Received 20 August 2013
Revised 25 February 2014
Accepted 17 September 2015

QUALITY PAPER

Quality moderates market competition: evidence of Taiwanese service industry

Yi-Fang Yang
Department of Accounting and Information System, Chang Jung Christian University, Tainan, Taiwan, and
Yahn-Shir Chen
Department of Accounting, National Yunlin University of Science and Technology, Douliu, Taiwan

Abstract

Purpose – The purpose of this paper is to examine the direct and interactive effects of audit service quality and audit market concentration on performance of public accounting firms in Taiwan.
Design/methodology/approach – Empirical data of this study come from registered public accounting firms in Taiwan, an industrial data. From the perspective of industrial economics and based on the structure-conduct-performance paradigm (Cowling and Waterson, 1976), this study use OLS to test the linear regression equation.
Findings – Empirical results indicate that both audit service quality and audit market concentration have positive effects on performance. The interaction terms between audit service quality and audit market concentration are positively related to performance.
Practical implications – This documents that human capital is the core resource in public accounting firms which could enhance performance through higher audit service quality under intense market competition. Specifically, facing increasingly competitive audit market, public accounting firms response to the hostile situation by employing auditors with higher educational level, more work experience, with professional licenses, and taking more continuing professional education.
Originality/value – Few previous researches consider the effects of either market concentration or audit service quality on firm performance. This study simultaneously examines the relation among audit service quality, audit market concentration, and performance of public accounting firms. With the results, this study contributes knowledge to human resource and quality management-related literatures.

Keywords Public accounting firms, Performance, Audit service quality, Market concentration
Paper type Research paper

Introduction

The 2001 Enron event leads to the demise of the then largest public accounting firms in the USA, Arthur Andersen. Investing community casts doubt on the quality of financial reporting and the effectiveness of audits. To respond to the challenge, the US Congress passes the Sarbanes-Oxley Act of 2002, which creates the Public Company Accounting Oversight Board (PCAOB) to oversee the public accounting firms. The PCAOB establishes auditing and quality control standards for audits of public company, and performs inspections of quality controls at public accounting firms rendering those services. Through regular inspections, the PCAOB evaluates the quality of auditing tasks on a specific engagement and reviews the practices of public accounting firms, operating policies, and auditing procedures related to audit quality. The inspections also apply to foreign public accounting firms offering services to

International Journal of Quality & Reliability Management
Vol. 33 No. 9, 2016
pp. 1332-1345

0265-671X
DOI 10.1108/IJQRM-08-2013-0133

companies issuing the American Depositary Receipt. For example, the 2008 and 2011 PCAOB inspection reports on two Taiwanese international firms, PricewaterhouseCoopers and Ernst & Young, indicate that the inspection team did not identify anything considered to be a quality control defect that warrants discussion in its inspection report. Further, PCAOB focusses on the assessment of professional competency of auditors, assignment of responsibility, and continuing professional education programs. These inspections clearly indicate that human resource management is an important determinant of audit quality. In addition, the UK Financial Reporting Council (FRC) (2006) identifies some relevant drivers behind audit quality. In light of the recent developments, regulators, academics, and the investing public have become increasingly concerned about audit quality from the perspective of auditors in public accounting firms.

For long, there is no single agreed definition of audit quality that can be used as a standard against which actual performance can be assessed (FRC, 2006). Public accounting firms with employees of high technical competencies will presumably be able to render high quality service. Auditors' technical competencies refer to their experience, education, professionalism, employment history, and organization structure of public accounting firms (Deis and Giroux, 1992). Prior studies identify some human capital factors affecting audit quality, such as educational level and work experience of auditors (Lee *et al.*, 1999; Liu, 1997; Aldhizer *et al.*, 1995; FRC, 2006). This study accesses to a unique data set about auditors' technical competencies, which is not available in other countries. We construct a human capital-based audit quality and term it as audit service quality. The ensuing question interests us is whether public accounting firms with high audit service quality result in superior performance? To answer the question forms the first purpose of this study.

After Enron, Taiwanese affiliate firm of the late Arthur Andersen combined with the member firm of Deloitte and Touche in 2003. This merger changes the audit market structure and creates the largest Taiwanese public accounting firm, Deloitte Touche Tohmatsu. The number of firms in a market and the firms' monopoly power can theoretically explain market structure. Measuring a market's structure is a quick and accurate way to assess the likely nature of its competition. In theory, a high market concentration level denotes low competition in a market (Besanko *et al.*, 2000). Economic theory suggests that price-cost margins (profits) should be higher in more concentrated markets (Besanko *et al.*, 2000). Prior studies in auditing show that audit market structure is related to audit pricing, audit fees, and market power (McMeeking *et al.*, 2007; Lee, 2005). Different market structures give rise to varied levels of rivalry, fee-setting practices, and client turnover (Ghosh and Lustgarten, 2006). To the best of our knowledge, few prior studies address the effects of audit market concentration level on operating performance. To examine the relation between audit market concentration and financial performance constitutes our second purpose.

The structure-conduct-performance (S-C-P) paradigm in the industrial organization literature states that market structures affect the conducts of firms and further affect firm performance (Cowling and Waterson, 1976). Around the world, audit market has become increasing competitive for the past three decades. Given the audit market structure, one responding conduct taken by public accounting firms is to enhance audit service quality. Whether enhanced audit service quality improves performance of public accounting firms? The final purpose of this study is to examine the performance effects of the interaction between audit market structure and audit service quality.

Prior researches note that performance determinants of public accounting firms are an area left under investigated due to data unavailability (Bröcheler *et al.*, 2004). Equipped with the available data in Taiwan, this study obtains empirical data from the 2002-2006 survey report of public accounting firms in Taiwan and constructs panel data to investigate the effects of audit service quality and market concentration on financial performance of public accounting firms. This study extracts audit service quality from the components of human capital in public accounting firms by the principal components analysis technique. Following Minyard and Tabor (1991) and Dunn *et al.* (2011), this study assesses market concentration by an adjusted Herfindahl-Hirschman index (AHHI). Two performance measures are estimated, financial performance and operating efficiency. Empirical results indicate that both audit service quality and audit market concentration have positive effects on performance. Also, the interaction between audit service quality and market concentration is positively associated with performance. This implies that audit service quality moderates the relationship between audit market concentration and audit firm performance. With empirical results, this study contributes knowledge to human resource and quality management-related literatures and provides managerial implications to the practitioners. Public accounting firms may improve performance through the upgrade of audit service quality under a competitive audit market, consistent with the regulatory implication suggested by the PCAOB.

The remainder of this study proceeds as follows. Second section reviews prior literature and develops our hypotheses. We describe methodology in third section and report empirical results in fourth section. We discuss and conclude in fifth section.

Literature review and hypothesis development

Audit service quality

A multitude of prior studies measure audit service quality by information from outside of public accounting firms (Casterella *et al.*, 2009; Palmrose, 1988; Heninger, 2001) or audit clients (Becker *et al.*, 1998; Francis *et al.*, 1999; Venkataraman *et al.*, 2008; Lawrence *et al.*, 2011). Recent developments indicate that regulators and academics have become increasingly concerned about audit service quality from inside of the public accounting firms, especially the human capital therein. Public accounting firms are a professional service organization and render services to companies by professional auditors. Human capital is embodied in the expertise and experience of the professional auditors. The resource-based view of firms states that variances in firms' resources and capabilities account for differences in performance across firms (Barney, 1991; Coff, 1997; Wernerfelt, 1984). Public accounting firms with auditors of high technical competencies have more ability to detect errors and provide greater assurance to readers that financial statements do not contain material errors (Becker *et al.*, 1998; Thornton and Moore, 1993; Chen *et al.*, 2010; Liu *et al.*, 2011).

Meinhardt *et al.* (1987) summarize an American Institute of Certified Public Accountants (AICPA) task force report on the quality of audits of governmental units and indicate that education of auditors is an important area affecting the quality of auditors' job. Analytically evaluating the effects of the 150-rule on audit market, Lee *et al.* (1999) note that the higher the education level of auditors, the higher the audit service quality. The FRC (2006) identifies some principal drivers of audit service quality, including the skill (experience) base of partners and staff, the training given to audit personnel. Aldhizer *et al.* (1995) report seven categories of auditor attributes appeared to be strongly associated with audit service quality, such as the senior

auditors being a certified public accountants (CPAs) (professionalism) or general audit knowledge and experience. Hence, skillful auditors render high quality services to clients, resulting in public accounting firms having good reputation and earning fee premiums. Public accounting firms with higher audit service quality differentiate themselves from others, not only retaining the existing clients but also attracting the new clients. Based on the literatures above, Chen *et al.* (2013) estimate audit quality of audit firms from human capital-related factors and report a positive association between audit quality and financial performance.

From the perspective of consumer behavior, service quality perceived by customers significantly impacts on their satisfaction index. Customers are becoming increasingly demanding in their search for suppliers who can supply quality products, provide excellent services, and continuously improve their offerings. Higher quality is associated with superior financial performance (Phillips *et al.*, 1983; Zakuan *et al.*, 2010). Based on the above statements, this study contends that audit service quality positively relates to performance of public accounting firms and suggests the following hypothesis:

H1. The relationship between audit service quality and performance of public accounting firms is positive.

Market concentration

The S-C-P paradigm states that market structure influences competition and price-setting, and market structure includes the relationship between sellers, buyers, and potential competitors in the market (Bain, 1968). Measuring a market's structure is a quick and accurate way to assess the likely nature of its competition (Besanko *et al.*, 2000). Market concentration is a commonly used representation of market structure. Theoretically, a positive association exists between market price and market concentration (Weiss, 1989) and a more concentrated market leads to a higher price-cost margin (profit) (Besanko *et al.*, 2000). Namely, higher market concentration presents lower market competition and in turn brings about superior performance for firms.

Rosenbaum (1993) examines the simultaneity between profits, entries, and changes in concentration and notes that profits respond positively to entry barriers and initial concentration. McMeeking *et al.* (2007) examine the effects of mergers between the large public accounting firms on UK audit market concentration and pricing. Yang *et al.* (2012) examine competition level and merger in Taiwanese audit industry and report that Taiwanese audit market structure is similar to that in the USA and in most other western countries. Both McMeeking *et al.* (2007) and Yang *et al.* (2012) find that concentration ratios increase after mergers and suggest that concentration ratios are associated with higher audit fees/financial performance. They find that concentration ratios increase after mergers and suggest that concentration ratios are associated with higher audit fees. Accordingly, this study expects that audit market concentration has a positive effect on performance of public accounting firms and hypothesizes:

H2. The relationship between audit market concentration and performance of public accounting firms is positive.

Interaction between audit service quality and audit market concentration

The S-C-P paradigm indicates that market structure impacts conducts of firms and in turn firms' performance (Caves, 1987). Further, the revised S-C-P paradigm states that

the relation between market structure and conducts and performance of firms is interactive, that is, market structure impacts conducts and performance of firms and vice versa (Koch, 1974). Audit service quality is an inner and vital resource of public accounting firms. When the economy is depressed or market competition is intense, public accounting firms react by upgrading audit service quality and thereby help them improve performance. Namely, audit service quality moderates the relationship between market competition and firm performance. Stated previously, Chen *et al.* (2013) investigate the association between audit quality and financial performance of Taiwanese audit firms, while Yang *et al.* (2012) examine competition level in Taiwanese audit industry. This study consequently extends Chen *et al.* (2013) and Yang *et al.* (2012) and expects that audit service quality (conduct) and market concentration (structure) have an interactive effect on firm performance and establishes hypothesis as follows:

H3. The interaction between audit service quality and audit market concentration has a positive effect on performance of public accounting firms.

Methodology

Data

Empirical data are from the 2002-2006 survey report of public accounting firms in Taiwan, published by the Financial Supervisory Commission (FSC). To collect business information on the public accounting profession for macro-economic analysis and industrial policy formation, the FSC administers the survey over all registered public accounting firms annually. Contents of the survey include quantitative information of total revenues and their compositions, total expenses and their compositions, demographics of various levels of employees, and ending amounts of and changes in fixed assets. An open questionnaire collects qualitative information by asking about operating difficulties public accounting firms encounter and future business strategies they take. Because the survey is conducted pursuant to the Statistics Act, public accounting 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 eighty percent. As the sample period of this study is five years, this study deflates all monetary variables by the yearly Consumer Price Index to account for inflation.

To test the hypotheses above, we construct a panel data of 136 public accounting firms per year, 680(136×5) observations, for the sample period. The panel data comprise 74 proprietorship firms and 62 partnership firms, including big international firms. Table I displays the sample distribution. Panel A indicates that the percentage of

Year	2002	2003	2004	2005	2006
Panel A: percentage of sample firms					
(a) No. of sample firms	136	136	136	136	136
(b) No. of total firms	762	723	736	801	807
(a)/(b)	17.85%	18.81%	18.48%	16.98%	16.85%
Panel B: percentage of total revenues of sample firms (in million New Taiwan dollars)					
(c) Revenues of sample firms	7,946	8,319	8,645	9,089	9,803
(d) Revenues of total firms	16,571	17,044,	17,126	18,377	20,470
(c)/(d)	47.95%	48.81%	50.48%	49.46%	47.89%

Table I.
Sample distribution

sample firms is less than 20. However, Panel B shows the percentage of total revenues of sample firms account for 47.89-50.48 percent revenues of the auditing industry. This denotes that our sample firms are appropriate representative of the industry.

Empirical model

Empirical data of this study come from registered public accounting firms in Taiwan, an industrial data. From the perspective of industrial economics and based on the S-C-P paradigm (Cowling and Waterson, 1976), this study establishes the following linear regression equation to test our hypotheses:

$$FPFM_{i,t} = \alpha_0 + \alpha_1 QUALITY_{i,t} + \alpha_2 CONCEN_{i,t} + \alpha_3 QUALITY_{i,t} \times CONCEN_{i,t} + \alpha_4 QUALITY_{i,t-1} + \alpha_5 CONCEN_{i,t-1} + \alpha_6 SIZE_{i,t} + \alpha_7 AGE_{i,t} + \alpha_8 DIV_{i,t} + \alpha_9 ECONOMY_{i,t} + \alpha_{10} DUMMY_{i,t} + \varepsilon_{i,t} \quad (1)$$

where i is the audit firm i, $i = 1, \ldots, 136$, and t is the sample period t, $t = 2002, \ldots, 2006$; $FPFM_{i,t}$ the financial performance; $QUALITY_{i,t}$ the audit service quality; $CONCEN_{i,t}$ the audit market concentration; $QUALITY_{i,t-1}$ the one-period-lagged audit service quality; $CONCEN_{i,t-1}$ the one-period-lagged audit market concentration; $SIZE_{i,t}$ the size of public accounting firms; $AGE_{i,t}$ the age of public accounting firms; $DIV_{i,t}$ the degree of business diversification; $ECONOMY_{i,t}$ the economic indicator; and $DUMMY_{i,t}$ the dummy variable of public accounting firm category.

Definitions of variable

Dependent variables. Financial performance of public accounting firms ($FPFM_{i,t}$) is our dependent variable and defined as net income. In accounting, net income equals total revenues deduct total expenses. Partners are the owners and residual interest claimants of public accounting firms. Their annual income comprises salaries and share of operating profits of the firms. The salaries of partners, weekly or monthly, are a part of total expenses of the firms. The more the salaries of the partners, the less the operating profit 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 partners vary across firms. Based on prior studies (Chen *et al.*, 2008), their salaries are added back to net income to reduce such an artificial noise.

Research variables

Our first research variable is the audit service quality ($QUALITY_{i,t}$) extracted by a principal component analysis technique from human capital-related factors suggested in prior studies. Meinhardt *et al.* (1987) summarize an AICPA task force report on the quality of auditing governmental units and indicate that education of auditors is an important area affecting the quality of auditor's work. The task force made a recommendation to the education of auditor, which require auditors to complete relevant continuing professional education programs. Aldhizer *et al.* (1995) report some human capital attributes that are strongly associated with audit service quality, including that senior auditors are a CPA, a symbol of professionalism, and general knowledge and experience of auditors. The UK FRC (2006) identifies some drivers of audit quality in four areas including the skills and personal qualities of audit partners and staff. Specifically, the principal drivers of audit quality in this area include the skill base (experience) of partners and staff, and the training given to audit personnel.

Lee *et al.* (1999) evaluate the effects of the 150-rule on the audit market and incorporate auditor education and auditor effort as joint inputs of audit quality. The 150-rule was established by the AICPA voting members in 1988 and required all new members to have completed 150 semester hours of college education by the year 2000.

Based on preceding studies, we extract an audit service quality from four factors related to human capital of public accounting firms, including educational level of auditors (Lee *et al.*, 1999), work experience of auditors (Aldhizer *et al.*, 1995; FRC, 2006), professionalism (Aldhizer *et al.*, 1995), and continuing professional education of auditors (Meinhardt *et al.*, 1987; FRC, 2006). Auditors with bachelor or masters degree in accounting have completed at least 150 semester hours of college education to meet the requirements of professional standards (Whittington and Pany, 2003). Next, following previous studies, we utilize the age of auditors to assess work experience of auditors (Collins-Dodd *et al.*, 2004; Bröcheler *et al.*, 2004; Fasci and Valdez, 1998; Chen *et al.*, 2008). Passage of the uniform CPAs examination together with experience and education requirements, auditors are awarded with a CPA license and are eligible to practice as an independent practitioner. Auditors with a CPA license are equipped with academic and professional expertise and work experience, a symbol of professionalism. This study estimates the degree of professionalism by the number of auditors with CPA license. Auditors have to meet continuing education requirements to maintain their licenses to practice, or as a condition for license renewal (Whittington and Pany, 2003). The public accounting profession provides continuing professional education to increase the likelihood of appropriate audit service quality and to keep auditors stay current on the extensive and ever-changing body of knowledge in accounting, auditing, and taxes (Elder *et al.*, 2008). We define continuing professional education as a natural logarithm of the total training expenses of public accounting firms. Next, this study employs principal component analysis technique to extract audit service quality from the previous four factors related to human capital in public accounting firms. The un-tabulated results indicate that the Kaiser-Meyer-Olkin measure of sampling adequacy value of our data set is 0.798 and Bartlett's test of sphericity reaches statistical significance ($\chi^2 = 4{,}809.09$; $p < 0.000$). This indicates that empirical data used is suitable for factor analysis. The eigenvalue-greater-than-one rule suggests that one principal component be obtained.

Audit market concentration is another research variable of this study. Prior audit market researches measure market concentration by the concentration ratio or the Herfindahl-Hirschman index (HHI). The HHI is sensitive to the number of firms active in an industry and to varying activity levels across firms (Yardley *et al.*, 1992). To measure market concentration, we employ the (*AHHI*) proposed by prior studies, such as Minyard and Tabor (1991) and Dunn *et al.* (2011). The *AHHI* is the difference between the HHI and the base level (expected market share based on the number of total public accounting firms). The *AHHI* defines as follows:

$$AHHI = \sum_{i=1}^{t} \left({X_{i,t}}^2 \right) - \frac{1}{n_t} \tag{2}$$

where n_t is the total number of public accounting firms in the audit market at year t; and $X_{i,t}$ represents market share of firm i at year t. In general, in a market with n equal-size firms, its mean HHI is $1/n$. In further, in a market with n firms, either equal-sized

or unequal-sized, its mean HHI is $1/n$ too. The mean HHI is also referred to as a base level HHI. Table II reports that the adjusted HHI lies between 7.0288 and 10.5561 percent.

The S-C-P paradigm states that market structure affects conducts of firms and in further affects their performance. To react to the prior period market structure, public accounting firms probably adjust their conducts and thereby influence current performance. We thus include a one-period-lagged audit market concentration ($CONCEN_{i,t-1}$) into the empirical model. In addition, more profitable firms have more resources to attract higher skilled workers and offer more training, which results in provisions of high quality audit service. Rendering high quality audit services in the previous period, public accounting firms attract more audit clients and earn more revenues in the current period. This implies that current performance partly results from prior period high quality service offerings. Hence, we take the above situation into account and include a one-period-lagged audit service quality ($QUALITY_{i,t-1}$) to control the effects from prior period.

Control variables

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). This study defines audit firm size ($SIZE_{i,t}$) as natural logarithm of total number of auditors in public accounting firms. Based on prior studies (Yang *et al.*, 2013; Chen *et al.*, 2008; Collins-Dodd *et al.*, 2004), this study specifies a positive relationship between audit firm size and performance. In practice, public accounting firms accumulate human resources and clients over time. Based on prior studies (Fasci and Valdez, 1998; Bröcheler *et al.*, 2004; Chen *et al.*, 2008), this study expects a positive association between age of public accounting firms ($AGE_{i,t}$) and performance. Diversity in service lines enhances the firms' efficiencies due to the existence of economies of scope arising from the sharing or joint utilization of inputs (Baumol *et al.*, 1982). We measure the degree of business diversification ($DIV_{i,t}$) by the Entropy index. Greater Entropy index means higher degree of business diversification. Prior studies report a mixed relationship between business diversification and performance (Rumelt, 1974; Khanna and Palepu, 1997; Singh *et al.*, 2001; Chen *et al.*, 2008; Servaes, 1996). Hence, this study does not specify a directional prediction on the relationship between business diversification and performance.

As a professional service organization, public accounting firms are affected by local economy (Reynolds and Francis, 2000). An economic indicator ($ECONOMY_{i,t}$), Taiwan Stock Exchange Capitalization Weighted Stock index, is included to control the annual external environment effects. Auditors have provided services to the same clients for years and most of their practices are statutory. This makes the effects of environment factors on performance of public accounting firms indeterminate. As a result, this study

Year	Total No. of public accounting firms (TN)	HHI (a) (%)	Mean HHI (b) $= 1/(TN)$ (%)	*AHHI* (a)−(b) (%)
2002	762	7.16	0.1312	7.0288
2003	723	9.92	0.1383	9.7817
2004	736	10.39	0.1359	10.2541
2005	801	9.70	0.1248	9.5752
2006	807	10.68	0.1239	10.5561

Table II. The estimates of adjusted HHI (*AHHI*)

does not specify a directional prediction on the relationship between economic indicator and performance. To compare the performance between proprietorship and partnership firms, we add a dummy variable of public accounting firm category ($DUMMY_{i,t}$). It is set to be 1 when the public accounting firms are proprietorship, and 0, otherwise.

Results

Descriptive statistics of variables

Table III displays the descriptive statistics of variables used in the regression model. Mean financial performance ($FPFM_{i,t}$), net income, is $15,922,622. As the audit service quality ($QUALITY_{i,t}$) is standardized, its mean is 0 and standard deviation is 1. Average audit market concentration ($CONCEN_{i,t}$) is 0.094. Mean number of auditors, audit firm size ($SIZE_{i,t}$), is 51, and mean age of public accounting firms ($AGE_{i,t}$) is 17 years. On average, the degree of business diversification ($DIV_{i,t}$) is 0.509. The mean dummy variable of public accounting firm category ($DUMMY_{i,t}$) shows that 54.4 percent of the sample firms are proprietorship firms.

Regression results

Table IV displays the regression results in hierarchical pattern. Model 1A only reports the results for control variables. The coefficients on the size of public accounting firms ($SIZE_{i,t}$) is statistically significant and positive ($t = 7.359$, $p < 0.01$). Larger public accounting firms have much better performance. The coefficients on the age of public accounting firms ($AGE_{i,t}$) is statistically significant and positive ($t = 4.815$, $p < 0.01$). The longer the age of public accounting firms, the higher the performance of public accounting firms. Coefficients on the dummy variable of audit firm category ($DUMMY_{i,t}$) is statistically significant and negative ($t = -8.336$, $p < 0.01$). It shows that the performance of partnership firms is better than that of proprietorship firms. The impact of the degree of business diversification ($DIV_{i,t}$) or the economic indicator ($ECONOMY_{i,t}$) on public accounting firms' performance is indeterminate.

	Mean	SD	Min.	Max.	Q1	Median	Q3
Dependent variables							
$FPFM_{i,t}$	15,922,622	80,900,932	−18,531,230	735,049,902	640,886	1,360,454	3,595,433
Research variables							
$QUALITY_{i,t}$	0	1	−0.432	8.968	−0.275	−0.183	−0.062
$CONCEN_{i,t}$	0.094	0.014	0.070	0.106	0.083	0.098	0.104
Control variables							
$SIZE_{i,t}$	51	207	2	1,732	6	11	24
$AGE_{i,t}$	17	9	1	53	11	15	22
$DIV_{i,t}$	0.509	0.128	0.162	0.875	0.435	0.507	0.594
$ECONOMY_{i,t}$	6,171	1,088	4,452	7,824	5,891	6,140	6,548
$DUMMY_{i,t}$	0.544	0.498	0	1	0	1	1

Notes: Number of observations is 680. Variable definitions; $FPFM_{i,t}$, financial performance; $QUALITY_{i,t}$, audit service quality; $CONCEN_{i,t}$, audit market concentration; $SIZE_{i,t}$, size of public accounting firms; $AGE_{i,t}$, age of public accounting firms; $DIV_{i,t}$, degree of business diversification; $ECONOMY_{i,t}$, economic indicator; $DUMMY_{i,t}$, dummy variable of public accounting firm category

Table III.
Descriptive statistics of variables

$$FPFM_{i,t} = \alpha_0 + \alpha_1 QUALITY_{i,t} + \alpha_2 CONCEN_{i,t} + \alpha_3 QUALITY_{i,t} \times CONCEN_{i,t} + \alpha_4 QUALITY_{i,t-1} + \alpha_5 CONCEN_{i,t-1} + \alpha_6 SIZE_{i,t} + \alpha_7 AGE_{i,t} + \alpha_8 DIV_{i,t} + \alpha_9 ECONOMY_{i,t} + \alpha_{10} DUMMY_{i,t} + \varepsilon_{i,t}$$

Variables	Predicted sign	Model 1A Standardized coefficient (*t*-statistics)	Model 1B Standardized coefficient (*t*-statistics)	Model 1C Standardized coefficient (*t*-statistics)
Constant	?	– (−17.914)	– (4.429)	– (4.417)
$QUALITY_{i,t}$	+	–	0.699 (14.786)***	0.604 (3.498)***
$CONCEN_{i,t}$	+	–	0.098 (1.317)*	0.090 (1.187)
$QUALITY_{i,t} \times CONCEN_{i,t}$	+	–	–	0.037 (4.603)***
$QUALITY_{i,t-1}$	?	–	0.330 (6.697)***	0.344 (6.394)***
$CONCEN_{i,t-1}$	?	–	0.007 (0.327)	0.009 (0.415)
$SIZE_{i,t}$	?	0.740 (7.359)***	0.077 (4.945)***	0.076 (4.937)***
$AGE_{i,t}$	+	0.146 (4.815)***	0.023 (2.548)***	0.023 (2.641)***
$DIV_{i,t}$	?	0.035 (1.048)	0.005 (0.549)	0.006 (0.633)
$ECONOMY_{i,t}$	?	−0.024 (−0.815)	−0.149 (−4.064)***	−0.152 (−4.193)***
$DUMMY_{i,t}$	–	−0.310 (−8.336)***	−0.029 (−2.523)***	−0.028 (−2.502)***
Adjusted R^2		0.4477	0.8545	0.9553
F-statistic		92.74***	1,613.36***	1,759.29***

Notes: Although the original number of observations is 680, this study includes the one-period-lagged variables in the empirical model. Variable definitions, $FPFM_{i,t}$, financial performance; $QUALITY_{i,t}$, audit service quality; $CONCEN_{i,t}$, audit market concentration; $QUALITY_{i,t-1}$, one-period-lagged audit service quality; $CONCEN_{i,t-1}$, one-period-lagged audit market concentration; $SIZE_{i,t}$, size of public accounting firms; $AGE_{i,t}$, age of public accounting firms; $DIV_{i,t}$, degree of business diversification; $ECONOMY_{i,t}$, economic indicator; $DUMMY_{i,t}$, dummy variable of public accounting firm category. Thus we have final number of observations 544 in Table IV. For the heteroskedasticity in model, *t*-statistics and *p*-value are adjusted by the White (1980) standard errors. The variance inflation factors (VIF) are less than 10 (un-tabulated), implying that no serious multi-collinearity exists among the independent variables. *,***Significance at the 10 and 1 percent level for a one-tailed test

Table IV.
Regression results of the empirical model

Next, the one-tailed testing results of *H1* and *H2* are shown in Model 1B. The coefficient of audit service quality ($QUALITY_{i,t}$) is positive significantly ($t = 14.786$, $p < 0.01$). This represents audit service quality positively relates to firm performance. Thus, *H1* receives a support. Further, the coefficient of audit market concentration ($CONCEN_{i,t}$) is significantly positive but marginally ($t = 1.317$, $p < 0.1$) for the one-tailed test. It denotes that audit market concentration positively relates to firm performance and lends a support to *H2*. Model 1C reports a positive coefficient on the interaction term of audit service quality and audit market concentration ($QUALITY_{i,t} \times CONCEN_{i,t}$) ($t = 4.603$, $p < 0.01$), which lends a support to *H3*. As shown previously, both audit service quality ($QUALITY_{i,t}$) and audit market concentration ($CONCEN_{i,t}$) positively relate to performance. The positive interaction effects between service quality and market concentration reinforce the financial performance of audit firms. This indicates that audit service quality moderates the relation between market structure and performance. Namely, public accounting firms with higher audit service quality still have better net income under the intense audit market competition.

Additional analysis

Apart from the financial performance ($FPFM_{i,t}$), this study utilizes two proxy variables to measure performance of audit firms, operating efficiency and scale efficiency. Because the value of both efficiencies lies between 0 and 1, we use Tobit regression model to test our hypotheses. The un-tabulated results indicate similar results to those reported in Table IV.

Discussions and conclusions

This study examines the effects of audit service quality and audit market concentration on public accounting firm performance. We use audit market concentration to proxy audit market competition and find a positive and significant effect on firm performance. Next, relationship between audit service quality and performance is positive. Empirical results above confirm the S-C-P paradigm in the industrial organization literature. Further, the interaction term between audit market concentration and audit service quality is positive, implying that audit service quality moderates the relation between market structure and performance. This documents that human capital is the core resources in public accounting firms which could enhance performance through higher audit service quality under intense market competition. Specifically, facing increasingly competitive audit market, public accounting firms response to the hostile situation by employing auditors with higher educational level, more work experience, with professional licenses, and taking more continuing professional education. Audit market concentration in different practice markets provides regulators and practitioners useful information. For example, prior studies indicate that post-merger Big firms have the higher concentration than pre-merger ones. This study finds that audit firms in a more concentrated market produce better financial performance. Further, under the higher audit market concentration, audit firms enhance their financial performance by providing higher audit service quality. Yang *et al.* (2012) report that Taiwanese audit market structure is similar to that in the USA and in most other western countries. Findings above are managerial implicative for practitioners in Taiwan, USA, and other western countries in their operating decision-making.

Few previous researches consider the effects of either market concentration or audit service quality on firm performance. This study simultaneously examines the relation among audit service quality, audit market concentration, and performance of public accounting firms. With the results, this study contributes knowledge to human resource and quality management-related literatures. Public accounting firms may take different business strategies to adapt to the dynamic operating environment. To examine the role played by audit service quality in public accounting firms taking varied business strategies constitute promising avenues for future studies.

References

Aldhizer, G.R., Miller, J.R. and Moraglio, J.E. (1995), "Common attributes of quality audits", *Journal of Accountancy*, Vol. 179 No. 1, pp. 61-68.

Bain, J.S. (1968), *Industrial Organization*, John Wiley & Sons, New York, NY.

Barney, J.B. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-129.

Baumol, W.J., Panzar, J.C. and Willig, R.D. (1982), *Contestable Markets and the Theory of Industry Structure*, Harcourt Brace Jovanovich, San Diego, CA.

Becker, C.L., DeFond, M.L., Jiambalvo, J. and Subramanyam, K.R. (1998), "The effect of audit quality on earnings management", *Contemporary Accounting Research*, Vol. 15 No. 1, pp. 1-24.

Besanko, D., Dranove, D. and Shanley, M. (2000), *Economics of Strategy*, John Wiley & Sons, New York, NY.

Bröcheler, V., Maijoor, S. and Witteloostuijn, A.V. (2004), "Auditor human capital and audit firm survival: the Dutch audit industry in 1930-1992", *Accounting, Organizations and Society*, Vol. 29 No. 7, pp. 627-646.

Casterella, J.R., Jensen, K.L. and Knechel, W.R. (2009), "Is self-regulated peer review effective at signaling audit quality?", *The Accounting Review*, Vol. 84 No. 3, pp. 713-735.

Caves, R. (1987), *American Industry: Structure, Conduct, Performance*, Prentice-Hall, Englewood Cliffs, NJ.

Chen, S., Sun, S.Y.J. and Wu, D. (2010), "Client importance, institutional improvements, and audit quality in China: an office and individual auditor level analysis", *The Accounting Review*, Vol. 85 No. 1, pp. 127-158.

Chen, Y.S., Chang, B.G. and Lee, C.C. (2008), "The association between continuing professional education and financial performance of public accounting firms", *The International Journal Human Resources Management*, Vol. 19 No. 9, pp. 1720-1737.

Chen, Y.S., Hsu, J., Huang, M.T. and Yang, P.S. (2013), "Quality, size, and performance of audit firms", *The International Journal of Business and Finance Research*, Vol. 7 No. 5, pp. 89-105.

Coff, R. (1997), "Human assets and management dilemmas: coping with hazards on the road to resource-based theory", *Academy of Management Review*, Vol. 22 No. 2, pp. 374-402.

Collins-Dodd, C., Gordon, I.M. and Smart, C. (2004), "Further evidence on the role of gender in financial performance", *Journal of Small Business Management*, Vol. 42 No. 4, pp. 395-417.

Cowling, K. and Waterson, M. (1976), "Price-cost margins and market structure", *Economica*, Vol. 43 No. 171, pp. 267-274.

Deis, D.R. and Giroux, G.A. (1992), "Determinants of audit quality in the public sector", *The Accounting Review*, Vol. 67 No. 3, pp. 462-479.

Dunn, K., Kohlbeck, M. and Mayhew, B.W. (2011), "The impact of the Big 4 consolidation on audit market share equality", *Auditing: A Journal of Practice & Theory*, Vol. 30 No. 1, pp. 49-73.

Elder, R.J., Beasley, M. and Arens, A. (2008), *Auditing and Assurance Services: An Integrated Approach*, Prentice -Hall, Upper Saddle River, NJ.

Fasci, M.A. and Valdez, J. (1998), "A performance contrast of male- and female-owned small accounting practices", *Journal of Small Business Management*, Vol. 36 No. 3, pp. 1-7.

Financial Reporting Council (FRC) (2006), "Discussion paper: promoting audit quality", London, available at: www.frc.org.uk/Our-Work/Publications/FRC-Board/Discussion-Paper-Promoting-Audit-Quality.pdf

Francis, J.R., Maydew, E.L. and Sparks, C.H. (1999), "The role of Big 6 auditors in the credible reporting of accruals", *Auditing: A Journal of Practice & Theory*, Vol. 18 No. 2, pp. 17-34.

Ghosh, A. and Lustgarten, S. (2006), "Pricing of initial audit engagements by large and small public accounting firms", *Contemporary Accounting Research*, Vol. 23 No. 2, pp. 333-368.

Heninger, W.G. (2001), "The association between auditor litigation and abnormal accruals", *The Accounting Review*, Vol. 76 No. 1, pp. 111-126.

Khanna, T. and Palepu, K. (1997), "Why focused strategies may be wrong for emerging markets", *Harvard Business Review*, Vol. 75, pp. 41-51.

Koch, J.V. (1974), *Industrial Organization and Price*, Prentice-Hall, Englewood Cliff, NJ.

Lawrence, A., Minutti-Meza, M. and Zhang, P. (2011), "Can Big 4 versus non-Big 4 differences in audit-quality proxies be attributed to client characteristics?", *The Accounting Review*, Vol. 86 No. 1, pp. 259-286.

Lee, C.J., Liu, C. and Wang, T. (1999), "The 150-hour rule", *Journal of Accounting and Economics*, Vol. 27 No. 2, pp. 203-228.

Lee, D.S. (2005), "The impact of the Big 8 mergers on market power: evidence from the Hong Kong market", *Journal of International Financial Management & Accounting*, Vol. 16 No. 1, pp. 69-96.

Liu, C. (1997), "Legal liability, human capital investment, and audit quality", unpublished doctor dissertation, University of National Taiwan University, Taipei.

Liu, J., Wang, Y. and Wu, L. (2011), "The effect of Guanxi on audit quality in China", *Journal of Business Ethics*, Vol. 103, pp. 621-638.

McMeeking, K.P., Peasnell, K.V. and Pope, P.F. (2007), "The effect of large audit firm mergers on audit pricing in the UK", *Accounting & Business Research*, Vol. 37 No. 4, pp. 301-319.

Meinhardt, J., Moraglio, J.F. and Steinberg, H.I. (1987), "Governmental audits: an action plan for excellence", *Journal of Accountancy*, Vol. 164 No. 1, pp. 86-91.

Minyard, D.H. and Tabor, R.H. (1991), "The effect of Big Eight mergers on auditor concentration", *Accounting Horizons*, Vol. 5 No. 4, pp. 79-90.

Palmrose, Z. (1988), "An analysis of auditor litigation and audit service quality", *The Accounting Review*, Vol. 63 No. 1, pp. 55-73.

Phillips, L.W., Chang, D.R. and Buzzell, R.D. (1983), "Product quality, cost position and business performance: a test of some key hypotheses", *Journal of Marketing*, Vol. 47 No. 2, pp. 26-43.

Reynolds, J. and Francis, J. (2000), "Does size matter? The influence of large clients on office-level auditor reporting decisions", *Journal of Accounting and Economics*, Vol. 30 No. 3, pp. 375-400.

Rosenbaum, D.I. (1993), "Profit, entry and changes in concentration", *International Journal of Industrial Organization*, Vol. 11 No. 2, pp. 185-203.

Rumelt, R.P. (1974), *Strategy, Structure, and Economic Performance*, Harvard University Press, Cambridge.

Servaes, H. (1996), "The value of diversification during the conglomerate merge wave", *Journal of Finance*, Vol. 51 No. 4, pp. 1201-1225.

Singh, M., Mathur, I., Gleason, K.C. and Etebari, A. (2001), "An empirical examination of the trend and performance implications of business diversification", *Journal of Business and Economic Studies*, Vol. 7 No. 2, pp. 25-51.

Thornton, D.B. and Moore, G. (1993), "Auditor choice and audit fee determinants", *Journal of Business Finance and Accounting*, Vol. 20 No. 3, pp. 333-350.

Venkataraman, R., Weber, J.P. and Willenborg, M. (2008), "Litigation risk, audit quality, and audit fees: evidence from initial public offerings", *The Accounting Review*, Vol. 83 No. 5, pp. 1315-1345.

Weiss, L. (1989), *Concentration and Price*, MIT Press, Cambridge, MA.

Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5 No. 2, pp. 171-180.

White, H. (1980), "A heteroskedasticity-consistent covariance matrix estimator and a direct text for heteroskedasticity", *Econometrica*, Vol. 48 No. 4, pp. 817-828.

Whittington, O.R. and Pany, K. (2003), *Principles of Auditing and Other Assurance Services*, McGraw-Hill, New York, NY.

Yang, Y.F., Chen, Y.S. and Yang, L.W. (2013), "Gender gap, training and financial performance: evidence from public accounting industry", *The International Journal of Human Resource Management*, Vol. 24 No. 19, pp. 3697-3718.

Yang, Y.F., Yang, L.W. and Chen, Y.S. (2012), "Market competition and mergers in professional service firms", *The International Journal of Business and Finance Research*, Vol. 6 No. 3, pp. 103-122.

Yardley, J., Kauffman, N., Cairney, T. and Albrecht, W. (1992), "Supplier behavior in the U.S. audit market", *Journal of Accounting Literature*, Vol. 11 No. 1, pp. 151-184.

Zakuan, N.M., Yusof, S.M., Laosirihongthong, T. and Shaharoun, A.M. (2010), "Proposed relationship of TQM and organizational performance using structured equation modeling", *Total Quality Management*, Vol. 21 No. 2, pp. 185-203.

Further reading

Bartlett, M.S. (1951), "The effect of standardization on a chi square approximation in factor analysis", *Biometrika*, Vol. 38 Nos 3/4, pp. 337-344.

Kaiser, H.F. (1974), "An index of factorial simplicity", *Psychometrika*, Vol. 39 No. 1, pp. 31-36.

Corresponding author
Yahn-Shir Chen can be contacted at: chenys@yuntech.edu.tw