行政院國家科學委員會補助專題研究計畫成果報告

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計畫類別：■個別型計畫　□整合型計畫

計畫編號：NSC 89－2416－H－004－061

執行期間：89 年 8 月 1 日至 90 年 7 月 31 日

計畫主持人：王國樑　教授

本成果報告包括以下應繳交之附件：

□赴國外出差或研習心得報告一份

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□出席國際學術會議心得報告及發表之論文各一份

□國際合作研究計畫國外研究報告書一份

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中　華　民　國　九十　年　　月　　日

行政院國家科學委員會專題研究計畫成果報告

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1. Abstract

針對台灣會計師事務所的經營特性，本研究將首先建立評估成本效率、技術效率、配置效率與規模效率的線性規劃實證模型（亦即 DEA 模型）。其次，依據台灣會計師事務所普查資料，利用上述 DEA 實證模型評估個別會計師事務所的成本效率、技術效率、配置效率與規模效率值。然後，根據上述各種效率估計值的分配進行初步分析。最後，就各種效率指標，建立迴歸實證模型，並分別進行 Tobit 截斷迴歸分析，探討影響各種經營效率的重要因素，並比較上述迴歸結果的差異性。DEA 估計的結果顯現，技術效率的平均為 0.720；22.4%的會計事務所處於固定規模報酬，是擁有規模效率；60.8%的會計事務所處於規模報酬遞增階段，為規模無效率。成本效率的平均為 0.625。迴歸結果顯示事務所的規模取對數值對於成本、技術、配置以及規模效率皆有正的效果；經營時間長短對技術效率會產生正面的影響；若服務項目集中度愈高，則成本效率愈高；會計師比率較高者擁有較好的成本、技術及配置效率，但有較差的規模效率；獨資的事務所有較好的成本、技術及配置效率，而合資的事務所有較好的規模效率；擁有分行的事務所在技術與規模效率表現較差。

關鍵詞：成本效率、技術效率、配置效率、規模效率、資料包絡分析法、Tobit 截斷迴歸模型

Dependent upon operational characteristics of CPA firms in Taiwan, this study is first to build empirical models of linear programming for evaluating cost, technical, allocative and scale efficiencies. Secondly, by using the 1994 survey data of CPA firms in Taiwan, the above DEA models are used to evaluate cost, technical, allocative and scale efficiencies of each CPA firms. Then, an elementary analysis is made based on the CPA firms' distribution of each indicator of efficiency. Finally, the Tobit censored regression model is built to investigate the determinants of each efficiency measure of the CPA firms in Taiwan. The DEA evaluation results shows that, the mean technical efficiency measure is 0.720. 22.4% of CPA firms operate in the region of constant returns to scale, and are gauged scale-efficient. 60.8% of CPA firms operate in the region of increasing returns to scale, and are gauged scale-inefficient. Average cost efficiency measure is 0.625. The

regression results show that the logarithm of firm size has a positive impact on cost, technical, allocative as well as scale efficiencies. The impacts of a firm's age on technical efficiency is positive. The service concentration has a positive impact on cost efficiency. The CPA-to-employee ratio has a positive impact on cost, technical and allocative efficiencies; but it has a negative effect on scale efficiency. CPA firms in the proprietorship form has a positive effect on cost, technical as well as allocative efficiencies; but has a negative effect on scale efficiency. Firms with a branch or branches are less efficient than those without any branch in terms of technical and scale efficiencies.

Keywords: Cost Efficiency, Technical Efficiency, Allocative Efficiency, Scale Efficiency, Data Envelopment Analysis, Tobit Censored Regression Model

2. Goals and Purpose

Since services provided by CPA firms can increase the credibility of financial information, economic development and the growth of capital markets hinge largely on the stable working of the CPA service market. Individual and corporate demand for accounting information has been increasing in Taiwan as its capital markets continue to expand and become more prosperous than ever. Therefore, the numbers of accounting practitioners and certified public accountant firms increased rapidly during the past few years, the operation of a CPA firm becomes increasingly complex due to increased environment pressures, including greater competition for clients, cost pressures and need to maintain and enhance the firms' skills and capacity. The 1995 Survey Report of CPA firms in Taiwan indicates that though total CPA firms' revenues increased from NT $5.784 billion in 1992 to NT $6.9 billion in 1993 at a rate of 19.3 percent due to the growing demand for CPA services, their operation costs, however, have also increased from NT $4.727 billion to NT $5.676 billion during the same period at a rate of 2.01 percent. In other words, the profit margins decreased by 0.6 percent.

These phenomena raise the questions: 1. Are the productive efficiencies significantly different among CPA firms in Taiwan? 2. What are the reasons for the difference of productive efficiencies among CPA firms in Taiwan? 3. Does the difference of productive efficiencies among CPA firms decrease under the pressure of actual and free potential competition? 4. Since productive efficiency can be measured by different indicators, such as cost efficiency, technical efficiency, allocative efficiency and scale efficiency, what do they imply when there's obvious differences among these efficiency indicators in a CPA firm? These motivates us in productive efficiency

analysis of CPA firms in Taiwan. Therefore, this paper is to evaluate the productive efficiency of CPA firms by the data envelopment analysis (DEA) approach at first, and then to study firms specific characteristics related to variations in efficiency among CPA firms.

3. Empirical Models

3.1 Efficiency Evaluation Models

The DEA approach introduced by Charnes et al. (1978) uses a mathematical programming technique to determine a piecewise linear envelopment surface from the observed levels of inputs and outputs of decision making units (DMU). The envelopment surface is referred to as the efficient frontier. DMUs which construct the frontier are termed efficient; DMUs which do not lie on the frontier are termed inefficient. The distance between the former and the later provides a measure of efficiency or inefficiency.

Although there are input-oriented and output-oriented models in the DEA, Lovell (1993) suggested that if producers are required to meet the market demand, and if they can freely adjust input usage, then an input-oriented model seems appropriate. On the one hand, CPA firms in Taiwan provide diverse services which satisfy different clients needs to respond to increased competition; on the other hand, the levels of efficiency of service production process of CPA firms need to be improved in response to increased cost pressures. Therefore, the input-oriented model will be chosen for this study due to the industry characteristics.

Consider a market in which there are n CPA firms, each using m inputs to produce s outputs. Let x_{ij} and y_{rj} denote respectively the i^{th} (i=1,2,...,m) input usage and the r^{th} (r=1,2,...,s) output production of the j^{th} (j=1,2,...,n) CPA firm. The input weak technical efficiency measure described by Färe et al. (1985), which assumes strong disposability of inputs, can be gauged by solving the linear programming problem (Model I):[1]

$$TE_k = \min_{\theta_k, \lambda_1, \ldots, \lambda_n} \theta_k \qquad (1)$$

subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta_k x_{ik}, \quad i = 1,2,\ldots,m,$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rk}, \quad r = 1,2,\ldots,s,$$

$$\sum_{j=1}^{n} \lambda_j = 1,$$

$$\lambda_j \ge 0, \quad j = 1,2,\ldots,n,$$

where λ_j is the weight to be computed for the j^{th} CPA firm, $0 < \theta_k \le 1$. The

minimum θ_k measures the input weak efficiency of the k[th] CPA firm. The inequality constraints in Model I define a reference technology with strong disposability of inputs. Constraining the weights to sum to unity allows the reference technology (the piecewise linear production surface) to exhibit variable returns to scale (VRS).

In the DEA model above, the performance of a CPA firm is evaluated in terms of its ability to reduce its input usage subject to the constraints imposed by the best observed practice. If radial reduction is possible for a CPA firm, its optimal $TE_k < 1$; while if radial reduction is not possible, its optimal $TE_k = 1$. Thus, the implication of the model is that under the assumptions of strong disposability of inputs, and the reference technology exhibiting variable returns to scale, for the k[th] CPA firm, TE_k gives the proportion by which inputs can be reduced to move the CPA firm from the interior of the production set (i.e., the relatively inefficient region) onto the piecewise linear boundary of the production set (i.e., the relatively efficient region).

The input cost efficiency (CE) score for the k[th] CPA firm is computed by first solving the following cost-minimizing linear programming problem (Model II):

$$C_k = \min_{x_1,\ldots,x_m,\lambda_1,\ldots,\lambda_n} \sum_{i=1}^{m} p_{ik} x_i \qquad (2)$$

subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} \le x_i, \quad i = 1,2,\ldots,m,$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rk}, \quad r = 1,2,\ldots,s,$$

$$\sum_{j=1}^{n} \lambda_j = 1,$$

$$\lambda_j \ge 0, \quad j = 1,2,\ldots,n,$$

$$x_i \ge 0, \quad i = 1,2,\ldots,m,$$

where p_{ik} is known and denotes the i[th] input price of the k[th] CPA firm, x_i is the efficient i[th] input usage to be computed.

The solution of Model II is the estimated minimum cost for the k[th] CPA firm. Then the input cost efficiency measure for the k[th] CPA firm is defined as the ratio of minimum to actual observed costs:

$$CE_k \equiv C_k \Big/ \sum_{i=1}^{m} p_{ik} x_{ik} \qquad (3)$$

The constraints in Model II are similar to those in Model I. The same reference technology is defined by the constraints in Model II, but instead of proportional reduction of inputs for the k[th] CPA firm to lie on the piecewise linear envelopment surface, inputs are further reduced proportionately until the CPA firm lies on the isocost plane tangent to the production set boundary.

The allocative efficiency (AE)

score for the k[th] CPA firm is hence defined by dividing the input cost efficiency measure by the input weak technical efficiency measure:

$$AE_k \equiv CE_k / TE_k \qquad (4)$$

Allocative inefficiency arises from using a combination of inputs that does not minimize total cost, as opposed to technical inefficiency, which results from proportional overuse of inputs.

The efficiency measures obtained from Model I measure technical efficiency as the distance to the relevant isoquant, but do not consider where the CPA firm is situated along the variable returns production frontier. Since scale efficiency can be used to determine how close an observed DMU is to the most productive scale size (Banker, 1984; Banker and Thrall, 1992), the rest of this section focuses on the measurement of scale efficiency. To measure scale efficiency, Model I must be resolved for each CPA firm, first assuming the reference technology to exhibit constant returns to scale (CRS) by dropping the restriction that constrains the weights to sum to one, and then assuming nonincreasing returns-to-scale (NIRS) technology by imposing the constraint, $\sum_j \lambda_j \le 1$, to produce technical efficiency measures $TE_k(CRS)$ and $TE_k(NIRS)$, respectively. The scale efficiency measure corresponding to Model I is defined as the ratio of $TE_k(CRS)$ to TE_k, that is

$$SE_k \equiv TE_k(CRS)/TE_k, \qquad (5)$$

$0 < SE_k \le 1$, since $TE_K(CRS) \le TE_k(NIRS) \le TE_K$ (Färe et al., 1985). If $SE_k = 1$, then the CPA firm is scale-efficient; that is, the CPA firm is operating at the point of constant returns to scale on the production frontier. If $SE_k < 1$, then the CPA firm is scale-inefficient due to either decreasing returns to scale if $TE_k(NIRS) = TE_K$, or increasing returns to scale if $TE_K(NIRS) < TE_k$ (Färe et al., 1985).

3.2 Regression Models

In the previous studies, efficiency in production has been linked with a number of firm-specific attributes. These attributes include firm size, age, ownership (or organizational form), and product mix, etc. (Ham, 1981; Seale, 1990; Majumdar and Chang, 1996; Wu, 1996; Cheng et al., 2000; Wang et al., 2001; Wang et al., 2002). The factor which captures the firm's long-term strategic consideration in the industry, for example, whether a CPA firm set up a branch or branches to meet clients needs geographically, is also considered. Consequently, the regression models for examining the relationship between each efficiency measure and firm-specific attributes in this paper can be built as follows:

$$CE = f_1(FS, AGE, H, RCPA, OFD, BD), \qquad (6)$$

$$TE = f_2(FS, AGE, H, RCPA, OFD, BD), \quad (7)$$

$$AE = f_3(FS, AGE, H, RCPA, OFD, BD), \quad (8)$$

$$SE = f_4(FS, AGE, H, RCPA, OFD, BD), \quad (9)$$

where FS is the firm size; AGE represents the age of the firm; H is the service concentration, which is the sum of the squared ratios of revenues from each revenues to total operating revenues;[2] $RCPA$ stands for the CPA-to-employee ratio; OFD denotes the dummy variable which indicates the firm's organizational form; and BD represents the dummy variable which indicates whether the firm has a branch or branches or not. Since the values of dependent variable $F(VRS)$, SE, CE and AE all lie between 0 and 1, equations (7)-(10) are censored regression models.

Theoretical foundation for the relationship between efficiency measures and firm-specific attributes can be illustrated as follows:

Firm Size (FS)

In general, firms can enjoy economies of scale as their sizes expand from the very beginning, and suffer diseconomies of scale while they grow beyond some level of size. Similarly, scale efficiency increases as firm size expands from IRS to CRS, but it decreases as firm size expands from CRS to DRS (refer to Figure 1). The advantage from sharing or joint utilization of inputs and the disadvantage from allocative complexity will exist simultaneously as firm size expands (Baumol et al., 1982, pp.75-79). However, the former dominates the latter at the very beginning, and then the latter outweighs the former after some point. Therefore, the relationships between firm size and four efficiency measues are ambiguous without further estimation.

Age (AGE)

Relative to the new entrants, one of the advantages that the incumbents can exploit is the learning-curve effects which mean that input resources can be organized more efficiently over time (Oster, 1994). However, this advantage for the incumbent CPA firms may not be significant in contrast to the new entrants due to the fact that more and more CPAs and professionals form their own practice units. Hence, the relationship between the firms' age and its four efficiency measures seem to be indeterminate.

Service Concentration (H)

By specializing in a single product (service), CPA firms can increase their efficiencies due to employees' familiarity with their simple and routine work (Baumol et al., 1982, p.75; Eaton and Eaton, 1995, pp.197-199; Cheng et al., 2000). Therefore, service concentration is expected to have a positive impact on technical efficiency because of gains from specialization. As the degree of

service concentration goes up, gains from specialization will come up, but the economies of scope may disappear gradually. The former effect will raise a firm's cost and scale efficiencies; the latter effect will reduce the firm's cost efficiency. As a result, the relationship between service concentration and scale efficiency is expected to be positive; that between service concentration and cost efficiency is indeterminate. A firm may not be able to allocate its inputs flexibly while its service concentration rises. Hence, service concentration is expected to have a negative effect on allocative efficiency.

CPA-to-employee Ratio (RCPA)

The practicing CPAs play the same role as the management group of an enterprise. The higher ratio of the management groups implies a better control and supervision for service-providing. Hence, it can be reasonably expected that CPA firms with higher CPA-to-employee ratios will be more efficient.

Organizational Form (OFD)

There are only two organizational forms in Taiwan's CPA service industry: the sole proprietorship and the partnership. In the sole proprietorship, the single owner, i.e., the proprietor, makes all of the management decisions and is the firm's sole residual claimant. Since the owner maintains full control over the firm, the goals and guidelines of the firm are unambiguous. In the partnership, two or more joint owners share the management functions and will be personally responsible for all of the firm's actions and liabilities. On the other hand, the partners' unlimited liability for one another's actions makes possible that the work done by some partner can be judged and monitored; on the other hand, achieving consensus, for example, on profits sharing, clients services, and personnel management, etc., among partners may be slow and expensive (Parkin, 1996, pp.194-196). Therefore, the sign of the coefficient for the organization form is ambiguous, and also needs to be empirically tested.

Branches (BD)

The purpose for setting up a branch or branches by a firm may be for efficient utilization of excess capacities or just for enlargement of the geographical coverage of the market (Cheng et al., 2000). In case of the former, setting up a branch or branches will be helpful to efficiency improvement; otherwise, it is not expected to have a favorable influence on the firm's efficiencies. Hence, the direction of the impact of setting up a branch or branches on four efficiency measures is hard to determine without further empirical investigation.

4.Data Description and Empirical Results

4.1 Data Description

The data used in this study are based on the survey held in 1995 among all 671 Taiwan's CPA firms which ran their business in 1994. The survey is conducted annually by the Department of Statistics, Ministry of Finance, Taiwan, ROC with the purpose to gain insights into the operations of CPA firms and to provide the reference for the government's policy-making decision. Following Jerris and Pearson (1996), the outputs of CPA firms in the study are classified into three broad categories: auditing, tax, and management advisory services. For the convenience of comparability, only the CPA firms which provide all three services are included in the sample. After deleting unqualified and incomplete observations, the effective sample size is 150.

In the survey data, there are two output measures, cases and revenues, available for three different services. This study considers revenues instead of cases from each service as outputs due to that the scale and thus the input usage for each case may vary to some extent. On the input side, two types of inputs are distinguished: labor and capital. Referring to Sueyoshi (1996) and Ferrier (1994), the quantity of labor is measured by the number of employees; and capital is measured by each CPA firm's net fixed assets at year's end. The price of labor input is measured by dividing annual labor expenditures (including salaries, pensions and fringe benefits) by the number of total employees, which is namely the average annual wage per employee. The price of capital input is approximately constructed by dividing capital expenditures (including rent, interest expenditures, depreciation and various amortizations and depletions) by the net fixed assets.

In the regression analyses, firm size (FS) is measured by a CPA firm's total operating revenues measured in NT dollars. The age of a CPA firm (AGE) is the number of years from the date of its foundation to the end of 1994.A firm's service concentration (H) is the sum of the squared ratios of revenues from each service to total operating revenues. Theoretically, the value of H lies between 0 and 1. Since CPA firms in the sample provide all three services, H is actually in a range of 1/3 to 1, with the value 1/3 representing balanced development of services and a higher value representing a higher service concentration. The CPA-to-employee ratio ($RCPA$) is defined as the number of a firm's practicing CPAs divided by that of its total employees. OFD equals 1 for CPA firms in the forms of partnerships, and 0 for those in the forms of sole proprietorships. The dummy variable $BD = 1$ indicates that an CPA firm has a branch or branches; otherwise, $BD = 0$. The descriptive statistics of the relevant variables for both efficiency and regression analyses are presented in Table 1.

4.2 Empirical Results

4.2.1 DEA Evaluation Results

The DEA evaluation results for each efficiency measure are summarized in Table 2. The mean cost efficiency measure of CPA firms is 0.625, implying that they on average would have needed to lower operating costs by 37.5%. The percentage of firms operating on the frontier is 15.4. The mean efficiency measure for nonfrontier firms is 0.557, implying that the inefficient firms use on average roughly 44.3% more costs per units of output than the efficient firms.

The mean technical efficiency measure of CPA firms is 0.720. It implies that CPA firms could have reduced inputs by 28.0%, on average, and still have produced the same level of services. The percentage of firms operating on the frontier is 28.7. The mean efficiency measure for nonfrontier firms is 0.607, implying that the inefficient firms use on average roughly 39.3% more inputs per units of output than the efficient firms.

The mean allocative efficiency measure of CPA firms is 0.872, implying that, given input prices, they on average operate at 12.8% higher costs than the cost-minimizing level due to the inappropriate input mix. The percentage of firms operating on the frontier is 21.0. The mean efficiency measure for nonfrontier firms is 0.838, implying that the inefficient firms use on average roughly 16.2% more costs per units of output than the efficient firms.

The mean scale efficiency measure of CPA firms is 0.834, implying that they could have reduced inputs by 16.6%, on average, and still have produced the same level of services under the optimal scale (CRS). 22.38% of CPA firms operate in the region of CRS, and are gauged scale-efficient. 60.84% of CPA firms operate in the region of IRS, and are gauged scale-inefficient. It implies that most of the scale inefficiency is owing to operating at a relatively small firm size. The mean efficiency measure of nonfrontier firms is 0.787, implying that the inefficient firms use on average roughly 21.3% more inputs per units of output than the efficient firms.

4.2.2 Regression Results

Since equations (6)-(9) are censored regression models, applying the ordinary least squares approach to these regression models will lead the estimated coefficients to be asymptotically biased toward zero (Greene, 1981). Therefore, by referring to McCarty and Yaisawarng (1993), Aokei et al. (1994), Kooreman (1994), Cheng et al. (2000) and Wang et al. (2001), the tobit censored regression model will be used to estimate equations (6)-(9). The regression results of four efficiency measures on firm-specific attributes are presented in Table 4-7.[3]

The regression result of cost efficiency shows that the logarithm of firm size has a positive impact on cost efficiency at the 0.01 significant level. That is, firms exploit economies of scale

as their sizes expand. There exist a positive relationship between service concentration and cost efficiency at the 0.01 significant level. That is, CPA firms with higher service concentrations do enjoy higher cost efficiency due to the existence of gains from specialization. As expected, the CPA-to-employee ratio has a positive impact on the firm's cost efficiency at the 0.01 significant level. It implies that firms with higher CPA-to-employee ratio can improve their efficiency of internal management. The coefficient of the organizational form dummy variable is negative at the 0.01 significant level, implying that the CPA firms in the sole proprietorship form are more efficient than those in the partnership form due to their unambiguous goals and guidelines.

The regression result of technical efficiency shows that the logarithm of firm size has a positive impact on technical efficiency at the 0.01 significant level. That is, firms exploit economies of scale as their sizes expand. There exist a positive relationship between the firms' age and technical efficiency at the 0.1 significant level, which means the firm's technical efficiency rises as the time of operations elapses. The evidence implies that the learning-curve effect is indeed present. As expected, the relationship between CPA-to-employee ration and technical efficiency is positive at the 0.01 significant level, it's evidence that the higher ratio of the management groups implies a better control and supervision for service-providing. The coefficient of the organizational form dummy variable is negative at the 0.01 significant level, the explanation for the result might be the same reason for cost efficiency. The coefficient of the branch dummy variable is negative at the 0.05 significant level, implying that the firms with a branch or branches are less efficient than those without any branch. The implication of the result might be that the firms to set up branches was just to enlarge the geographical coverage of the market.

The regression result of allocative efficiency shows that there exist a positive relationship between the logarithm of firm size and allocative efficiency at the 0.01 significant level, implying that the advantage from sharing or joint utilization of inputs as their firm sizes expand. The coefficient of CPA-to employee ratio is positive at the 0.01 significant level as expected. The coefficient of the organizational form dummy variable is negative at the 0.01 significant level, the explanation for the result might be the same reason for cost and technical efficiencies.

The regression result of scale efficiency shows that the logarithm of firm size has a positive coefficient at the 0.01 significant level, implying that a firm's size has a positive impact on scale efficiency while the firm grows beyond some level of size; but the positive impact is decreasing. The relationship

between CPA-to-employee ratio and scale efficiency is negative at the 0.01 significant level, the implication for this result might reflect the effect of the input congestion situation. The coefficient of the organizational form dummy variable is positive at the 0.01 significant level, implying that the firms in the partnership form is more efficient than those in proprietorship form. The explanation for the result might be that the partners' unlimited liability for one another's actions makes partner can be judged and monitored and this advantage overcome the expense of achieving consensus among partners. The coefficient of the branch dummy variable is negative at the 0.1 significant level, implying that the firms with a branch or branches are less efficient than those without any branch. The implication for the result might be that the purpose of CPA firms to set up branches was just to enlarge the geographical coverage of the market, and the increased complexities on operations make difficult of managers' decisions to be put into effect.

5. Conclusions

Based on the 1994 data of CPA firms in Taiwan, this paper first uses DEA to assess cost, technical, scale as well as allocative efficiencies, and then applies the tobit censored model to investigate the relationship between each efficiency measure and firm-specific attributes. The DEA evaluation results shows that, the mean technical efficiency measure is 0.720, indicating that CPA firms could have reduced inputs on average by 28.0%; the inefficient CPA firms overuse 39.3% inputs on average than the efficient ones do. 22.4% of CPA firms operate in the region of constant returns to scale, and are gauged scale-efficient. 60.8% of CPA firms operate in the region of increasing returns to scale, and are gauged scale-inefficient. That is, most of the scale inefficiency is due to operating at a relatively small firm size. Average cost efficiency measures is 0.625, implying that CPA firms on average would have needed to lower operating costs by 37.5%. Given prices of inputs, CPA firms on average operate at 16.2% higher costs than the cost-minimizing level due to the inappropriate input mix.

The regression results show that the logarithm of firm size has a positive impact on cost, technical, allocative as well as scale efficiencies because of the existence of scale economies and/or the advantage from joint use of inputs. The impacts of a firm's age on technical efficiency is positive due to gains from learning-curve effect. The service concentration has a positive impact on cost and allocative efficiencies. The CPA-to-employee ratio has a positive impact on cost, technical and allocative efficiencies because the higher ratio of the management groups implies a better control and supervision for service-providing; but it has a negative effect on scale efficiency, implying that the input congestion problem might

reflect on scale efficiency measure. CPA firms in the proprietorship form has a positive effect on cost, technical as well as allocative efficiencies due to unambiguous goals and guidelines; but has a negative effect on scale efficiency for the possible reason that the partners' unlimited liability for one another's actions makes partner be judged and monitored, and this advantage overcome the expense of achieving consensus among partners. Firms with a branch or branches are less efficient than those without any branch in terms of technical and scale efficiencies because the purpose of CPA firms to set up branches was just to enlarge the geographical coverage of the market, and the increased complexities on operations make difficult of managers' decisions to be put into effect.

Footnotes

1. Free disposability, or called strong disposability, refers to the ability to dispose of unwanted commodity with no private cost. Free disposability of inputs models the situation in which inputs can be increased without reducing output. That is, this condition excludes "upward sloping" isoquants (Färe et al., 1994, p.38).

2. The concept of Hirfindahl-Hirschman index is used here to measure the service concentration since it takes into account both the number of services and the inequality of services' revenue shares.

3. In fact, four different models are estimated for each efficiency measure in order to achieve the best result. Only the preferred result for each efficiency measure is listed in Table 4-7. However, the regression results of models will be available upon request. Additionally, the variance inflationary factor is also used to test the degree of multicollinearity among independent variables. The result shows that there is no multicollinearity among these variables.

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Table 1 The Descriptive Statistics of the Relevant Variables

Variable	Average	Std. Dev.	Max.	Min.
Auditing service revenue	25,802,947	76,497,707	578,000,000	10,000
Tax service revenue	2,146,388	5,990,701	52,940,429	3,000
Management revenue				
Advisory service	6,072,712	25,655,962	276,569,264	10,000
Number of employees	42	98	653	2
Net fixed assets	43,448,052	120,674,622	1,097,865,287	872,226
Firm size (FS)	34,022,047	101,781,228	735,322,451	399,400
Age (AGE)	9.7700	10.5324	79.0833	1.0000
Service concentration (H)	0.6418	0.1652	111327930	0
CPA-to-employee ratio (RCPA)	0.1583	0.1155	1.0000	0.0222
Organizational form dummy (OFD)	0.5400			
Branch dummy (BD)	0.3533			
Number of observation: 150				

Notes:

1.All items of revenues, net fixed assets, and firm size are measured in terms of NT dollars; Age is measured in years.

2.If only the mean is reported, the variable is a 1/0 dummy.

3.The numbers of CPA firms in the forms of sole proprietorships and partnerships are 69 and 81, respectively.

4.The number of CPA firms with a branch (or branches) is 53.