to less pressure to succumb to an individual client (DeFond and Zhang, 2014). Further, international firms are regarded to have "deep pockets" which subject them to higher litigation risk (Becker *et al.*, 1998; Francis and Michas, 2012). Whether higher audit quality brings about superior operating performance to international firms? The first motivation is to compare the financial performance between international and non-international firms to answer the question.

Regarding the international firm affiliations, Taiwan had 6 largest international firms, the Big 6, before 1999. They included Arthur Andersen, KPMG, Price Waterhouse, Ernst and Young, Deloitte and Touche and Coopers and Lybrand. The number of international firms was further reduced to five when Taiwanese associates of PricewaterhouseCoopers and Lybrand merged in 1999 to form the PricewaterhouseCoopers, resulting in the Big 5. The loss of Arthur Andersen in the Enron accounting scandal leaves 4 international firms in Taiwan after 2003, the Big 4 including KPMG, PricewaterhouseCoopers, Ernst and Young and Deloitte. The largest audit firm was always the Arthur Andersen except in 1999 due to the merged PricewaterhouseCoopers. The successor of Arthur Andersen, Deloitte, has ranked the first, since, 2003.

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During the sample period of this study, 1992-2012, Taiwanese auditing industry experienced two international firm consolidations, resulting in 6 international firms between 1992-1998, 5 firms between 1999-2002 and 4 firms between 2003-2012. For ease of later expositions, this study defines the audit market structure by the three time periods and names them as Big 4-6 periods, respectively. Prior studies report that audit firm mergers increase audit quality, indicating that larger auditors provide higher audit quality due to the increased incentives provided by larger quasi-rents (Chan and Wu, 2011). Such mergers are also likely to increase the competency of merged audit firm to provide higher audit quality (DeFond and Zhang, 2014).

To the best of our knowledge, few prior researchers study the operating performance of international firms. Equipped with a unique auditing industry dataset not available in other countries this study exclusively focuses on international audit firms to examine their operating performance in different market structures. This constitutes our second motivation.

In this study, non-international firms refer to audit firms providing audit services to public companies but not the members or affiliates of the US international audit firms. Both the international and non-international firms situate in the same market to compete for clients. Given the three market structures, Big 4-6 periods this study further compares the operating performance between international and non-international firms which forms our third motivation. Specifically, this study contrasts the operating performance of international firms with that of non-international firms between different market structures.

The Structure-Conduct-Performance (S-C-P) theoretical framework in the industrial organization literature states that market structures affect the conducts of firms and further affect their performance (Cowling and Waterson, 1976). Based on the S-C-P framework and given the three market structures, we demonstrate that operating performance of international firms is better than that of non-international firms in the Big 4-6 periods. Operating performance of international firms in the 14 period is better than that of in the Big 6 and 5 periods but Big 5 period is not better than Big 6 period.

In sum, this study reports that quality determines performance in different market structures. In addition, the findings confirm that audit firm mergers increase audit quality and improve operating performance. With empirical results, this study first contributes knowledge to quality management-related literatures. Second, this study provides managerial implications to the practitioners of international audit firms. That is, product differentiation

Table 1: Market shares of international audit firms in Taiwan

Audit firms	Big 6 period: 1992~1998	
	Market share 1 (%)	Market share 2 (%)
Arthur Andersen	10.12	13.57
KPMG Peat Marwick	8.25	21.81
Pricewaterhouse	7.35	13.79
Ernst and Young	5.74	10.53
Deloitte and Touche	5.50	6.99
Coopers and Lybrand	3.91	6.45
Total	40.87	73.14
Big 5 period: 1999~2002		
Arthur Andersen	13.54	12.95
KPMG	13.06	16.30
PricewaterhouseCoopers	11.20	35.94
Deloitte and Touche	8.18	9.18
Ernst and young	7.40	10.96
Total	53.38	85.33
Big 4 period: 2003~2012		
Deloitte	25.40	39.15
KPMG	14.13	19.54
PricewaterhouseCoopers	13.99	21.40
Ernst and Young	8.66	10.87
Total	62.18	90.96

by quality is the best policy for professional organization, such as audit firms to maintain competitive advantages. Our findings also echo with the Public Company Accounting Oversight Board (PCAOB) regulatory implications in the US after the Enron accounting scandal. PCAOB (2008) suggests audit firms to improve operating performance by upgrading audit quality under a competitive audit market structure.

Literature review: The Financial Supervisory Commission (FSC) annually publishes a survey report of audit firms in Taiwan, the most authoritative source of information on auditing industry. According to the data base, the number of audit firms was 557 in 1992 and climbed to 1.050 in 2012. The number of practicing accountants, Certified Public Accountants (CPAs) was 1.066 in 1992 and 1.990 in 2012 (Anonymous, 2012.) Table 1 presents two market shares of Taiwanese international audit firms. Market share 1 is based on the auditing industry and market share 2 is defined from the public company auditing market. The market share 1 of international firms is 40.87% in Big 6 period and rises to 53.38% in Big 5 periods. It continuously climbs to 62.18% in the Big 4 period. In terms of market share 2, international firms occupy 73.14% in the Big 6 period and it leaps up to 85.33% in the Big 5 period. In the Big 4 period, market share 2 reaches as high as 90.96%. Market share 1 indicates that international firms provide most of the audit services in the industry and maintain a steady growth in market share. Further, international firms dominate the public company auditing market with less than ten percent services are rendered by the other non-international firms. A dual market structure exists in the audit market with a few large international

audit firms and many small ones (Brocheler *et at.*, 2004). Table 1 shows that Taiwanese auditing market structure is similar to that in the US and most other western countries.

Prior studies note that the success of organizations in the future will depend heavily on the way in which they utilize the creative potential of their human resources (Guest, 1986). From the resource-based view of firm, performance differences across firms can be attributed to the variance in the firm's resources and capabilities (Penrose, 1959; Wernerfelt, 1984; Prahalad and Hamel, 1990; Peteraf, 1993). Among the resources owned which one enables the firms to outperform others? Barney (1991) states that resources which are valuable, rare, unique and difficult to imitate can provide the basis for firm's sustainable competitive advantages. Grant (1996) suggests that knowledge, existing primarily in human capital is the critical ingredient for gaining a competitive advantage. Pfeffer (1994) points out that human capital has long been regarded as the critical resources in most firms. Accordingly, prior studies document that human capital attributes, such as education, experience and skills and characteristics of top managers, affect a firm's outcomes significantly (Huselid, 1995; Wright *et al.*, 1995; Pennings *et al.*, 1998; Carpenter *et al.*, 2001; Ling and Jaw, 2006).

In theory, scale economies exist in an industry when its constituent firms can reduce their average cost or increase their average revenues by expanding firm size (Christensen and Greene, 1976; Darrough and Heineke, 1978; Gyimah-Brempong, 1987). Scale economies prevail in the auditing industry as well (Banker *et al.*, 2003). Large audit firms earn more fee premiums over small ones due to product differentiation, brand name reputation and audit quality (Francis, 1984; Gul, 1999; Taylor and Simon, 1999; Peel and Roberts, 2003; Carson *et al.*, 2012).

In terms of the audit clients, consumers of audit services, they form opinions of quality through the evaluation of intrinsic and extrinsic product cues. Consumers regard quality as a subjective appraisal of the ability of a product or service to meet their needs (Acebron and Dopico, 2000; Ophuis and Trip, 1995) and they typically rely more heavily on intrinsic cues when forming their opinions (Bredahl, 2004). However, intrinsic product attributes affecting objective product quality are discounted in favor of extrinsic cues in some situations, if consumers believe extrinsic cues to be more credible and reliable than even their own judgment (Srinivasan *et al.*, 2004; Wansink *et al.*, 2000). Extrinsic cues believed by consumers to be consistent and credible predictors of value and quality include brand name and price (Dodds, 1991; Kardes *et al.*, 2004).

Consumers consistently use price as a predictor of quality, particularly when they have limited knowledge of product category offerings (Bredahl, 2004; Dickson and Sawyer, 1990; Glitsch, 2000; Kardes *et al.*, 2004; Manrai *et al.*, 1988). They have been found to believe that there is a natural ordering of products according to a price scale. That is the higher quality products are more expensive and products of lesser quality are cheaper. In the literature this price/quality relationship is described as the 'price-reliance schema's. It reflects consumer's strongly held view that 'you get what you pay for (Lee *et al.*, 1996). Indeed, the power of price is often linked to the additional information available for consumers to consider, making price a particularly powerful tool to support other product cues and price is consistently found to exert the most powerful influence on consumer quality assessments (Veale and Quester, 2009).

The affiliations between Taiwan and US international firms provide abundant resources for Taiwanese member firms including professional auditing techniques and expertise, human capital development and continuing professional education. Further, headquarters of international firms determine the services offered by their worldwide member firms which often exchange valuable information. With this systematic mechanism of professional development, international firms represent a symbol of high quality auditors and their reputation remains strong in Taiwan (Yang *et al.*, 2012). After the Enron event, the US. Congress passes the Sarbanes-Oxley Act of 2002 which creates the Public Company Accounting Oversight Board (PCAOB) to supervise the audit firms. The PCAOB establishes auditing and quality control standards for audits of public companies and performs inspections of quality controls at audit firms rendering services to public companies. The inspections also apply to Foreign audit firms offering services to companies issuing the American Depositary Receipt (ADR). For example, the 2008 and 2011 PCAOB inspection reports on two Taiwanese international firms, PricewaterhouseCoopers and Ernst and Young, indicate that the inspection team did not identify anything considered to be a quality control defect that warrants discussion in its inspection report (PCAOB, 2008).

Product differentiations exist in the audit market (Yang *et al.*, 2014). Regulations over Taiwanese international firms are stricter than other categories of audit firms (Chen *et al.*, 2008). Taiwanese international firms have more auditors with high academic education level, much work experience and CPA designation (Chen *et al.*, 2014). International firms also devote more resources on the continuing professional education of auditors. Consequently, Taiwanese international firms

render higher audit quality services and charge higher audit fees compared to other audit firms. Based on the preceding researches in both audit firms and audit clients, international firms render higher quality services than non-international firms. Con summers of audit firms pay higher audit fees for higher quality services. Hence, we predict that operating performance of international firms is superior to that of non-international firms in the Big 4-6 periods and hypothesize:

- H_{1a}: operating performance of international firms is better than that of non-international firms in the Big 6 period
- H_{1b}: operating performance of international firms is better than that of non-international firms in the Big 5 period
- H_{1c}: operating performance of international firms is better than that of non-international firms in the Big 4 period

Prior studies examining the pricing of audit fees generally report a fee premium of international firm due to a variety of factors such as greater expertise, audit quality, enhanced auditor independence and/or more resources international firms have than non-international firms to satisfy legal claims (Simunic, 1980; DeAngelo, 1981; Chaney *et al.*, 2004). To the extent, the fee premiums are also a function of the degree of market power exercised by these large international firms in the audit market. Previous studies investigating the effects of audit firm merger on competition find that merger resulted in increased audit market concentration and reduced competition (Minyard and Tabor, 1991; Wootton *et al.*, 1994; Choi and Zeghal, 1999; Pong, 1999). Further, Dunn *et al.* (2011), find that while market concentration increased during the 4 international-firm period, the market shares of the surviving 4 firms became more equal compared to the 5 international-firm period. Abidin *et al.* (2010) find a similar result in the UK. Using a large sample of Australian publicly listed companies over the years of 1996-2007, Carson *et al.* (2012) find that, premiums paid to international auditors have increased significantly for the 4 and 5 international firms periods compared to the earlier 6-international-firm period. That is the premiums paid by international firm clients increased in line with consolidation in the number of international audit firms.

Using a sample of Taiwanese audit firms, Yang *et al.* (2012) demonstrate that, mergers between international firms increase market concentration level but the long-term concentration level of international firms does not change significantly. This indicates that mergers

between international firms do not adversely change market structure. Further, combining two firms leads to synergy, substantial cost savings, increased revenues, and economies of scale (Banker *et al.*, 2003). Chan and Wu (2011) find that audit firm mergers increase audit quality, indicating that larger auditors provide higher audit quality due to the increased incentives provided by larger quasi-rents. DeFond and Zhang (2014) observe that such mergers are also likely to increase the competency of merged audit firm to provide higher audit quality.

Taiwanese auditing industry experienced two major international firm mergers during the sample period of this study. Before 1999, it had six largest international firms. Price Waterhouse and Coopers and Lybrand merged in 1999 to form the PricewaterhouseCoopers, resulting in five international firms. After the demise of Arthur Andersen in the Enron event, Taiwanese Arthur Andersen merged with Deloitte Touche and established the Deloitte, leaving 4 international firms in Taiwan after 2003. As a result, audit market in Taiwan is more concentrated in Big 4 period (2003-2012) compared to Big 5 period (1999-2002) and Big 6 period (1992-1998).

Based on prior researches this study expects that the audit quality of international firms in the Big 4 period is better than that of in the Big 5 and 6 periods and that of Big 5 period is better than that of in the Big 6 period. Consequently, the operating performance of international firms in the Big 4 period is better compared to the Big 5 and 6 periods and that of Big 5 period is better than that of Big 6 period. Hence, we hypothesize:

- H_{2a}: operating performance of international firms in the Big 5 period is better than that of in the Big 6 period
- H_{2b}: operating performance of international firms in the Big 4 period is better than that of in the Big 6 period
- H_{2c}: operating performance of international firms in the Big 4 period is better than that of in the Big 5 period

Both international and non-international firms defined in this study provide audit services to public companies and situate in the same market to compete with each other for audit clients. The reduction in the number of international firms leads to a more concentrated audit market which is more hostile to the non-international firms. Further, after the merger of international firms, audit quality of international firms is enhanced. Hence, non-international firms face a more competitive audit market in the Big 4 period than in the Big 5 and 6 periods. Based on previous hypotheses this study predicts that

operating performance of non-international firms in the Big 4 period will be worse than that of in the Big 5 and 6 periods and that of non-international firms in the Big 5 period will be worse than that of in the Big 6 period. Hence, this study hypothesizes:

- H_{3a}: operating performance of non-international firms in the Big 5 period is inferior to that of in the Big 6 period
- H_{3b}: operating performance of non-international firms in the Big 4 period is inferior to that of in the Big 6 period
- H_{3c}: operating performance of non-international firms in the Big 4 period is inferior to that of in the Big 5 period

MATERIALS AND METHODS

Empirical model: Sample observations of this study are registered audit firms in Taiwanese auditing industry, an industrial data. The Structure-Conduct-Performance (S-C-P) paradigm in the industrial economics states that market structures affect conducts of firms and further affect firm performance (Cowling and Waterson, 1976). Based on the S-C-P framework and prior studies on audit firms (Collins-Dodd *et al.*, 2004; Chen *et al.*, 2008; Yang *et al.*, 2013) this study establishes the following cross-sectional regression equation to test our hypothese:

$$PFM = \beta_0 + \beta_1 LARGE + \beta_2 TIMES + \beta_3 TIME4 + \beta_4 EDU + \beta_5 EXP + \beta_6 CPE + \beta_7 SIZE + \beta_8 DGP + \varepsilon$$

Where:
PFM = Operating Performance of audit firms
LARGE = Dummy variable of international firms
TIME 5 = Dummy variable of Big 5 period (1999-2002)
TIME 4 = Dummy variable of Big 4 period (2003-2012)
EDU = Education level of auditors
EXP = Work Experience of auditors
CPE = Continuing Professional Education of auditors
SIZE = Size of audit firms
GDP = Economic indicator
ε = Error term

Variable definitions
Dependent variable: Dependent variable of this study is the operating Performance of audit firms (PFM) which is defined as the net income per partner, a financial performance measure. Accounting defines net income as total revenues minus total expenses. Partners are the owners and residual interest claimants of audit firms. Their

annual income comprises salaries received from the firms and share of operating profits of the firms. The salaries of the partners, weekly or monthly are a part of total expenses of the firms. According to related laws and regulations, operating profits of the firms should be allocated to the owners annually and cannot be kept as retained earnings. The more the salaries of the partners, the less the operating profits of the firms. It makes no differences to the partners whether they receive salaries or not in terms of their total annual income. In addition, the criteria for salary payments to the partners vary across audit firms. The salary expenses of the partners are thus added back to the operating profits to reduce such an artificial noise (Chen *et al.*, 2008; Yang *et al.*, 2013). Consequently, operating performance of audit firms (PFM) is defined as follows:

$$PFM = (revenues - expenses + salaries\ paid\ to\ partners)/ending\ number\ of\ partners$$

Research variables: The first variable of interest is the dummy variable of international firms (LARGE), set to be 1 if the audit firms are international firms and 0, otherwise. Another is the dummy variables of market structure. If the years are in the 1999-2002 period, TIME 5 equals 1 and 0 otherwise. If the years are in the 2003-2012 period, TIME 4 is equal 1 and 0 otherwise.

Control variables: Apart from the research variables, some human capital factors affecting audit quality and operating performance are included as control variables. Educational level of auditors affects audit quality (Lee *et al.*, 1999) and operating performance of audit firms (Brocheler *et al.*, 2004; Collins-Dodd *et al.*, 2004; Fasci and Valdez, 1998). This study measures Education level of auditors (EDU) by a mean number of years auditors need to obtain an academic qualification, (In terms of average number of years which auditors take to obtain an academic degree this study defines EDU as follows): (number of auditors with a PhD. degree*23)+(number of auditors with a Master degree*18)+(number of auditors with a Bachelor degree*16)+(number of auditors with junior college degree*14)+(number of auditors with a senior high school diploma*12)+(others*9)/total number of auditors). Another human capital factor that affects audit quality is work experience of auditors (Aldhizer *et al.*, 1995; Council, 2012). Previous studies find a positive association between employee experience and job performance (Schmidt *et al.*, 1986) and point out that work experience relates positively to the performance of proprietorship audit firms (Fasci and Valdez, 1998; Collins-Dodd *et al.*,

2004; Chen *et al.*, 2008). This study measures the work Experience of auditors (EXP) by an average age of auditors in audit firms, (the empirical data of this study include six intervals of auditor's age including younger than 25, 25-34,35-44,45-54,55-64 and older than 65. We calculate the work experience of auditors as follows: [(number of auditors younger than 25*25)+(number of auditors aged between 25-34*30)+(number of auditors aged between 35-44*40)+(number of auditors aged between 45-54*50)+(number of auditors aged between 55-64*60)+(number of auditors older than 65*70)]÷total number of auditors).

Prior researches on training of audit firms indicate that professional training enhances auditor's competency and audit performance (Bonner and Pennington, 1991; Grotelueschen, 1990; Thomas *et al.*, 1988). Further, continuing professional education positively affects audit quality (Meinhardt *et al.* 1987) and relates to financial performance of audit firms (Chen *et al.*, 2008; Yang *et al.*, 2013). This study defines Continuing Professional Education of auditors (CPE) by the expenditures incurred in an audit firm.

In addition, size of a company might substitute for many omitted variables and its inclusion as a control variable enhances the accuracy of model specification (Becker *et al.*, 1998). Prior studies report a positive relationship between audit firm size and performance (Chen *et al.*, 2002, 2008; Collins-Dodd *et al.*, 2004; Rescho, 1988). This study defines Size of audit firms (SIZE) as a natural logarithm of ending number of auditors. As a professional organization, audit firms are affected by the local economy or environment factors (Reynolds and Francis, 2000). Economic indicator (GDP), Taiwan Gross Domestic Product is included to control for both year effect and local economy effect.

Data: This study obtains empirical data of audit firms from the 1992-2012 Survey Report of Audit Firms in Taiwan, published by the Financial Supervisory Commission (FSC). As the survey is administered pursuant to the Statistics Act, audit firms surveyed are required to fill out the questionnaire correctly within the due time. Thus, the survey report reveals an annual response rate of over 8%.

To ensure confidentiality of business transactions, the FSC provides no specific information on individual audit firms. Samples used in this study are pooled data which combine both cross-sectional and time series information. Increasingly more studies use pooled data because they allow researchers to exploit the entire available sample. In contrast to yearly estimates Geletkanycz and Hambrick (1997), indicate that results from pooled data reflect a mean effect of independent

Table 2: Sample distribution

Period/Year	International firms	Non-international firms	Total
Big 6			
1992	6	54	60
1993	6	53	59
1994	6	53	59
1995	6	63	69
1996	6	65	71
1997	6	60	66
1998	6	68	74
Subtotal	42	416	458
Big 5			
1999	5	66	71
2000	5	68	73
2001	5	55	60
2002	5	55	60
Subtotal	20	244	264
Big 4			
2003	4	54	58
2004	4	46	50
2005	4	50	54
2006	4	46	50
2007	4	46	50
2008	4	50	54
2009	4	48	52
2010	4	46	50
2011	4	45	49
2012	4	40	44
Subtotal	40	471	511
Total	102	1,131	1,233

variables during the sampling period. Thus, statistics obtained from the pooled data are more accurate. To account for inflation, we deflate all monetary variables by the yearly Consumer Price Index (CPI). During the sample period, this study deletes firm-year observations that newly established in the survey year and that with dependent variables having value more or less than three standard deviations away from their means. The final number of observations is 1.233. Table 2 presents the annual sample distribution.

Total samples are divided into international and non-international firms. Both firms provide audit services to public companies and situate in the same market to compete customers with each other. International firms are members or affiliates of the US international audit firms. Other sample firms are non-international firms. For the sample period, the number of observation of international and non-international firms is 102 and 1.131. The number of observation of international firms in the Big 4-6 periods is, 20, 40and 42, respectively.

RESULTS AND DISCUSSION

Descriptive statistics: Table 3 displays the descriptive statistics of variables. Panel A shows the results for international firms. Mean PFM, the net income per partner is $8,154,831. Mean EDU is 16.164, indicating that the average education level of auditors is above bachelor degree. Average EXP is 30.902 and denotes that the

Table 3: Descriptive statistics

Variables	Mean	SD	Minimum	Maximum	Median
Panel A international firms (n = 102)					
PFM	8,154.831	3,083.244	1,937.123	15,281.074	7,974.706
EDU	16.164	0.274	15.398	16.738	16.163
EXP	30.902	1.374	26.460	37.308	30.964
CPE	15.989	1.932	0.000	18.333	16.068
SIZE	6.821	0.685	5.257	8.148	6.891
Panel B Non-international firms (n = 1.131)					
PFM	1,897.778	1,317.513	-1,544.269	10,990.820	1,675.954
EDU	15.402	0.584	12.104	18.409	15.461
EXP	33.250	2.948	26.857	49.722	32.794
CPE	9.572	4.455	0.000	14.959	11.082
SIZE	3.720	0.789	0.693	6.190	3.689

Variable definitions: PFM = Operating Performance of audit firms; EDU = Education level of auditors; EXP = Work Experience of auditors; CPE = Continuing Professional Education of auditors; SIZE = Size of audit firms and GDP = Economic indicator

Table 4: Results of operating performance comparisons between international and non-international firms in different market structures

$PFM = \beta_0 + \beta_1 LARGE + \beta_2 EDU + \beta_3 EXP + \beta_4 CPE + \beta_5 SIZE + \beta_6 GDP + \epsilon$

		Big 4 period	Big 5 period	Big 6 period
Variables	Predicted sign	Standardized coefficients (t-values)	Standardized coefficients (t-values)	Standardized coefficients (t-values)
Research variable				
LARGE	+	0.552(11.023)***	0.520(6.514)***	0.317(4.430)***
Control variable				
EDU	+	0.070(3.773)***	0.120(3.436)***	0.168(5.056)***
xEXP	?	-0.009(-0.409)	-0.023(-0.519)	-0.097(-3.022)***
CPE	+	0.013 (0.360)	-0.024(-0.736)	0.107(3.692)***
SIZE	?	0.343(7.177)***	0.294(4.228)***	0.249(4.116)***
GDP	+	0.013(0.640)	0.014(0.374)	0.048(1.336)*
Adjusted R^2		0.762	0.674	0.496
F-statistic		272.668***	91.423***	76.056***
N		511	264	458

*%, *** Denote significance at the 10, 5 and 1% levels, respectively (one-tailed where coefficient sign has prediction, two-tailed otherwise); Variable definitions: PFM = Operating Performance of audit firms, LARGE = Dummy variable of international firms, EDU = Education level of auditors, EXP = Work Experience of auditors, CPE = Continuing Professional Education of auditors, SIZE = Size of audit firms and GDP = Economic indicator

average age of auditors is about 31. The mean of CPE is 15.989. Its un-transformed CPE indicates that the average expenditures of continuing professional education of international audit firms are \$16,752,558. Average SIZE is 6.821 and its un-transformed figure indicates that the ending number of auditors in the international audit firms is 1.138. Panel B presents the descriptive statistics of variables for non-international firms. Except EXP, the averages of all variables of non-international firms are less than that of international firms.

Regression results

Comparisons of operating performance between international and non-international firms: Table 4 reports the regression results of operating performance in different market structures. The explanatory power (adjusted R^2) in the Big 4-6 period models is 0.496, 0.674 and 0.762, (F = 76.056, 91.423, and 272.668; p<0.01), implying that the models are well specified. All t-statistics of variable coefficient are calculated using White (1980) robust standard errors to correct for heteroscedasticity. As a check on the multi-collinearity among independent

variables, we estimate the Variance Inflation Factors (VIFs). In Table 4, all regression models having variable VIFs >3.17 imply that no serious multi-collinearity exists among the independent variables. In addition, we estimate the standardized regression coefficients for each independent variable to ease comparisons between variables.

As shown in the Big 4-6 period columns, the coefficients on dummy variable of international firms (LARGE) are positive significantly (t = 4.430, 6.514, 11.023; p<0.01), indicating that operating performance of international firms is better than that of non international firms during these three time periods. The H_{1a}-H_{1c} are supported.

Comparisons of operating performance of international firms between different market structures: Previous section compares the operating performance between international and non-international firms during the Big 4-6 periods. Instead this section compares the differences in operating performance between the three market structures for international and non-international firms, respectively.

Table 5: Results of comparisons of operating performance between different market structures for international and non-international firms

$PFM = \beta_0 + \beta_1 \, TIME5 +_2 \, TIME4 + \beta_3 \, EDU + \beta_4 \, EXP + \beta_5 \, CPE + \beta_6 \, SIZE + \beta_7 \, GDP + \varepsilon$

Variables	Predicted sign	International firms Standardized coefficients (t-value)	Non-international firms Standardized coefficients (t-value)
Research variables			
TIME 5	+	0.105(0.942)	-0.117(-3.824) ***
TIME 4	+	0.455(3.311)***	-0.181(-4.351)***
Control variables			
EDU	+	-0.026(-0.322)	0.189(6.961)***
EXP	?	0.003(0.045)	-0.064 (-2.153)**
CPE	+	-0.005(-0.138)	0.070(2.284)**
SIZE	?	0.309(2.106)**	0.355(9.612)***
GDP	+	0.167(1.959)*	0.005(0.178)
Adjusted R^2		0.544	0.186
F-statistic		18.228***	37.917***
N		102	1131

*, **, ***Denote significance at the 10, 5 and 1% levels, respectively (one-tailed where coefficient sign has prediction, two-tailed otherwise); Variable definitions: PFM = Operating Performance of audit firms, TIME5 = Dummy variable of Big 5 period, TIME4 = Dummy variable of Big 4 period, EDU = Education level of auditors, EXP = Work Experience of auditors, CPE = Continuing Professional Education of auditors, SIZE = Size of audit firms and GDP = Economic indicator

As shown in Table 5, both international and non-international firm's empirical models have a moderate model specification with adjusted R^2 being 0.544 and 0.186. Related econometric problems such as heteroscedasticity and multi-collinearity, are also treated appropriately. The international firm column shows a positive but insignificant coefficient on dummy variable of Big 5 period (TIME5) (t = 0.94), implying no material differences in performance of international firms between Big 5-6 periods. This lends no support to H_{2a}. Next, the coefficients on dummy variable of Big 4 period (TIME4) are significantly positive (t = 3.31; p<0.01). This denotes that operating performance of international firms in the Big 4 period is better than that of in the Big 6 period and H_{2b} is supported. Further, the Wald test reveals a significant difference in coefficient between the TIME5 and TIME4 (F = 12.40; p<0.01). This represents that the operating performance of international firms in the Big 4 period is better than that of in the Big 5 period and H_{2c} is supported. In the non-international firm column, we have a significantly negative coefficient on dummy variable of Big 5 period (TIME5) (t = -3.824; p<0.01) imply that operating performance of non-international firms in the Big 5 period is inferior to that of in the Big 6 period. Hence, H_{3a} receives a support. Also, coefficients on dummy variable of Big 4 period (TIME4) are negative and significant (t = -4.351; p<0.01), indicating that operating performance of non-international firms in the Big 4 period is inferior to that of in the Big 6 period and H_{3b} is supported accordingly. However, the Wald test shows an insignificant difference in coefficients between the TIME5 and TIME4 (F = 1.09; p>0.01). This indicates that the operating performance of non-international firms in the Big 4 period is not inferior to that of in the Big 5 period significantly and H_{3c} receives no support.

CONCLUSION

By covering three different market structures, this study examines financial operating performance of international firms. Empirical results demonstrate that operating performance of international firms is better than that of non-international firms in the Big 4-6 periods because of higher audit quality rendered by international firms. Next, we contrast the financial performance between different market structures for international firms. The empirical results display that operating performance of international firms in the Big 4 period is better than that of in the Big 6 and 5 periods. However, the operating performance of international firms in the Big 5 period is insignificantly better than that of in Big 6 period. The passage of the Sarbanes-Oxley Act of 2002 (SOX) establishes a watershed of regulation over audit firms. Before SOX, the regulation of auditors is a self-disciplined system that the auditing profession sets rules to regulate themselves. After SOX, the Public Company Accounting Oversight Board (PCAOB) supervise the audit firms by establishing auditing and quality control standards and performing inspections of quality controls at audit firms that render services to public companies, a heteronomous system. After SOX, the regulatory environment is severer compared to before SOX. Regulators around the world strengthen their supervision over audit firms by posing more restrictions on the services rendered by auditors and more requirements to upgrade audit quality. The Big 6 and 5 periods of this study are in the pre-SOX period and share similar regulatory regimes. In contrast, the Big 4 period situates in the post-SOX period and faces more regulatory requirements. As a result, this study asserts that the audit quality of international firms in the Big 6 and 5 periods is similar. This leads to an insignificant difference in operating performance of international firms in the Big 6 and 5 periods.

Taiwanese auditing industry had six largest international firms before 1998, five international firms between 1999 and 2002 and four international firms during 2003 and 2012. Mergers between international firms lead to higher audit quality and in turn bring about superior operating performance. This study further documents that audit quality determines operating performance. Banker *et al.* (2003) suggests that combining two audit firms leads to synergy, substantial cost savings, increased revenue and economies of scale. Chan and Wu (2011) states that audit firm mergers result in higher audit quality. We confirm them and document that higher audit quality results in better performance for mergers between international firms.

One of the key determinants of audit quality is the independence of auditors. This study omits it from our empirical models because of major measurement errors which constitute a limit of this study. International firms play a key role in the sound operation of capital market around the world.

RECOMMENDATIONS

A promising avenue for future studies is to examine the effects of audit quality on international firm audit fees paid by individual audit clients. This will confirm that quality determines performance in terms of capital market, a perspective different from this study.

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