

6. THE IMPACT OF CORPORATE SOCIAL RESPONSIBILITY AND CORPORATE GOVERNANCE ON BANK EFFICIENCY. COMPARATIVE ANALYSIS OF CONSOLIDATED AND NON-CONSOLIDATED BANKS

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Abstract

This study investigates the impacts of corporate social responsibility (CSR) and corporate governance of consolidated and non-consolidated banks on cost efficiency. Taking 37 banks of Taiwan from 2008 to 2016 as the sample and employing stochastic frontier analysis (SFA), we separately discuss these impacts and then use the stochastic metafrontier approach (SMA) to compare the difference in cost efficiency between consolidated banks and non-consolidated banks. The empirical results show that, first, CSR exerts its influence on consolidated banks and improves bank efficiency. Second, in the corporate governance part, the more diverse a board's backgrounds are, the greater is the efficiency of the consolidated bank, while an increase in the share of independent directors in the non-consolidated bank reduces its cost efficiency. In the bank characteristic part, when the proportion of foreign shareholding rises, the cost efficiency of banks declines regardless of consolidated banks or non-consolidated banks. Finally, whether measured by the technology gap ratio (TGR) or meta-cost efficiency (MCE), the efficiency of consolidated banks is better than that of non-consolidated banks.

Keywords: corporate social responsibility, corporate governance, bank consolidation, bank efficiency, stochastic metafrontier approach

JEL Classification: G21, G34, M14

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1. Introduction

Corporate Social Responsibility (CSR) is a topic that has attracted significant attention in recent years and has been gradually incorporated by enterprises in both domestic and international markets. While pursuing profit, creating value, and increasing shareholder wealth, enterprises also realize that it is vital to their success that they fulfill their social responsibilities and implement the goal of sustainable development. Because of globalization and liberalization in Taiwan, many companies have grown rapidly and improved their competitiveness. However, behind growth, they often face challenges such as environmental pollution, tension among employees, and human rights issues. The reason why CSR is valued by enterprises is not only due to ethical standards or the concept of the "reinvest act" (that we make the profits from society and then reinvest them back into the society). In fact, managers may employ CSR to create a strong corporate image, improve their reputation (Barnea and Rubin, 2010; Petrenko, Aime, Ridge, and Hill, 2016), or avoid corporate risk (Jizi, Salama, Dixon, and Stratling, 2014). Certainly, this may also incur agency costs (Masulis and Reza, 2015). Enterprises have paid increasing attention to the promotion of government policies, have actively promoted CSR-related activities, and have participated in various CSR awards. Many studies have also found that those enterprises with CSR are positively related to financial performance (Gao and Zhang, 2015). More research indicates that banks that do participate in CSR can earn higher compensation than those that do not (Barko, Cremers and Renneboog, 2021).

In 2001, accounting scandals broke out in the United States, including those related to Enron and WorldCom, caused by occurrences of accounting fraud. In response, the government launched a reform plan to strengthen its corporate governance standards. Financial institutions are unique in that they often have low transparency, strict supervision, and a high degree of government intervention. Levine (2004), Adams and Mehran (2003), and Macey and O'Hara (2003) emphasize the differences and importance of corporate governance between banks and non-banks. In corporate governance, imperfections in the board of directors often affect operating performance. Lee and Yeh (2004) believe that companies with weak corporate governance are likely to cause economic recession and financial distress, and may condone the self-interested behavior of insiders so that shareholders cannot get their due rewards (Morck *et al.*, 1990; Shleifer and Vishny, 1997). In recent years, there have also been reports of malpractice in Taiwan's financial institutions, such as The Chinese Bank's run-off crisis due to China Rebar Co., Ltd's empty sweeping at the end of 2006, and the case of counterfeit US banknotes at Mega Bank before the Lunar New Year in 2016. The above-mentioned cases are attributed to the negligence of the board of directors, operator abuse, and a lack of bank internal controls. Therefore, corporate governance issues arise with increasing frequency.

In the 1980s, in response to the wave of globalization and financial liberalization, the Taiwanese government opened 16 new banks at once and reorganized credit cooperatives into commercial banks, resulting in excessive competition and a high degree of homogeneity in the banking industry. In order to deter vicious competition, the government actively promoted the merger of financial institutions in 2000.

The types of bank mergers are mainly divided into voluntary mergers of banks and take-overs of troubled banks. An example of the former is the voluntary merger of Taipei Bank with Fubon Commercial Bank in 2005, which changed its name to Taipei Fubon Commercial Bank. Another example is Citi Bank (Taiwan), which merged with Bank of Overseas Chinese in 2007. As for taking over troubled banks, the Financial Restructuring Fund (FRF) was

established by the government in 2001 to eliminate troubled financial institutions and assist banks in categorically assuming or assigning both assets and liabilities of troubled banks. For instance, in 2008, the foreign bank HSBC (Taiwan) could assume both assets and liabilities of the Chinese Bank, and DBS (Taiwan) could assume the assets and liabilities of Bowa Bank.

Until now, most of the literatures on CSR have focused on the relationship between CSR and corporate performance (Jensen, 2001; Jawahar and McLaughlin, 2001; Freeman, Wicks, and Parmar, 2004; Makni, Francoeur, and Bellavance, 2009). Regarding bank mergers and acquisitions, they mainly focus on post-merger performance (Bliss and Rosen, 2001; Morck, Shleifer, and Vishny, 1990; Datta, Iskandar-Datta and Raman, 2001), the impact of mergers and acquisitions on managers and shareholders (Hagendorff, Collins and Keasey, 2007; Bektas and Kaymak, 2009; Brickley and James, 1987) and other viewpoints. There is limited literature discussing the impact of corporate social responsibility and corporate governance on both consolidated and non-consolidated banks.

When banks implement corporate social responsibility and corporate governance, is there any difference in cost efficiency for consolidated and non-consolidated banks? This paper takes 37 banks in Taiwan as the research object. The research period is from 2007 to 2016. First, the stochastic frontier approach (SFA) of Battese and Coelli (1995) is used to estimate the impact of corporate social responsibility and corporate governance on bank efficiency.

In this paper, innovative elements, employing the stochastic metafrontier approach (SMA) by Huang, Huang, and Liu (2014), compare merged banks and non-merged banks under the meta-cost frontier, considering corporate social responsibility and corporate governance. Under the variable, we compare whether the technical gap ratio (TGR) and meta-cost efficiency (MCE) of the two groups are different.

The rest of this paper is organized as follows: Section 2 gives a brief literature review on CSR, corporate governance, and the efficiency of banking consolidation. Section 3 presents model specification of SFA and SMA to estimate the cost efficiency (CE), TGR and MCE. Section 4 provides the empirical results, whereas the last Section concludes the paper.

2. Review of Literature

2.1 Corporate Social Responsibility

CSR in recent years has gradually become a new indicator to evaluate firms in various parts of the world. Through its evaluation, we can grasp the efficiency of managers and market strategies, as business operations not only seek to maximize shareholder profits, but also must attach importance to the rights of other stakeholders. Preston and O'Bannon (1997) put forward the social impact hypothesis of the stakeholder theory, believing that companies should meet the needs of stakeholders to improve corporate reputation. They also indicate that good social performance will affect corporate performance (Jawahar and McLaughlin, 2001; Jensen, 2001; Freeman *et al.*, 2004). There are also opposing views. Friedman (1970) notes the offsetting hypothesis that the business goal of a company is to maximize profits. If a company invests in social responsibility, then it will spend a lot on costs, which will reduce its operating performance. Barnea and Rubin (2010) also find that with the increase in internal ownership a company's commitment to social responsibility decreases, mainly because management's personal interests (such as improving personal reputation or obtaining media coverage) are not able to improve corporate performance and shareholder value. Belasri, Gomes and Pijourlet (2020) employ a DEA Dynamic Network Model and

analyze the impact of CSR on bank efficiency. The empirical results find that in the developing countries with high protection for investors and a high degree of stakeholder orientation, CSR has a positive impact on the banks. Zhu, Stjepcevic, Baležentis, and Yu (2017) conducted a study on Chinese banks and found that a small increase in CSR helps to stimulate productivity; however, when the conditional frontier shifts, CSR shows negative performance on banks, which may be due to increase in taxes, salaries, and other expenses which reduced efficiency. This is a trade-off between the two. In addition, the banking industry is very special and different from other industries, resulting in little attention given to the banking industry in these regards.

2.2 Corporate Governance

Imperfection within the board of directors in corporate governance often affects the operating performance, because the board plays an important role in the internal mechanism of corporate governance. In addition to supervising its internal control, the board of directors must supervise the execution and implementation of high-level managers and be an important bridge between the owner and managers. Past literature mainly discussed board size and board independence. A larger board size indicates better firm performance (Zahra and Pearce, 1989; Lipton and Lorsch, 1992). In a study on independent directors, Lin and Chang (2016) point out that an increase in the proportion of independent directors can improve management consulting and supervision functions, thereby increasing management decision-making and operating performance. Banks with higher return on assets have a relatively higher share of independent directors.

Many scholars have paid attention to the impact of board diversity on a company. Fama (1980) believes that the diversity of board members has an upward impact on the supervision of corporate governance. The existing literature defines the diversity of board members in terms of education level with experience diversity as the main measure. Kim and Lim (2010) found that the academic majors or age of independent directors had a positive relationship with firm performance, but if independent directors were all accountants, it had a negative relationship with firm performance; board diversity was not only related to quantity but it is also affected by quality.

2.3 The Efficiency of Banking Consolidation

Regarding the discussion of bank mergers on bank efficiency, there is no consistent view in the literature. For single country mergers, Egger and Hahn (2010) find that after small-scale banks engage in merger activities, their cost efficiency becomes better than that of larger banks. Humphrey and Vale (2004) show that bank mergers can improve cost efficiency; on the contrary, Rhoades (1993) explores the comparison of bank merger and non-merger efficiency and finds that bank mergers do not significantly improve cost efficiency. Lee, Liang and Huang (2013) found that the bank mergers decrease immediately cost efficiency due to consolidation of equipment and staff, then become more efficient about 3 years after mergers. Financial holding company (FHC) subsidiary banks are more efficient than independent banks.

Based on the correlation between bank mergers and efficiency mentioned above, it may be found that bank mergers and acquisitions in a single country or those involving multinational banks have different effects on efficiency, and the influencing factors are relatively vague and difficult to define. Therefore, this paper divides the sample banks into two groups: merger banks and non-merger banks. We then estimate the impacts of CSR and corporate

governance on their efficiency and further compare the efficiency differences between consolidated banks and non-consolidated banks.

3. Methodology

3.1 Model Specification

Analysis of bank efficiency and productivity can usually be done using parametric and nonparametric methods (Berger and Humphrey, 1997; Berger and Mester, 2003; Casu, Girardone, and Molyneux, 2004). For parametric methods such as SFA, the output of DMU is a function of input, inefficiency, and random error; thus, distribution of the error term must be defined at first. The most used nonparametric method is DEA, a deterministic method based on linear programming; however, it does not take into account "statistical noise" (Andries, 2011). Therefore, we use SFA to estimate bank efficiency.

3.1.1 Stochastic Frontier Analysis (SFA)

According to the panel data model of Battese and Coelli (1995), we estimate all parameters that may affect the efficiency value at the same time as the bank's cost frontier by maximum likelihood method. The translog cost function is used throughout the literature (Rezvanian and Mehdian, 2002; Liang, Chang and Shao, 2018), and the model is set as Equation (1):

$$\begin{aligned} \ln TC_{it} &= \ln TC_{it}^* + u_{it} + v_{it} \\ &= \alpha_0 + \sum_{m=1}^3 \alpha_m \ln Y_{mit} + \sum_{n=1}^3 \beta_n \ln P_{nit} + \delta_1 t + \frac{1}{2} \sum_{m=1}^3 \sum_{k=1}^3 \delta_{mk} \ln Y_{mit} \ln Y_{kit} \\ &\quad + \frac{1}{2} \sum_{n=1}^3 \sum_{k=1}^3 \gamma_{nk} \ln P_{nit} \ln P_{kit} + \frac{1}{2} \delta_2 t^2 + \sum_{m=1}^3 \sum_{n=1}^3 \rho_{mn} \ln Y_{mit} \ln P_{nit} \\ &\quad + \sum_{m=1}^3 \eta_m \ln Y_{mit} t + \sum_{n=1}^3 \varphi_n \ln P_{nit} t + u_{it} + v_{it} \end{aligned} \tag{1}$$

Here, TC_{it} represents the total cost of the decision making unit (DMU); TC_{it}^* is the minimization cost; Y_n is the n^{th} output (loans, investment, and non-interest income, respectively); P_m is the m^{th} input price (price of funding, labor, and capital, respectively); t is time; i is the banking firm; $\alpha, \beta, \delta, \gamma, \rho, \eta, \varphi$ are the coefficients to be estimated; v_{it} and u_{it} are random error terms, assumed to be individually and mutually independent; and u_{it} is a function of firm-specific factors that affect cost inefficiency. Specifically, u_{it} belongs to a truncated normal distribution, given by $u_{it} \sim N^+(m_{it}, \sigma_u^2)$ and $v_{it} \sim N(0, \sigma_v^2)$. The cost inefficiency model of Equation (2) is fully expressed as:

$$m_{it} = \delta_0 + \delta_1 z_{1it} + \delta_2 z_{2it} + \delta_3 z_{3it} + \delta_4 z_{4it} + \delta_5 z_{5it} + \delta_6 z_{6it} + \delta_7 z_{7it} + \delta_8 z_{8it} + \delta_9 z_{9it} + \delta_{10} z_{10it} + \delta_{11} z_{11it} \tag{2}$$

In this equation, i represents the i^{th} different bank; t represents the t^{th} period; δ is the coefficient to be estimated; and z_{it} is the inefficiency factor, including: 1) CSR variables (z_{1it}); 2) corporate governance variables: board education level (z_{2it}), diversity of board members' education and experiences (z_{3it}), board size (z_{4it}), independence of the board of directors (z_{5it}), whether the director is also CEO (z_{6it}), foreign shareholding (z_{7it}); and 3) the bank-specific variables: Z-Score ROE (z_{8it}), overdue loan ratio (z_{9it}), capital adequacy ratio (z_{10it}), and revenue diversification (z_{11it}). The cost inefficiency is set as $CE_{it} = e^{u_{it}}$, and its value is $CE_{it} \geq 1$. The larger the CE value is, the less efficient bank is.

3.1.2 Stochastic Metafrontier Approach (SMA)

Huang *et al.* (2014) propose the metafrontier production functions to measure the efficiency of different DMUs and also consider error term and group heterogeneity (Liang, Chang, Liu, 2019). Liang *et al.* (2018) and Liang *et al.* (2019) also use the Huang *et al.* (2014) model and apply it to the cost function. It is assumed that all DMUs are divided into J groups, and the i^{th} DMU of the j^{th} group is random in period t . The metafrontier cost model is:

$$C_{jit} = f_t^j(X_{jit})e^{V_{jit}+U_{jit}} \quad (3)$$

Among them, $j=1,2,\dots,J$; $i=1,2,\dots,N_j$; $t=1,2,\dots,T$; C_{jit} and X_{jit} are the cost and input of DMU_{*i*} in period t , respectively; and $f_t^j(\cdot)$ is the group frontier of a specific group, which represents the group cost technology of the j^{th} group in period t , reflecting the certainty of the cost frontier. For example, if $f_t^j(X_{jit}) = e^{X_{jit}\beta_t^j}$, β_t^j is the parameter vector to be estimated for the j^{th} group, which is the same as the stochastic frontier model. The random errors V_{jit} represent statistical noise, and the non-negative random errors U_{jit} represent cost inefficiency.

According to Huang *et al.* (2014) and Liang *et al.* (2018), the common underlying metafrontier cost function for all groups in the t^{th} period is defined as:

$$f_t^j(X_{jit}) = f_t^M(X_{jit})e^{U_{jit}^M} \quad (4)$$

Here, $J=1,2,\dots,J$; $i=1,2,\dots,N_i$; and $t=1,2,\dots,T$. $U_{jit}^M \geq 0$. Subsequently, the metafrontier cost must be less than or equal to the group frontier cost $f_t^M(X_{jit}) \leq f_t^j(X_{jit})$.

The DMU's cost efficiency is $CE_{it}^j = \frac{f_t^j(X_{jit})e^{U_{jit}}}{f_t^j(X_{jit})} = e^{U_{jit}}$; a random noise component is $\frac{C_{jit}}{f_t^j(X_{jit})e^{U_{jit}}} = e^{V_{jit}}$, which can be further calculated as $\frac{C_{jit}}{f_t^M(X_{jit})} = TGR_{it}^j \times CE_{it}^j \times e^{V_{jit}}$. Therefore, we know the metafrontier cost efficiency (MCE_{jit}) as:

$$MCE_{jit} = \frac{C_{jit}}{f_i^M(X_{jit})e^{v_{jit}}} = TGR_{it}^j \times CE_{it}^j \quad (5)$$

3.2 Data Sources

This paper uses Taiwanese banks as the research sample. The research period is from 2008 to 2016. The data source comes from the Taiwan Economic Journal (TEJ) database and annual reports of the banks. The research sample consists of 37 banks, divided into two groups: 12 consolidated banks and 25 non-consolidated banks.

3.3 Input-Output Variables

Based on the intermediary method proposed by Ellinger and Neff (1993) as a method to define bank input and output, input variables include: funding, labor, and capital; output variables include: loans, investments, and non-interest income. The basic descriptive statistics of each variable are shown in Table 1. One may see from the table that the total cost of the consolidated bank is significantly higher than that of the non-consolidated bank; the total loan amount of the merging bank and the non-merging bank is higher than the total investment, indicating that the main business of the bank is mainly loans.

Table 1 further compares consolidated and non-consolidated banks. Considering the maximum value, one may see that the non-consolidated banks are the larger banks, so that the total cost of 82.266 billion is higher than the 69.814 billion of the consolidated banks. However, it is at the minimum value, the total cost of non-consolidated banks (926 million) was significantly lower than that of consolidated banks (4.909 billion). Judging from the average of consolidated banks and non-consolidated banks, the average total cost of each consolidated bank is 19.861 billion higher than that of non-consolidated banks of 16.619 billion. There is a significant difference between the two groups of banks that is less than 10% significance level. In terms of output, investment, and non-interest income, each consolidated bank on average is larger than non-consolidated banks; while loan is the opposite, indicating that the non-consolidated bank's business is relatively simple and mainly concentrated in the lending industry; there are significant differences between the two groups of banks in terms of loan and non-interest income. Regarding in capital price, it is obvious that the consolidated bank has increased its capital setting due to merger and the capital price of the consolidated bank higher than the non-consolidated bank.

3.4 Inefficiency Variables

The variable setting of the inefficiency model in this study is mainly divided into corporate social responsibility, corporate governance, and bank-specific variables. As shown in Table 2, the inefficiency variables of consolidated banks and non-consolidated banks, including CSR, Education Level of the Board, Board Members' Education and Experiences, Board Size, Board Independence, Whether the Director Is Also the CEO, Foreign Shareholdings Ratio, Capital Adequacy Ratio and Revenue Diversification; the differences of means are statistically significant at the 1% level.

Table 1. Descriptive Statistics of Variables Used in Cost Efficiency Estimations

	Maximum		Minimum		Std. Dev		Means		Difference of Means	t-value
	MB	NMB	MB	NMB	MB	NMB	MB	NMB		
Total Cost (TC)	69,814,109	82,266,741	4,909,089	926,852	14,842,621	14,906,549	19,861,225	16,619,106	3,242,119	1.793*
Investment (Y1)	954,435,694	1,552,435,399	2,285,445	2,338,824	220,406,251	251,750,968	257,615,061	212,713,452	44,901,609	1.523
Loan(Y2)	1,950,106,672	2,443,783,325	66,419,511	26,423,527	440,083,558	668,747,078	532,231,381	686,426,974	-154,195,593	-2.084**
Non-interest Income (Y3)	36,480,286	17,066,403	761,979	25,581	7,569,898	2,837,223	7,822,251	3,274,208	4,548,043	7.837***
Funding Price (P1)	0.054	0.107	0.002	0.005	0.009	0.013	0.014	0.018	-0.004	-2.381***
Labor Price (P2)	2,024	3,020	745	757	255	372	1,351	1,284	67.716	1.635
Capital Price (P3)	6.523	1.718	0.280	0.065	1.410	0.248	1.286	0.343	0.943	9.715***
No. of observations	97	225	97	225	97	225	97	225		

Note: 1. 12 consolidated banks; 25 non-consolidated banks.

2. Except for labor input as a person, capital price and funding price as a ratio, the remaining units are NT\$1,000.

3. MB: Consolidated Banks; NMB: Non-consolidated Banks.

4. *** means significant at the level of 1%, ** means significant at the level of 5%, and * means significant at the level of 10%.

Table 2. Descriptive Statistics of Variables Employed in Inefficiency Model

	Maximum		Minimun		Std. Dev		Means		Difference	t-value
	MB	NMB	MB	NMB	MB	NMB	MB	NMB		
CSR	1.000	1.000	0.000	0.000	0.503	0.298	0.505	0.098	0.407	9.035***
Education Level of the Board	3.333	3.778	2.375	1.706	0.227	0.432	2.914	2.649	0.265	5.710***
Board Members' Education and Experiences	0.793	0.777	0.153	0.395	0.145	0.071	0.605	0.663	-0.058	-4.811***
Board Size	15.000	19.000	6.000	6.000	2.818	3.231	10.093	12.929	-2.836	-7.501***
Board Independence	0.429	0.444	0.000	0.000	0.087	0.096	0.253	0.197	0.056	4.950***
Whether the Director Is Also the CEO	1.000	1.000	0.000	0.000	0.391	0.468	0.814	0.680	0.134	2.482***
Foreign Shareholdings Ratio	100.000	73.010	0.000	0.000	35.611	20.195	56.375	16.965	39.411	12.573***
Z-Score ROE	16.621	20.633	0.000	-15.942	2.835	2.418	2.068	1.756	0.311	1.005
Overdue Loan Ratio	7.640	4.590	0.040	0.020	0.982	0.700	0.669	0.702	-0.033	-0.344
Capital Adequacy Ratio	30.200	17.900	10.020	7.660	2.583	1.766	13.647	11.813	1.834	7.380***
Revenue Diversification	1.036	0.901	0.248	0.081	0.185	0.155	0.683	0.437	0.246	12.329***
No. of Observations	97	225	97	225	97	225	97	225		

Note: 1. 12 consolidated banks; 25 non-consolidated banks.

2. MB: Consolidated Banks; NMB: Non-consolidated Banks.

3. *** means significant at the level of 1%.

The CSR mean of 0.505 for consolidated banks was significantly higher than that of 0.098 for non-consolidated banks; the means of the consolidated banks were higher than those of the non-consolidated banks for variables such as Education Level of the Board, Board Independence, whether the Director is also the CEO. However, the means of Board Members' Education and Experiences, Board Size of non-consolidated banks were higher than those of consolidated banks. It is speculated that the directors of the non-consolidated banks may not be able to reach a consensus on their own. Consolidated banks' Foreign Shareholdings Ratio is as high as 56.375%, while that of non-consolidated banks is only 16.695%. Although the Z-Score ROE of the consolidated bank is higher, the Overdue Loan Ratio is lower, and its Capital Adequacy Ratio is higher than that of a non-consolidated bank, indicating that its risk tolerance is higher, and the Revenue Diversification is also relatively better.

3.4.1 Corporate Social Responsibility

In order to explore the impact of CSR on the efficiency of banks, this paper refers to Taiwan's CSR awards as the "Corporate Citizenship Award" of Commonwealth Magazine, the "Corporate Social Responsibility Award" of Global Views Magazine, the "Best Social Responsibility Award" of Taiwan Banking and Finance Best Practice Awards, and selected by DJSI. For a dummy variable, if a bank won an award between 2007 and 2016 in one of the above four categories in a specific year, then it is set to 1 and otherwise it is 0.

3.4.2 Corporate Governance

1. Education Level of the Board

Kim and Lim (2010) find that academics have a positive impact on company value and also indicate that companies can solve problems efficiently. This study calculates the education level of board members by separating the board members into groups: if they are below high school, 1; with a college degree, 2; Master's degree, 3; and doctoral degree, 4. The education level scores of all directors of each company are added up and divided by the total number of directors in the year to calculate the average education score of the board of directors.

2. Diversity of Board Members' Education & Experiences

Goodstein *et al.* (1994) distinguish between the level of board members' education and experiences. For banks with innovative power, management typically has a higher educational background and academic diversity (Bantel and Jackson, 1989). This research refers to Aebi, Sabato, and Schmid (2012) and Gray and Nowland (2017) for classification and uses four major categories: financial background, government, academic, and business management. We further refer to Kim and Lim (2010) to calculate the HHI of banking experience over the years. A higher value means a greater degree of dispersion - that is, higher diversity.

3. Board Size

Zahra and Pearce (1989) and Lipton and Lorsch (1992) find that the larger the size of the board of directors is, the wider the board functions are, and the better is the performance of the company. However, Chu *et al.* (2016) point out that board size and banks' merger performance are negatively correlated.

4. Board Independence

Independence among the board of directors helps to enhance supervisory functions and professionalism and can also strengthen management decision-making. Therefore, the independence of the board of directors has a positive impact on corporate performance

(Linck, Netter, and Yang, 2008; Adams and Ferreira, 2009; Adams, 2012; Lin and Chang, 2016).

5. Whether the Director Is Also the CEO

Adams, Almeida, and Ferreira (2005) point out that a director concurrently serving as a CEO has a significant impact on the company's decision-making; Jo and Harjoto (2011) hold different views in that whether a director concurrently serves as a CEO does not affect corporate value. In this study, a dummy variable is set. If the CEO and director are the same person, then the dummy variable is set to 1 and otherwise to 0.

6. Foreign Shareholdings

Khanna and Palepu (1999) note that the ratio of foreign shareholding significantly and positively correlates with corporate value and state that foreign institutional investors can play a supervisory role.

3.4.3 Bank Characteristic Variables

1. Z-Score ROE

To measure a bank's bankruptcy risk, Konishi and Yasuda (2004) and Stiroh (2004) show that there is a significant relationship between a bank's risk incentives and performance. The higher the value is, the lower is the probability of a bank's bankruptcy.

2. Overdue Loan Ratio

Hughes and Mester (1993) state that when banks have higher overpayment ratios, they pay higher risk premiums and are less cost-effective. This study uses the ratio of overdue loans to total loans as the overdue loan ratio to measure the quality of bank credit. The lower the ratio is, the better the bank's ability to control credit risk is, which will help improve bank efficiency.

3. Capital Adequacy Ratio

The higher the bank's capital adequacy rate is, the more stable the operational structure is, the more protection public deposits have, the better the safety is, and better are its operational and financial performances. The higher the capital adequacy ratio is, the higher the risk tolerance and the bank's efficiency are.

In order to avoid selected variables exhibiting inefficiency due to high correlation, as collinearity leads to estimation bias, this paper therefore analyzes the correlation coefficient. The correlation coefficient between the variables is lower than 0.6, and so there is no high correlation. The basic narrative statistics of the inefficiency variables of consolidated banks and non-consolidated banks are shown in Table 2.

4. Revenue Diversification

The degree of diversification in the banking industry means diversified services to clients and customers, but it has a negative impact on banks' efficiency, indicating that the higher the diversification of bank revenue is, the worse is its efficiency. This paper refers to Laeven and Levine (2007) for a dummy variable with a value between 0 and 1. The higher the value is, the greater the diversification of bank revenue is.

In order to prevent the selected inefficiency variables from being too correlated, collinearity leads to estimation bias. Therefore, the correlation coefficient analysis is carried out in this paper. The correlation coefficients between the variables are all lower than 0.6, so there is no high correlation. The basic narrative statistics of the inefficiency variables of merging banks and non-merging banks are shown in Table 2. It can be seen in the table that firstly, the CSR merging banks are significantly larger than the non-merging banks, indicating that

the merging banks invest more in CSR; at the corporate governance level, the directors of the merged bank have a higher education level, indicating that the directors of the merged bank have a higher educational background, while the non-merged bank has a higher diversity of directors' educational experiences and a larger number of directors; third, the income diversification of consolidated banks is significantly greater than that of non-consolidated banks, indicating that consolidated banks can provide more diversified services.

4. Empirical Results

4.1 Stochastic Frontier Model Analysis

We implemented the maximum likelihood estimation method to simultaneously estimate the stochastic cost function and the inefficient model of Battese and Coelli (1995). Table 3 shows the estimated results of stochastic frontier cost functions for consolidated and non-consolidated banks. Before estimating the stochastic frontier cost functions for the two groups of banks, we employed the likelihood ratio (LR) test to verify whether the proposed inefficiency model was well specified. The LR test was performed by using the following formula: $LR = -2 \{ \ln[L(H_0)] - \ln[L(H_1)] \}$. The results showed that the LR statistic for consolidated banks was 84.71 and that for non-consolidated banks was 113.42. Both statistics significantly rejected H_0 and implied the suitability of the proposed inefficiency model.

In Table 3, more than half of the estimated cost function variables in both groups are at the 10% significance level, indicating a good fit for the stochastic frontier model. We further calculated the cost-efficiency of each bank by defining the cost-efficiency function as $CE_{kt} = e^{u_{kt}}$, where: $1 < CE_{kt} < \infty$. As a result, we found efficiency values between 1 and ∞ , closer to 1 showing the higher levels of efficiency (Liang, Chang, and Shao, 2018).

4.2 The Inefficiency Model

Table 3 shows the empirical results of the inefficiency model of consolidated banks and non-consolidated banks. The following explains the three categories of corporate social responsibility, corporate governance, and bank characteristics.

Table3. Empirical Results of the Stochastic Cost Frontier and Inefficiency Model

Variables	Consolidated Banks			Non-consolidated Banks				
	Coefficient	Std. Dev.	t value	Coefficient	Std. Dev.	t value		
Constant	-7.3798	***	0.9910	-7.44654	0.2791	1.7765	0.157104	
lnY1	0.7867		0.7612	1.033414	-0.2883	0.6362	-0.45313	
lnY2	-6.4407	***	1.0998	-5.85614	-1.5768	**	0.6336	-2.4887
lnY3	6.5988	***	1.5466	4.26676	2.2188	***	0.8083	2.744982
ln(P1/P2)	-0.6286		0.9763	-0.64392	-1.9753	***	0.7134	-2.7688
ln(P3/P2)	-3.7954	***	1.1315	-3.35429	1.2166	*	0.7112	1.710488
1/2*(lnY1)2	0.0914		0.0617	1.481093	0.0586	*	0.0320	1.832156
1/2*(lnY2)2	0.8764	***	0.0901	9.729359	-0.1334		0.1515	-0.88073
1/2*(lnY3)2	0.4911	***	0.0766	6.409749	0.0607		0.1699	0.3575
lnY1*lnY2	-0.0510		0.0366	-1.3939	0.1190	**	0.0603	1.974426
lnY1*lnY3	-0.1500	***	0.0521	-2.87764	-0.1564	***	0.0537	-2.91364

Variables	Consolidated Banks			Non-consolidated Banks				
	Coefficient	Std. Dev.	t value	Coefficient	Std. Dev.	t value		
$\ln Y_2 * \ln Y_3$	-0.5210	***	0.1349	-3.86088	0.0650	0.1521	0.427494	
$1/2 * [\ln(P1/P2)]^2$	-0.0649		0.0605	-1.07304	-0.1003	0.0792	-1.26519	
$1/2 * [\ln(P3/P2)]^2$	-0.1695	***	0.0586	-2.89329	-0.1270	0.1344	-0.94549	
$\ln(P1/P2) * \ln(P3/P2)$	-0.0203		0.0607	-0.33363	0.0260	0.0670	0.388112	
$\ln Y_1 * \ln(P1/P2)$	-0.0740	**	0.0304	-2.43109	0.0094	0.0336	0.279616	
$\ln Y_1 * \ln(P3/P2)$	0.0112		0.0900	0.124072	0.0686	0.0427	1.609257	
$\ln Y_2 * \ln(P1/P2)$	0.0297		0.0909	0.326743	0.1132	0.0842	1.344205	
$\ln Y_2 * \ln(P3/P2)$	0.1309		0.0944	1.385814	-0.3456	***	0.1532	-2.25632
$\ln Y_3 * \ln(P1/P2)$	0.0663		0.0769	0.861578	-0.0698	0.0758	-0.92065	
$\ln Y_3 * \ln(P3/P2)$	-0.0138		0.0337	-0.40985	0.2608	**	0.1458	1.788922
$t * \ln Y_1$	0.0283	***	0.0102	2.781503	-0.0105	0.0092	-1.13782	
$t * \ln Y_2$	-0.0453	**	0.0188	-2.41383	0.0020	0.0160	0.127504	
$t * \ln Y_3$	0.0212	*	0.0118	1.786049	0.0123	0.0158	0.779347	
$t * \ln(P1/P2)$	-0.0232	***	0.0083	-2.80685	-0.0452	***	0.0106	-4.27346
$t * \ln(P3/P2)$	-0.0422	***	0.0045	-9.28565	-0.0086	0.0143	-0.60266	
t	-0.5629	***	0.1349	-4.17322	-0.7242	***	0.1148	-6.30785
t^2	-0.0021		0.0014	-1.55113	0.0044	*	0.0025	1.739292
Constant	-2.1993	***	0.7827	-2.8101	2.2801	***	0.3816	5.9757
Inefficiency model: (dependent variables is U_{it})								
CSR	-0.1850	***	0.0668	-2.7710	0.1303	*	0.0738	1.7648
Corporate Governance								
Education Level of the Board	0.4848	***	0.0955	5.0788	-0.7135	***	0.0559	-12.7681
Board Members' Education & Experiences	-0.914	***	0.3296	-2.7753	0.3910		0.2710	1.4425
Board Size	0.0609	***	0.0183	3.3336	-0.0307	***	0.0044	-7.0224
Board Independence	-0.0830		0.3554	-0.2336	0.5541	***	0.1980	2.7991
Whether the Director Is Also the CEO	-0.4485	***	0.0907	-4.9466	0.1420	***	0.0450	3.1526
Foreign Shareholdings	0.0078	***	0.0016	5.0365	0.0036	**	0.0014	2.5136
Bank-Specific Characteristics								
Z-Score ROE	0.0442	***	0.0155	2.8539	0.0012		0.0063	0.1858
Overdue Loan Ratio	0.0715	**	0.0354	2.0186	0.0148		0.0426	0.3486
Capital Adequacy Ratio	0.0396	**	0.0177	2.2329	-0.0180		0.0154	-1.1671
Revenue Diversification	-0.1499		0.2717	-0.5518	-0.6661	***	0.1997	-3.3361
σ^2	0.0349	***	0.0028	12.5602	0.0239	***	0.0022	10.9151
γ	0.9993	***	0.0004	2630.0046	0.2023	***	0.0344	5.8881

Variables	Consolidated Banks			Non-consolidated Banks		
	Coefficient	Std. Dev.	t value	Coefficient	Std. Dev.	t value
log likelihood function	121.3496			115.6294		
LR test	84.7135			113.4239		

Note: *** means significant at the level of 1%, ** means significant at the level of 5%, and * means significant at the level of 10%.

4.2.1 Corporate Social Responsibility

For a consolidated bank, the more it invests in CSR, the higher is its cost efficiency. According to Social Impact Hypothesis (Freeman *et al.*, 2004; Hull and Rothenberg, 2008; Kapoor and Sandhu, 2010), this is because when a bank invests more in CSR, it can produce positive effects and indirectly bring about benefits, the combined making the bank to exhibit better cost efficiency. Conversely, the less CSR is invested in, the higher the cost efficiency will be, and the benefits will be lower than the investment cost, which will increase the cost efficiency of non-consolidated banks, based on Shift of Focus Hypothesis (Becchetti *et al.*, 2007; Makni *et al.*, 2009).

4.2.2 Corporate Governance Variables

1. Education Level of Board Members

Consolidated banks show that the more educated board members are, the less cost-effective the bank is because they tend to hold strong opinions about their views. This is due to the greater difference in the structure of the board of directors of the consolidated bank. The higher the level of education is, the greater is the potential cost. It may be that a higher education level leads to autonomy or divergence of directors, making it more difficult to reach a consensus, which reduces team cohesion and efficiency (Westphal and Milton, 2000). Conversely, for non-consolidated banks, since their board members are relatively stable and their academic qualifications are higher, the professional capabilities of non-consolidated banks help improve their cost efficiency (Kim and Lim, 2010).

2. Board Members' Education & Experiences

For a consolidated bank, the greater the diversity of the board's academic background is, the more efficient a bank can be, because the background of diversified board members can mean different views and solutions to problems, thus preventing the board of directors from colliding with senior managers (Fama and Jensen, 1983). It is estimated that different professional backgrounds not only can complement each other, but also properly evaluate an issue before making a decision, reducing operational risks and costs. On the contrary, the background variables and efficiency of the board of directors of non-consolidated banks are not significant and have no clear impact.

3. Board Size

For a consolidated bank, the larger the number of board members is, the more complicated the communication and coordination issues are, which make it difficult for the organization to integrate opinions and reach a consensus. Thus, there is less decision-making efficiency that produces unfavorable performance (Jensen, 1993), thereby reducing a bank's cost effectiveness. Conversely, if the board of directors is larger, then different opinions and views based on diverse viewpoints of directors can help a bank's operating efficiency and improve its cost efficiency (Coles, Daniel, and Naveen, 2008).

4. Board Independence

As far as merging banks are concerned, although independent directors can improve their cost efficiency, they are not statistically significant and have no clear benefits. On the contrary, independent directors of non-consolidated banks do not exert their benefits and cannot reduce cost efficiency. However, an increase in the share of independent directors may harm the interests of banks and shareholders' equity (Jensen and Mecking, 1976).

5. Whether the Director Is Also the CEO

For a consolidated bank, the director concurrently serving as the CEO can help improve cost efficiency, because he can obtain all aspects of information at any time, which helps the bank grasp the operational overview (Weir and Laing, 2001), therefore facilitating the cost efficiency of consolidated banks. On the contrary, for non-consolidated banks, directors serving as CEOs reduce their cost efficiency. When directors serve as CEOs, they play the roles of both executive and supervisor at the same time, which lead to excessive power and reduce the capability of supervision, thus decreasing bank efficiency (Patton and Baker, 1987).

6. Proportion of Foreign Shareholdings

Whether it is a consolidated bank or a non-consolidated bank, as foreign shareholding increases, its cost efficiency drops. The reason is that foreign capital entering the domestic bank will increase the cost of the domestic bank due to the improvement of its operations or the adjustment of the organizational structure. Moreover, the cost efficiency of the bank will be reduced before the benefits are realized (Lensink and Niels, 2005).

4.2.3 Bank-Specific Variables

1. Z-Score ROE

This study measures the risk of bank failure by using Z-Score ROE as the proxy variable. As far as consolidated banks are concerned, the higher the Z-score ROE value is, the greater is the probability of bank bankruptcy, which reduces its cost efficiency (Chortareas *et al.*, 2012). As for non-consolidated banks, although the results are the same, they are not statistically significant and have no clear impact.

2. Overdue Loan Ratio

An increase in the overdue loan ratio will reduce a consolidated bank's cost efficiency. The reason is that as the overdue loan ratio increases, it will raise the bank's bad debts and increase costs (Drake and Hall, 2003). Non-consolidated banks show the same results, but they are not statistically significant, and the impact is less clear.

3. Capital Adequacy Ratio

For a consolidated bank, when its capital adequacy ratio increases, its cost efficiency drops. Mester (1996) uses the moral crisis viewpoint to explain the opportunities for increasing the capital adequacy ratio to reduce moral hazard - that is, increasing the capital adequacy ratio can significantly cut the cost efficiency of banks. For non-consolidated banks, increasing the capital adequacy ratio can improve their cost efficiency, but it is not statistically significant, and the impact is less clear.

4. Revenue Diversification

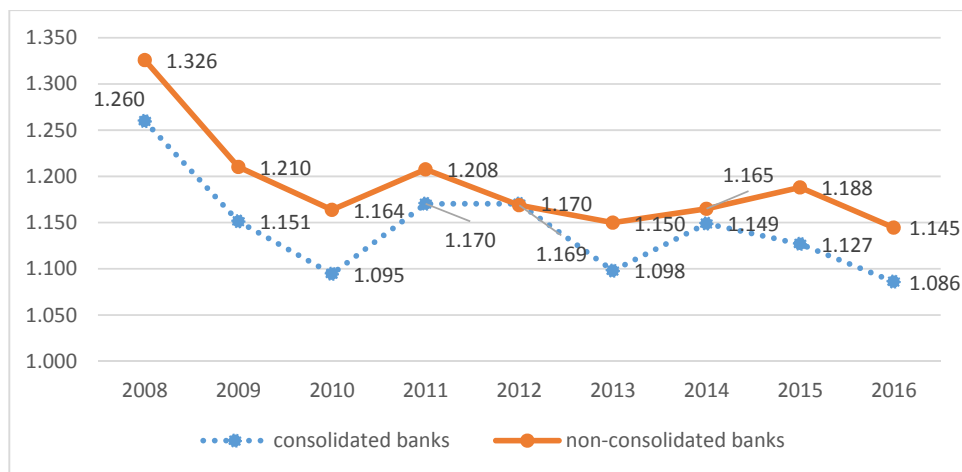
Regarding merging banks, although revenue diversification can improve their cost efficiency, it has no clear impact, because the data are not statistically significant. As for non-consolidated banks, the higher the degree of diversification of revenue is, the more room for improving cost efficiency is. It means that through diversification, the dispersion of different

products reduces operating risks, reduces financial pressure or costs, and can play the role of related benefits from economies of scale. This improves profitability and efficiency of banks (Boot and Schmeits, 2000; Elsas, Hackethal, and Holzhäuser, 2010).

4.3. Cost Efficiency (CE) of Consolidated Banks and Non-consolidated Banks

This study uses a stochastic frontier approach to estimate the cost efficiency (CE) of consolidated and non-consolidated banks. In this paper, the CE values range between 1 and ∞ , and the closer the value is to 1, the more efficient the bank is. Figure 1 shows the CE of consolidated and non-consolidated banks. From 2008 to 2016, except for 2012, when the CE of non-consolidated and consolidated banks was close, the rest of the period showed that consolidated banks outperformed non-consolidated banks. The bank's results suggest that greater consolidation and better economies of scale and scope contribute to cost efficiencies.

Figure 1. The Cost Efficiency (CE) of Consolidated Banks and Non-Consolidated Banks

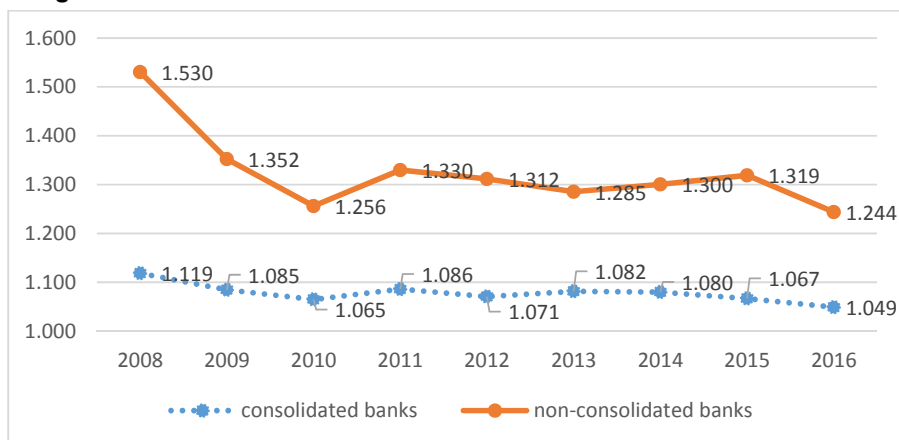


4.4 Metafrontier Cost Analysis

4.4.1 Technology Gap Ratio (TGR)

Figure 2 shows the average technology gap ratio (TGR) of consolidated banks and non-consolidated banks. From 2008 to 2016, the TGR of consolidated banks was better than that of non-consolidated banks and was closer to 1, showing that the cost of consolidated banks' control is more technically efficient, making the resource allocation effect better and relatively close to the cost edge. The TGR ratio of consolidated and non-consolidated banks ranges between 1.0330 and 1.7788.

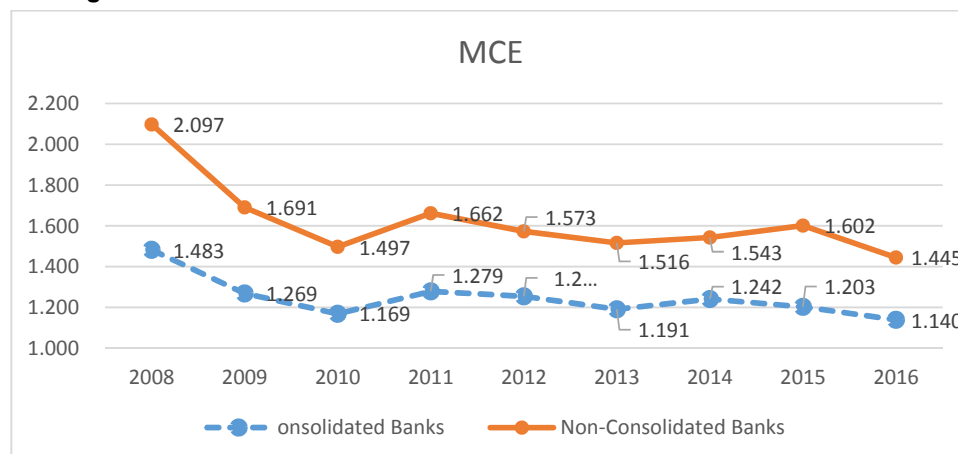
Figure 2. The TGR of Consolidated Banks and Non-Consolidated Banks



4.4.2 Meta-Cost Efficiency (MCE)

Figure 3 shows the meta-cost efficiency of consolidated banks and non-consolidated banks. From 2008 to 2016, the meta-cost efficiency (MCE) of consolidated banks decreased from 1.119 in 2008 to 1.049 in 2016; the MCE of non-consolidated banks decreased from 1.530 in 2008 to 1.244 in 2016. This shows that consolidated banks are closer to the frontier of the cost function than non-consolidated banks and are more efficient. It shows that the economies of scale produced by merged banks can help improve the cost efficiency of banks. In 2008, affected by the financial turmoil, the MCE gap between consolidated banks and non-consolidated banks was relatively large, and the gap was relatively small after that. Liang *et al.* (2018) showed that DJSI banks' MCE is lower than that of non-DJSI banks. However, both of their inefficiencies increased in 2008 owing to the impact of the financial crisis. This paper, considering CSR and corporate governance obtained similar results.

Figure 3. The MCE of Consolidated Banks and Non-Consolidated Banks



5. Conclusions

In recent years, the issues of corporate social responsibility and corporate governance have gradually received attention. Few works in the literature discuss the impact of bank efficiency on corporate social responsibility and corporate governance at the same time. According to the empirical results, this study finds that CSR does help to improve the cost-efficiency of the merging banks. The reason is that when a bank invests more in corporate social responsibility, it can make the merged bank have a positive image effect and gain public recognition, indirectly bringing benefits and contributions (Tsoutsoura, 2004); when implementing CSR, its risk may be lower (Albuquerque *et al.*, 2020; Broadstock *et al.*, 2020), showing that when merging banks expand their scale through mergers and acquisitions, they are more actively engaged in corporate social responsibility to build corporate image, improve performance, and reduce costs. On the contrary, the more non-consolidated banks invest in CSR, the lower the cost efficiency, which shows that the investment cost of the bank is higher than the benefit of CSR (Becchetti and Kobeissi, 2012). If a bank engages in CSR only to increase its personal reputation and internal power, it will reduce the efficiency of the bank (Chahine, Fang, Hasan, and Mazboudi, 2019).

Therefore, this study suggests that consolidated banks should actively engage in CSR activities as their business strategy, which can reshape the bank's image, improve its performance, reduce risks, and thus improve its efficiency. Conversely, for non-merged banks, banks engage in CSR only for personal reputation, which reduces efficiency. Taiwanese banks should actively engage in mergers and acquisitions, as economies of scale bring cost reductions and improve their technical and cost efficiencies.

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