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銀行產業特性、品質因素與生產力及效率衡量(1/2)

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中文摘要

本研究使用非中立隨機邊界生產函數，研究我國商業銀行在資訊設備(IT)的投資，是否顯著提升要素生產力與效率。經由問卷調查方式，總共回收 23 家銀行的問卷，資料期間涵蓋民國 85 年至 90 年。估計結果發現 IT 資本與資訊人員的生產力，比非 IT 資本與非資訊人員為高；平均技術效率估計值等於 0.6；樣本期間內，我國銀行業總要素生產力，平均每年成長 2.53%。

關鍵詞： 資訊設備 總要素生產力 技術效率

Abstract

The current paper extends the non-neutral stochastic frontier production function - which belongs to the class of a one-step procedure as defined by Wang and Schmidt (2002) and developed by Huang and Liu (1994) - from a cross-sectional setting to a panel data modeling. Using a newly-surveyed data set from Taiwan’s commercial banks on their investments in information and communication technologies (IT), I find that IT capital and computer labor tend to exhibit higher productivities than their non-IT and non-computer counterparts, that IT capital has a positive impact on productivity, and that the mean technical efficiency is around 60.29%. Evidence is found that the total factor productivity of the banking sector grew at the average rate of 2.53% per annum, albeit fluctuating, for the past six years.

Keywords: IT capital, total factor productivity, technical efficiency

報告內容

一、前言及研究目的

Over the past few decades, firms have spent a huge amount in acquiring information and communication technologies (IT) equipment and hiring IT-related employees. Gera et al. (1999) found that the real IT investment rate in Canada and the U.S. rose in most manufacturing and services industries, with the services industries having the highest IT investment rate. Wolff (1999) was aware that finance, insurance, and real estate (henceforth, FIRE) in the services industries made the largest investment in terms of average annual investment in office, computing, and accounting equipment per full-time equivalent employee during the period 1958 to 1987, in comparison with other industries using U.S. input-output dollar flow tables.

Similar evidence can be found from the annual survey on IT expenditures by firms, households, and the government of Taiwan, conducted by the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan, The Republic of China, starting from 1996. In the nearest two waves of survey for the period of 2000-2001, total spending on computer hardware, software, communication, personnel, and other related items was led by FIRE. However, does the intensive utilization of IT capital improve firms' productivity and benefit the economy as a whole?

The purposes of the current paper are threefold. First, it investigates the output elasticities of IT capital and computer labor for Taiwan's banking sector, in the context of a flexible translog production frontier. Since I employ pooled time-series and cross-sectional data, the paper is capable of extending the non-neutral stochastic frontier model (which is a one-step model and was developed by Huang and Liu (1994)) to the framework of panel data.[1] It next attempts to detect the cross-effect of the use of IT hardware capital on the productivities of the remaining inputs. Lastly, the rate of change of total factor productivity ($T\dot{F}P$) is evaluated and decomposed into various sources, which take the contribution of technical efficiency change to productivity change into account.

二、文獻探討

Mixed evidence is available on the productivity of IT capital. Loveman (1994) failed to reject the hypothesis that computers add nothing at all to total output. Berndt et al. (1992) uncovered that changes in the ratio of an industry's high-tech capital stock to its total capital stock are negatively associated with labor productivity growth for the period 1968-86. Morrison and Berndt (1991) estimated that the marginal benefits of investments in high-tech office and information technology equipment fall short of the marginal costs. Berndt and Morrison (1995) concluded that increases in high-tech investments are negatively correlated to multi-factor productivity growth. Wolff (1999) argued that computerization does not appear to exert a

[1] Although the model to be used by this exercise does not have the scaling property, as addressed by Wang and Schmidt (2002), it is nevertheless able to avoid getting biased estimates by applying the two-step procedure. See Wang and Schmidt (2002) for details.

positive effect on productivity growth.

Brynjolfsson and Hitt (1995, 1996), Lichtenberg (1995), Greenan and Mairesse (1996), Lehr and Lichtenberg (1999), and Gera et al. (1999) by contrast generally found positive and significant coefficients on their computer-related variables. Black and Lynch (2001) and Zwick (2003) observed considerable impacts of IT capital on productivity, with both using a two-step estimation procedure. The former studied the data set on 3000 U.S. private establishments, while the latter employed a German establishment panel data set. Bresnahan et al. (2002) reached similar results based on panel data of around 300 U.S. establishments from several sectors. Using the industry data of the U.S., Stiroh (2002) confirmed that the U.S. productivity revival, starting from roughly 1995, is substantially associated with strong investment in IT assets in the 1980s and early 1990s. More recently, Becchette et al. (2003) analyzed the determinants of IT investment and the effect of information technology on productivity and efficiency on small and medium-sized Italian firms. Their results showed that software investment promotes average labor productivity and proximity to the production frontier.

As pointed out by Wang and Schmidt (2002), the two-step procedure - adopted by, for example, Black and Lynch (2001), Zwick (2003), and Becchetti et al. (2003), among others - may suffer from estimation biases. Such biases are found to be likely substantial by Monte Carlo experiments. Wang and Schmidt (2002) instead suggested the use of one-step models, whenever the inefficiency term has the “scaling property”. In fact, they recommended against using two-step procedures in any cases.

三、計量模型

Following Huang and Liu (1994), but extending to the context of panel data, I reformulate the unobserved stochastic frontier (log) output, η, as

$$\eta_{it} = f(X_{it}, t) + v_{it}, \quad i = 1, \ldots, N, \quad t = 1, \ldots, T, \tag{3-1}$$

where subscripts *i* and *t* are firm and time indices, respectively, $f(\cdot)$ is the deterministic (log) production function exploiting *M* inputs of X_{it}, which will be specified as taking a flexible translog form shortly, and v_{it} is a classical random disturbance representing all exogenous shocks uncontrollable by firms, distributed as $\mathrm{N}(0, \sigma_v^2)$.

The non-positive technical inefficiency (TI), u_{it}, is defined as

$$u_{it} \equiv y_{it} - \eta_{it} = g(X_{it}, Z_{it}) + w_{it}, \tag{3-2}$$

where y_{it} denotes the actual (log) output of firm *i* at time *t*, and Z_{it} is a *J*-vector of the firm’s characteristics and policy variables, which helps identify the sources of TI. The unexplained (residual) inefficiency is denoted by an error term w_{it}, which is assumed to be independent of v_{it} and distributed as $\mathrm{N}(0, \sigma_w^2)$. The residual inefficiency is inherently truncated from above, i.e.,

$$w_{it} \leq -g(X_{it}, Z_{it}), \tag{3-3}$$

for all *i* and *t*. The residual inefficiency can vary across firms and over time.

A complete production frontier can be obtained by plugging (3-1) into (3-2),

$$y_{it} = f(X_{it}, t) + g(X_{it}, Z_{it}) + w_{it} + v_{it}. \tag{3-4}$$

This specification is similar to that of Battese and Coelli (1995), while they estimated a Cobb-Douglas form of production frontier with a neutrality specification for TI. They assumed that function g(.) is solely dependent of the firm-specific variables and time, irrespective of the input usage.

Following Huang and Liu (1994) and Battese and Coelli (1995), it is not difficult, although tedious, to derive the probability density function of $\varepsilon_{it} = w_{it} + v_{it}$,

$$h(\varepsilon_{it} \mid X_{it}, Z_{it}; \theta) = \frac{\Phi\left(\dfrac{-g(X_{it}, Z_{it})\sigma^2 - \varepsilon_i \sigma_w^2}{\sigma_v \sigma_w \sigma}\right)}{\sqrt{2\pi\sigma^2}\,\Phi\left(\dfrac{-g(X_{it}, Z_{it})}{\sigma_w}\right)} \exp\left(\frac{-\varepsilon_i^2}{2\sigma^2}\right), \tag{3-5}$$

where θ is the unknown parameter vector, $\Phi(\cdot)$ is the standard normal distribution function, and $\sigma^2 = \sigma_w^2 + \sigma_v^2$. The log likelihood function of y_{it}, $i = 1, \mathrm{K}, N$, and $t = 1, \mathrm{K}, T$, is deduced by first multiplying (3-5) over all *N* firms and *T* time periods, and next taking a natural logarithm. The maximum likelihood estimator is obtained by the maximization of the log likelihood function with respect to θ.

For the purpose of estimation, the deterministic production function is assumed to have a translog form as

$$f(X_{it}, t) = \sum_{j=1}^{M} \beta_j \ln X_{jit} + \beta_t t + \frac{1}{2}\sum_{j=1}^{M}\sum_{k=1}^{M} \beta_{jk} \ln X_{jit} \ln X_{kit} + \frac{1}{2}\beta_{tt} t^2 + \sum_{j=1}^{M} \beta_{tj} \ln X_{jit} t. \tag{3-6}$$

The non-neutral efficiency function is specified as

$$g(X_{it}, Z_{it}) = \sum_{j=1}^{J} \alpha_j Z_{jit} + \sum_{j=1}^{J}\sum_{k=1}^{M} \alpha_{jk} Z_{jit} \ln X_{kit}, \tag{3-7}$$

where Z denotes a set of factors that influence the efficiency through coefficients α_j and α_{jk}.

四、資料與實證結果

There are two main sources of data used by this exercise. One of them comes from the Taiwan Economic Journal’s (TEJ) financial database, which provides a collection of financial statement accounts for corporations listed on Taiwan’s stock market. Most of the commercial banks in Taiwan are listed here. The other source comes from a survey conducted by the author covering the period 1996-2001. The survey collects data especially on the book value of IT hardware capital, including computer, communication, and related equipment (K_2), the ratio of the number of employees acquiring a bachelor or above degree (Z_1), and the number of computer employees (L_1). Twenty-five out of forty-nine banks answered the questionnaire. Two of them incurred some serious missing value problems and had to be removed. The remaining variables are taken from TEJ.

[Insert Table 4-1 Here]

In summary, this exercise identifies five factors of production, i.e., non-IT capital (K_1), K_2, borrowed funds (F), L_1, and non-computer employees (L_2), based on the intermediation approach. To be more specific, borrowed funds consist of all deposits and borrowed money. The output variable is measured by adding investments to loans, including government and corporate securities as well as short- and long-term loans. Another output measure, defined as a weighted sum of investments and loans using their respective revenue shares as the weights, has been utilized in the following estimation process. Similar results are obtained and hence overlooked to save space. Moreover, two extra variables, characterizing the sources of efficiency, are identified as Z_1 and the amount of non-performing loans (Z_2). Table 4-1 summarizes the sample statistics for the aforementioned variables.

For the purpose of comparison, we estimate two models. Model I employs the entire five factors of production, while Model II combines IT with non-IT capital together, i.e., $K = K_1 + K_2$, and aggregates computer- and non-computer labor, i.e., $L = L_1 + L_2$, leaving three factors to be considered. Model II is nothing but a conventional production frontier augmented by simultaneously considering the non-neutral efficiency regression. Parameter estimates are presented in Table 4-2.

[Insert Table 4-2 Here]

Thirteen out of forty-two parameters are significantly estimated by Model I at least at the 10% level of significance. The finding of a small number of significant parameter estimates may arise from the use of a small data set. Exploiting a total of 125 observations, Battese and Coelli (1995) found similar results especially for their TI effects. Conversely, most of the parameter estimates obtained by Huang and Liu (1994) are statistically significant, where their sample size is up to 2800 firms. Fifteen out of twenty-five parameters are significantly estimated by Model II at the same significance level. It is noteworthy that all the parameter estimates of the non-neutral efficiency regression in Model II are insignificantly estimated. These parameters are next used to calculate the subsequent estimates of interest.

[Insert Table 4-3 Here]

Table 4-3 shows the partial output elasticities of each input, based on (3-4), for both models. According to Model I, evidence is found that output elasticities of IT capital and computer labor are both positive and greater than their non-IT capital and non-computer labor counterparts. In fact, output elasticities of non-IT capital and non-computer labor are both negative due potentially to the fact that the two inputs tend to be over-employed to produce the current level of output. In order to raise the level of output without altering capital and labor inputs, the sample banks are suggested to hire more IT capital and computer employees and, at the same time, to lay off non-IT capital and non-computer workers. It is interesting to note that the output elasticity of borrowed funds slightly exceeds unity. This implies that a 1% increase in F will cause roughly an equal percent increase in investments and/or loans. Acting as financial intermediaries, the sample banks are likely to be able to successfully transform various types of funds into an equal percent of a variety of earning assets.

As far as Model II is concerned, it reveals that the output elasticity of capital is very close to zero and that of labor is negative. The model is unable to provide any further information on the possible reasoning of the findings due to its employment of aggregated inputs. It indeed obtains a similar estimate of output elasticity for *F*. In line with the foregoing, Model I may be regarded as more reliable and appealing than Model II. The measures of scale economies from both models are calculated as 1.06 and 1.03, respectively. The sample banks under study exhibit constant returns to scale.

[Insert Table 4-4 Here]

Applying formulae (3-5) and (3-6), the author empirically computes all the cross-effects of input *k* on MP_j. Table 4-4 summarizes the results. All the own second-order partial derivatives, except for K_1 (non-IT capital) due possibly to sampling variations, are found to be negative, consistent with the law of diminishing returns. I am particularly interested in the cross-effects of K_2 on the MPs of other inputs. It is observed that an increase in IT investment raises all other inputs' MPs, excluding L_1 (computer labor). This implies that IT capital positively affects the productivities of non-computer labor (L_2), non-IT capital, and borrowed funds (*F*). In addition, IT capital and computer labor are apt to be complementary inputs, such that the purchase of IT capital must be matched by hiring more computer-related workers to operate the acquired equipments. The foregoing results appear to be quite insightful and in accordance with the previous studies, as mentioned in Section 1.

The average mean TE measures from (3-1) for both models are 60.29% and 78.14%, respectively. This seems to be acceptable, because the disaggregations of inputs in Model I may raise the possibilities that a firm fails to produce maximum output using a given input mix or to exploit a minimum input mix to produce the same level of output. The figures are close to 68%, obtained by Huang and Wang (2002), who investigated the same industry, covering the period of 1982-1997, but utilized partially different sample banks and translog cost frontiers. In addition, the figures lie in the range of the average efficiency of U.S. banks summarized by Berger and Humphrey (1997). The measure of 60.29% (78.14%) indicates that a representative bank in the sample produces nearly 60% (78%) of the maximum output attained by a technically efficient bank that employs the same volume of resources.

To test the null hypothesis of a neutral specification of efficiency regression, i.e., $\alpha_{jk} = 0$, $\forall j, k$, in (2-7), a Wald test is applied. With a Chi-square statistic of 86.3 and degrees of freedom 10, the specification of a neutral effect in Model I is decisively rejected even at the 1% level of significance. The same conclusion can be drawn from Model II. The marginal effects of Z_1 and Z_2 on the mean TE, based on (3-2), are computed as 0.0040 and –0.0029 for Model I and as 0.0052 and –0.0001 for Model II, respectively. As expected, the productive efficiency of a bank that employs a better quality of work force tends to be higher. Conversely, the emergence of non-performing loans appears to reduce a bank's efficiency. Perhaps this implies that a bank incurring non-performing loans is in need of reviewing and modifying its process of credit evaluation and loan policy. It can be further inferred that a 10-percentage point increase in labor quality will promote the mean TE by 0.0004 (Model I) and 0.0005 (Model II), while a 10-percent increase in the amount of non-performing loans will lower the mean TE by 0.029 (Model I) and 0.001 (Model II).

[Insert Table 4-5 Here]

Table 4-5 shows the estimated rate of change of TFP measures for both models. Model I suggests that the total factor productivities of the sample banks increase over time on average, while Model II draws a reverse conclusion. Specifically, in the sample period the average TFP rises at a rate of 2.53% per annum as found by Model I, but declines at a rate of 2.68% per annum as indicated by Model II. It is noteworthy that the fluctuations of TFP growth revealed by Model I are congruent with the actual macroeconomic activities in Taiwan. The Asian financial crisis starting from late 1997 appeared to exert a non-trivial adverse effect on the TFP growth of the sample banks. This negative shock lasted over and was exaggerated in the following year. The same model is also capable of correctly reflecting the negative impact of Taiwan's economic downturn occurring in 2001 on TFP growth. The rate of TFP growth slumps from 7.19% in 2000 to 3.72% in 2001, while at the same time the rate of economic growth on the island figures at 5.86% and –2.18%, respectively. It is seen that evidence found by Model II is in sharp contrast to reality and Model I.

Taking a closer look at its various components, the scale effect is obviously the major one. The sample banks are capable of enhancing their TFP through expanding their output due to the fact that the average scale economy measure is slightly greater than unity, shown in Table 4-3. Model I suggests that an average bank moves toward its production frontier, which itself is shifting over time, at the rate of 0.32% per year as time elapses. However, Model II suggests an opposite direction and a much faster rate per annum.

五、結論

This paper applies a very general model to investigate the productivities and efficiencies of Taiwan's commercial banks, under the framework of a one-step procedure. As suggested by Wang and Schmidt (2002), the one-step procedure tends to outperform the two-step procedure, which has been extensively exploited to analyze the impact of information technology on productivity and efficiency by nearly all the previous studies in this area. Viewing from this angle, the results obtained by the current paper may be more suggestive and fruitful.

Computer employees and IT capital are found to be complementary and exhibit higher productivities than respective non-computer employees and non-IT capital. The employment of IT capital does improve the marginal productivities of the remaining inputs, except for computer labor. Moderate technical efficiency prevails in the industry under consideration, during the period of 1996 to 2001. The results of the efficiency measure from the current study are within the scope of the literature. Except for year 1997, the scale effect plays a key role in the determination of the pace of TFP progress, followed by the effect of technical efficiency change. During the sample period, TFP grows at the rate of 2.53% each year. The Asian financial crisis seems to have regressed substantially the TFP growth of Taiwan's banking sector. Finally, Model I fits the data quite well and is able to fully match the variations of TFP growth in banking with business cycles of the whole economy. The use of disaggregated inputs in the examination of productivities and efficiencies is possibly preferable.

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Table 4-1. Sample Statistics

Variable Name	Mean	Standard Deviation
non-IT-capital $(K_1)^a$	323.77	270.83
IT-capital $(K_2)^a$	9172.52	10201.4
computer employees (L_1)	97.35	66.38
non-computer employees (L_2)	2643.80	2012.50
borrowed funds $(F)^a$	423253	407669
Z_1	0.7653	0.1109
Z_2^a	18535.5	23569.3

a: measured by real millions of New Taiwan Dollars.

Base year: 1996

Table 4-3. Measures of Output Elasticities

Model I		Model II	
Variable Name	Output Elasticities	Variable Name	Output Elasticities
L_1 (computer labor)	0.0771	L	-0.1170
L_2 (non-computer labor)	-0.2199	K	0.000033
K_1 (non-IT capital)	-0.0126	F	1.1429
K_2 (IT capital)	0.1216		
F	1.0942		
Scale Economies	1.0603	Scale Economies	1.0259

*** : Significant at the 1% level.

** : Significant at the 5% level.

* : Significant at the 10% level.

Table 4-2. Parameter Estimates

Model I			Model II		
Variable Name	Estimate	Standard Error	Variable Name	Estimate	Standard Error
$\ln K_1$	-2.2952	3.3815	$\ln K$	-6.8714***	1.2912
$\ln K_2$	-3.6644	4.1790	$\ln L$	42.6338***	10.3652
$\ln L_1$	10.9677	11.5699	$\ln F$	-17.7488**	7.3692
$\ln L_2$	-14.5873*	8.6869	t	0.7028*	0.4055
$\ln F$	4.3038	10.1268			
t	-0.7929	0.6695			
$\ln K_1 \times \ln K_1$	0.0604*	0.0309	$\ln K \times \ln K$	0.1099***	0.0369
$\ln K_2 \times \ln K_2$	-0.0089	0.0337	$\ln L \times \ln L$	5.5064***	0.8242
$\ln L_1 \times \ln L_1$	-0.5813	0.6592	$\ln F \times \ln F$	1.1124**	0.4623
$\ln L_2 \times \ln L_2$	-0.9904*	0.5410	t^2	-0.0064*	0.0035
$\ln F \times \ln F$	-0.2391	0.5165			
t^2	-0.0032	0.0057			
$\ln K_1 \times \ln K_2$	0.1165**	0.0595	$\ln K \times \ln F$	0.4270***	0.0677
$\ln K_1 \times \ln L_1$	-0.2048*	0.1208	$\ln K \times \ln L$	-0.8681***	0.1142
$\ln K_1 \times \ln L_2$	0.3093	0.2334	$\ln L \times \ln F$	-2.5387***	0.6402
$\ln K_1 \times \ln F$	-0.0912	0.2036			
$\ln K_2 \times \ln L_1$	-0.4756**	0.1886			
$\ln K_2 \times \ln L_2$	0.1798	0.1946			
$\ln K_2 \times \ln F$	0.0848	0.1749			
$\ln L_1 \times \ln L_2$	1.1082*	0.6738			
$\ln L_1 \times \ln F$	-0.1428	0.6560			
$\ln L_2 \times \ln F$	0.5662	0.5544			
$t \times \ln K_1$	-0.0020	0.0147	$t \times \ln K$	-0.0152	0.0096
$t \times \ln K_2$	0.0190	0.0217	$t \times \ln L$	0.1371***	0.0326
$t \times \ln L_1$	-0.0256	0.0711	$t \times \ln F$	-0.0539**	0.0222
$t \times \ln L_2$	-0.0220	0.0553			
$t \times \ln F$	0.0285	0.0416			
Z_1	-0.8621	29.2023	Z_1	56.3610	54.4446
Z_2	1.0666	1.1797	Z_2	-1.2951	1.8717
$Z_1 \times \ln K_1$	0.7116	0.8107	$Z_1 \times \ln K$	-1.1940	1.0157
$Z_1 \times \ln K_2$	1.3385*	0.7108	$Z_1 \times \ln L$	6.0700	4.0239
$Z_1 \times \ln L_1$	3.3928**	1.6165	$Z_1 \times \ln F$	-2.8575	3.1261
$Z_1 \times \ln L_2$	-5.8912***	1.7311			
$Z_1 \times \ln F$	-0.4182	1.3514			
$Z_2 \times \ln K_1$	-0.0445	0.0304	$Z_2 \times \ln K$	0.0243	0.0362
$Z_2 \times \ln K_2$	-0.0439	0.0275	$Z_2 \times \ln L$	-0.0922	0.1367
$Z_2 \times \ln L_1$	-0.0590	0.0598	$Z_2 \times \ln F$	0.0546	0.1083
$Z_2 \times \ln L_2$	0.1449**	0.0729			
$Z_2 \times \ln F$	-0.0036	0.0544			
σ_v^2	0.0038**	0.0016	σ_v^2	0.0004	0.0003
σ_w^2	0.0069**	0.0033	σ_w^2	0.0490***	0.0112
log-likelihood	132.19			123.84	

*** : Significant at the 1% level.

** : Significant at the 5% level.

* : Significant at the 10% level.

Table 4-4. Estimates of $\frac{\partial MP_j}{\partial X_k}$

	L_1 (computer labor)	L_2 (non-computer labor)	K_1* (non-IT capital)	K_2* (IT capital)	F* (borrowed funds)
L_1 (computer labor)	-4.2416×10^{7}	2573430.902	-618640	-13602510	1282.8
L_2 (non-computer labor)		-100327.705	51098	402888	158.16
K_1* (non-IT capital)			656680	304171	-250.54
K_2* (IT capital)				-5008280	1660.23
F* (borrowed funds)					-0.6504

*: measured by real millions of New Taiwan Dollars.

Table 4-5. Estimates of $T\dot{F}P$

	Model I Sources of $T\dot{F}P$					Model II Sources of $T\dot{F}P$				
year	Total	$T\Delta$	Scale Effect	TEΔ	TZΔ	Total	$T\Delta$	Scale Effect	TEΔ	TZΔ
1997	-0.0026	-0.0084	-0.0250	0.0299	0.0008	0.0053	-0.0136	0.0689	-0.0560	0.0061
1998	-0.0647	-0.0201	-0.0961	0.0629	-0.0114	0.0102	-0.0308	0.0696	-0.0445	0.0160
1999	0.0714	-0.0214	0.1188	-0.0341	0.0081	-0.0356	-0.0470	0.0544	-0.0428	-0.0002
2000	0.0719	-0.0289	0.0756	0.0464	-0.0212	-0.0717	-0.0588	0.0442	-0.0797	0.0226
2001	0.0372	-0.0359	0.1678	-0.0787	-0.0160	-0.0324	-0.0709	0.0709	-0.0473	0.0150
Average	0.0253	-0.0238	0.0544	0.0032	-0.0085	-0.0268	-0.0459	0.0611	-0.0543	0.0122

計畫成果自評

本研究內容幾乎完全照原計畫內容執行，達到預期目標，研究成果具有學術價值，具有投稿至學術性期刊之潛力。