QUALITY, SIZE, AND PERFORMANCE OF AUDIT FIRMS

Yahn-Shir Chen, National Yunlin University of Science and Technology, Taiwan
Joseph Hsu, National Yunlin University of Science and Technology, Taiwan
Mei-Ting Huang, National Yunlin University of Science and Technology, Taiwan
Ping-Sen Yang, National Yunlin University of Science and Technology, Taiwan

ABSTRACT

This study examines the relations between audit quality, audit firm size, and financial performance. This study estimates audit quality of audit firms from human capital-related factors, such as educational level of auditors, work experience of auditors, and professional training. From the perspective of market segmentation, the sample is divided into three categories: national, regional, and local firms. Empirical results report a positive association between audit firm size and audit quality for the three categories of audit firms. The positive relationship of national audit firms is higher than that of regional and local audit firms. The relationship between audit quality and financial performance is positive. The positive relationship of national audit firms is higher than that of regional and local audit firms.

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INTRODUCTION

In the auditing industry, service quality refers to audit quality or auditor quality. DeAngelo (1981) firstly defined audit quality as the joint probability that auditors will discover and report a breach in their clients' accounting system. No single agreed definition of audit quality serves as a standard against which actual performance can be assessed (FRC, 2006). As audit quality is unobservable, after DeAngelo (1981), researchers established several proxy variables for testing, including auditor size (Simunic and Stein, 1996; Francis and Wilson, 1988; Palmorse, 1988; DeFond, 1992), auditor litigation (Palmrose, 1988; Heninger, 2001), and discretionary accruals (Becker et al., 1998; Francis et al., 1999; Venkataraman et al., 2008). These definitions of audit quality are from either outside audit firms or audit client perspectives. Few prior studies estimate audit quality by using measures from inside audit firms.

Audit firms are a professional service organization rendering services to companies by professional auditors. Milgrom and Roberts (1992) indicate that the most important specialized input in partnerships is typically the knowledge and ability of workers, that is, their human capital. Human capital of audit firms is embodied in the expertise and experience of auditors and is a critical input in determining their audit quality. In the definition of audit quality, DeAngelo (1981) assumes that the probability of discovering a breach is positive and fixed, implying no variation in the competency of auditors (Niemi, 2004). In effect, auditor competency varies across audit firms due to different levels of human capital possessed. Audit firms with skillful and proficient employees will presumably be able to bring closer concordance of the reported earnings with generally accepted accounting principle (GAAP) and are perceived as a high auditor quality firm (Teoh and Wong, 1993). As a result, prior studies identify some human capital factors affecting audit quality, such as educational level of auditors (Lee et al., 1999; Liu, 1997) and work experience of auditors (Aldhizer et al., 1995; FRC, 2006). This motivates us to relax DeAngelo's constant auditor competency assumption and assess audit quality in terms of human capital factors of audit firms.

Audit firms can enjoy economy of scale when their size expands (Watts and Zimmerman, 1986). Prior studies report a positive relationship between audit firm size and performance (Chen and Cheng, 2008; Chen et al., 2008; Collins-Dodd et al., 2004; Rescho, 1987). Further, profitable audit firms reinvest more resources to advance their service quality, implying a positive relation between audit firm size and audit quality. To examine the relation constitutes our first motivation.

A multitude of prior studies indicate that adopting total quality management (TQM) or ISO series can improve organizational performance (Brah et al., 2000; Kunst and Lemmink, 2000; Naser et al., 2004; Dimara et al., 2004; Martinez-Lorente et al., 2004; Soltani and Lai, 2007). In contrast, some researchers find that the implementation of TQM does not improve performance (Dow et al., 1999; Beaumont and Sohal, 1999; Terziovski and Samson, 1999; Singles et al., 2001). Further, some studies contend and confirm that the impact of improved quality on financial performance is primarily indirect in nature (Victor et al., 2010a, 2010b). It is practically important for the practitioners to know what the effects of audit quality on financial performance of audit firms are. As few prior studies provide empirical evidences for the auditing industry, examining the association between audit quality and financial performance of audit firms forms our second motivation.

The auditing industry is regulated by the SEC in the U.S. or by the Financial Supervisory Commission in Taiwan. Market segmentation exists in the industry due to government regulation or the size of clients served (Defond et al., 2000; Ghosh and Lustgarten, 2006). Accordingly, this study classifies the total sample into three categories, including national, regional, and local audit firms.

Prior studies identify human capital-related factors affecting audit quality. This study extracts audit quality from these factors by the principal component analysis technique. Empirical results indicate that the relation between audit firm size and audit quality is significantly positive in the three categories of audit firms. This positive relationship is higher in national audit firms compared to regional and local audit firms, consistent with our expectations and with the findings in previous studies (e.g., DeAngelo, 1981; Palmrose, 1988; DeFond, 1992; Teoh and Wong, 1993; Becker et al., 1998). However, no significant difference in the positive relation exists between regional and local audit firms. Next, a positive association exists between audit quality and financial performance for national, regional and local audit firms. The positive relationship of national audit firms is higher than that of regional and local audit firms, agreeing with our expectations and prior studies (e.g., Francis, 1984; Palmrose, 1986; Johnson et al., 1995; Craswell et al., 1995). No significant difference in the positive relationship exists between regional and local audit firms.

This study is the first to define audit quality in terms of human capital and empirically tests the relation among audit firm size, audit quality, and financial performance. Prior studies report a positive relationship between audit firm size and audit quality (DeAngelo, 1981; Palmrose, 1988; DeFond, 1992; Teoh and Wong, 1993; Becker et al., 1998). This study corroborates the results from the perspective of human capital of audit firms. Furthermore, this study provides findings that audit quality is positively related to financial performance, an extension of prior studies. Empirical results of this study contribute to the knowledge about the audit market and to conclusions drawn in previous research. The remainder of this study proceeds as follows. Section 2 reviews relevant literature and develops our hypotheses. Section 3 presents the research method and Section 4 discusses the empirical results. This study summarizes and concludes in Section 5.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The concept of market segmentation originates from the incomplete competition market theory suggested by economic scholars in the 1930's. Theorists assume that, in the market, consumers are heterogeneous and possess different preferences. Under the situation, firms seek consumers with homogeneous preferences and group them into smaller units with which to market their products. The concept of market segmentation thus comes from the demand side of the market. When consumers are too numerous and diverse in their buying requirements, a single product mix offered by the firms is unable to satisfy all consumers (Kotler, 2003). As a result, the marketing strategies evolve from mass marketing to product-variety marketing, and finally to target marketing. By market segmentation, the firms point to the target market and precisely adjust their products and marketing activities to meet consumer or user needs (Smith, 1956). Target marketing takes three steps: segmenting, targeting, and positioning (Kotler, 1998). Hence, the first step of marketing is segmentation with which the firms concentrate resources on consumers who have more opportunity to be satisfied by the firms. Market segmentation refers to a group

of consumers within a broader market who possess a set of common characteristics, including demographic factors, geography, buyer's industry, and size of the purchasing firm (Besanko et al., 2000).

Practically, the larger the company, the more complicated the organizational structure, and the higher the internal agency cost. As a result, companies employ larger audit firms to audit their financial statements to alleviate the agency cost (Simunic and Stein, 1996；Francis et al., 1999). Public companies are larger in size compared to private companies. Substantial difference in size exists between audit firms offering and not offering services to public companies. Hence, audit firms are grouped into different categories in terms of client size or service area.

Obtaining the 2000-2003 audit fee data from Standard & Poor's, Ghosh and Lustgarten (2006) investigate the extent to which auditors of U.S. companies reduce fees on initial audit engagements (fee discounting). They hypothesize and confirm that there are separate segments within the auditing industry in which different levels of rivalry and fee-setting practices prevail. They add that segmentation of the audit market occurs in part because some clients need internationally recognized auditors or specialized auditing services that can be provided only by the largest audit firms. Accordingly, they divide total samples into two categories: large (Big 4 or 5 auditors) and non-large auditors. Chen et al. (2008) investigate the association between continuing professional education and financial performance of audit firms in Taiwan. In terms of market segment, they categorize audit firms into big, medium, and local-sized firms.

Defond et al. (2000) examine the audit fees of Big 6 and non-Big 6 audit firms for 348 publicly listed Hong Kong companies to investigate auditor industry specialization and market segmentation. They report evidence of Big 6 premiums for both general brand name and for industry specialization, consistent with Craswell et al. (1995). In addition, they find a large local audit firm Kwan Wong Tan & Fong (KWTF), which is the market leader in the property sector, has significantly lower fees than both Big 6 and other non-Big 6 auditors in that industry. They contend this is evidence of market segment not previously identified. KWTF develops production economies and captures market share through lower fees for a clientele seeking low-priced audits. Similarly, in Taiwan and around the world, small and medium-sized enterprises seek low-priced audits and are served by smaller audit firms. In contrast, large audit firms render high quality services and provide audits to public companies.

The original wave of auditor-differentiation research focuses on the dichotomy between large and small audit firms as a basis for differential service quality. DeAngelo (1981) defines audit quality and concludes that larger audit firms have incentives to offer higher level audit quality service due to more aggregate client-specific quasi-rents at stake.

Following DeAngelo, several streams of research are motivated by the dichotomy of larger and smaller audit firms. Corroborative evidence from prior research indicates that larger audit firms supply higher quality audits. Palmrose (1988) sets a framework suggesting that auditors with relatively low (high) litigation activities represent higher (lower) audit quality suppliers and that non-Big 8 firms as a group have higher litigation activities than Big 8 firms. DeFond (1992) suggests that companies with higher agency conflicts have a greater need for credible monitoring and are more likely to employ a larger auditor. Teoh and Wong (1993) document that companies audited by Big 8 firms have higher earnings response coefficients compared to companies audited by non-Big 8 firms. Becker et al. (1998) examine the effects of audit quality on earnings management through discretionary accruals reported by audit clients. They find that companies audited by non-Big 6 auditors report significantly higher discretionary accruals than that of companies audited by Big 6 auditors. Further, the clients of non-Big 6 auditors have significantly larger variations in discretionary accruals than the clients of Big 6 auditors. In sum, the collective evidences support a positive relation between audit firm size and audit quality.

Hypothesis Development

In both theoretical and empirical research, audit quality has often been estimated via audit firm size. Audits by large audit firms are of higher quality than audits by local audit firms, a view bolstered by

many prior studies. Audit quality has two components: auditor competence and auditor independence. Given the auditor independence constant, we argue that human capital of audit firms is not homogeneous and audit quality differs accordingly. Further, large audit firms would invest more resources in human capital to provide higher quality services.

Based on prior studies, we contend the relation between audit firm size and audit quality is positive. Prior studies suggest that large audit firms tend to provide higher quality audits than other audit firms (e.g., Palmrose, 1988; Teoh and Wong, 1993). Accordingly, this study expects a higher positive relationship between audit firm size and auditor quality in the national (large) audit firms compared to the regional and local (small) audit firms. Further, we examine whether there are differences in the positive relation between regional and local audit firms. In Taiwan, both regional and local audit firms are not allowed to provide services to public companies. They are allowed to provide services to the same client groups, small and medium-sized enterprises (SMEs), resulting in relatively smaller firms audited. Further, both regional and local audit firms offer homogeneous services, including corporate registration, accounting and bookkeeping, and tax services. Thus, this study expects that no difference exists in the positive relationship between audit firm size and audit quality for regional and local audit firms. This study establishes the following hypotheses to articulate the above expectations.

H1a: Audit firm size is positively related to audit quality.

H1b: National audit firms have higher positive relationship between firm size and audit quality than regional and local audit firms.

H1c: No difference in the positive relationship between audit firm size and audit quality exists between regional and local audit firms.

Audit firms invest resources in the creation of a brand name reputation which is a costly endeavor. The firms might recoup this investment through a fee premium. Several prior studies document the existence of a Big N audit fee premium (Francis, 1984; Palmrose, 1986; Johnson et al., 1995; Craswell et al., 1995), an evidence of product differentiation in the audit market. This study argues that audit firms with audit fee premiums result in better financial performance compared to those without audit fee premiums. Accordingly, we expect a positive relation between audit quality and financial performance for national, regional, and local audit firms.

Prior studies document that large audit firms tend to have higher audit fees than other audit firms (e.g., Francis, 1984; Palmrose, 1986; Johnson et al., 1995; Craswell et al., 1995). We further expect that national audit firms have a higher positive relationship between audit quality and financial performance compared to regional and local audit firms. As stated earlier, both regional and local audit firms provide services to the same client groups, medium-sized enterprises (SMEs). Taiwanese tax authorities established a tax agent system and legalized the provisions of corporate registration and accounting and bookkeeping services by tax agents to SMEs in 1998. Both regional and local audit firms have provided the same practices to the SMEs for years. Tax agent legalization negatively influences regional and local audit firms because of the competitive advantages the tax agents possess for a relatively lower service fees and easy service access by the clients. As a consequence, this study expects that no difference exists in the positive relationship between audit quality and financial performance for regional and local audit firms. The following hypotheses are formed to characterize the above expectations.

H2a: Audit quality is positively related to financial performance.

H2b: National audit firms have higher positive relationship between audit quality and financial performance than regional and local audit firms.

H2c: No difference in the positive relationship between audit quality and financial performance exists for regional and local audit firms.

RESEARCH METHOD

Sample Selection

Empirical data of this study are from the 1992-2006 Survey Report of Audit Firms in Taiwan, published by the Financial Supervisory Commission (FSC). To collect business information on the auditing industry for macro-economic analysis and policy formation, the Taiwanese Ministry of Finance administered the survey over all registered audit firms for the 1989 to 2003 period. The FSC took charge of the affairs in 2004. Both government agencies publish the Survey Report annually, except in 1991, because its data is inseparable from other industry's statistics. Items surveyed include quantitative information of total revenues and their composition, total expenses and their composition, demographics of various levels of employees, ending amount and changes in fixed assets. An open questionnaire collects qualitative information by asking about operating difficulties encountered by audit firms and future business orientation the audit firms take. Because both government agencies administer the survey pursuant to the Statistics Act, they require audit firms surveyed to fill out the questionnaire correctly within the time allowed. Thus, the Survey Report reveals an annual response rate of over eighty percent. As the sample period of this study is 15 years, this study deflates all monetary variables by the yearly consumer price index to account for inflation.

To ensure confidentiality of business transactions, the FSC provides no specific information on individual audit firms, including names and addresses. Thus, samples used in this study are pooled data, which combine both cross-sectional and time series data together. Increasingly more studies use pooled data because they allow researchers to exploit the entire available sample. In contrast to yearly estimates, results from pooled data reflect a mean effect of independent variables during the sampling period, yielding more accurate statistics (Geletkanycz and Hambrick, 1997).

Market segmentation exists in the auditing industry. This study categorizes total audit firms into different segments to reveal their unique attributes and obtain results better reflecting practical phenomenon. Following Elder et al. (2008) and Chen et al. (2008), audit firms are grouped into three categories: national, regional, and local firms. National audit firms are defined as the partnership audit firms offering audit services to public companies. Regional audit firms are the partnership audit firms but do not offer audit services to public companies. Local audit firms are the proprietorship audit firms. This study deletes firm-year observations associated with newly established firms in the survey year. We also delete observations with dependent variable having value more or less than three standard deviations away from their means. The final number of observations is 9,192, including 930 national firms, 2,042 regional firms, and 6,211 local firms.

Empirical Model

To test H1a, H1b, and H1c, we estimate the following regression equation. The equation examines the association between audit firm size and audit quality.

$$AQ = \alpha_0 + \alpha_1 SIZE + \alpha_2 DUVA * SIZE + \varepsilon \tag{1}$$

Where:

AQ = audit quality;

SIZE = audit firm size;

DUVA = dummy variable of audit firm category.

In testing H1a, the coefficient on the audit firm size (SIZE), α_1, is predicted to be positive. The coefficient on the interaction term of dummy variable of audit firm category and audit firm size (DUVA* SIZE), α_2, is predicted to be significantly positive for H1b but insignificantly positive for H1c. Next, our

hypotheses H2a, H2b, and H2c test the association between audit quality and financial performance. We set control variables and develop the following regression equation on basis of the literature related to audit firm performance (e.g., Bröcheler et al., 2004; Collins-Dodd et al., 2004; Chen et al., 2008; Chen et al., 2011).

$$FP = \beta_0 + \beta_1 AQ + \beta_2 DUVA * AQ + \beta_3 SIZE + \beta_4 AGE + \beta_5 DIV + \beta_6 INDEX + \varepsilon \qquad (2)$$

Where:
FP = financial performance;
AQ = audit quality;
$SIZE$ = audit firm size;
$DUVA$ = dummy variable of audit firm category;
AGE = age of an audit firm;
DIV = degree of business diversification;
$INDEX$ = economic indicator.

When testing H2a, this study predicts a positive coefficient on auditor quality (AQ), β_1. The coefficient on the interaction term of dummy variable of audit firm category and audit quality (DUVA*AQ), β_2, is predicted to be significantly positive for H2b, and insignificantly positive for H2c.

Variable Definitions

Dependent variable, financial performance (*FP*), is defined as the net income of audit firms. Accounting defines net income as total revenues minus total expenses. Partners are the owner and residual interest claimant of audit firms. Their annual income comprises salaries received from the firms and a share of operating profit of the firms. The salaries of the partners, weekly or monthly, are a part of total expenses. According to the Certified Public Accountants Act, the operating profit of audit firms should be allocated to the owner annually and cannot be kept as retained earnings. The more the salary of the partners, the less the operating profit of the firms. It makes no difference to the partners whether they receive salary or not in terms of their total annual income. In addition, the criteria for salary payment to partners vary across audit firms. Their salary expenses are added back to the operating profit to reduce such an artificial noise. This study thus defines financial performance, net income per partner, as follows.
FP= (total revenues of audit firms - total expenses of audit firms + total salaries of partners) / (number of partners in the firms).

Research Variables

Our first variable of interest is audit quality (*AQ*) extracted by a principal component analysis technique from human capital related factors in audit firms identified in previous studies. Meinhardt et al. (1987) summarize an American Institute of Certified Public Accountants (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 the findings of a 1992 survey by the AICPA federal assistance audit quality task force. A number of human capital attributes related to auditors are strongly associated with audit quality. These include that the in-charge auditor is a certified public accountant (CPA), a symbol of professionalism, and general knowledge and experience of auditors.

In November 2006, the Financial Reporting Council (FRC), an independent regulator for corporate reporting and governance in the U.K., issued a provocative discussion paper, *Promoting Audit Quality*. It identifies the 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. Adapting Dye's (1993) model, 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. Human capital is one determinant of audit quality and education is an area in which auditors can invest and the 150-hour rule is a minimum requirement (Liu, 1997).

Based on preceding studies, we extract audit quality from four factors related to human capital of audit firms, including educational level of auditors (Lee et al., 1999; Liu, 1997), 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). Two indicators of the educational level of auditors are used to derive audit quality: the number of auditors with bachelor degrees (*BACHELOR*) and the number of auditors with masters or PhD degrees (*MASTER*). Previous studies 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).

Practitioners argue that auditors over 35 years of age have worked in audit firms for over 10 years, and are regarded as highly experienced employees. Three indicators of work experience are included: the number of auditors aged between 35 and 44 (*EXP_35-44*), the number of auditors aged between 45 and 54 (*EXP_45-54*), and the number of auditors aged over 55 (*EXP over 55*). Passage of the uniform certified public accountant (CPA) 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 (*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 auditing industry provides continuing professional education to increase the likelihood of appropriate audit 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 (*CPE*) as a natural logarithm of the total training expenses of audit firms.

Another variable of interest in this study is the audit firm size (*SIZE*), defined as a natural logarithm of total revenues of audit firms. Indicators of the educational level of auditors, work experience of auditors, and professionalism are deflated by the number of partners to control audit firm size. Operational definitions of the above variables are summarized as follows.

MASTER	=	(number of auditors with master or Ph.D degree) / (number of partners);
BACHELOR	=	(number of auditors with bachelor degree) / (number of partners);
EXP_35-44	=	(number of auditors aged between 35 to 44) / (number of partners);
EXP_45-54	=	(number of auditors aged between 45 to 54) / (number of partners);
EXP_ over 55	=	(number of auditors aged over 55) / (number of partners);
LICENSE	=	(number of auditors with CPA license) / (number of partners).
CPE	=	natural logarithm of total training expenses of audit firms;
SIZE	=	natural logarithm of total revenues of audit firms.

In addition to the above research variables, we establish a dummy variable of audit firm category, DUVA, to test our hypotheses. In conducting comparisons between the national firms and both regional and local firms this study sets the dummy variable DUVA to be 1 if the firm is a national firm, and 0 otherwise. When comparing the regional firms and local firms, the dummy variable is set to be 1 if the firm is a regional firm, and 0 otherwise.

Control Variables

Some other factors influencing financial performance of audit firms are included in the regression model as our control variables. The control variables are age of audit firms (*AGE*), diversification (*DIV*), and an economic indicator (*INDEX*). Audit firms are a professional service organization. Human resources and customer base of audit firms increase over time, which contribute revenues to the firms. Prior studies report a positive relation between age of audit firms (*AGE*) and performance (Fasci and Valdez, 1998; Bröcheler et al., 2004; Chen et al., 2008). To meet the growing needs for non-audit services, audit firms expand their scope of services into non-assurance services, such as tax services and management consulting services. Diversity in service lines enhances firm 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 (*ENTROPY*) by the following Entropy index.

$$ENTROPY = \sum_{i=1}^{10} S_i LOG\left(\frac{1}{S_i}\right)$$

Si denotes revenues from practice i as a percentage of total revenues in an audit firm. According to the data set, audit firms may offer 10 practices, including audit of financial statements of public companies, audit of financial statements of nonpublic companies, audit of financial statements for granting a bank loan, audit of an income tax return, tax planning, administrative remedy of internal taxation, other tax operations, management consultation, corporate registration, and bookkeeping and accounting. A greater Entropy index means higher degree of business diversification. Based on previous studies (Rumelt, 1974; Khanna and Palepu, 1997; Singh et al., 2001; Chen et al., 2008), this study expects a positive relationship between business diversification and financial performance.

Economic indicator (*INDEX*). The sample period of this study is 15 years and spans over two centuries. As a professional service organization, audit firms are affected by the local economy (Reynolds and Francis, 2001). An economic indicator, the Taiwanese gross domestic product, is included to control the external environment effect. Auditors have provided services to the same clients for years (Chang and Lin, 2000) and most of their practices are statutory. This makes the effects of environment factors on financial performance of audit firms indeterminate. As a result, this study does not specify a directional prediction on the relationship between economic indicator and financial performance.

EMPIRICAL RESULTS

Extraction of Audit Quality

Table 1 illustrates the descriptive statistics and correlation matrix of variables used to extract the human capital-based audit quality. Panel A lists the results for the national firms while Panels B and C for regional and local firms, respectively. When Panels are compared, the mean value of variables in national firms is higher than that of in regional and local firms except work experience of auditors (*EXP_35-44*, *EXP_45-54*, and *EXP_over55*). This indicates that national firms have more auditors with master degrees (*MASTER*) (0.3110) than regional and local firms do (0.0863 and 0.0612). Also, the mean number of auditors with bachelor degrees (*BACHELOR*) in the national firms (4.8862) is greater than that of regional and local firms (1.8503 and 1.5111). Next, national firms have more auditors with CPA licenses (*LICENSE*) (0.3494) compared to regional and local firms (0.0935 and 0.0649). In addition, the total training expenses (*CPE*) of the national firms (9.2814) are higher than that of regional and local firms (5.7486 and 5.3539). To sum up, national firms, on average, have more auditors with a higher academic education level and with CPA licenses, and devote more resources to the continuing professional education of auditors.

Table 1: Descriptive Statistics and Correlation Matrix of Variables Used to Extract Human Capital-based Audit Quality

Panel A: National audit firms (n=930)

	Mean	S.D.	MASTER	BACHELOR	EXP_35-44	EXP_45-54	EXP_over55	LICENSE	CPE
MASTER	0.3110	0.8818		0.3694***	0.1622***	0.1928***	0.2037***	0.5845***	0.3413***
BACHELOR	4.8862	2.2894	0.4589***		0.3243***	0.2142***	0.1556***	0.5036***	0.4331***
EXP_35-44	0.7214	1.1274	0.0988***	0.3448***		0.3135***	0.2110***	0.1592***	0.1378***
EXP_45-54	0.0936	0.2026	0.0628**	0.0923***	0.2031***		0.2336***	0.1325***	0.1160***
EXP_over55	0.0240	0.0886	0.0399	0.0045	0.1112***	0.1258***		0.1577***	0.1322***
LICENSE	0.3494	0.7689	0.7943***	0.5720***	0.1266***	0.0518***	0.0104		0.3546***
CPE	9.2814	5.0265	0.3412***	0.3506***	0.1149***	-0.0017	-0.0916	0.3439***	

Panel B: Regional audit firms (n=2,042)

	Mean	S.D.	MASTER	BACHELOR	EXP_35-44	EXP_45-54	EXP_over55	LICENSE	CPE
MASTER	0.0863	0.3866		0.1578***	0.0839***	0.0687***	0.0911***	0.3931***	0.1484***
BACHELOR	1.8503	2.5686	0.2595***		0.1546***	0.1300***	0.0860***	0.2797***	0.2365***
EXP_35-44	0.8078	1.2040	0.0436***	0.1460***		0.1135***	0.0617***	0.0600***	-0.0020
EXP_45-54	0.2459	0.6263	0.0190*	0.0335***	0.1543***		0.1412***	0.0405***	0.0093
EXP_over55	0.0573	0.2553	0.0304***	0.0031	0.0782***	0.1444***		0.0470***	0.0083
LICENSE	0.0935	0.4051	0.4815***	0.3278***	0.0469***	-0.0191*	-0.0016		0.1786***
CPE	5.7486	5.1600	0.1389***	0.2352***	-0.0268***	-0.0487***	-0.0364***	0.1307***	

Panel C: Local audit firms (n=6,211)

	Mean	S.D.	MASTER	BACHELOR	EXP_35-44	EXP_45-54	EXP_over55	LICENSE	CPE
MASTER	0.0612	0.2704		0.0455***	0.0728***	0.0350***	0.0519***	0.2588***	0.0501***
BACHELOR	1.5111	2.0337	0.0146		0.1473***	0.1203***	0.0710***	0.1547***	0.1466***
EXP_35-44	0.8174	1.2119	0.0427***	0.1413***		0.0981***	0.0467***	0.0464***	-0.0217**
EXP_45-54	0.2629	0.6547	0.0459***	0.0815***	0.1544***		0.1268***	0.0102	-0.110
EXP_over55	0.0610	0.2673	0.0542***	0.0270***	0.0776***	0.1416***		0.0040	-0.0198*
LICENSE	0.0649	0.3291	0.1863***	0.1077***	0.0399***	-0.0067	0.0090		0.0600***
CPE	5.3539	5.0230	0.0300***	0.1262***	-0.0362***	-0.0328***	-0.0281	0.0260**	

*This table shows the descriptive statistics and correlation matrix of variables for National, Regional, and Local audit firms. Pearson (Spearman) correlation coefficients are in the lower (upper) triangle. n= number of observations. *** **, and * denote significance at the 1%, 5%, 10% level, respectively (two-tailed test). MASTER = (number of auditors with master or Ph.D degree) / (number of partners); BACHELOR = (number of auditors with bachelor degree) / (number of partners); LICENSE = (number of auditors aged between 35 to 44) / (number of partners); EXP_35-44 = (number of auditors aged between 45 to 54) / (number of partners); EXP_45-54 = (number of auditors aged over 55) / (number of partners); EXP_over 55 = (number of auditor with CPA license) / (number of partners); CPE = natural logarithm of total training expenses of an audit firm.*

As prior studies identify some elements affecting audit quality, this study employs principal component analysis technique to extract audit quality from the previous four factors related to human resources in audit firms. As shown in Table 2, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value of our dataset is 0.653 and Bartlett's test of sphericity reaches statistical significance ($\chi 2$ = 4,811.65; p<.000). This indicates that our empirical data is suitable for factor analysis. The eigenvalue-greater-than-one rule suggests that three principal components be obtained and they cumulatively explain approximately 69.77% of the total variance. After identifying the attributes of each component, we name the three components as (1) education (including MASTER, BACHELOR and LICENSE), (2) experience (including EXP_35-44, STAF45-54, and EXP_over55), and (3) training (CPE). As more than one component is extracted, we apply a linear combination to form a single human capital-based audit quality index by the relative percentage of total variance explained by individual components. The linear-combined human capital-based audit quality is expressed as follows. *AQ = 0.4627 Education +* 0.3423 *Experience* + 0.1951 *Training*

Descriptive Statistics and Correlation Matrix

This section reports preliminary results in the form of descriptive statistics and correlation matrix for the variables used in this study. Panels A, B, and C of Table 3 provide results for national, regional, and local audit firms, respectively. For the descriptive statistics, national firms are superior in financial performance (*PF*) (2,217,767) to that of regional and local audit firms (916,713 and 744,523). Audit quality (*AQ*) of national firms (0.738) is higher than regional firms (0.112) and local firms (-0.062). Because we

Table 2: Results of Principal Component Analysis

Panel A KMO and Bartlett test	
Kaiser-Meyer-Olkin measure	0.653
Bartlett's test of sphericity:	
Approximate Chi-square	4811.65***
Degree of freedom	21
Significance	0.000

Panel B Variance explained by extracted components, factor loading and communality				
	Factor 1	**Factor 2**	**Factor 3**	**Communality**
MASTER	0.754			0.679
BACHELOR	0.816			0.713
LICENSE	0.793			0.705
EXP_35-44		0.787		0.698
EXP_45-54		0.758		0.682
EXP_over 55		0.710		0.619
CPE			0.699	0.519
Eigenvalues	3.679	2.255	2.056	
Percentage of variance	32.28	23.88	13.61	
Cumulative percentage%	32.28	56.16	69.77	

*This table shows the results of principal component analysis with Kaiser-Meyer-Olkin(KMO) and Bartlett testing results in Panel A and the extracted components in Panel B. Number of observation is 9,183. **, **, * denotes significance at 1%, 5%, and 10% levels, respectively, for one-tailed tests. Variable definitions are listed in Table 1.*

standardize the extracted audit quality, standard deviation of auditor quality is equal to one and local firms have negative value, -0.062. Audit firm size (*SIZE*) of national firms is significantly greater than regional firms (t = 4.293, p < 0.01) and local firms (t = 6.012, p < 0.01). The untransformed figures indicate that average total revenues of national firms are NT$42,667,891 and that of regional and local audit firms are NT$8,701,972 and NT$2,437,393. National firms have older age of audit firm (*AGE*) (16.35) compared to regional (10.27) and local audit firms (10.65). The degree of business diversification (*DIV*) in national firms is 1.383, higher than that of regional firms (1.027) and local firms (0.906).

Table 3: Descriptive Statistics and Correlation Matrix of Variables Used in the Regression Model

Panel A: National audit firms (n=930)								
	Mean	S.D.	*FP*	*AQ*	*SIZE*	*AGE*	*DIV*	*INDEX*
FP	2,217,767	1,883,861		0.583***	0.684***	0.706***	0.371***	-0.003
AQ	0.738	1	0.726***		0.817***	0.797***	0.399***	0.016
SIZE	17.568	1.224	0.779***	0.698***		0.791***	0.429***	0.010
AGE	16.35	10.46	0.659***	0.624***	0.888***		0.356***	0.000
DIV	1.383	0.310	0.335***	0.322***	0.337***	0.352***		-0.034
INDEX	6,164	1,521	0.023	-0.001	0.018	0.016	-0.037	

Panel B: Regional audit firms (n=2,042)								
FP	916,713	779,581		0.131***	0.669***	0.496***	0.157***	0.039*
AQ	0.112	1	0.138***		0.287***	0.269***	0.101***	-0.033
SIZE	15.979	0.880	0.617***	0.290***		0.667***	0.190***	0.030
AGE	10.27	7.84	0.620***	0.207***	0.905***		0.084***	0.074***
DIV	1.027	0.325	0.171***	0.086***	0.154***	0.123***		-0.032
INDEX	6,164	1,521	0.038*	-0.057**	0.014	0.066***	-0.027	

Panel C: Local audit firms (n=6,211)								
FP	744,523	934,304		0.062***	0.712***	0.610***	0.224***	0.008
AQ	-0.062	1	0.049***		0.188***	0.106***	-0.016	0.003
SIZE	14.706	1.052	0.583***	0.161***		0.647***	0.360***	0.019
AGE	10.65	8.93	0.652***	0.144***	0.895***		0.225***	0.053***
DIV	0.906	0.405	0.254***	-0.032**	0.327***	0.322***		-0.011
INDEX	6,164	1,521	0.027**	0.007	0.019	0.032***	0.001	

*The descriptive statistics and correlation matrices of variables for national, regional, and local audit firms are shown in Panel A, Panel B, and Panel C, respectively. Pearson (Spearman) correlation coefficients are presented in the upper (lower) diagonal. ***, **, * Denotes significance at 1%, 5%, and 10% levels, respectively, for two-tailed tests. Variable definitions: FP = financial performance; AQ =audit quality; SIZE = audit firm size; DUVA = dummy variable of audit firm category; AGE = age of an audit firm; DIV = degree of business diversification; INDEX = economic indicator; ε = an error term.*

Next, the correlation matrix shows significant relation between dependent variable and all independent variables in both Pearson and Spearman correlation coefficients. Some independent variables are highly correlated. To account for the possibility of multi-collinearity among independent variables, this study assesses the variance inflation factors (VIF) in the subsequent section.

Regression Results

Test of the relationship between audit firm size and auditor quality.   Using the audit quality extracted from human capital-related factors, this study firstly investigates the relationship between audit firm size and audit quality and displays empirical results in Table 4.

As shown in the columns National, Regional, and Local, the coefficients on *SIZE* are positive and significant in national (t = 43.134), regional (t = 13.513), and local audit firms (t = 15.098). Consistent with expectation, this indicates that audit firm size is positively related to audit quality and hypothesis H1a is supported. The testing results of hypothesis H1b are reported in the column Total Sample. The coefficient on interaction term (*DUVA*SIZE*) is positive and significant (t = 1.996). This indicates that national audit firms have higher positive relationship between audit firm size and audit quality than regional and local audit firms and lends a support to hypothesis H1b. The rightmost column Regional and Local lists the testing results for hypothesis H1c. The coefficient on interaction term (*DUVA*SIZE*) is positive but insignificant, indicating that no difference in the positive relationship between audit firm size and audit quality exists for regional and local audit firms. Hence, hypothesis H1c is supported. The above results suggest that national audit firms have higher audit quality, consistent with expectation and the findings of previous studies (e.g., DeAngelo, 1981; Palmrose, 1988; DeFond, 1992; Teoh and Wong, 1993; Becker et al., 1998).

Table 4: Regression Results of Audit Firm Size and Audit Quality

$$AQ = \alpha_0 + \alpha_1 SIZE + \alpha_2 DUVA * SIZE + \varepsilon$$

	Predicted sign	National (n=930)	Regional (n=2,042)	Local (n=6,211)	Total Sample (n=9,183)	Regional and Local (n=8,253)
SIZE	+	0.817 (43.134)***	0.287 (13.513)***	0.188 (15.098)***	0.495 (27.166)***	0.203 (14.278)***
DUVA*SIZE	+				0.021 (1.996)**	
DUVA*SIZE	+/-					0.012 (1.119)
Adjusted-R^2		0.667	0.082	0.035	0.051	0.058
F-value		1,860.56***	182.61***	227.94***	112.293***	205.28***

This table shows the regression results of audit firm size and audit quality for national, regional and local audit firm.

Given the results of positive relation between audit firm size and audit quality, shown in Table 4, we further examine the association between audit quality and financial performance with results reported in Table 5. The explanatory power of regression model (adjusted R2) lies between 0.638 and 0.401. F-statistics of each regression model are large enough and significant at the 1% level to reject the null hypothesis that independent variables have no effect on the dependent variable. This implies that our empirical models are well specified. All t-statistics of variable coefficients 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 (VIF). The VIF for independent variable Xi is defined as 1/ (1-RSQi), where RSQi is the R2 from the regression of Xi on the remaining k-1 predictors. If Xi is highly correlated with the remaining predictors, its VIF is very large. In econometrics, VIF greater than 10 implies that serious multi-collinearity exists among independent variables. Since the VIFs in each regression model are less than 3.878, implying that no serious multi-collinearity exists among the independent variables.

In addition, we estimate the standardized regression coefficient (Beta) for each independent variable to ease comparisons between variables. Beta of an independent variable X_i is calculated as: $COE.(X_i)*S.D(X_i)/ S.D(Y)$, where $COE.(X_i)$ is the estimated coefficient of X_i, and $S.D(X_i)$ and $S.D(Y)$ are the standard deviations of X_i and dependent variable, respectively. Standardized coefficient possesses attributes similar to correlation coefficient with value lying between -1 and +1. The more the absolute value of standardized coefficient, the higher is its predicting ability to the variation of dependent variable. No intercept term exists in the standardized regression model.

We first examine the effects of audit quality on financial performance. As can be seen, the coefficient on audit quality (AQ) is positive and significant in national firms (t = 5.097), regional firms (t = 3.231) and local firms (t = 6.290). Hypothesis H2a is supported in the three categories of audit firms. Next, this study tests whether national firms have higher positive relationship between audit quality and financial performance than regional and local audit firms. As shown in column Total Sample, coefficient on the interaction term ($DUVA*AQ$) is positive and significant (t = 13.276). Consistent with expectations, the above result lends a support to hypothesis H2b. Finally, we compare the differences in the degree of positive relationship between audit quality and financial performance for regional and local audit firms. The rightest column Regional and Local reports a negative but insignificant coefficient on the interaction term ($DUVA*AQ$) (t = -1.093). This means that no difference in the positive relationship between audit quality and financial performance exists for regional and local audit firms, supporting hypothesis H2c.
As regard control variables shown in Table 5, the coefficients on *SIZE*, *AGE*, and *DIV* are positive and significant at the 1% level but the coefficient on *INDEX* is insignificant, consistent with expectations.

Table 5: Regression Results of Audit Quality and Operating Performance

	Predicted sign	National (n =930)	Regional (n =2,042)	Local (n =6,211)	Total Sample (n=9,183)	Regional and Local (n=8,253)
$FP = \beta_0 +\beta_1 AQ +\beta_2 DUVA*AQ +\beta_3 SIZE +\beta_4 AGE +\beta_5 DIV +\beta_6 INDEX+\varepsilon$						
Research variable						
AQ	+	0.194 (5.097)***	0.058 (3.231)***	0.059 (6.290)***	0.151 (4.027)***	0.047 (5.089)***
DUVA *AQ	+				0.145 (13.276)***	
DUVA *AQ	+/-					-0.008 (-1.093)
Control variable						
SIZE	+	0.484 (12.724)***	0.532 (22.290)***	0.374 (29.077)***	0.553 (61.567)***	0.453 (24.38)***
AGE	+	0.158 (4.428)***	0.146 (6.204)***	0.367 (29.661)***	0.138 (11.451)***	0.256 (18.115)***
DIV	+	0.029 (1.331)*	0.049 (2.782)***	0.051 (5.289)***	0.053 (6.611)***	0.055 (3.601)***
INDEX	?	-0.010 (-0.502)	0.013 (0.738)	-0.016 (-0.741)	0.003 (0.373)	-0.011 (-0.346)
Adjusted-R^2		0.638	0.401	0.469	0.517	0.435
F-value		328.94***	274.79***	1,096.02***	1,642.23***	685.17

*This table shows the regression results of audit quality and operating performance for national, regional and local audit firm. n= number of observations. ***, **, * Denotes significance at 1%, 5%, and 10% levels, respectively, for one-tailed tests. FP =   financial performance; AQ = audit quality; SIZE = audit firm size; DUVA = dummy variable of audit firm category; AGE = age of an audit firm; DIV = degree of business diversification; INDEX = economic indicator; ε = error term.*

PRACTICAL IMPLICATIONS OF THE RESULTS

In this study, national firms are larger in size than both regional and local firms. National firms also own higher human capital-related audit quality, having more auditors with a higher academic education level and with CPA licenses, and devoting more resources to the continuing professional education of auditors National firms include international firms, also referred to the Big N firms. Taiwanese Big N firms have associated with big international audit firms in the U.S. for more than four decades. The members of these

international firms share abundant resources, including professional auditing techniques and expertise, human resource development, and continuing professional education. Further, the headquarters of Big N firms determine the services offered by their worldwide members, who often exchange valuable information. With this systematic mechanism of professional development, Big N firms have become a symbol of high audit quality, and their reputation remains strong in Taiwan. In addition to the Big N firms, many other national firms are associated with American audit firms, such as BDO, Grant Thornton, and Baker Tilly International.

Audit films are a professional service organization. Human capital is their major input in the rendering of services to clients. Audit quality determines the survival and sustainable competitive capabilities of audit firms. In Table 4, audit firm size positively relates to audit quality. Furthermore, Table 5 indicates that audit quality is positively associated with financial performance. The evidences suggest that regional and local firms expand their firm size and thereby to gain the benefits of financial performance improvement. One feasible way for an audit firm to expand firm size is through a merger with another audit firm. Combining firms results in synergy, substantial cost savings or revenue augmentation, and scale economy. Synergy resulting in greater productivity is often presented as a justification for merger activity (Banker et al., 2003). Existence of scale economies supports audit firm mergers that increase operating size. Once audit firms become larger in size, they have more resources to invest in the advancement of human capital. With higher level of human resources, audit firms render services with higher quality and thereby earn more revenues.

CONCLUSIONS AND DISCUSSIONS

This study investigates the relationship between audit firm size and audit quality, and the relationship between audit quality and financial performance with the following main results. First, the association between audit firm size and audit quality is significantly positive in national, regional, and local audit firms. The positive relationship between audit firm size and audit quality of national firms is higher than that of regional and local firms. However, no significant difference in the positive relationship exists between the regional and local audit firms. Moreover, national firms have higher audit quality, consistent with the findings of previous studies (e.g., DeAngelo, 1981; Palmrose, 1988; DeFond, 1992; Teoh et al., 1993; Becker et al., 1998). Second, a positive relationship between audit quality and financial performance exists for national, regional, and local audit firms. The positive relationship of national firms is higher than that of regional and local audit firms. However, no significant difference in the positive relationship exists between regional and local audit firms.

The above findings must be interpreted in light of the following limitation. This study extracts human capital-based audit quality from the factors related to human resources within audit firms. Previous studies identify some other factors affecting auditor quality, such as the culture within an audit firm, audit methodology, and professional ethical standards. These factors are omitted from the empirical model primarily due to the lack of available data.

In this study, local audit firms account for over two third of the number of observations (67.64%). Local firms are proprietorship audit firms, including both male and female-owned operations. Prior studies state that small audit firms are less investigated (Bröcheler et al., 2004) and an examination of audit quality related issues for male and female-owned audit firms constitutes a promising avenue for future studies.

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BIOGRAPHY

Yahn-Shir Chen is a Professor of the Department of Accounting at the National Yunlin University of Science and Technology, Taiwan. His research appears in journals such as *The International Journal of Human Resources Management, Asia-Pacific Journal of Accounting & Economics, International Journal of Business and Finance Research, Global Journal of Business Research, and Economics Bulletin*. He can be reached at No. 123, Sec. 3, University Rd., Douliou, Yunlin County, 64002, Taiwan, chenys@yuntech.edu.tw.

Joseph Hsu holds a Ph.D. in accounting from National Yunlin University of Science and Technology, Taiwan. His main interest of research is financial accounting and auditing. His research appears in journals such as *Global Journal of Business Research, and Middle Eastern Finance and Economics*. He can be reached at g9520810@yuntech.edu.tw.

Mei-Ting Huang is a Ph.D. candidate of the Department of Accounting at the National Yunlin University of Science and Technology. Her research appears in journals such as *Global Journal of Business Research, and Middle Eastern Finance and Economics*. She can be reached at No. 123, Sec. 3, University Rd., Douliou, Yunlin County, 64002, Taiwan, g9620806@yuntech.edu.tw.

Ping-Sen Yang is a Ph.D. candidate of the Department of Accounting at the National Yunlin University of Science and Technology. He is also an Instructor of Department of Accounting Information at the Dayeh University. He can be reached at No. 123, Sec. 3, University Rd., Douliou, Yunlin County, 64002, Taiwan, pingsen@mail.dyu.edu.tw.