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The Effects of Ownership Structure on Bank Efficiency for Taiwan: Is there a Non-Linear Relationship?

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Abstract

To investigate the impact of ownership structure and concentration on bank efficiency in the case of Taiwan, we consider the non-linear relationship between ownership and efficiency, using the panel threshold model technique to test whether a non-linear relationship is significant. Empirical findings indicate that ownership structure is significantly impacted by bank efficiency; the results show that managerial ownership negatively relates to efficiency and ownership concentration, and state-ownership has no regard for bank efficiency. The results show that the threshold effect is significant, implying a significant non-linear relationship between board ownership and efficiency. This supports the form of non-linear relation as found in previous literature.

JEL Classification: G21, G34.
Keywords: Ownership structure, Concentration, Panel threshold model.

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1. Introduction

Since the original study of Jensen and Meckling (1976), the relationship between ownership structure and firm performance has been one of the most important issues in corporate finance. They argued that a fraction of larger insider shareholder ownership might reduce agency problems, insider shareholding ratio is lower while the outsider shareholder is at a relatively higher level, and this condition may give insider shareholders an incentive to act in a way that benefits their own interest and to expropriate outsider or minority shareholders. The primary focus of concern has been the potential conflict of interest between managers and shareholders; traditional agency theory illustrated that managers have a higher incentive to expropriate minority shareholder rights while managers only hold a few shares.

To limit these agency conflicts, various mechanisms have been suggested on how to work in corporate governance. Most studies illustrate various governance issues with ownership structure, executive turnover, executive compensation, and foreign investment. The foreign ownership-efficiency relationship is the subject of a wide range of international empirical studies (Zhao et al. 2020), which particularly focus on testing the global and home-field advantage hypothesis. This study examined the relationship between bank efficiency and ownership in Taiwan, as a governance mechanism examined by ownership structure, the structure of institutional investors, ownership concentration, and to further explore whether there exists a non-linear relationship between ownership and efficiency at different ranges of ownership.

This study provides an interesting case study of corporate governance and efficiency for three primary reasons. First, most studies focus on how ownership affects the banks' efficiency, e.g. Demsetz and Lehn, 1985, Ang et al., 2000 within the US, Kapopoulos and Lazaretou, 2007 within Greece, and Lemmon and Lins, 2003, within East Asian countries. They often use the accounting rate to measure the firm performance, such as return of asset, Tobins' Q. In our known few studies that explore the relationship between ownership and efficiency score, an econometric model may provide an appropriate indicator to proxy firm performance, thus this study attempts to use two approaches to measure efficiency score: data envelopment analysis and distribution-free approach.

Second, like in most developing countries, the bank's board members are similar family-controlled in Taiwan, and there are no outside block shareholders to monitor and prevent insider expropriation of minority shareholders. The family board controls the bank and makes decisions with regard to corporate operations, business strategy, and human resource management. As a result, no credible supervisor provides incentives to the board members to make decisions that benefit their interests and expropriate minority shareholders[3]. Taiwan is a model for newly emerging countries and a valuable case for corporate governance; this study will

[3] Li et al. (2004) found that mixed banks have the highest technical efficiency and that private banks have the lowest technical efficiency. They considered that bureaucratic power still plays an important role in improving efficiency and that mixed banks benefit from balancing bureaucratic power and internal incentive schemes.

test whether corporate governance is ineffective by estimating the link between ownership structure and efficiency.

Thirdly, in a classic study, Morck et al. (1988) proposed that insider ownership and performance is a non-linear relationship by piecewise linear regression. Most papers follow this topic to further illustrate their relationships, such as Chen et al. (1993), and Kapopoulos and Lazaretou (2007). This study attempts to investigate whether a linear or non-linear relationship between ownership structure and banks' efficiency is significant, to avoid subjectively setting the boundary of ownership structure that may lead to bias; following Hansen (1999), this study provides a new technique to test it, so the panel threshold model is used.

This paper is organized as follows: section one contains the introduction; section two describes the model specification, data source, and empirical design; and section three presents the empirical results and findings pertaining to ownership structures, concentration and testing for non-linear relation. The paper ends with a conclusion, which makes some suggestions for regulatory policy to improve the corporate governance of the banking industry.

2. Methodology

2.1 Efficiency measurement

Previous studies in banking literature consider the measurement of bank efficiency to be an important problem; in an attempt to find a solution to this problem, this study used parametric and non-parametric approaches to measure bank efficiency. The contemporary empirical literature on efficiency of banks employs "frontier-based approaches" to measure the relative efficiency of banks. To estimate cost efficiency, suppose that in addition to the assumption cost efficiency is $\mathrm{C} = w^T x^E / w^T x^A$, where w is input price vector, $\mathrm{C}(\mathrm{y}, \mathrm{w}) = w^T x^E$ is efficient total cost, input vector x^A. Input prices $\mathrm{p} \in \mathbb{R}_+^N$ are given.

Thus, calculated for production plan (y, x) of production unit *i* as the solution to the linear programming problem as below:

$$\min_{\lambda,\emptyset} \sum_{\mathrm{i}} \mathrm{P_m x_n}$$

$$\text{s.t. } \mathrm{y_{i,m}} \leq \sum_{\mathrm{i}} \emptyset_{\mathrm{i}} \mathrm{y_{im}}, \quad \mathrm{m} = 1, \cdots \mathrm{M}$$

$$\sum_{\mathrm{i}} \emptyset_{\mathrm{i}} \mathrm{x_{in}} \leq \lambda \mathrm{x_{in}}, \quad \mathrm{n} = 1, \cdots, \mathrm{N}; \ \emptyset_{\mathrm{i}} \geq 0, \mathrm{i} = 1, \cdots, \mathrm{I} \tag{1}$$

Where: $\emptyset$ is a scaling vector for the production plans, λ is efficiency scale.

Cost efficiency attains a value of less than unity if and only if at least one of its three components attains a value of less than unity. Cost efficiency is decomposed as below:

$$\mathrm{C_j}(\mathrm{y^i}, \mathrm{x^i}) = \mathrm{A_j}(\mathrm{y^i}, \mathrm{p^i}, \mathrm{x^i}) . \mathrm{S_j}(\mathrm{y^i}, \mathrm{x^i}) . \mathrm{T_j}(\mathrm{y^i}, \mathrm{x^i}) \tag{2}$$

Where: $A_j(y^i, p^i, x^i)$ is allocative efficiency, $S_j(y^i, x^i)$ is efficiency size of scale $T_j(y^i, x^i)$ is technical efficiency.

On the other hand, we also use the parametric approach to measure banks efficiency, cost x-efficiency measures the extent to which a bank's cost approximate those of the best practice or least cost bank, producing an identical output bundle under the same conditions. The measure is derived from a cost function where the dependent variable is each bank's total cost, and the independent variables include the prices of inputs, the quantities of variable outputs and the composite error term, a general version of this cost function for a bank may be written as:

$$\ln C_{it} = \ln C_t(y_{it}, w_{jt}) + \ln u_t + \ln v_{it} \tag{3}$$

The error term is $\varepsilon_i = u_i + v_i$ and decomposes into two parts, which v_{it} is the conventional white noise and a mean-zero random error incorporating the measurement error or a random shock to bank costs deemed occasional, while u_{it} is a multiplicative X-inefficiency factor that may raise costs above the best-practice level. X-inefficiency $\ln \hat{u}_i$ is estimated econometrically, it reflects any failure to minimize the total cost of production and the residual is calculated as $ln\hat{u}_t^{min} - ln\hat{u}_{it}$. The function $ln\hat{u}_i$ is transformed into a normalised X-efficiency measure as follows:

$$XEFF_{it} = \exp\left(\ln\hat{u}_t^{min} - \ln\hat{u}_{it}\right) \tag{4}$$

where $ln\hat{u}_t^{min}$ indicates the minimum in all banks and $ln\hat{u}_{it}$ for all *i* bank for that *t*. while it may be seen that this is an estimate of $\hat{u}^{min}/\hat{u}_i$. Suppose that the XEFF value equals one; this would indicate that the firm is the most efficient and ranges over (0~1)[4].

The input-output specification of this paper is based on the intermediation approach as suggested by Berger (1995); most studies are followed the intermediation approach definition of input-output variables such as Shen (2005) and Liao (2020), where the salary expense, capital expense, and interest expense as the input factors are used to produce earning assets, and salary, capital and interest price. The three outputs are total loans, investment, and non-interest revenues. Total loans include short-, medium- and long-term loans, overdrafts, discounts, and advances on imports. The primary data source for this study was the *Taiwan Economics Journal* (TEJ); the samples included 29 listed banks during the period from 1994 to 2010, a total observation of 453 in the entire sample, and 20 banks build a panel data sample observation is 340. Descriptive statistics of the empirical variables are provided in Table 1.

[4] More detail describes how to calculate x-efficiency, see Berger (1995).

Table 1: Descriptive statistics of Cost Function (Unit: million)

	Mean	**Std.**	**Max.**	**Min.**
Total cost	20,862.3	2.324.3	1.114E-5	581
Output				
Investment	94,079.14	1.308	1.092E-6	711
Loans	4.06E-5	4.217	2.08E-6	23,393
Non interest revenues	5,679.6	6,921	5,679	608
Input price				
Labor price	917.52	342.2	4760.43	149.01
Fund price	0.4272	0.3087	4.1083	0.006
Capital price	0.0332	0.0198	0.076	0.0046

Note: The labor price unit measure by thousand, fund and Capital price measure by percent。

2.2 Non-linear relationship and Panel threshold model

Previous studies attempt to explore the non-linear relationship between ownership and firm performance. In a classic study, Morck et al. (1988) proposed that insider ownership and performance is a non-linear relationship. Most papers follow this topic to illustrate further their relationships, such as Chen et al. (1993) and Kapopoulos and Lazaretou (2007). They often use a piecewise linear regression, which divides a different range of ownership and runs regression by statistics technique, such as Morck et al. (1988), and finds a negative relationship between performance and managerial ownership at a low range of ownership (0%–5%), but a positive relationship at the middle range (5%–25%). To avoid a subjective set, a threshold value identical across all observations in the study sample may cause biased results. This study used a panel threshold method to test whether a non-linear or linear relationship between ownership and efficiency is significant. Based on these arguments, We propose the following hypothesis:

H_1: The relationship between ownership and bank efficiency is non-linear.

To briefly describe the panel threshold model, We assume that the data are from a balance panel $[y_{it,}q_{it}, x_{it}; 1 \le i \le n, 1 \le t \le T]$, where dependent variabley_{it} is scalar and the repressors x_{it} is a k vector, i indicates the individual and the t indicates time. The threshold function is followed as:

$$y_{it} = \alpha_i + \beta_1' x_{it} I(q_{it} \le \gamma) + \beta_2' x_{it} I(q_{it} > \gamma) + e_{it} \quad (5)$$

Where: $I(.)$ is the indicator function, an alternative intuitive way of writing (5) is

$$y_{it} = \begin{cases} \alpha_i + \beta_1^{'} x_{it} + e_{it}, & q_{it} \le \gamma \\ \alpha_i + \beta_2^{'} x_{it} + e_{it}, & q_{it} > \gamma \end{cases} \tag{6}$$

This model assumes the observations are cut into two regimes depending on whether the threshold variable q_{it} is larger or smaller than the threshold γ, the regimes are distinguished by differing regression slope β_1 and β_2, and its required that the elements of x_{it} are not time invariant, the analysis is asymptotic with fixed T as $n \to \infty . e_{it} \sim (0, \sigma^2)$. Hansen (1999) illustrates that slope coefficient β can be estimated by ordinary least squares (OLS) while γ is known, that is:

$$\hat{\beta}(\gamma) = (X^*(\gamma)^{'} X^*(\gamma))^{-1} X^*(\gamma)^{'} Y^* \tag{7}$$

We also expand the single threshold model that may be have multiple thresholds; in the study used, tripe threshold model takes the form

$$\begin{aligned} y_{it} = \alpha_i + \beta_1^{'} x_{it} I(q_{it} \le \gamma_1) + \beta_2^{'} x_{it} I(\gamma_1 < q_{it} \le \gamma_2) + \beta_3^{'} x_{it} I(\gamma_2 < q_{it} \\ \le \gamma_3) + \beta_4^{'} x_{it} I(\gamma_3 < q_{it}) + e_{it} \end{aligned} \tag{8}$$

where the thresholds are ordered so that $\gamma_1 < \gamma_2 < \gamma_3$. The equation (8) is leaner in the slope $(\beta_1, \beta_2, \beta_3)$ so OLS estimation is appropriate while $(\gamma_1, \gamma_2, \gamma_3)$ is known. An alternative, intuitive way of writing (9) is:

$$y_{it} = \begin{cases} \alpha_i + \beta_1^{'} x_{it} + e_{it}, & \gamma_1 \le q_{it} \\ \alpha_i + \beta_2^{'} x_{it} + e_{it}, & \gamma_1 < q_{it} \le \gamma_2 \\ \alpha_i + \beta_3^{'} x_{it} + e_{it}, & \gamma_2 < q_{it} \le \gamma_3 \\ \alpha_i + \beta_4^{'} x_{it} + e_{it}, & \gamma_3 < q_{it} \end{cases} \tag{9}$$

2.3 Empirical function: Ownership structure and institution investors

How does ownership structure affect the bank's efficiency? The empirical literature shows the relationship between ownership and performance is still puzzling. The relationship between ownership structure and firm efficiency is positive, such as Lichtenberg and Pushner (1994) and Hu and Zhou (2008). On the contrary, some studies illustrate the negative relativity to the firm's performance, such as Al Farooque et al. 2007. Even though previous studies indicated that a meaningful association between ownership and performance had not been identified, Demsetz and Lehn (1985), Loderer and Martin (1997), and Demsetz and Villalonga (2001) find that no systematic relation should exist between changes in ownership and the

firm's value. There has been a diverse stream of theoretical and empirical research related to ownership structure on many subjects, such as ownership concentration, managerial ownership, and the non-linear relation between ownership and performance. In this paper, this study further explores this last subject of analyst activity. In general, empirical literature usually adopts the return of an asset, return of equity and Tobin's Q as a proxy for the bank's performance. Is it an appropriate variable to measure the bank performance by traditional account ratio? Bonin et al. (2005) argue that standard financial performance measures are often higher in developing countries and less developed regulatory procedures. Previous studies used the econometric model to estimate banks' efficiency to substitute for account ratio variables, e.g. Figueira et al., 2009, and Bonin et al., 2005. Considering these arguments, this study uses DFA and DEA techniques to measure banks' efficiency prefer than financial ratio.

This study explores the effect of ownership structure with three conceptions as follows: basic ownership structure; ownership concentration; and non-linear relationship. First, basic banks' ownership variables include board, managerial, outside block shareholders and institutional investors. Institutional investors have identified corporate governance as a key factor affecting their willingness to invest in an emerging market (Gibson, 2003). This study examined the effect of institutional investors to classify institutional investors into state-owned shareholders, domestic financial institutions shareholders, domestic trust funds, domestic corporations, private domestic investors, and foreign investors. Thus, the empirical equation combined ownership variables and control variables can be written as:

$$EFF_{it} = \beta_0 + \beta_1 BOARD_{it} + \beta_2 Top\_Ten_{it} + \beta_3 CEO_{it} + \beta_4 B\_Size_{it} + \beta_5 STATE_{it} + \beta_6 BANK_{it} + \beta_7 FOREIGN_{it} + \beta_8 TRUST_{it} + \beta_9 CORPOR_{it} + \beta_{10} PERSONAL_{it} + \beta_{11} A\_Bize_{it} + \beta_{12} Equite_{it} + \beta_{13} ROA_{it} + \beta_{14} R\_Growth_{it} + \beta_{13} LODE_{it} + \varepsilon_{it} \quad (10)$$

Where: BOARD indicates the percentage of equity owned by board[5]; Top_Ten indicates percentage of equity owned by top ten shareholders; CEO indicates percentage of equity owned by CEO, B_SIZE indicates natural log of number of directors, STATE indicates percentage of equity owned by the government; BANK indicates percentage of equity owned by domestic financial institutions shareholder, TRUST indicates percentage of equity owned by domestic trust fund; CORPOR indicates percentage of equity owned by investors of domestic corporations, PERSONAL indicates percentage of equity owned by private domestic investors; and FOREIGN indicates percentage of equity owned by foreign investors, Equity indicates total equity divided by total assets; SIZE indicates natural log of total

[5] Partial bank joint into financial holding companies (FHC), the banks are FHC subsidiary that ownership 100% holding by parent companies; thus, we used the parent of ownership structure substitute subsidiary bank of ownership structure.

assets, and ROA indicates the return of asset ratio. R_Growth indicates banks annual revenue growth ratio, and LODE indicates total loan divided by deposit.
According to the classical literature on agency problems, Jensen and Meckling (1976) claimed that a high level of board and managerial ownership would increase the incentive to maximize corporate value. On contrary, Morck et al. (1988) illustrate that when the ownership of the large owner exceeds a certain threshold, they gain nearly full control over the firms, and they prefer extracting private benefits that do not accrue to minority shareholders. As we already noted, it may be increased supervise the manager to the maximum all shareholder wealth when the outsider shareholder is not slight. How the board and managerial ownership affect the bank efficiency, these results haven't a common consensus. This suggests that the ownership structure has, without a doubt, a significant impact on banks' efficiency. Based on these arguments we propose the following hypothesis:

H_2: Between the ownership structure and bank efficiency is a cross-relationship.

Previous studies on institutional investors have considered whether institutional investors improve or not on corporate performance (e.g., Pound, 1988). Duggal and Millar (1999) found no relationship between institutional investors and firms' performance. Bonin et al. (2005) find that foreign ownership has a significantly positive effect on banks' efficiency and a positive impact on international institutional investors. The case for believing that private ownership is superior to state ownership in creating managerial incentives to raise productivity and lower the cost of production is primarily based on principal-agent theory (Beck et al., 2003). This suggests that more state- ownership may reduce bank efficiency. State-owned bank managers offer no incentives to pursue maximum profit strategies due to not losing their jobs; even banks have inefficiency and less profitability. Whether the institutional investor is a determinant of bank efficiency or not. Previous studies did not classify institutional investors by attribute, which may have resulted in some substantial factors being ignored. We examined the effect of institutional investors by classifying institutional investors into state-owned shareholders, domestic financial institutions shareholders, domestic trust funds, domestic corporations, private domestic investors, and foreign investors. Through further discussion of these variables, this model might result in the emergence of a new viewpoint for institutional investors. In light of these arguments, we propose the following two hypotheses.

H_3: The state-owned shareholder is a negative relation to banks efficiency.

H_4: The foreign investor is positive relation to banks efficiency.

2.4 Empirical function: Ownership Concentration and Efficiency

It is an important empirical work that intends to study how concentrated ownership affects banks' efficiency. As shareholding concentration increases, the main bank has an increased incentive and ability to monitor the management of firms (Prowse, 1995). This hypothesis states that ownership concentration is a proxy for monitoring and that profit stability should be positively related to the level of ownership concentration. Mitton (2002), consistent with this view, explored the firm stock performance during the Asia financial crisis and found that large shareholders can prevent expropriation, and higher ownership concentration is associated with significantly better stock performance. Bouvatier et al. (2014) find that banks with low levels of ownership concentration do not display such discretionary income smoothing behavior.

On the contrary, Demsetz and Lehn (1985) argued the Berle-Means thesis; they found no significant relationship between ownership concentration and accounting profit rates. Following previous studies adopts the Herfindahl index measure of ownership concentration (CONC), calculated by summing the squared percentage of shares controlled by each shareholder. CR_Ten is another measure concentration indicator, using the common equity owned by the ten largest shareholders as proxy ownership concentration and following Demsetz and Lehn (1985), who apply a logistic transformation to these percentages[6]. In summary, most studies supported that less diffused ownership positively affects firm performance. In light of these arguments, we propose the following hypothesis:

H_5: The concentration ownership is a positive relation to banks efficiency.

The empirical equation on concentration ownership and ownership variables can be written as:

$$EFF_{it} = \beta_0 + \beta_1 BOARD_{it} + \beta_2 CONC_{it} + \beta_3 CR\_Ten_{it} + \sum_i X_{it} + \varepsilon_{it} \qquad (11)$$

The main primary data source for this study was the *Taiwan Economics Journal* (TEJ). Table 2 presents descriptive statistics for ownership structure, institution investor structures, and other control variables.

[6] Following Demsetz and Lehn (1985) used a logistic transformation to these shareholder percentage, using the formula as: $\text{CR\_Ten} = \log \frac{Top\_Ten}{1-Top\_Ten}$.

Table 2: Descriptive statistics of regression

	Mean	Std.	Max.	Min.
BOARD	0.221	0.191	1	0
Top_Ten	0.1256	0.1348	0.86	0
CEO	0.0023	0.0379	0.03	0
B_SIZE	2.5348	0.3607	3.43	1.79
STATE	0.0689	0.1534	1	0
BANK	0.072	0.1186	0.59	0
FOREIGN	0.1319	0.1936	1	0
TRUST	0.0053	0.0796	0.04	0
CORPOR	0.192	0.1917	0.77	0
PERSONAL	0.4412	0.2285	0.94	0
A_SIZE	17.7729	0.9096	21.52	17.74
Equity	0.0724	0.026	0.21	0.03
ROA	0.0312	0.0227	0.07	-0.06
R_Growth	0.0663	0.2232	1.49	-0.54
LODE	0.8166	0.0849	1.11	0.57

Note: These variables definition see in section 2.2 Definition of regression analysis.

3. Empirical Results

3.1 Empirical results: Ownership structure and Institutional investors

3.1.1 Empirical results of panel data

This section explains how dose ownership structure and institution investors affect bank efficiency, using the X-efficiency, technical efficiency, allocative efficiency and cost efficiency as proxy efficiency scores in Eq (10), the main regression results are shown in Table 3[7]. This study adopts the fixed-effect model and random-effect model to estimate empirical function, and the Hausman test indicated that the random effect model is more appropriate for empirical regression. This finding XEFF and TE regression have partial conflict results. Previous study literature shows that the effect of ownership is mixed even though used identical independent variables in various study periods and countries' subsamples. On the other hand, XEFF is measured by the parametric approach; it is considered the white noise term and exogenous effect in a single frontier, the parametric approach is more preferred than the non-parametric approach in the study period 1994 to 2010[8]. The XEFF regression model R^2 of 0.5384 and is stronger than the TE result. Some sign has the same results, but this study explores content that mainly relies on the XEFF

[7] For brevity, the dependent variables TE, AE and CE have similar results. We have not listed the regression result AE and CE and regression intercept in Table 3.

[8] For this period, the banking industry undergo important financial reform, privatization, open new competitors, and foreign banks entry in the 1990s, the government has advanced a series of financial reform policies to improve the quality of banks' assets and capital adequacy ratios, NPL ratio in 2001.

regression, and we also attempt to illustrate a conflicting sign from TE regression as to why their relationship is mixed[9].

The coefficient of BOARD is positive, but it is insignificant, indicating that there is no relationship between board ownership and banks efficiency within XEFF and TE regression. This result shows beyond doubt that larger ownership by the board does not improve bank efficiency. My result is inconsistent with Jensen and Meckling (1976) and Fama and Jensen (1983), who found that ownership does have a significant impact on performance[10]. But this result is consistent with Himmelberg et al. (1999) and Liao (2019). Liao (2019) finds that ownership structure does not play an important role in sthe tock return of banks. The coefficient of Top_Ten is negative with XEFF regression, implying that outsider major shareholder ratios have a destructive effect on banks efficiency, but the coefficient is insignificant. These results are inconsistent with Lemmon and Lins (2003), whose results showed that firm values are higher when the cash flow rights held by block shareholders are higher. Kapopoulos and Lazaratou (2007) showed that outside invest shareholdings affect firms' performance positively. On the contrary, Demsetz and Villalonga (2001) showed no relationship between performance and managerial and Top 5 shareholder ownership.

The coefficient of CEO is negative and significant, implying that bank efficiency has a negative relation to the managerial shareholders. Traditional corporate governance mechanisms in emerging markets seem to fail to explain the relationship between performance and ownership structure, CEO characteristics, and risk-taking. For instance, in emerging market firms with large domestic shareholders, CEOs of poorly performing firms are not more likely to lose their jobs (Gibson, 2003). Most banks control rights owned by the family board in Taiwan, so top executive turnover is not majorly decided by their performance or profitability; the family board follow their druthers or political factor in decision-making. On the other hand, Ang et al. (2000) find agency cost increases with a reduction in managerial ownership, so it is possible that large managerial ownership has a negative relation to bank efficiency.

The coefficient of B_SIZE is significantly positive with XEFF and TE regression, implying that a larger board size may improve banks' efficiency. This result is inconsistent with Jensen (1993) and Eisenberg et al. (1998). Andres and Vallelado (2008) point out that the effect of board size on bank value is a trade-off between advantages (monitoring and advising) and disadvantages (coordination, control and decision-making problems), while the board of directors be larger; a giant board facilitates manager supervision and brings more human capital to advise managers.

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[9] Using the Variance Inflation Factor (VIF) to test whether the collinearity problem is significant, as can be seen in Table 3, column 5 shows all variables of VIF less than 10, which implies there are no collinearity problems in the regression analysis.

[10] Jensen and Meckling (1976) illustrate that the relationship between ownership and performance is positive, which suggests that firm performance is an increasing function of the extent of board shareholding; it is the so-called incentive alignment hypothesis. On the contrary, Fama and Jensen (1983) illustrate the entrenchment hypothesis that its relationship is negative.

In sum, this results in no reject H_2; a cross-relationship between ownership and bank efficiency is significant.

The coefficient of STATE is insignificant with XEFF and TE. We expect state ownership to have a negative impact on bank efficiency, but the results show that between state ownership and bank efficiency is irrelevant, so this result show H_3 is not supported. The wave of privatization to improve efficiency and increase the degree of competition started in the 1990s, decreasing the ownership percentage by state-owned to avoid political intervention and protection. The privatized policy had a partial effect on increasing the competitive condition toward the perfect market. The coefficient of BANK and PERSONAL is insignificant, indicating that financial institution investors and personal investors (individuals) have no impact on banks efficiency. The coefficient of PENSONAL is insignificant, implying that individual domestic investors do not effectively monitor managers, and they do not have enough power to do so.

The coefficient of CORPOR is significantly negative with TE regression, but the sign is insignificant with XEFF regression. In general, most directors adopt the legal person from holding their share in Taiwan. This implies that domestic corporations do not effectively monitor CEOs due to the board of directors and domestic corporate form are a duality. The coefficient of TRUST is negative and significant with TE regression, implying that domestic trust fund managers are incapable of monitoring managers due to myopic goals and conflict of interests. Fund managers approach their investments with a myopic view, guided solely by the short-term goal of out-performing earnings benchmarks in a particular quarter. Duggal and Millar (1999) illustrated that this short-term perspective leads to overreactions to information and excessive trading and renders these investors not striving to monitor CEOs.

The results of FOREIGN is a conflict result; the coefficient is positive and significant with XEFF regression, but a contrary result with TE regression. Thus, this result is not supported by H_4. Previous studies do not have certain results, e.g., Bonin et al. (2005) find that foreign ownership has a significant positive effect on efficiency, and some studies show that foreign ownership is negative and significant on efficiency. Foreign ownership may contribute to the stability and monitor board and management in emerging countries. The foreign investors have a negative effect from liability of foreignness; they uncertainly have better decision-making to invest bank ownership in a host country. Figueira et al. (2009) point out that foreign investors hold minority shareholdings, and domestic shareholders could overrule their views.

Table 3: Results of Efficiency and ownership structure

	XEFF		**TE**		**VIF**
	FM	RM	**FM**	RM	
BOARD	-0.0965 (-0.7866)	-0.0244 (-0.1767)	0.0034 (0.168)	0.1263 (0.8044)	4.087
Top_Ten	-0.1571 (-1..2505)	-0.1274 (-0.9458)	-0.1133 (-0.5703)	-0.0613 (-0.3639)	2.322
CEO	-5.9712 (-1.8276)*	-7.2438 (-2.049)**	6.0054 (1.1513)	5.3444 (1.2478)	1.185
B_SIZE	0.072 (1.6781)*	0.0839 (1.7182)*	0.1083 (1.5014)	0.094 (1.798)*	1.594
STATE	0.196 (1.18)	0.0682 (0.3629)	-0.3602 (-1.2993)	-0.1902 (-0.886)	4.876
BANK	0.0268 (0.165)	0.001 (0.0531)	-0.2975 (-1.0719)	-0.0137 (-0.0647)	2.873
FOREIGN	0.2523 (2.033)**	0.273 (1.9356)*	-0.178 (-0.855)	-0.2729 (-1.7011)*	4.338
TRUST	-2.6091 (-1.65)*	-0.0262 (-1.2454)	5.1275 (2.1356)**	4.1707 (1.8597)*	1.438
CORPOR	0.0506 (0.5195)	0.0547 (0.5199)	-0.3484 (-2.244)**	-0.2722 (-2.0896)**	2.808
PERSONAL	0.0426 (0.4478)	0.1098 (1.0258)	-0.3559 (-2.252)**	-0.1937 (-1.6301)	3.308
A_SIZE	-0.1533 (-5.8525)***	-0.1676 (-4.1352)***	-0.0205 (-0.3431)	-0.052 (-1.6499)	3.695
Equity	-0.5803 (-0.8582)	-0.9503 (-1.2281)	-0.0502 (-0.0439)	1.015 (1.145)	2.401
ROA	1.8425 (2.6288)***	1.9415 (2.61)***	-0.2131 (-0.194)	-0.3225 (-0.3362)	2.142
R_Growth	0.0149 (-0.2374)	0.0012 (0.019)	0.1401 (1.487)	0.1081 (1.18)	1.887
LODE	0.5503 (3.1461)***	0.4191 (2.3436)**	-0.0238 (-0.0903)	0.127 (0.5799)	1.557
Hausman test		19.954 (0.1737)		18.181 (0.2532)	
R^2	0.4294	0.5384	0.1641	0.111	

Note：* Significant level at the α=0.1, **at α=0.05 and ***at α=0.01.

3.1.2 Efficiency and ownership concentration

In this subsection, how does the ownership concentration affect banks' efficiency? The regression of ownership concentration measured by the random effect and fixed effect model can be seen in Table 5. The sign of CONC and CR_Ten is negative, indicating that even though a higher degree of ownership concentration cannot benefit bank efficiency, these coefficients are insignificant. This result is inconsistent with our hypothesis and previous studies. Shleifer and Vishny (1997) illustrate that large shareholders can benefit minority shareholders because they have the power and incentive to prevent expropriation. But Demsetz and Lehn (1985) find that the ownership concentration and firm profit rate should be unrelated. One possible reason to explore this result is that a high concentration ownership structure implies that the board of directors and managerial positions are stable or entrenched; even banks' efficiency or profitability is worse, and they would not lessen their position due to their widely held company share.

The second possible reason to explore is that family-controlled firms play a vital role in Asian countries[11]. In practice, the high concentration ownership firm trend is to be controlled by the board of a single-family; they have less incentive to maximize firm value or shareholder wealth. Thus, the between ownership concentration and bank efficiency is an insignificant relation, and a higher degree of family-controlled ownership increases the potential for expropriation of minority shareholders' rights.

[11] We do not have to consider this factor due to the family-controlled ownership is not obtained for my database.

Table 4: Results of regression on concentration ownership

	XEFF		TE	
	FM	**RM**	**FM**	**RM**
BOARD	-0.027 (-0.1846)	-0.1628 (-1.2634)	-0.0254 (-0.1177)	0.0434 (0.2529)
Top_Ten	-0.1215 (-0.6844)	-0.2616 (-1.615)	-0.1743 (-0.665)	-0.2136 (-0.9782)
CEO	-7.2073 (-2.004)**	-6.5585 (-1.9924)*	5.693 (1.0728)	5.0721 (1.144)
B_SIZE	0.0843 (1.718)*	0.0666 (1.5635)	0.1074 (1.4828)	0.0924 (1.642)
STATE	0.082 (0.4048)	0.2791 (1.6219)	-0.3138 (-1.0493)	-0.1713 (-0.7483)
BANK	0.0093 (0.0493)	0.0107 (0.0659)	-0.2978 (-1.07)	-0.082 (-0.3763)
FOREIGN	0.2723 (1.9008)*	0.2885 (2.286)**	-0.1659 (-0.785)	-0.2321 (-1.372)
TRUST	-2.0345 (-1.239)	-2.7878 (-1.7567)*	5.0238 (2.0747)**	4.2693 (1.9529)*
CORPOR	0.0477 (0.4437)	0.0287 (-1.756)*	-0.3551 (-2.24)**	-0.3314 (-2.4809)**
PERSONAL	01015 (0.9152)	0.0151 (0.1579)	-0.3695 (-2.259)**	-0.2596 (-2.04)**
CONC	-0.0173 (-0.1332)	-0.1687 (-1.4459)	-0.0815 (-0.4249)	-0.1673 (-1.059)
CR_Ten	-0.0023 (-0.3424)	-0.0639 (-0.6071)	-0.0008 (-0.0813)	0.0002 (0.0285)
A_SIZE	-0.1678 (-4.0916)***	-0.1689 (-6.0967)***	-0.0236 (-0.391)	0.0322 (0.888)
Equity	-0.9211 (-1.1586)	-0.5012 (-0.744)	0.0574 (0.0489)	0.8417 (0.9325)
ROA	1.9363 (2.5716)**	1.734 (2.4706)**	-0.274 (-0.2465)	-0.325 (-0.3406)
R_Growth	0.0029 (0.0452)	-0.0135 (-0.2122)	0.1389 (1.4629)	0.1186 (1.3441)
LODE	0.413 (2.2838)**	0.5091 (3.01)***	-0.0368 (-0.1382)	0.196 (0.8563)
Hausman test		0.2286		0.9943
R^2	0.5385	0.4429	0.1646	0.1132

Note:*Significant level at the α=0.1, **at α=0.05 and ***at α=0.01.

3.2 Non-linear relationship between ownership and efficiency

3.2.1 Results of cubic regression on board ownership

In this subsection, this study attempts to investigate whether a linear or non-linear relationship exists between ownership structure and banks efficiency, using two

approaches to explore their relationship. First, following Al Farooque et al. (2007), the cubic form OLS regression model is adopted; it only considers the board ownership variable influencing efficiency in cubic regression. Second, to avoid subjectively setting the boundary of ownership structure may lead to a biased; exclude the OLS piecewise regression, panel threshold model technique is used.

Table 5: Results of cubic regression on ownership structure

	XEFF		**TE**	
	FM	**RM**	**FM**	**RM**
BOARD	-0.5563 (-1.032)	-0.469 (-0.9612)	0.2416 (0.3046)	0.4893 (0.737)
$(BOARD)^2$	1.9095 (1.3897)	1.8412 (1.4108)	0.5081 (0.2512)	0.0598 (0.0334)
$(BOARD)^3$	-1.5249 (-1.637)	-1.6838 (-1.888)*	-0.9726 (-0.7098)	-0.6551 (-0.5345)
Top_Ten	-0.1487 (-1.1035)	-0.1715 (-1.389)	-0.1352 (-0.682)	-0.0796 (-0.4746)
CEO	-7.3886 (-2.086)**	-6.0619 (-1.881)*	5.061 (0.971)	4.9013 (1.1236)
B_SIZE	0.0765 (1.5601)	0.0593 (1.4035)	0.0889 (1.2323)	0.0743 (1.3148)
STATE	0.0988 (0.4965)	0.2497 (1.4794)	-0.1748 (-0.5965)	-0.1297 (-0.5712)
BANK	-0.073 (-0.3795)	-0.1279 (-0.7597)	-0.3932 (-1.388)	-0.2038 (-0.8935)
FOREIGN	0.2528 (1.7808)*	0.2635 (2.1074)**	-0.169 (-0.8091)	-0.2001 (-1.1826)
TRUST	-2.085 (-1.2843)	-2.6683 (-1.7017)*	4.9017 (2.0514)**	4.5037 (2.0848)**
CORPOR	0.0339 (0.3216)	0.0264 (0.2754)	-0.3742 (-2.4122)**	-0.34 (-2.6036)**
PERSONAL	0.0874 (0.8065)	0.0089 (0.0953)	-0.4191 (-2.6265)**	-0.269 (-2.1676)**
A_SIZE	-0.1524 (-3.6993)***	-0.1572 (-5.9064)***	-0.0048 (-0.0791)	0.0263 (0.745)
Equity	-0.7345 (-0.9412)	-0.5068 (-0.7583)	0.3392 (0.2953)	0.6196 (0.684)
ROA	1.7928 (2.4028)**	1.6379 (2.3436)**	-0.3498 (-0.318)	-0.2295 (-0.24)
R_Growth	0.0102 (0.1603)	-0.0021 (-0.0335)	0.1524 (1.6219)	0.1402 (1.6085)
LODE	0.396 (2.2163)**	0.487 (2.9413)***	-0.0618 (-0.235)	-0.0556 (-0.2465)
Hausman test		0.2125		0.9989
R^2	0.5442	0.4619		0.1297

**Note: ***Significant level at the α=0.1, **at α=0.05 and ***at α=0.01. Hausman test:$H_0 = RM\ vs. FM$

Table 5 reported the cubic regression results with XEFF and TE, like in the former section, the AE and CE results were not listed. The results show a non-linear relationship between the board ownership and efficiency, the sign initially decreases, then increases and again decreases as board shareholding increases. This result is consistent with Hubbard and Palia (1995), Hu and Izumida (2008) and Al Farooque et al. (2007). The coefficient of BOARD is negative and insignificant, the same as the former results. The square term is positive and insignificant, and the cubic term is negative and significant, implying that board ownership increases further, the boundary turning become negative about efficiency. This result supported our hypothesis; the non-linear relationship between board ownership and efficiency endorses the conclusions of Morck et al. (1988). This finding is that in an approximate lateral S-shaped relation of ownership to efficiency, its relationship seems not a simple linear one, this finding suggests.

3.2.2 Results of panel threshold model

In this subsection, the panel threshold model technique measured the different ranges of ownership structure's impact on efficiency. Following Hansen (1999), we use the F test to test whether the threshold effect is significant or not. Table 6 presents the results of F test; the p-value less than 10% shows the threshold effect is substantial, and in the null hypothesis that no threshold effect can be rejected with BOARD in XEFF regression, and BOARD, Top_Ten and PERSONAL in TE regression. For instance, the BOARD is a three-threshold model; the threshold value is 0.1081, 0.2083 and 0.4046, respectively. To divide four different ranges of board ownership subsamples to measure the regression of parameters by OLS, the four subsamples are:

$$\{0.1081 \leq q_{it}, 0.1081 < q_{it} \leq 0.2083, 0.2083 < q_{it} \leq 0.4046, 0.4046 > q_{it}\}$$

In XEFF regression, the three-threshold effect is significant with board ownership, while other ownership variables are not insignificant. The coefficient of BOARD is negative and significant in all subsamples; these results are consistent with former results. It is obvious that a falling tendency of negative effect, while board ownership increases further threshold boundary, leads to the negative shock to efficiency narrowing gradually. In the first regime, where the board ownership is less than 10.81%, the estimated coefficient is -4.3, which indicates that a 1% increase in board ownership decreases bank efficiency by 430%; in the fourth regime, where the board ownership is more giant than 40.46%, the estimated coefficient is -0.37, which indicates that a 1% increase in board ownership decreases bank efficiency by 0.37%. It implies bank efficiency with higher board ownership than bank efficiency with lower board ownership.

As can be seen in Table 7, this finds a similar result in TE regression with BOARD.[12] This finding again supports that higher board ownership is more efficient. The coefficient of the top ten shareholders is positive and significant, which results in the first regime, where the board ownership is less than 1.19%, the estimated coefficient is 35.5602, and in the second regime, where the board ownership is larger than 1.19%, and the estimate of the coefficient is 0.0311, which indicates that a 1% increase in board ownership decreases bank efficiency by 355.602 and 3.11%, respectively. These results show lower block shareholder ownership efficiency than efficiency with large block shareholders. Some studies use a measure of outside block shareholders as a proxy for the degree of monitoring activity, such as Singh and Davidson (2003). A large negotiation cost with external block shareholders for banks to interfere with professional managerial decision-making and led managers not maximum banks' resource utilized. The board or outside block shareholders' usual maxima benefited banks in Taiwan. The private domestic investor ownership variable has two thresholds in the F-test regression relationship. The two threshold values are 0.3879 and 0.6268, so the three regimes of the coefficient are -1.1498, -0.6889 and -0.279 in sequence, respectively. The result shows that bank efficiency is significantly negatively related to a large percentage of minority shareholders. This is an obvious variation between Taiwan's equity market and other developed countries; the private domestic shareholder are major investors in the equity market in Taiwan, and they are minority shareholders compared with other companies' shareholders. On the other hand, a more dispersed ownership structure bank has a high efficiency from observing regression coefficient is a raised tendency.[13]

In summary, the F test shows the threshold effect is significant; this implies a significant non-linear relationship between board ownership and efficiency with XEFF and TE regression. Thus, we support the form of non-line relation as found by Morck et al. (1988) again. The coefficient varies with several ranges of board ownership, indicating that bank efficiency with higher board ownership is more than bank efficiency with lower board ownership.

[12] In the first regime, where the board ownership is less than 40.46% the estimate of coefficient is -0.7544, in the second regime, where the board ownership is larger than 40.46%, the estimate of coefficient is -0.0876, which indicates that a 1 percent increase in board ownership decreases bank efficiency by 0.0876 percent.

[13] More than 60 percent of minority shareholder in firms' ownership structure, which implies that ownership structure is dispersed.

Table 6: Tests for threshold effects

	P-value	Threshold value		
XEFF				
BOARD	0.01***	0.1081	0.2083	0.4046
TE				
BOARD	0.1*	0.4046		
Top_Ten	0.08*	0.0119		
PERSONAL	0.06*	0.3879	0.6268	

Note: Using F-test to test whether threshold effect is significant, p-value result from repeating the bootstrap procedure 1000 times for each of the three bootstrap tests. * Significant level at the α=0.1, **at α=0.05 and ***at α=0.01

Table 7: Regression estimate: threshold model

	Coefficient	OLS SE	White SE
XEFF			
BOARD			
$Board_{it} \le 0.1081$	-4.3746	0.7382***	0.6798***
$0.2083 \le Board_{it} < 0.1081$	-2.0946	0.4176***	0.365***
$0.4046 \le Board_{it} < 0.2083$	-0.9831	0.1998***	0.1786***
$Board_{it} > 0.4046$	-0.3742	0.1146***	0.0998***
TE			
BOARD			
$BOARD_{it} \le 0.4046$	-0.7544	0.2652***	0.2294***
$BOARD_{it} > 0.4046$	-0.0876	0.15***	0.1249***
Top-Ten			
$Top\_Ten_{it} \le 0.0119$	35.5602	11.3013***	6.8512***
$Top\_Ten_{it} > 0.0119$	0.0311	0.1813***	0.1809***
PERSONAL			
$PENSONAL_{it} \le 0.3879$	-1.1498	0.258***	0.2317***
$0.6268 \le PENSONAL_{it} < 0.3879$	-0.6889	0.1657***	0.1326***
$PENSONAL_{it} > 0.6268$	-0.279	0.1225***	0.1022***

Note: * significant level at the α=0.1, **at α=0.05 and ***at α=0.01

4. Robustness checks

In this subsection, we check the robustness of our result by several sensitivity analyses. We have two ways to treat the various subsamples. First, are our results robust to the inclusion of unbalanced data firms? The initial sample used panel data

covering 20 banks from 1994 to 2010. We remove some bank samples due to these data having no balance. Major state-owned banks are excluded from panel samples, which may make the results biased. We re-estimate regression after including our obtained bank samples in equation (10), using 29 banks from 1994 to 2010. The total observation was 453. As can be seen in Table 8, these signs obtained were qualitatively similar, the coefficient of STATE is still positive and significant, and former results show that state ownership has a positive impact on efficiency, but it is insignificant. Previous studies illustrated that state-owned banks remain and enjoy government policy advantage because of their efficiency and profitability compared to private banks in developing countries, such as Liao (2020), Bonin et al. (2005), and Li et al. (2004).

Table 8: Results of Robustness test

	Unbalance		**Post-2011**	
	XEFF	**TE**	**XEFF**	**TE**
BOARD	-0.137 (-2.066)**	0.046 (0.4822)	-0.212 (-2.7426)	0.051 (0.4647)
Top_Ten	-0.103 (-0.988)	-0.0436 (-0.301)	-0.1223 (-0.912)	0.0146 (0.0767)
CEO	-5.712 (-2.751)***	4.1851 (1.4438)	-7.126 (-3.067)***	4.7963 (1.4524)
B_SIZE	0.042 (1.255)	0.724 (1.5472)	0.0272 (0.5534)	0.0459 (0.6527)
STATE	0.2735 (3.39)***	0.0626 (0.555)	0.332 (3.369)***	0.085 (0.6067)
BANK	0.053 (0.4991)	-0.0968 (-0.6873)	-0.022 (-0.1555)	-0.1555 (-0.7729)
FOREIGN	0.1784 (2.431)**	-0.1382 (-1.3476)	0.2033 (2.3135)**	-0.1619 (-1.2965)
TRUST	-3.181 (-2.4883)**	4.326 (2.421)**	-4.1768 (-3.0387)***	4.8027 (2.4581)**
CORPOR	-3.1807 (-0.5899)	-0.2082 (-2.3028)**	-0.0179 (-0.2192)	-0.1395 (-1.1969)
PERSONAL	-0.0038 (-0.1762)	-0.0731 (-1.1368)	-0.0116 (-0.187)	-0.129 (1.4615)
A_SIZE	-0.1565 (-10.3)***	0.0506 (2.383)**	-0.1539 (-8.2582)***	0.0552 (2.081)**
Equity	-0.342 (-0.6465)	1.1998 (1.6228)	0.9075 (-1.7387)*	0.4329 (0.3478)
ROA	1.9618 (3.283)***	-0.1442 (-0.1727)	0.9075 (0.9196)	-1.0829 (-0.7719)
R_Growth	-0.089 (-1.939)*	0.1498 (2.333)**	-0.0912 (-1.4521)	0.1728 (1.934)*
LODE	0.5601 (4.665)***	-0.002 (-0.1193)	0.4939 (3.398)***	-0.0654 (-0.3168)
Observation	453	453	297	297
R^2	0.4458	0.1165	0.3814	0.1404

Note：* Significant level at the α=0.1, **at α=0.05 and ***at α=0.01

Second, are second financial reforms not impacting our results? Since 2001, the government has carried out a series of financial reform policies to improve banks' asset quality and reduce bank non-performance loans. The bank business model had a radical change after financial reform; for instance, in the Financial Holding Companies (FHC) Act, there can be FHC subsidiaries and independent banks. Thus, we re-estimate regression (10) that the entire sample can be divided into pre-and post- 2001 (finance reform), only to list post-2001, as shown in Table 8. The results remain qualitatively the same, with the financial reforms not influencing it.

Thirdly, previous studies often employ accounting variables to measure firm performance; these include return of equity, return of an asset, and Tobin's Q. To further investigate the various dependent variables in our empirical equation and whether to change our main results, we re-estimate regression and use the dependent variable, return of asset. As can be seen in Table 9, this study of former effects shows that bank efficiency with foreign investors is ambiguous. The coefficient of FOREIGN is negative and significant; this implies large foreign investors had a negative association with profitability. This result is inconsistent with efficiency regression. One possibility is that the foreign investors have a negative effect on the liability of foreignness, and the second possibility is that the efficiency and performance are reduced by intangible intervention from politics in emerging countries, such as Taiwan. Thirdly, the foreign bank acquired domestic banks to expand their market share in recent years. The acquired banks almost with poor performance and lousy asset quality; foreign banks would improve bank efficiency with their know-how but cannot increase bank profit in the short-term. The results remain qualitatively similar and imply that efficiency and performance regression is the same.

Table 9: Results of ROA regression

	ROA	
	FM	**RM**
BOARD	0.0124 (1.179)	0.0057 (0.593)
Top-Ten	-0.3187 (-1.176)	-0.2721 (-1.062)
CEO	-0.0627 (-6.459)***	-0.0676 (-7.433)***
B_SIZE	0.098 (2.64)**	0.0067 (1.9932)*
STATE	-0.016 (-1.1177)	-0.0022 (-0.167)
BANK	-0.0138 (-0.955)	-0.0051 (-0.3976)
FOREIGN	-0.0429 (-4.0625)***	-0.0412 (-4.3129)***
TRUST	0.0002 (0.0021)	-0.0581 (-0.4754)
CORPOR	-0.0142 (-1.773)*	-0.0146 (-1.929)*
PERSONAL	-0.011 (-1.351)	-0.069 (-1.287)
A_SIZE	-0.0084 (-2.743)***	-0.0039 (-1.814)*
Equity	-0.026 (-0.4405)	0.359 (0.6737)
R_Growth	0.0176 (3.6745)***	0.195 (2.0993)**
LODE	0.004 (0.2904)	0.0004 (0.027)
Hausman test		0.0125
R^2	0.6445	0.5089

Note： * Significant level at the α=0.1, **at α=0.05 and ***at α=0.01.

5. Conclusions

The ownership structure is a key element of corporate governance. However, literature providing these relationships is still a puzzle, and an empirical case of developed countries may be inappropriate for emerging countries' applications. To investigate the impact of ownership structure and concentration on bank efficiency in Taiwan, we consider the non-linear relationship between ownership and efficiency, using the panel threshold model technique to test whether the non-linear

relationship is significant. This study attempts to build five hypotheses for testing whether a cross-relationship between ownership structure and efficiency is observed. The results show that there is no relationship between state ownership and bank efficiency. The wave of privatization is to improve efficiency and increase the degree of competition that started in the 1990s, decreasing the ownership percentage by state-owned to avoid the political intervention and protection. The privatized policy had a partial effect on increasing the competitive condition toward the perfect market. The relationship between foreign investors and efficiency is significantly negative; one possible explanation is that the foreign investors have a negative effect from liability of foreignness; the second possible explanation is that the efficiency and performance are reduced by intangible intervention from politics in emerging countries, such as Taiwan.

Empirical findings indicate that ownership concentration has no relation to bank efficiency. One possible reason to explore this result is that a high concentration ownership structure implies that the board of directors and managerial position is stabled or entrenched. Even banks' efficiency or profitability is worse because they would not lessen their position due to their widely held company share. The second possibility is that, in practice, the high concentration ownership firm trend is controlled by the board of a single-family; they have less incentive to maximize firm value or shareholder wealth. Thus, the between ownership concentration and bank efficiency has an insignificant relation, and a higher degree of family-controlled ownership increases the potential for expropriation of minority shareholders' rights. The results show that the threshold effect is significant, which implies that a significant non-linear relationship between board ownership and efficiency supports the form of non-line relation as found by previous literature. Through various degree of ownership, their connection to efficiency is changeful, the insignificant relationship between board ownership and efficiency on linear function estimated, but the non-linear regression estimated show the board owner has a negative relation to efficiency, and it is obvious that a falling tendency of negative effect, while board ownership increases further threshold boundary, the negative shock to efficiency is narrowed gradually.

This study also offers some practical guidance for corporate governance in banks in Taiwan. First, traditional corporate governance mechanisms in emerging markets fail to explain the relationship between performance and ownership structure, managerial characteristics, and risk-taking. Most banks control rights owned by family boards in Taiwan, managerial turnover does not rely on their performance or profitability, and the family board follows their druthers or political factors in decision-making. Second, foreign investors have a slightly positive effect on banks' efficiency; they may provide a better experience building managerial monitory mechanisms and dealing with agency costs through contact with various national and cultural factors. Thirdly, poor managerial efficiency for banks due to a lack of external corporate governance mechanism, and banks must follow the policy-oriented business of the government. The government must establish a market-oriented external corporate governance mechanism.

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