

An Empirical Analysis of Bank Mergers and Cost Efficiency in Taiwan

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ABSTRACT. This study compiled input and output panel data of 46 commercial banks in Taiwan during the period from 1997 to 1999 and used the two-stage method to evaluate the effects of bank mergers on bank efficiency. Generally speaking, a bank's cost efficiency would be improved if the bank mergers happened between banks with different culture backgrounds. On the other hand, if the mergers happened between homogeneous banks, there would be little financial innovation and the cost efficiency would be unsubstantially improved. Another finding is that small banks have superior performance than larger banks in Taiwan. Also, efficiency would seem to dictate against merger mania.

1. Introduction

The global economic deregulation and internationalization movements that pushed governments to relax economic controls also introduced new competitors to a number of industries, causing sudden changes in the market structure. Corporations hoping to cope with operating demands and maintain existing competitive advantage resorted to mergers and acquisitions (*M&A*) for survival. The period following the East Asian currency crisis witnessed Southeast Asian nations, Japan, and Korea adopting aggressive financial reforms to further deregulate domestic financial markets. Shortly afterward, a number of bank mergers sprouted in the region. As banks in Japan, U.K., Australia, and Sweden gradually removed financial barriers, the U.S. Congress passed its Financial Services Modernization Act of 1999 in

late 1999. The move was aimed to allow U.S. banks to diversify operations, as well as enhance operational efficiency and competitive power. International bank mergers became the predominant trend.

Since 1991, the Ministry of Finance (MOF) licensed the establishment of sixteen new banks, afterwards, the MOF allowed the conversion of credit cooperatives, trust investment companies, and small and medium business banks into commercial banks; hence the soaring increase in numbers of commercial banks. Taiwan passed the Bank Mergers and Acquisitions Act in November 2000. The government aggressively promoted mergers among banks. In addition to promulgating tax incentives for merging banks and extending the legal validity deadlines, the new law also relaxed regulations on mergers between banks and non-banking corporations. It also granted the Ministry of Finance the right to force the receivership and merger of the credit departments of the non-profitable farmer or fishery associations. Furthermore, it provided the legal foundation for placing non-profitable credit establishments under the "asset management company" setup. Six major laws,¹ including the Financial Holding Company Act passed in June 2001, were aimed to make the system of Taiwan financial laws stronger. Some unsound financial institutions withdrew from the market, boosting the competitive power of remaining the financial institutions.

Conclusions of past studies delving into the effects of *M&A* on operational efficiency remain inconsistent. This is mainly due to the varying modes used in these mergers, and since each merger mode has its own effect on operational efficiency. Recent studies, e.g. Rhoades (1993), Rose (1995), and Vennet (1996) analyzed the

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effects of the different bank merger modes. Traditional bank merger modes were mainly profit-enhancing mergers instituted by stable or sound banks to obtain economies of scale, reduce production costs, and improve operational efficiency. The recent period bank mergers in Taiwan were mainly total absorption types; that is a sound bank absorbing an unsound bank (such as inefficient credit cooperatives). Whether such untraditional bank mergers could improve operating efficiency is a matter worth further research. Chatterjee (1992) postulated that the key to the merger efficiency of two merging corporations lies in the blending of their corporate culture. As long as both cultures could properly integrate, then efficiency performance should be constructive. Therefore, our research was divided into the following: (1) mergers between credit cooperatives turned commercial banks and other credit cooperatives; and (2) mergers between regular banks and credit cooperatives. The paper delved into the effects of the different modes of bank mergers on the cost efficiency of banks.

On the other hand, in the recurrent merger waves, some economists believe in economies of scale and scope which larger firms enjoy superior performance, but there is overwhelming evidence that smaller firms in general are not inferior to larger ones. During the last two decades, there are many empirical studies focusing on the performance of small and large manufacturing establishments, but few similar empirical studies are on the financial industry.

The main purpose of this study is to investigate the cost efficiency of varying modes of bank merges as well as to find out if larger financial institutions are more efficient.

First, we used the stochastic frontier function approach of Battese and Coelli (1995)² to understand the effects of the bank mergers on the cost inefficiency of banks. Then we studied the commercial banks that started as credit cooperatives to determine whether their higher corporate culture integration compared to regular commercial banks produced a higher efficiency score. This study hoped that the empirical findings could provide a reference to government and bank authorities.

2. Literature review

Numerous studies have been conducted using the parametric and non-parametric approaches to evaluate bank mergers efficiency. Rhoades (1993) used the Logit model to study the 898 U.S. bank merger data (1981–89), findings obtained showed no significant improvement in the post-merger cost efficiency. Favero and Pepi (1995) evaluated the efficiency of 174 Italian banks in 1991, aside from computing bank technical efficiency and scale efficiency through the data envelopment analysis (*DEA*) model, they also employed the regression model to delve further into the factors causing bank inefficiency. Rose (1996) studied 84 large U.S. bank holding companies undergoing interstate bank mergers. Findings showed that, after the bank mergers, operations of banks in four state or two different economic districts were diversified, thus reducing operating costs and bankruptcy probability. Vennet (1996) used the stochastic frontier cost function to conduct an empirical study on the 492 EU credit institution mergers during the 1988–92 period. Findings revealed that bank mergers having adequate scale produced a significant cost efficiency, but bank mergers would not result in economies of scale. Peristiani (1997) employed the distribution-free approach to analyze the 4,900 commercial and savings bank mergers in the U.S. during the 1980–90 period. Findings showed no significant post-merger X efficiency but mergers created economies of scale. Akhavein, Berger, and Humphrey (1997) replaced the traditional cost efficiency analysis with the profit function and conducted a distribution-free empirical study on the USD 100M+ U.S. commercial banks during the 1981–89 period. Findings revealed that mergers could reduce cost and improve profit efficiency of banks. Resti (1997) simultaneously used the parametric approach and *DEA* to compare the operating efficiency of 270 U.S. banks. Empirical findings of the two approaches did not show significant differences, the only difference were in the properties of the two approaches. Bauer, Berger, Ferrier, and Humphrey (1998) simultaneously used four approaches (*DEA*, stochastic frontier cost function, thick frontier analysis, and distribution-free approach) to measure the efficiency score of 683 USD 100M+ U.S. banks

during the 1977–88 period. Empirical findings revealed that the three other approaches obtained more consistent efficiency score, moreover the efficiency scores were higher than that of the *DEA* derived efficiency score. Lang and Welzel (1999) based on an unbalanced panel of all Bavarian cooperative banks for the years of 1989 includes information on 283 mergers, using a frontier cost function with a time-variable stochastic efficiency. It is shown that positive scale and scope effects from a merger arise only if the merged unit close part of the former branch network. Lin (2001) also used the stochastic frontier cost function to analyze the technical inefficiency, allocative inefficiency, and cost inefficiency score of 43 Taiwan commercial banks during the 1997–99 period. The cost inefficiency effects model were later integrated for a further understanding of the effects of bank mergers on the technical inefficiency and cost inefficiency. Findings showed that bank engaging in mergers could improve cost efficiency, as well as improve bank efficiency to veer towards allocative efficiency.

3. Data definition and empirical model construction

3.1. Definition

This study compiled the 1997–99 input and output panel data of 46 Taiwan commercial banks, then integrated Battese and Coelli's (1995) stochastic frontier cost function and cost inefficiency effects model for a two-stage empirical analysis. Data

were gathered from the Taiwan Economic Journal Co. Ltd., *Financial Statistics Abstract* of Bureau of Monetary Affairs of the MOF, and *the Condition and Performance Statistics of Financial Institutions* of the Bank Examination Department of Central Bank. Variable definition and description are shown in Table I.

3.2. Empirical model

(A) Stochastic Frontier Cost Function

$$\ln \left(\frac{C}{P_L} \right)_{nt} = \beta_0 + \beta_1 \ln Q_{nt} + \beta_2 \ln \left(\frac{P_K}{P_L} \right)_{nt} + \beta_3 \ln \left(\frac{P_F}{P_L} \right)_{nt} + V_{nt} + U_{nt} \quad (1)$$

Wherein

- C_{nt} : Total cost of bank n at t period, including labor cost, capital cost, and funding cost.
- P_{nt}^L : Price of labor of bank n during t period.
- Q_{nt} : Loans of bank n during t period.
- P_{nt}^K : Price of capital of bank n during t period.
- P_{nt}^F : Price of funds of bank n during t period.
- $V_{nt} \sim N(0, \sigma_v^2)$: V_{nt} is a symmetrical random error
- $U_{nt} \sim N(0, \sigma_u^2)$: U_{nt} is a random variable with technical inefficiency

(B) Cost Inefficiency Effects Model

$$CIEF_{nt}^M = c_0 + c_1 X_{nt}^1 + c_2 X_{nt}^2 + c_3 X_{nt}^3 + c_4 X_{nt}^4 + c_5 X_{nt}^5 + c_6 X_{nt}^6 + \mu_{nt} \quad (2)$$

TABLE I
Input and output variable definition and description

Variable	Definition	Description
Q	Output	Loans (including business and individual loans) ^a
P_L	Price of labor	Employee salary ÷ total employees
P_K	Price of capital	(Depreciation + agency expense + other operating expense) ÷ net fixed assets
P_F	Price of funds	Interest payments ÷ (Time deposits + current deposits + other loanable funds by deposits)
L	Labor	Total employees
K	Capital	Net fixed assets
F	Funds	Time deposits + current deposits + other loanable funds by deposits
<i>merger</i>	Bank mergers	Merger and non-merger banks ($D = 1$, merger banks; $D = 0$, non-merger banks)
C	Total cost	Labor cost + capital cost + funding cost

^a Bank outputs are mainly loans, check discounting, import/export remittances, overdrafts, payment collection, and allowances for possible losses; most of which are short-term and mid-to-long term loans. Hence, "bank output" in this paper is mainly loans.

Wherein

- $CIEF_{nt}^M$: Post-merger cost inefficiency index of banks.
- X_{nt}^1 : Nonperforming loan ratio of bank n during t period.
- X_{nt}^2 : Loan-to-deposit ratio of bank n during t period.
- X_{nt}^3 : Merger between regular bank and credit cooperative.
- X_{nt}^4 : Merger between a credit cooperative turned bank and credit cooperative.
- X_{nt}^5 : Gross assets of bank n during t period.
- X_{nt}^6 : Ratio of deposit against net value of bank n during t period

In equation (2), the nonperforming loan ratio of banks referred to the percentage of nonperforming loans over total loans; a higher ratio meant poorer quality of loans, higher risks, and lower efficiency. The loan-to-deposit ratio was mainly used to measure the loan and deposit fund utilization of banks. Banks with high operating performance would produce high deposits and loans, and thus a higher loan-to-deposit ratio. In short, the loan-to-deposit ratio is positively related to the bank efficiency. A high loan-to-deposit ratio due to low loan ratio meant poor bank performance and poor operating efficiency; hence the relationship between the loan-to-deposit ratio and bank efficiency is indeterminate. Merger with unsound banks would drag the performance of the sound bank or the credit cooperative turned bank and reduce its operating efficiency; hence one could not ascertain the effects of a merger on the bank efficiency. In terms of economies of scale, the scale of bank is represented by its gross assets. Usually, a greater gross asset figure means higher

organizational cost; it means poor performance quality and high cost inefficiency score. A higher ratio of deposit against net value means better performance quality; therefore, the ratio of deposit against net value is negatively related to the bank cost inefficiency index.

4. Empirical finding analysis

This study compiled panel data of 46 commercial banks in Taiwan during the period from 1997 to 1999. First, we used the FRONTIER Version 4.1 software Tim Coelli designed in 1996 and computed the Cobb-Douglas functional form the regression estimate and cost inefficiency score of each bank.

Table II shows:

- (i) Under a 1% significant standard, a positive significant relationship exists between bank output and total cost.
- (ii) Under a 1% significant standard, a positive significant relationship exists between bank (P_K/P_L) and total cost.
- (iii) Under a 1% significant standard, a negative significant relationship exists between bank (P_F/P_L) and total cost.

Table III reveals the following banks engaging in mergers: Bank of Overseas Chinese that absorbed the Yunlin County Peikang Credit Cooperative in 1997 ranked no. 28 in 1997, in 1998 it went up to no. 17 but in 1999 it dropped down to no. 34. No significant increase was noted in its cost efficiency. Pan Asia Bank that absorbed the Kaohsiung City Tenth Credit Cooperative in 1997 ranked no. 20; but the following year, standing dropped to no. 31. A huge decline was

TABLE II
The estimation of the Cobb-Douglas form Stochastic Frontier Cost Function

Interpreting variables	Coefficient	Standard deviation	t value
Constant	-0.9340	0.1281	-4.2810***
$\ln Q$	00.5939	0.0707	08.3954***
$\ln (P_K/P_L)$	00.1761	0.0271	06.4760***
$\ln (P_F/P_L)$	-0.2393	0.0891	-2.6850***
Total banks	46		
Logarithm likelihood	77.70***		

*** Significant at the 1 percent level.

TABLE III
Cost inefficiency estimates of Taiwan commercial banks

	1997			1998			1999		
	D	Cost inefficiency	Rank	D	Cost inefficiency	Rank	D	Cost inefficiency	Rank
Chiao Tung Bank	0	3.378299	46	0	1.350927	41	0	1.077957	21
The Farmers Bank of China	0	1.042160	09	0	1.099997	19	0	1.042770	05
Central Trust of China	0	1.049154	12	0	1.156823	32	0	1.040133	03
Bank of Taiwan	0	1.051974	15	0	1.026156	01	1	1.039769	02
Taipei Bank	0	1.066742	25	0	1.233515	40	0	1.055276	14
Bank of Kaohsiung	0	1.089055	29	0	2.159566	46	0	1.041510	04
Land Bank of Taiwan	0	1.112757	35	0	1.109221	23	0	1.133370	39
Taiwan Cooperative Bank	0	1.092343	30	0	1.104427	21	0	1.052146	11
First Commercial Bank	0	1.354028	43	0	1.167707	35	0	1.104727	33
Hua Nan Commercial Bank, Ltd.	0	1.428976	45	0	1.132992	26	0	1.092494	26
Chang Hwa Bank	0	1.125589	36	0	1.146482	28	0	1.107046	35
The International Commercial Bank of China	0	1.109208	34	0	1.112590	24	0	1.096095	28
United World Chinese Commercial Bank	0	1.061053	21	0	1.065762	09	0	1.048748	09
Bank of Overseas Chinese	1	1.081319	28	0	1.087285	17	0	1.105431	34
The Shanghai Commercial & Savings Bank	0	1.062266	22	0	1.068508	11	0	1.068032	16
Grand Commercial Bank	0	1.040389	08	0	1.085876	15	0	1.052906	13
Dah An Commercial Bank	0	1.047521	10	0	1.068415	10	0	1.068646	17
Union Bank of Taiwan	0	1.067838	27	0	1.107246	22	0	1.096846	30
The Chinese Bank	0	1.058901	19	0	1.047376	04	0	1.038088	01
Far Eastern International Bank	0	1.039978	07	0	1.047298	03	0	1.070154	18
Asia Pacific Bank	0	1.034938	04	0	1.050074	05	0	1.046342	07
Bank SinoPac	0	1.023804	01	0	1.187287	37	0	1.097771	31
E. Sun Bank	0	1.065077	24	0	1.052744	06	0	1.048313	08
Cosmos Bank, Taiwan	0	1.051407	14	1	1.143608	27	0	1.086221	24
Pan Asia Bank	1	1.059385	20	0	1.155715	31	0	1.073814	19
Chung Shing Bank	1	1.048532	11	0	1.096279	18	1	1.086930	25
Taishin International Bank	0	1.067750	26	1	1.073651	12	0	1.146802	40
Fubon Commercial Bank	0	1.039520	05	0	1.038721	02	0	1.102093	32
Ta Chong Bank Ltd.	0	1.056375	17	1	1.086683	16	0	1.060855	15
Baodao Commercial Bank	0	1.057796	18	0	1.062363	08	0	1.075790	20
En Tie Commercial Bank	0	1.028460	02	1	1.073667	13	0	1.044233	06
Chinatrust Commercial Bank	0	1.131073	37	0	1.531664	44	0	1.163412	42
ChinFon Commercial Bank	0	1.108609	33	1	1.151409	30	0	1.050433	10
Makoto Bank	1	1.242182	39	0	1.123673	25	0	1.171012	43
Sunny Bank	0	1.063192	23	0	1.148572	29	0	1.084083	23
Bank of Panhsin	1	1.049960	13	0	1.080738	14	0	1.081915	22
Lucky Bank	1	1.039525	06	1	1.184270	36	0	1.096738	29
Kao Shin Commercial Bank	0	1.031486	03	1	1.218909	39	0	1.159870	41
The Medium Business Bank of Taiwan	0	1.408188	44	0	1.162985	34	0	1.116656	36
International Bank of Taipei	0	1.055109	16	0	1.0617130	07	0	1.052529	12
Hsinchu International Bank	0	1.102279	31	0	1.102702	20	0	1.093949	27
Taichung Commercial Bank	0	1.104554	32	0	1.447208	43	0	1.118943	37
Tainan Business Bank	0	1.187455	38	0	1.161267	33	0	1.399949	44
Kaohsiung Business Bank	0	1.347658	42	0	1.354152	42	0	1.417750	45
Enterprise Bank of Hualien	0	1.247296	40	0	1.191583	38	0	1.121546	38
Taitung Commercial Bank	0	1.333843	41	0	1.691423	45	0	1.530900	46
Average cost inefficiency of non-merger bank		1.170602			1.181514			1.109870	
Average cost inefficiency of merger bank		1.086817			1.133171			1.063349	

Note: When bank cost inefficiency score is between 1 to ∞ , then a higher cost inefficiency would mean a lower bank cost efficiency.

noted in its cost efficiency.³ Chung Shing Bank absorbed Tainan City Second Credit Cooperative in 1997, then in 1999, it again absorbed the Taichung Fourth Credit Cooperative, completing two mergers within a two-year period. However, its cost efficiency continued to decline and showed no signs of improving. Taishin International Bank absorbed the Tainan First Credit Cooperative in 1998, it was ranked no. 12 that year. The following year, its standing dropped to no. 40. Its post-merger cost efficiency dropped significantly. However in the case of Cosmos Bank, Entie Commercial Bank, and ChinFon Commercial Bank, the merger they executed caused a slight improvement of their cost efficiency. The foregoing cases showed that absorbing unsound credit cooperatives did not significantly upgrade the cost efficiency of sound banks.

Next, we looked into credit cooperatives turned banks engaging in mergers with credit cooperatives. After the reorganization of the Taipei Third Credit Cooperative into the Makoto Bank in 1997, it became bold and ambitious. It absorbed the Hsinchu City Second Credit Cooperative and the Taichung City Eight Credit Cooperative in the same year; its standing rose from no. 37 to no. 25 in 1998; however in the third year, it suffered a dropped to no. 43, thus indicating that cost efficiency posted no significant increase. After its transformation into the Bank of Panhsin in 1997, the Panchiao Credit Cooperative absorbed the Kaohsiung City Fifth Credit Cooperative. Standing dropped by one notch from no. 13, but in the third year, standing fell to no. 22. In 1997, the Taichung Seventh Credit Cooperative was reorganized and became the Seventh Commercial Bank. That same year, it absorbed the Hsinchu Sixth Credit Cooperative and in the following year, it absorbed the Changhwa City Second Credit Cooperative. Cost efficiency fell from no. 6 of 1997 to no. 36 of 1998; however in 1999, it improved slightly and standing rose to no. 29. It showed that cost efficiency has a tendency to drop. In 1997, the Kaohsiung City First Credit Cooperative was reorganized into the Kao Shin Commercial Bank. The following year, it absorbed the Chishan Credit Cooperative. Its standing fell from no. 3 of 1997 to no. 39 of 1998, and in 1999, it further dropped to no. 41. It was noted that in the case of credit cooperative turned bank merger with other credit

cooperatives, cost efficiency would drop significantly.

For the purpose of verifying whether the various factors of cost inefficiency effects model could have a significant effect on cost inefficiency of banks, the study further analyzed the factors affecting the bank cost efficiency. The stochastic frontier cost function estimates were used to compute the effect of such factors on the bank cost inefficiency score. Estimates were as shown in Table IV.

The Table IV data shows that in the cost inefficiency effects model, banks with higher overdue loan ratio would have a higher inefficiency score. This finding is consistent with the perception that banks with higher overdue loan ratio would have poorer performance quality and efficiency. A significant positive correlation was found between deposit-loan ratio and cost inefficiency. A high deposit-loan ratio could be due to the poor performance quality caused low loan ratio, hence bank cost efficiency score is apparently low. A merger between sound and poor-performing banks would post an adverse correlation between merger and cost inefficiency; but correlation would not reach significant levels. This finding is consistent with the idea presented in Table III. In the case of mergers between credit cooperative turned banks merging with credit cooperatives, a significant positive correlation was noted between merger and cost inefficiency. Hence, the merger between a credit cooperative turned bank with another credit cooperative of the same cultural background does not immediately guarantee an increase in clientele and profitability; on the

TABLE IV
Cost inefficiency effect estimates

	Cost inefficiency effects	
	Parametric estimates	<i>t</i> value
Constant	-4.952	-1.696*
X^1	16.607	01.860*
X^2	01.870	01.700*
X^3	-1.254	-1.577
X^4	01.789	01.761*
X^5	00.00034	01.843*
X^6	-0.0019	-0.134

* Significant at the 10 percent level.

TABLE V
Gross assets of Taiwan commercial banks

	1997		1998		1999	
	Gross assets (millions NT\$)	Rank	Gross assets (millions NT\$)	Rank	Gross assets (millions NT\$)	Rank
*Chiao Tung Bank	475,236	12	537,495	11	529,663	13
*The Farmers Bank of China	470,517	13	503,728	13	540,470	12
*Central Trust of China	181,953	20	229,405	19	248,270	18
*Bank of Taiwan	1,768,290	01	1,983,711	01	2,7074,455	1
*Taipei Bank	503,148	10	534,018	12	569,093	11
*Bank of Kaohsiung	137,675	34	148,820	36	164,527	36
*Land Bank of Taiwan	1,185,027	03	1,290,960	03	1,407,395	3
*Taiwan Cooperative Bank	1,428,553	02	1,487,610	02	1,567,821	2
*First Commercial Bank	1,049,286	04	1,124,217	04	1,197,184	4
*Hua Nan Commercial Bank, Ltd.	952,023	05	1,050,862	05	1,082,373	6
*Chang Hwa Bank	927,604	06	1,027,127	06	1,102,272	5
*The International Commercial Bank of China	601,519	08	720,215	8	720,215	8
*United World Chinese Commercial Bank	495,081	11	565,070	10	616,753	10
*Bank of Overseas Chinese	238,591	17	280,442	15	292,630	16
*The Shanghai Commercial & Savings Bank	255,080	14	303,249	14	327,059	14
*Grand Commercial Bank	150,359	27	175,636	30	198,468	26
*Dah An Commercial Bank	144,539	30	177,320	29	183,594	30
*Union Bank of Taiwan	150,231	28	184,807	27	194,476	27
*The Chinese Bank	135,118	35	199,465	24	199,465	25
*Far Eastern International Bank	133,533	36	161,446	32	168,519	34
*Asia Pacific Bank	118,703	38	139,152	38	153,763	37
*Bank SinoPac	172,007	21	192,287	26	204,342	24
*E. Sun Bank	158,980	25	200,245	23	218,495	22
*Cosmos Bank, Taiwan	145,995	29	198,234	25	190,053	28
*Pan Asia Bank	159,462	24	156,075	35	168,765	33
*Chung Shing Bank	154,355	26	203,953	21	227,416	20
*Taishin International Bank	184,479	19	233,044	18	240,722	19
*Fubon Commercial Bank	165,549	22	201,769	22	223,717	21
*Ta Chong Bank Ltd.	139,038	33	157,951	34	180,191	32
*Baodao Commercial Bank	141,524	31	161,426	33	166,660	35
*En Tie Commercial Bank	122,863	37	169,186	31	187,172	29
*Chinatrust Commercial Bank	545,257	09	586,093	09	642,390	09
*ChinFon Commercial Bank	160,351	23	177,618	28	182,555	31
*Makoto Bank	78,491	41	114,017	39	137,990	38
*Sunny Bank	70,762	42	81,996	42	90,162	41
*Bank of Panhsin	91,581	40	86,592	41	88,297	42
*Lucky Bank	63,116	43	74,730	43	81,412	43
*Kao Shin Commercial Bank	52,085	44	53,401	44	52,997	44
*The Medium Business Bank of Taiwan	770,655	07	797,804	07	852,985	07
*International Bank of Taipei	253,275	15	274,100	16	293,027	15
*Hsinchu International Bank	240,950	16	270,980	17	270,461	17
*Taichung Commercial Bank	229,916	18	225,454	20	213,197	23
*Tainan Business Bank	141,019	32	141,148	37	134,810	39
*Kaohsiung Business Bank	91,876	39	94,299	40	94,718	40
*Enterprise Bank of Hualien	42,759	46	52,442	45	48,511	45
*Taitung Commercial Bank	47,671	45	48,999	46	43,569	46

* Banks engaging in mergers in 1997–99.

contrary, it could cause a huge drop in the bank cost efficiency. The significant positive correlation between bank gross assets and cost inefficiency indicated that a higher bank gross assets would also mean higher organizational costs and higher cost inefficiency. Finally, a negative but insignificant correlation was noted between bank cost inefficiency index and bank deposit-against-net-value ratio.

There are thirteen commercial banks engaging in mergers during 1997 and 1999. According to the comparison between the data in Table III and Table V, only Bank of Taiwan, Ta Chong Bank Ltd., and ChinFon Commercial Bank enjoy positive effects of larger gross assets and higher cost efficiency after the merger. Pan Asia Bank and Bank of Panhsin have no scale-growth effect after the merger. The post-merger cost efficiency of the remaining eight banks dropped significantly despite of their larger scale of bank. This result is similar to Aiginger and Tichy (1991) result.

Among the top ten larger commercial banks in Taiwan in 1997–99, except Bank of Taiwan and United World Chinese Commercial Bank, the other eight are inferior to the smaller banks in cost efficiency. Thus, the result is consistent with Nguyen and Reznick's result that a large establishment size is not a necessary condition for efficient production (Nguyen and Reznick, 1991; Nguyen and Lee, 2001).

5. Conclusion

Corporations capable of integrating in the interplay between globalization and intellectual economics could establish strategic alliances founded on their competitive edges to further growth and development. As the saying goes, "merge or submerge". On one hand, as domestic banks set up more branches and expanded service networks, their profits shrank; on the other hand, the development of new technology and open competition among banks took a huge bite out of the traditional commercial bank market. In this period of internal troubles and external problems, in addition to capital infusion and bank mergers, domestic bankers need to ponder on internal restructuring and corporate adjustments for a timely expansion of scale, greater market share, diversified operations, and better operating efficiency. Naturally,

merger is a panacea. A bank merger may cause adverse reactions, such as declining operating efficiency due to overlapping operations, personnel and cultural conflicts, etc., as one can see from the number of unsuccessful bank mergers abroad.

The empirical study findings revealed the following: Firstly, the size of the nonperforming loan ratio, loan-to-deposit ratio, gross assets, and the mergers mode are factors determining the cost inefficiency of banks. A merger between a sound bank and an unsound bank does not have a significant effect on the bank cost efficiency. A merger between a credit cooperative turned bank and another credit cooperative could greatly reduce the cost efficiency of the bank. This is mainly because the proximity of their cultural backgrounds could only bring about a limited effect on market share expansion; on the contrary, the bank will be affected by the poor operating conditions of the cooperative and thus suffer a significant drop in cost efficiency. In other words, in Taiwan, merger between banks of varying cultural background could improve bank cost efficiency; however merger between banks with highly similar setup would make it difficult to open new business grounds. As a result, only a limited improvement could be achieved in terms of cost efficiency.⁴ Secondly, small banks have superior performance. Efficiency would seem to dictate against merger mania. Evidence revealed smaller banks in general are not inferior to larger banks in Taiwan.

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Notes

¹ In late June 2001, The Legislative Yuan passed the third reading of the Security and Finance Management Act, Financial Holding Company Act, Financial Restructuring Fund Institution and Management Procedure, Deposit Insurance Law amendments, Business Tax Law amendments, and the Insurance Law amendments. The move fully indicated the government's resolve for financial reforms.

² See G. E. Battese and Tim Coelli, 'A Model for Technical Inefficiency Effects in a Stochastic Frontier Production

Function for Panel Data', *Empirical Economics*, 20, pp. 325–332.

³ Although Pan Asia acquired 13 more branches after its merger with the Kaohsiung City Tenth Credit, it also absorbed almost NT\$4 billion of the Kaohsiung City loans. As a result, Pan Asia's overdue loan rate in 1998 shot up to 10.05% and losses before tax reached NT\$62 billion.

⁴ This is inconsistent with the government policy to urge mergers between banks with close cultural backgrounds and overlapping business scope for the purpose of reducing bank merger risks.

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