

**The Divergence of Long- and Short-run Effects of Manager's Shareholding on
Bank Efficiencies in Taiwan**

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Abstract

This paper adopts a panel error-correction model to explore dynamic impact of manager's shareholding on bank efficiencies by utilizing the pooled mean group. The sample comprises unbalanced panel data of 30 Taiwanese listed domestic commercial banks over the period 1998 to 2009. Empirical results show divergence of long- and short-run effects of manager's shareholding on bank efficiencies. The effect of manager's shareholding exerts a significantly positive effect on technical efficiency in the long run while coexisting with a negative short-run relationship. Conversely, increase in manager's shareholding leads to a reduction of scale efficiency in the long run whereas its short-run effect on scale efficiency is positive.

JEL classification: C23, D20, G21

Keywords: Manager's shareholding, Efficiency, PMG, Heterogeneity

I. Introduction

In the country's economic activities, banking industry is an important role of financial intermediary. Through a financial intermediary, the public savings will be effectively translated into various investments and loans to promote economic growth and social development. As financial liberalization, changes in deregulation that allowed establishment of private banks since 1991 in Taiwan lead to the 'over-banking' problem, which brought more degree of competition among banks and squeeze of bank profit margins.

At its peak in 2001, there were 53 local banks and 38 foreign bank branches in the Taiwanese banking industry. According to the 2009 financial statistics of Financial Supervisory Commission, local banks experienced a sharp decline in return on equity (ROE) and return on assets (ROA) between 1990 and 2001, from 20.79% to 3.60% and from 0.9% to 0.27%, respectively. Consequently, the analysis of sources of bank performance growth over time, improvement of bank efficiency in particular, has been critical subjects in sustainable management for many years.

In the agency problems of separation of ownership and control, manager's behavior and remunerations will be one of the main determinants affecting the corporate performance. Motivating managers approach becomes widely discussed topics by management researchers. However, managers are not perfect agents for

shareholders because managers' compensation and owners' interests are often conflicting. This conflict between shareholders and managers is the result of the separation between ownership and control, which are proposed by Berle and Means (1932), and Jensen and Meckling (1976). According to Gadhoun (1999), a conflict of interest exists between shareholders who wish to maximize wealth and pursue long term performance policies, and managers, who are portrayed as pursuing personal objectives, such as growth, perquisite seeking, personal power and risk reduction, and hence may increase the company's agent costs.

According to Berle and Means (1932), and Jensen and Meckling (1976), the ways of this conflict is addressed by the equity holdings of managers as a self-control method and the costs of deviation from value maximization decline as management ownership rises, supported by Fama and Jensen (1983), and Yermack (1996). In other words, manager's shareholding system may reduce the discrepancies in objectives between shareholders and managers, which is called convergence-of-interest hypothesis by Jensen and Meckling (1976), and then decrease agency costs and promote the company's operating performance

However, there is a debate regarding the relationship between manager's shareholding and company's operating performance issues. The convergence-of-interest hypothesis assumed when the market of corporate control is

efficient can be presented in contrast to the entrenchment hypothesis (Gadhoun, 1999). According to the literatures about management entrenchment, when managers who own shares allocate company resources, they may prioritize to maximize their benefit function, resulting in a damage of value of the company and shareholders' interests. In other words, a negative relationship between manager's shareholding and company's operating performance may exist. Griffith et al. (2002) found that management entrenchment may offset the effects predicted by Jensen and Meckling's (1976) convergence-of-interest hypothesis in commercial banks.

The extant literature provides no consistent evidence regarding whether performance gains derive from manager's shareholding. This result may be due to may be the previous studies do not distinguish between short- and long-run effects because the company manager's behavior and considerations should change over time. It is essential to integrate a time factor into the model to avoid distorting the empirical results. This paper applies the mean group (MG) estimator and the pooled mean group (PMG) estimator to explore dynamic impacts from a general autoregressive distributed-lag (ARDL) model. We use the above two models to estimate dynamic impacts of manager's shareholding on technical efficiency and scale efficiency for 30 listed domestic commercial banks over the period 1998 to 2009 in Taiwan. To date, no study has used the panel error-correction model to address this issue.

The rest of the paper is organized as follows. Section 2 describes the theoretical model and model specification used for estimates. Section 3 briefly describes the empirical data and variable definitions. Section 4 discusses the main empirical results, while the last section concludes this paper.

II. Model specification

Two procedures are commonly used for dynamic panel data. The traditional procedure is the fixed or random effect model, where the intercepts are allowed to differ across groups while other coefficients and error variance are constrained to be the same. Pesaran and Smith (1995) indicated that the fixed or random effect estimator is inconsistent under heterogeneity of other slope coefficients and error variances. Therefore, they proposed the MG estimator in which separate equations are used to estimate for each group and to examine the distribution of the estimated coefficients across groups to obtain consistent estimates of the average of the parameters.

To modify extreme estimators, Pesaran *et al.* (1999) proposed the PMG estimator that allows the intercepts, short-run coefficients and error variances to differ across groups but constrains the long-run coefficients to be homogeneous. The long-run equilibrium relationships between variables are assumed to be similar across groups

because some factors such as arbitrage conditions or common technologies influence all groups in a similar way.

Differing from traditional procedures for estimation of dynamic panel data, the MG and PMG estimators allow intercepts, short-run coefficients and error variances to differ across groups. A Hausman test can be used to test the null hypothesis of homogeneity in order to select the most appropriate empirical results.¹

According to Pesaran *et al.* (1999), assume an ARDL (p, q, q, ..., q) model

$$y_{it} = \sum_{j=1}^p \lambda_{ij} y_{i,t-j} + \sum_{j=0}^q \delta_{ij}' x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (1)$$

where $i = 1, 2, \dots, N$ and $t = 1, 2, \dots, T$; x_{it} is a $K \times 1$ vector of independent variables for firm i ; μ_i represent the fixed effects; the coefficients of the lagged dependent variables, λ_{ij} , are scalars; and δ_{ij} are $K \times 1$ coefficient vectors. ε_{it} is a random error term.

Replace $\Delta y = y_{it} - y_{it-1}$ and $\Delta x_{it} = x_{it} - x_{it-1}$ into Equation (1). The equation with short- and long-run effects then can be presented as follows.

$$\Delta y_{it} = \phi_i y_{i,t} + \beta_i' x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{i,t-j} + u_i + \varepsilon_{it} \quad (2)$$

where $\phi_i = -(1 - \sum_{j=1}^p \lambda_{ij})$, $\beta_i = \sum_{j=0}^q \delta_{ij}$, $\lambda_{ij}^* = -\sum_{m=j+1}^p \lambda_{im}$, $j = 1, 2, \dots, p-1$,

¹ If the null hypothesis is accepted, MG and PMG estimates are all consistent, but PMG estimates are more efficient. If the null hypothesis is rejected, MG estimates still are consistent, but PMG estimates are not. The consistency of these estimates could be generated subject to flexible parameter settings.

$$\delta_{ij}^* = -\sum_{m=j+1}^q \delta_{im}, j=1,2,\dots,q-1.$$

The PMG estimator proceeds as follows. First, estimation of the long-run slope coefficients is done jointly across groups through a maximum likelihood procedure. Second, the pooling implied by homogeneity restrictions on the long-run coefficients and averaging across groups are used to obtain the estimation of short-run coefficients and error-correction coefficients. In the MG estimator, it assumes that all parameters are heterogeneous across groups in the second procedure.

To examine the effects of manager's shareholding on bank efficiency (E), Equation (3) is further defined by

$$E_{it} = \theta_{0i} + \theta_{1i}MS_{it} + \theta_{2i}NS_{it} + \theta_{3i}NAL_{it} + \theta_{4i}MP_{it} + \varepsilon_{it} \quad (3)$$

where i indexes the banks; t is the time period; MS denotes the level of bank manager's shareholding, which is measured as a ratio of the number of shares held by the bank manager to the total number of shares outstanding. Furthermore, we use three control variables about operating characteristics into Equation (3). First, NS denotes the number of supervisors, which is a proxy for assessing internal corporate governance system because the supervisor functions contain supervising the execution of the bank's business and accounting audit. Second, NAL denotes the non-accrual loan ratio measured as ratio of non-accrual loan to total loan, and it is a proxy for assessing the quality of bank loans. Finally, MP represents loan market share of an

individual bank, which is a proxy for assessing market power according to the relative market power hypothesis (Shepherd, 1982).

According to Pesaran *et al.* (1999) and to simplify the model specification, one lagged dependent variable is integrated into the model to explore the dynamic impact of market power, diversification and stock market development on efficiency. Equation (3) can be rewritten into an ARDL (1, 1, 0, 0, 0) model.²

$$E_{it} = \lambda_i E_{it-1} + \delta_{10i} MS_{it} + \delta_{11i} MS_{it-1} + \delta_{2i} NS_{it} + \delta_{3i} NAL_{it} + \delta_{4i} MP_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

where i indexes the banks; t is the time period and $t-1$ denotes the lag 1 period. The definitions of variables are similar to the above. μ_i presents the fixed effects. By defining the first differences, Equation (4) can be presented in the error-correction form as follows.

$$\Delta E_{it} = \phi_i (E_{it-1} - \theta_i MS_{it}) - \delta_{11i} \Delta MS_{it} - \delta_{21i} \Delta NS_{it} - \delta_{3i} \Delta NAL_{it} - \delta_{4i} \Delta MP_{it} + \mu_i + \varepsilon_{it} \quad (5)$$

where $\Delta E_{it} = E_{it} - E_{it-1}$, $\Delta MS_{it} = MS_{it} - MS_{it-1}$, $\Delta NS_{it} = NS_{it} - NS_{it-1}$, $\Delta NAL_{it} = NAL_{it} - NAL_{it-1}$, $\Delta MP_{it} = MP_{it} - MP_{it-1}$.

A long-run relationship between diversification, market power and efficiency exists when ϕ_i is significantly negative. The coefficient θ_i denotes corresponding long-run equilibriums and is constrained to be the same across the group. Short-run causality is observed if the lag first-differenced variables in Equation (5) are

² The other macroeconomic variables such as the financial crisis are not integrated into the model because the value of first differences of dummy variables cannot exist.

significant.

In terms of bank efficiency (E) estimates, two procedures are commonly used namely stochastic frontier approach (SFA) and data envelopment analysis (DEA). SFA and DEA differ in the assumptions they make regarding the shape of the efficient frontier and the existence of random error. DEA do not require any assumptions with respect to efficiency or the underlying functional form for the technology. This paper employs DEA with the variable returns to scale setting developed by Banker *et al.* (1984). For an introduction to DEA methodology with excellent illustrations, see Coelli *et al.* (1998).

For input-orientated measures, technical efficiency (TE) is measured by the ratio of optimal inputs to observed inputs, which reflects the ability of a bank to obtain minimal inputs from a given set of outputs. In addition, scale efficiency (SE) is due to the choice of production scale problem that a bank is not operating under constant returns to scale, and it measures the ray average productivity at the observed input scale relative to what is attainable at the most productive scale size. All of these efficiency measures are bounded by zero and one.

III. Data description

The sample is an unbalanced panel of 30 Taiwanese listed domestic commercial banks during the period from 1998 to 2009 totalling 340 observations. Financial data are obtained from the Taiwan Economic Journal's financial database and from other official sources such as relevant publications of the central bank and the Ministry of Finance's Bureau of Monetary Affairs.

Following the intermediation approach, the inputs contain net physical capital (x_1), all kinds of deposits and borrowed funds (x_2) and number of employees (x_3), while the output entities comprise interest revenues (y_1), and non-interest revenues (y_2) which reflects activities pertinent to non-traditional production processes. Correlation is used to measure the relativity between the two outputs and three inputs, and the results are shown that all correlations coefficients are positive and above 0.5 significantly at 1%, particularly. It exhibit that output and input variables selected in this paper should be able to capture the true production characteristics of Taiwanese listed domestic commercial banks.

Sample statistics of all variables are summarized in Table 1. Table 1 shows that for the outputs, interest revenues (y_1) are the main product of the overall banks, and the gap between interest revenues (y_1) and non-interest revenues (y_2) is large. The input item funds (x_2) appear to be the most important factor of production and there is large variability in the input items.

Table 1: Sample statistics

Variable	Symbol	Mean	Std. Dev.	Min.	Max.
Interest revenues	y_1	20.8153	17.4620	0.9345	83.6114
Non-interest revenues	y_2	4.9419	5.2471	0.0177	28.4897
Physical capital	x_1	12.5974	11.6001	0.2299	44.2661
Funds	x_2	496.7061	475.1262	8.2934	2217.8250
Labour	x_3	3151	2218	195	8980
Manager's shareholding (%)	MS	0.1460	0.3724	0.0000	4.9800
Number of supervisors	NS	3.0000	1.1641	0.0000	6.0000
Non-accrual loan ratio (%)	NAL	4.1444	4.4249	0.0000	27.7800
Market power of loans (%)	MP	2.3450	2.1122	0.0505	10.0885
Technical efficiency	TE	0.9662	0.0235	0.8980	1.0000
Scale efficiency	SE	0.9919	0.0086	0.9550	1.0000
Number of observations			340		

Notes: Variables are reported in NT\$ millions.

The average level of manager's shareholding (MS) is 0.15%, and the bank that has the highest degree is a private bank. The average number of supervisors (NS) is three people and the maximum number of ones is six people. The average non-accrual loan ratio (NAL) is 4.14%; this measure gradually increases per annum from 1998 to 2001 but after 2004, the quality of overall bank loans exhibits imperceptible improving. Furthermore, the average market share of loans (MP) is only 2.35%, implying that the over-banking problem seems to exist subject to small market shares. These variables also present a higher degree of variation.

According to Table 1, the average TE score of all sample banks is 0.9662, indicating the sample banks can reduce approximately 3.39% of inputs given the same

outputs. The scale efficiency measure can be roughly interpreted as the ratio of the average product of a bank operating at variable returns to scale to the average product operating at optimal scale. The mean *SE* score is 0.9919 and it implies that the sample banks can increase up to around 0.81% average productivity if they operate at constant returns to scale.

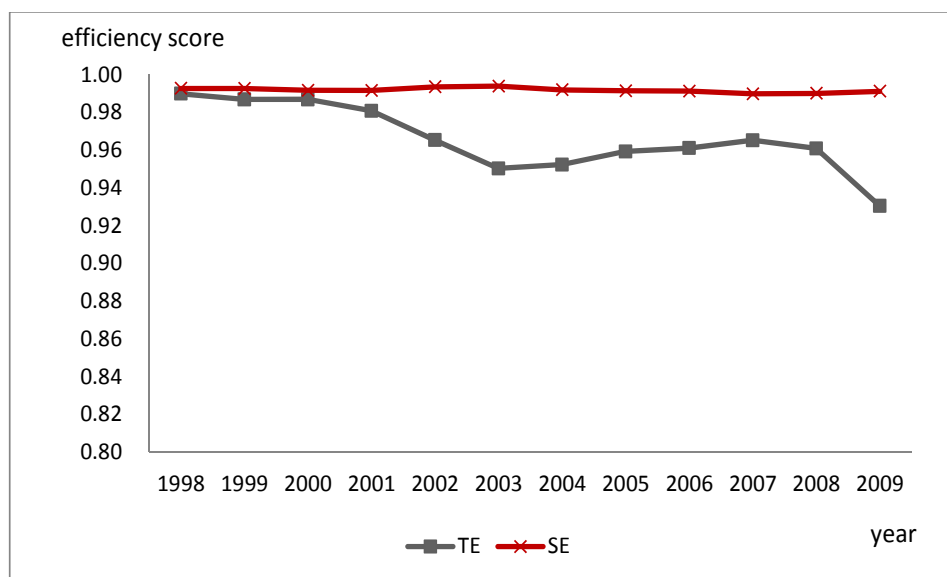


Figure 1: Volatility of Efficiency Scores from 1998 to 2009

In order to analyse the volatility of efficiencies over time, efficiency scores are drawn on a time series graph and these results are illustrated in Figure 1. From 2001 to 2003, the average *TE* has significantly decreased in substance, but after 2004, it exhibits imperceptible improving until 2009. Moreover, the change degree of *SE* is very small over the years. Next, the PMG estimators are applied to depict the overall picture of long- and short-run relationships for both determinants of bank efficiencies.

IV. Empirical results

Table 2 presents the results of specification tests and the estimation of long- and short-run parameters linking bank efficiencies and manager's shareholding by the PMG model. First, the long-run relationship (dynamic stability) exists subject to the coefficient on the error-correction term being negative and not less than -2 . This coefficient falls within the dynamically stable range in the cases of the PMG and MG estimators; thus, long-run effects of manager's shareholding on efficiency exist.

Second, the null hypothesis of homogeneity through a Hausman test can be examined based on the comparison between the PMG and MG estimators. If the long-run coefficients are not equal across banks, then the PMG estimator will be inconsistent; however, the MG estimator will still provide a consistent estimate of the mean of long-run coefficients across banks. The coefficient estimates of the MG model are shown in Appendix 1.

In panel A of Table 2, the homogeneity restriction is not rejected jointly for all parameters by the Hausman test; thus, the PMG estimates are consistent and efficient compared with the MG ones. Comparing the long- and short-run coefficients of PMG estimates, the long-run effect of manager's shareholding on *TE* disagrees with the short-run effect. The results indicate that sample banks with greater manager's shareholding can possess superior technical efficiency in the long run. In other words,

the raise of manager's shareholding can help the sample banks to obtain minimal inputs from a given set of outputs.

Table 2: Estimation results of long- and short-run coefficients by PMG model

Dependent variable	Panel A: <i>TE</i>	Panel B: <i>SE</i>
Long-run coefficients		
MS	0.8175 *** (0.1125)	-0.0035 *** (0.0009)
Error correction coefficient	-0.1549 * (0.0800)	-0.5571 *** (0.1042)
Short-run coefficients		
Δ MS	-0.1637 ** (0.0823)	0.0237 * (0.0133)
Δ NS	-0.0006 (0.0018)	-0.0006 (0.0005)
Δ NAL	0.00289 * (0.0017)	0.0002 (0.0005)
Δ MP	0.0034 (0.0181)	-0.0112 ** (0.0056)
Intercept	0.1420 * (0.0770)	0.5537 *** (0.1038)
No. Banks	30	30
No. Observations	310	310
Joint Hausman Test	0.6000 [0.4400]	0.0000 [0.9989]
Log Likelihood	1080.7730	1569.3020

Notes:

1. Numbers in parentheses are standard error.
2. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Conversely, the average relationship between *TE* and manager's shareholding appears to be negative in the short-run, which indicates the sample banks increase manager's shareholding may lead to a management entrenchment problem, causing inputs to deviate from the optimum. In terms of three control variables, the short-run effect between non-accrual loan ratio and *TE* is significantly positive, whereas others are insignificant.

In panel B of Table 2, the homogeneity restriction is not rejected jointly for all parameters by the Hausman test; thus, the PMG model is applied to measure the parameters. According to the estimation results, *SE* is negatively related to manager's shareholding in the long run, but the short-run relationship between manager's shareholding and *SE* is significantly positive. The results show that manager's shareholding impairs the long-run scale efficiency of sample bank, which could be attributed to personal interests outweigh production performance of banks for the bank manager in the long run.

Nonetheless, a short-run scale efficiency gain can be obtained by manager's shareholding, could be driven by adjusting the bank scale of production to promote average productivity. In terms of three control variables, only the short-run effect between market share of loans and *SE* is significant and it is negative, which indicates the sample banks enlarge market shares may lead to a resource integration problem, causing production scale to deviate from the optimum.

V. Conclusion

This paper applies a panel error-correction model to explore the dynamic impacts of manager's shareholding on bank efficiencies by utilizing the pooled mean group estimators. The unbalanced panel data includes 30 listed domestic commercial banks

in Taiwan over the period from 1998 to 2009. Evidence is found of divergence of long- and short-run effects of manager's shareholding on bank efficiencies. The effect of the manager's shareholding exerts a significantly positive effect on technical efficiency in the long-run while coexisting with a negative short-run relationship. Conversely, increase in manager's shareholding leads to a reduction of bank scale efficiency in the long run whereas its short-run effect on scale efficiency is positive.

This paper provides dynamic impact evidence of manager's shareholding to disentangle the aggregate effect typically measured by prior studies and to explain the ambiguous results of extant literature. Our findings could not only provide new evidence to explain the ambiguous results of the extant literature but also provide a comprehensive perspective for bank managers and policy makers.

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Appendix 1: Estimation results of long- and short-run coefficients by MG model

Dependent variable	Panel A: <i>TE</i>	Panel B: <i>SE</i>
Long-run coefficients		
MS	0.4060 (0.4170)	-0.0033 (0.1088)
Error correction coefficient	-0.2144 (0.1640)	-0.7678 *** (0.0947)
Short-run coefficients		
Δ MS	0.1693 (0.1172)	-0.0188 (0.0298)
Δ NS	0.0012 (0.0027)	-0.0006 (0.0005)
Δ NAL	0.0045 ** (0.0018)	-0.0014 * (0.0008)
Δ MP	0.0076 (0.0303)	-0.0160 * (0.0091)
Intercept	0.2029 (0.1611)	0.7610 *** (0.0942)
No. Banks	30	30
No. Observations	310	310

Notes:

3. Numbers in parentheses are standard error.
4. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.