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Cost Function Estimation Before and After Regulatory Reform: Evidence from Korea's CPA Service Industry

Sang-Lyul Ryu[1#], Yeong-wha Sawng[1#] and Jayoun Won[2*]
[1]School of Business, Konkuk University, 05029 Seoul, Korea
[2]College of Global Business, Korea University, 2511 Sejong, Korea

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This paper aims to examine how the cost structure of certified public accountant firms changed after the accounting reform of 2005. Korea enacted various accounting reform acts adopting Sarbanes-Oxley Act in 2005. Our sample comprises 1,230 firm-year observations from 1997 to 2012. The sample period is decomposed into two sub-periods: pre-reform (1997–2004) and post-reform (2005–2012) periods. We estimate a multi-product translog cost function to determine whether there are significant changes in the economies of scale during the pre- and post- reform periods. The estimated cost function suggests that overall and product-specific economies of scale prevailed during the full sample, pre- and post-reform periods. However, overall economies of scale lessened after the accounting reform and the economies of scale seemed to be depleted for the larger firms during the full and post-reform periods. As for product-specific scale economies after the reform, the marginal costs of producing Audit and Accounting increased, whereas those of producing Tax services declined. The economies of scale in business advisory services remained constant before and after the accounting reform. The results gleaned from this study may provide CPA firms with managerial implications regarding the changes in cost structure after the accounting reform.

Keywords: Accounting Reform, Cost Function, CPA Firm, Economies of Scale

Introduction

This paper investigates the changes in the cost structure of the certified public accountant (CPA) service industry before and after the accounting reform of 2005 in Korea. We estimate a multi-product translog cost function. The degrees of scale economies are determined using the estimated coefficients of the cost function. The U.S. enacted the Sarbanes-Oxley Act of 2002 (SOX) as a reaction to a battery of large-scale accounting malpractices in the early 2000s. In response to the perception of the need for stricter financial regulations, many non-U.S. regimes subsequently adopted SOX-type reform acts.[1] Korea is one of the countries that have adopted the SOX-type regulations. Accounting reforms may affect the cost structure and operating efficiency of CPA firms. By law, a CPA firm is a special purpose company that carries out audit and accounting (A&A), tax services (TAX) and business advisory services (BAS).[2] The CPA service industry in Korea is highly competitive with quite homogenous services.[3] Success in this industry depends on how well the firm controls total costs. Prior studies on the production structure of CPA firms have not incorporated a multi-product translog cost function to determine the effects of the accounting reform. If the scale economies of CPA firms are exacerbated by the reform acts, the firms' managers can improve their efficiency by adjusting inputs or changing the output mix.

Overview of the Accounting Reform in Korea

Korea imitated the U.S. in adopting the essence of SOX and amended three existing laws: the Securities and exchange act (SEA), the act on External audit of stock companies (EASC) and the Certified public accountant act (CPAA). The amendments to the above laws have been in effect since April 2004. They require senior management and external auditors to certify the accuracy and completeness of financial reports, and to establish internal controls and reporting methods on the adequacy of the controls. Furthermore, the Securities-related class action act (SRCA) was newly enacted and enforced in January 2005. The SRCA applies to securities-related claims for damages caused by false information in business reports, stock price manipulation or negligent auditing by external auditors. The main objective of these laws is to protect investors by improving the reliability of corporate disclosures including accounting information. In this study, the accounting reform acts of 2005 encompass the SEA, EASC, CPAA and SRCA that have been in effect since 2005.

*Author for Correspondence
E-mail: eureka9114@korea.ac.kr; # Equal Contribution

Materials and Methods

Translog Cost Function

We specify a translog cost function to represent the relationship between total costs and revenues of the CPA service industry. We consider CPA firms producing multi-outputs using multi-inputs. The translog cost function with K input prices $w=(w_1, \ldots, w_K) > 0$ and I outputs $q=(q_1, \ldots, q_I) > 0$ can be expressed as follows:

$$\ln C(w, q) = a_0 + \sum_{k=1}^{K} b_k(\ln w_k) + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} c_{kl}(\ln w_k)(\ln w_l) + \sum_{i=1}^{I} d_i(\ln q_i) + \frac{1}{2}\sum_{i=1}^{I}\sum_{j=1}^{I} e_{ij}(\ln q_i)(\ln q_j) + \sum_{k=1}^{K}\sum_{i=1}^{I} f_{ki}(\ln w_k)(\ln q_i) \quad \ldots (1)$$

where, $\ln C(\cdot)$ is the logarithm of total costs, $\ln q_i$ is the logarithm of the quantity of output i, and $\ln w_k$ is the logarithm of the price of input k.The symmetry condition requires that $c_{kl}=c_{lk}$ and $e_{ij}=e_{ji}$. Since input prices in the model are measured in monetary amounts, we write the price of each input k in the year t as $w_k^t = w_k^{97} \cdot \rho_k^t$ for $k=1,\ldots,K$ and $t=1998, 1999,\ldots, 2012$. w_k^t (>0) is the factor measuring the change in price of input k in year t compared to 1997. We normalise input prices by setting $w_k^{97}=1$ for k ($w_k^t=\rho_k^t$). As it is difficult for researchers to observe input prices in the real world, we treat the w_k^t as parameters to be empirically estimated. We rewrite (1) as follows:

$$\ln C(w, q) = a_0 + \sum_{k=1}^{K} b_k(\ln \rho_k^t) + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} c_{kl}(\ln \rho_k^t)(\ln \rho_l^t) + \sum_{i=1}^{I} d_i(\ln q_i) + \frac{1}{2}\sum_{i=1}^{I}\sum_{j=1}^{I} e_{ij}(\ln q_i)(\ln q_j) + \sum_{k=1}^{K}\sum_{i=1}^{I} f_{ki}(\ln \rho_k^t)(\ln q_i) \quad \ldots (2)$$

Let $\phi^t Y^t = \sum_{k=1}^{K} b_k(\ln \rho_k^t) + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} c_{kl}(\ln \rho_k^t)(\ln \rho_l^t) + \upsilon_t$. ϕ^t includes w_k^t and it is a parameter for the year dummy Y^t.

Includes w_k^t and it is a parameter for the year dummy Y^t.$\lambda_i^t Y^t = \sum_{k=1}^{K} f_{ik}(\ln \rho_k^t)$ for t=1998,1999,…,2012 andi= 1,…,I. Considering three outputs q_1, q_2 and q_3, we can express (2) as (3):

$$\begin{aligned}\ln C = {} & a_0 + d_1 \ln q_1 + d_2 \ln q_2 + d_3 \ln q_3 \\ & + \frac{1}{2}e_{11}(\ln q_1)^2 + \frac{1}{2}e_{22}(\ln q_2)^2 + \frac{1}{2}e_{33}(\ln q_3)^2 \\ & + e_{12}(\ln q_1)(\ln q_2) + e_{13}(\ln q_1)(\ln q_3) \\ & + e_{23}(\ln q_2)(\ln q_3) + \theta_1 \text{BIG-N} + \phi^t Y^t \\ & + \lambda_1^t Y^t(\ln q_1) + \lambda_2^t Y^t(\ln q_2) + \lambda_3^t Y^t(\ln q_3)\end{aligned} \quad \ldots (3)$$

This analysis uses three output variables identified according to CPA firms' business activities: A&A, TAX and BAS. In Eq. (3), q_1, q_2 and q_3 indicate A&A, TAX and BAS, respectively. By not including input prices in (3), the cost function we estimate is indeed a 'pseudo-cost function', and we implicitly assume that firms try to minimise their costs. Big firms would benefit from carrying out a variety of tasks in a much more systematic manner than non-Big firms. This helps the big firms to manage their activities efficiently and cut down on the costs of servicing clients. On the other hand, given the output level, an increase in the size of firms increases the degree of difficulty in administration and therefore raises operating costs. Therefore, BIG-N is included in (3) as a control variable and measured as a dummy variable that equals one if the firm is one of the Big firms.

By taking the derivatives of (2) with respect to the price of each input, we obtain a system of cost share equations. The cost share of k input, s_k, is as follows:

$$s_k = \frac{\partial \ln C}{\partial \ln w_k} = b_k + \sum_{l=1}^{K} c_{kl}(\ln w_l) + \sum_{i=1}^{I} f_{ki}(\ln q_i) \quad \text{for } k, l = 1, \ldots, K \quad (4)$$

Let $\sum_{l=1}^{K} c_{kl}(\ln w_l) = \sum_{l=1}^{K} c_{kl}(\ln w_l^t)$ be $\gamma_k^t Y^t$, Eq. (4) can then be rewritten as follows:

$$s_k = \beta_k + \gamma_k^t Y^t + \sum_{i=1}^{3} \zeta_{ki}(\ln q_i) \quad \text{for } k=1, \ldots, K \text{ and } t=1998, 1999, \ldots, 2012 \quad (5)$$

The parameters of the cost function are commonly estimated by treating (3) and (5) as a multivariate regression. Since the cost share equations add structural information without increasing the number of parameters, the multivariate regression of (3) in conjunction with (5) produces more efficient estimates than those achieved by (3) alone. We add disturbance terms to (3) and (5) for estimation.[4] Generally, a CPA firm has three kinds of human resources: partners (PRT), other professionals (PRF) and other employees (OTH). PRT has ownership, acts as the highest executive and determines final decisions on the firm's projects and activities. PRF includes registered CPAs but not partners, apprentice CPAs, information technology experts and consulting personnel, and PRF generally provides A&A, TAX and BAS services for individual clients. OTH supports partners and other professionals and is usually involved in the maintenance and administration of the firm. We consider the input of each firm in terms of its labour grouped into three human resources: the number of PRT, the number of PRF and the number of OTH. In Eqs (4) and (5), k=1, 2, 3 and each designation number stands for PRT, PRF and OTH in order. CPA firms provide their clients with A&A, TAX and BAS services by utilising human resources who have accounting expertise. We do not include capital inputs in our analysis because they are believed to be of only secondary importance.[2] Since the cost shares sum to unity, one of the cost share equations is excluded from the estimation to avoid the singularity problem. The system of regression equations can be iteratively estimated using Zellner's (1962) seemingly unrelated regression (SUR) algorithm.[5] As the Cobb–Douglas cost function is nested in the translog model, this paper conducts a statistical test to check whether the Cobb–Douglas function fits the data as well as the translog model.

Economies of Scale

Economies of scale pertain to whether a firm can reduce its total costs by increasing the output level. In the multi-output case, because average costs cannot be defined, the standard definition of scale economies cannot be applied. The concept of ray scale economies (RSCE) is a straight forward extension of the concept of single-output scale economies and indicates how total costs behave as the levels of all outputs change, holding output bundles fixed.[6] In the translog cost function specified in Eq. (3), RSCE is given by the following:

$$
\begin{aligned}
\mathrm{RSCE} &= \sum_{i=1}^{I} \mathrm{SCE}_i = \sum_{i=1}^{I} \frac{\partial \ln C(\cdot)}{\partial \ln q_i} \\
&= \sum_{i=1}^{I} d_i + \sum_{i=1}^{I}\sum_{j=1}^{I} e_{ij}(\ln q_j) + \sum_{i=1}^{I} \lambda_i^t Y^t \\
&= (d_1+d_2+d_3) + (e_{11}+e_{21}+e_{31})\ln q_1 \\
&\quad + (e_{12}+e_{22}+e_{32})\ln q_2 + (e_{13}+e_{23}+e_{33})\ln q_3 \\
&\quad + \lambda_1^t Y^t + \lambda_2^t Y^t + \lambda_3^t Y^t
\end{aligned}
\qquad \ldots 6)
$$

where SCE_i is the measure of the product-specific scale economies.[7] A value of SCE less than one indicates that firms are operating in the region of increasing returns-to-scale. Returns-to-scale are said to be constant or decreasing when RSCE is equal to or greater than unity, respectively.

Data and Descriptive Statistics

The data used in this paper are obtained from the regulatory annual reports filed by CPA firms in Korea for each of the 16 years from 1997 to 2012. The sample period includes the accounting reform of 2005. We break the sample period down into two sub-periods: pre-reform (1997–2004) and post-reform (2005–2012). We include CPA firms that provide all three services in the sample to mitigate the misspecification problem due to fitting a translog cost function over sample firms that vary widely in output mix.[8] After deleting unqualified observations, the final sample consists of 1230 firm-year observations: 377 firms in the pre-reform period and 853 firms in the post-reform period. The list of variables and the definition and measurement thereof are presented in Table 1.

Descriptive statistics on total costs, revenues, and labour variables are given in Table 2. Total costs are operating costs incurred during normal operations and the sum of labour and administrative costs. The high standard deviations of revenues suggest that CPA firms vary greatly in their size and output mix. The mean values of total costs, total revenues and total number of employees declined from the pre-reform period to the post-reform period. We perform paired t-tests, and the results indicate that there are significant differences in both total costs and revenues between the two periods (not reported here).

Results and Discussion

Parameter Estimation of the Translog Cost Function

The translog cost function specified in Eq. (3) and each of the cost share equations in Eq. (5) are estimated contemporaneously using Zellner's technique.[5] Zellner's procedure is iterated until convergence to guarantee that the estimates are invariant to which cost share equation is dropped.[9] We estimate the cost function for the pre- and post-reform periods to examine the differences in the parameter estimates between the two periods. This paper employs the more flexible translog cost function rather than the log-linear Cobb–Douglas function. We conducted likelihood ratio tests to

Table 1 — Variable Definitions and Measurements

Variable	Definition and Measurement
N	Number of observations
C	Total cost defined as operating costs reported on the income statement
A&A	Revenues from Audit and Accounting (A&A)
TAX	Revenues from TAX services (TAX)
BAS	Revenues from Business Advisory Services (BAS)
PART%	Proportion of partners
PROF%	Proportion of professionals that are registered CPAs who are not partners, apprentice CPAs, information technology experts and consulting personnel
OTHR%	Proportion of other employees that are support personnel usually involved in the maintenance and administration of the firm
BIG-N	A dummy variable that equals 1 if the CPA firm is one of the Big firms which are Samil-PricewaterhouseCoopers (PWC), Hanyoung-Ernst &Young (EY), Anjin-Arthur & Andersen (AA) and Samjung-Klynveld Peat Marwick & Goerdeler (KPMG)
SCE_i	Measure of scale economies specific to a product i(i= 1, 2 and 3 denote A&A, TAX and BAS, respectively)
RSCE	Ray scale economies evaluated for each firm or sample mean

Notes: Total costs and revenues are expressed in million Korean won. All monetary terms have been deflated to 2010 Korean won using the consumer price index published by the Bank of Korea.

Table 2 — Descriptive Statistics

Variable	Mean	Std Dev.	25%	Median	75%
Panel A: full sample (1997–2012, N=1, 230)					
Total costs	15,262	45,605	3,123	5,060	7,753
Revenues:					
Total revenues	15,732	46,587	3,252	5,213	8,102
A&A	6,396	18,176	801	1,575	2,982
TAX	2,655	8,270	510	958	1,712
BAS	6,681	21,474	1,279	2,410	3,809
Labour:					
Total number of employees	141	346	36	61	91
PRT%	20.78	10.82	13.33	18.56	26.41
PRF%	26.33	19.94	10.00	21.43	37.66
OTH%	52.89	19.29	42.28	54.86	66.67
Panel B: pre-reform (1997–2004,N=377)					
Total costs	16,199	38,969	2,782	4,968	9,236
Revenues:					
Total revenues	16,866	40,794	2,820	5,015	10,141
A&A	7,495	16,578	778	1,725	4,324
TAX	2,157	5,031	430	942	1,687
BAS	7,214	21,330	1,095	2,252	4,129
Labour:					
Total number of employees	155	285	40	72	116
PRT%	19.93	11.98	12.04	17.20	26.06
PRF%	28.19	21.63	9.58	24.00	43.30
OTH%	51.89	19.93	37.48	53.33	66.11
Panel C: post-reform (2005–2012, N=853)					
Total costs	14,848	48,264	3,255	5,104	7,375
Revenues:					
Total revenues	15,231	48,944	3,385	5,318	7,653
A&A	5,911	18,829	808	1,561	2,685
TAX	2,875	9,344	549	964	1,724
BAS	6,446	21,546	1,354	2,441	3,661
Labour:					
Total number of employees	135	370	35	59	82
PRT%	21.15	10.25	14.12	19.23	26.52
PRF%	25.52	19.09	10.00	21.05	36.51
OTH%	53.34	18.99	44.28	55.56	66.67

Note: See Table 1 for variable definitions.

evaluate whether the Cobb–Douglas form could have provideda more adequate representation of CPA firms' cost function.

The parameter estimates and the test results for the translog cost function are presented in Table 3. The estimates were calculated in five to seven iterations. The explanatory power of the function is high, as indicated by the McElroy R^2 with a highly significant F-statistic. The likelihood ratio tests show that the Cobb–Douglas function is rejected by the data in favour of the translog model. The first-order parameters and the parameters that measure the interactions among the output levels are all significant. The estimated parameter of A&A decreases, while those of TAX and BAS increase in the post-reform years compared to the pre-reform period. This implies that the impact of A&A on operating costs was reduced after the accounting reform. The parameters of BIG-N are significant and negative for both the full sample and post-reform periods, implying that the Big firms strived to save operating costs during the full sample period and the cost savings were much larger in magnitude during the post-reform period than the pre-reform period.

Economies of Scale

To interpret the translog cost function reported in Table 3, we focus on economies of scale. In Table 4 RSCE and SCE_i, which are measured using the parameter estimates in Table 3 at the arithmetic means of $\ln q_1$, $\ln q_2$ and $\ln q_3$ for the full sample, pre- and post-reform periods are presented. Product-

Table 3 — Translog Cost Function Estimates

Parameter	Full Sample (1997–2012)		Pre-reform (1997–2004)		Post-reform (2005–2012)	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Intercept	9.6646[a]	0.0221	9.6998[a]	0.0216	9.5881[a]	0.0099
d_1	0.4513[a]	0.0169	0.4761[a]	0.0176	0.4209[a]	0.0097
d_2	0.1875[a]	0.0213	0.1313[a]	0.0218	0.1572[a]	0.0098
d_3	0.3778[a]	0.0164	0.3652[a]	0.0171	0.4291[a]	0.0107
e_{11}	0.1735[a]	0.0038	0.1607[a]	0.0048	0.2117[a]	0.0056
e_{22}	0.1288[a]	0.0039	0.0849[a]	0.0061	0.1587[a]	0.0042
e_{33}	0.1509[a]	0.0038	0.1381[a]	0.0045	0.2253[a]	0.0067
e_{12}	−0.0577[a]	0.0034	−0.0311[a]	0.0052	−0.0859[a]	0.0039
e_{13}	−0.1002[a]	0.0035	−0.1101[a]	0.0047	−0.1249[a]	0.0049
e_{23}	−0.0608[a]	0.0029	−0.0517[a]	0.0047	−0.0738[a]	0.0033
θ_1	−0.0566[a]	0.0177	0.0349	0.0235	−0.1256[a]	0.0235
λ_1^{98}	−0.0099	0.0227	−0.0158	0.0231		
λ_2^{98}	−0.0278	0.0291	−0.0213	0.0297		
λ_3^{98}	0.0200	0.0201	0.0222	0.0205		
λ_1^{99}	−0.0415[c]	0.0235	−0.0342	0.0239		
λ_2^{99}	−0.0242	0.0288	−0.0233	0.0294		
λ_3^{99}	0.0494[b]	0.0197	0.0561[a]	0.0202		
λ_1^{00}	−0.0683[a]	0.0201	−0.0591[a]	0.0206		
λ_2^{00}	0.0025	0.0274	−0.0049	0.0281		
λ_3^{00}	0.0153	0.0203	0.0353[c]	0.0209		
λ_1^{01}	−0.0092	0.0195	−0.0196	0.0199		
λ_2^{01}	0.0272	0.0246	0.0262	0.0251	n/a	n/a
λ_3^{01}	0.0030	0.0195	0.0217	0.0201		
λ_1^{02}	−0.0213	0.0196	−0.0152	0.0202		
λ_2^{02}	0.0625[a]	0.0232	0.0608[b]	0.0239		
λ_3^{02}	−0.0487[b]	0.0204	−0.0512[b]	0.0215		
λ_1^{03}	−0.0288	0.0204	−0.0356[c]	0.0208		
λ_2^{03}	0.0196	0.0243	0.0548[b]	0.0249		
λ_3^{03}	−0.0159	0.0201	−0.0289	0.0209		
λ_1^{04}	−0.0147	0.0193	−0.0169	0.0199		
λ_2^{04}	−0.0456[c]	0.0239	0.0099	0.0247		
λ_3^{04}	0.0806[a]	0.0196	0.0293	0.0209		

(*Contd.*)

Table 3 — Translog Cost Function Estimates — (*Contd.*)

Parameter	Full Sample (1997–2012)		Pre-reform (1997–2004)		Post-reform (2005–2012)	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
λ_1^{05}	0.0092	0.0193	n/a	n/a		
λ_2^{05}	−0.0279	0.0231				
λ_3^{05}	−0.0241	0.0191				
λ_1^{06}	−0.0342[c]	0.0200			−0.0129	0.0125
λ_2^{06}	0.0028	0.0234			0.0191[c]	0.0111
λ_3^{06}	0.0137	0.0204			0.0119	0.0132
λ_1^{07}	−0.0269	0.0193			−0.0059	0.0119
λ_2^{07}	−0.0006	0.0232			0.0214[c]	0.0111
λ_3^{07}	0.0136	0.0199			−0.0046	0.0129
λ_1^{08}	−0.0431[b]	0.0202			−0.0323[b]	0.0125
λ_2^{08}	0.0245	0.0232			0.0477[a]	0.0108
λ_3^{08}	0.0003	0.0189			0.0017	0.0117
λ_1^{09}	−0.0359[c]	0.0196			−0.0176	0.0121
λ_2^{09}	0.0188	0.0229			0.0378[a]	0.0107
λ_3^{09}	0.0065	0.0191			−0.0025	0.0119
λ_1^{10}	−0.0606[a]	0.0196			−0.0461[a]	0.0121
λ_2^{10}	0.0236	0.0229			0.0352[a]	0.0106
λ_3^{10}	−0.0105	0.0189			−0.0021	0.0117
λ_1^{11}	−0.0522[a]	0.0198			−0.0313[b]	0.0123
λ_2^{11}	0.0186	0.0228			0.0371[a]	0.0104
λ_3^{11}	0.0233	0.0196			0.0112	0.0126
λ_1^{12}	−0.0511[a]	0.0195			−0.0274[b]	0.0123
λ_2^{12}	0.0381[c]	0.0229			0.0529[a]	0.0108
λ_3^{12}	0.0058	0.0195			−0.0099	0.0126
ϕ^t	Included		Included		Included	
McElroy R^2	0.988		0.991		0.991	
System DF	3581		1070		2498	
Number of Iterations	6		7		5	
LR test (H_0: e_{ij}=0 for all i, j):Chi-square	2623.4[a]		964.31[a]		1873.8[a]	
F-statistic	4256[a]		2933[a]		7428[a]	

Notes: See Table 1 for variable definitions. [a], [b] and [c] indicate statistical significance at the 1%, 5% and 10% levels for two-sided tests, respectively.

specific SCE_i is often realised by specialising in the production of one or a few outputs over a larger scale of output. We also report RSCE and SCEi by quintile of output size for each sample period.

According to the results in Table 4, RSCE and SCE_i measures are significantly less than one for the full sample, pre- and post- reform periods, indicating that CPA firms on average exploit overall and product-specific scale economies in providing their services. That is, an equally proportionate increase in all three outputs (A&A, TAX and BAS) results in a decline in ray average costs.[10] The value of RSCE in the post-reform period (0.9918, Panel C) is greater than that in the pre-reform period (0.9734, Panel B). This implies that the individual firm's overall economies of scale lessened after the accounting reform of 2005. One must be careful about interpreting the results that CPA firms enjoy scale economies. Economies of scale may not necessarily be caused by the size of outputs, but they may be the results of the firms' ability to lower total costs. To explore how economies of scale vary with firm sizes, we present RSCE and SCE_i for each quintile of size vectors of outputs in Table 4. RSCE and SCE_i measures increase in moving from the first quintile to the fifth quintile and differ significantly from zero, meaning that CPA firms' overall economies of scale and product-specific scale economies diminish as firm sizes increase. RSCE seems to be exhausted, and even diseconomies of scale exist for large firms in the fifth quintile for the full sample and post-reform periods.

Table 4 — Ray and Product-specific Economies of Scale (Std. Errors in Parentheses)

Output	Sample Mean	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Panel A: Full Sample (1997–2012, N=1230)						
RSCE	0.9785[a]	0.9543[a]	0.9698[a]	0.9772[a]	0.9831[a]	1.008[a]
	(0.0318)	(0.0305)	(0.0233)	(0.0213)	(0.0227)	(0.0328)
SCE_1	0.3511[a]	0.1971[a]	0.3002[a]	0.3535[a]	0.3915[a]	0.5132[a]
	(0.1469)	(0.1421)	(0.0917)	(0.0767)	(0.0801)	(0.1138)
SCE_2	0.2013[a]	0.1122[a]	0.1731[a]	0.2064[a]	0.2492[a]	0.2654[a]
	(0.1137)	(0.1275)	(0.0684)	(0.0704)	(0.0956)	(0.1209)
SCE_3	0.4261[a]	0.3618[a]	0.4292[a]	0.4606[a]	0.4689[a]	0.4099[a]
	(0.1395)	(0.1816)	(0.1249)	(0.1152)	(0.1131)	(0.1244)
Panel B: Pre-reform (1997–2004, N=377)						
RSCE	0.9734[a]	0.9710[a]	0.9699[a]	0.9723[a]	0.9722[a]	0.9815[a]
	(0.0299)	(0.0331)	(0.0224)	(0.0271)	(0.0285)	(0.0361)
SCE_1	0.3918[a]	0.2055[a]	0.3309[a]	0.3868[a]	0.4587[a]	0.5721[a]
	(0.1693)	(0.1677)	(0.0836)	(0.0798)	(0.0985)	(0.1292)
SCE_2	0.1756[a]	0.1343[a]	0.1717[a]	0.1836[a]	0.1997[a]	0.1885[a]
	(0.0894)	(0.1110)	(0.0623)	(0.0524)	(0.0955)	(0.0985)
SCE_3	0.4061[a]	0.3654[a]	0.4229[a]	0.4548[a]	0.4098[a]	0.3781[a]
	(0.1644)	(0.2371)	(0.1474)	(0.1068)	(0.1176)	(0.1681)
Panel C: Post-reform (2005–2012, N=853)						
RSCE	0.9918[a]	0.9591[a]	0.9808[a]	0.9928[a]	0.9958[a]	1.029[a]
	(0.0321)	(0.0275)	(0.0173)	(0.0129)	(0.0156)	(0.0316)
SCE_1	0.3368[a]	0.1853[a]	0.2893[a]	0.3501[a]	0.3789[a]	0.4778[a]
	(0.1498)	(0.1509)	(0.1211)	(0.0906)	(0.0878)	(0.1091)
SCE_2	0.1995[a]	0.0956[a]	0.1594[a]	0.1946[a]	0.2649[a]	0.2814[a]
	(0.1342)	(0.1429)	(0.0821)	(0.0903)	(0.1082)	(0.1404)
SCE_3	0.4555[a]	0.3266[a]	0.4399[a]	0.4827[a]	0.5369[a]	0.4905[a]
	(0.1625)	(0.1779)	(0.1551)	(0.1425)	(0.1293)	(0.1202)

Notes: See Table 1 for variable definitions. H_0: true mean is equal to 1. [a], [b] and [c] indicate statistical significance at the 1%, 5% and 10% levels for two-sided tests, respectively

Conclusions

The findings of this study are summarised as follows. First, CPA firms varied widely in their sizes and output mix, and both total costs and revenues declined from the pre-reform period to the post-reform period. Second, compared to the log-linear model, the translog model provided a more adequate representation of CPA firms' cost function. Third, relative to other revenue sources, the impact of A&A on total costs decreased after the accounting reform. Fourth, the Big firms made more efforts to save total costs during the full sample period, and their cost savings were much bigger in magnitude during the post-reform period than the pre-reform period. Fifth, the estimated cost function suggests that overall and product-specific scale economies prevailed during the full sample, pre- and post- reform periods. CPA firms on average exhibited significant increasing returns-to-scale and product-specific returns-to-scale. However, RSCE lessened after the accounting reform of 2005 and the scale economies appeared to be depleted for the larger firms during the full sample and post-reform periods. Sixth, as for product-specific scale economies after the accounting reform, the marginal costs of producing A&A increased, whereas those of producing TAX declined. The scale economies in BAS remained constant before and after the accounting reform.

The empirical evidence indicates that CPA firms enjoyed overall and product-specific economies of scale, though overall scale economies fell after the accounting reform of 2005. Despite these contributions, this study has limitations that are difficult to control the effect of factors other than the accounting reform on the cost function during the analysis period. Our study remains that of a single case, specifically in Korea. Therefore, it will be interesting to explore the relationships documented in our analysis in other countries that have enacted accounting reforms.

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