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STOCK PERFORMANCE, CORPORATE GOVERNANCE, AND EFFICIENCY OF CHINA AND TAIWAN BANKS: IS THERE A RELATIONSHIP?

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ABSTRACT

This article examines whether the efficiency and ownership structure of banks is related to their stock performance in China and Taiwan. The DEA and DFA estimated the efficiency scores to be 0.3229 and 0.5048, respectively. The mean efficiency from the DFA method is more than the cost efficiency derived from the DEA. Is there a relationship? This article finds that banks have a greater efficiency then is directly reflected in enhanced expectations for the performance of the banks in the stock market, and the DFA efficiency estimates have a more valuable function reflected in the stock return when compared with the DEA efficiency estimates. This suggests that an X-efficiency score is a better indicatory index than the DEA model and traditional financial ratios for explaining stock returns.

Contribution/ Originality: This article examines whether the efficiency and ownership structure of banks is related to their stock performance in China and Taiwan. This suggests that an X-efficiency score is a better indicatory index than the DEA model and traditional financial ratios for explaining stock returns

1. INTRODUCTION

This study attempts to examine whether efficiency and corporate governance in the listed banking industry in China and Taiwan is related to the bank's stock performance. Some studies on the stock market point out that there is a link between stock prices and earnings (Kothari, 2001; Beccalli *et al.*, 2006) relatively few studies attempt to link the bank's efficiency to their stock performance. Considering the argument that efficiency estimates derived from frontier techniques are superior to traditional accounting ratios in assessing the performance of banks, it would be interesting to examine whether such information is incorporated in stock returns (Liadaki and Gaganis, 2010). Thus, this study attempts to study whether banks' efficiency reflects the price formation process, and test whether banks' efficiency is better than traditional accounting ratios in explaining stock returns.

Over the last four decades, the majority of studies have estimated the efficiency of banks by parametric and non-parametric techniques, and a major part of this literature explores factors affecting the banks' efficiency. These studies explain the individual issues of determining efficiency; for instance, the impact of ownership structure (Isik, 2008) the impact of risk (Nguyen, 2011) the impact of deregulation/ liberalization (Rezities, 2006) ,with new EU

countries (Brissimis *et al.*, 2008) and with China (Chen *et al.*, 2005) the impact of corporate events (Al-Sharkas *et al.*, 2008). Commonly found bank-specific factors are size, profitable, capitalization, and non-performance loan ratios (Ariff and Can, 2008). Numerous studies compare the efficiency of banks across different ownership types; ownership structure is an important impact factor for banks' efficiency and performance (measured by accounting information). Large shareholders such as institutional investors have been documented to have a positive influence on firm valuation (McConnell and Servaes, 1990). Larger shareholders have the incentive to exercise control over management and the power to initiate change in case of poor performance (Aman and Nguyen, 2008). Corporate governance is an interesting topic over four decades, and an efficient corporate governance mechanism ensures that the interests of shareholders are protected, such as through ownership structure. I believe ownership characteristics are a determinant of banks' valuation and stock return. In this article, I contribute to the literature on the relationship between efficiency and stock return with specific references to China and Taiwan, which offers an interesting case study.

The banking industry has undergone significant changes in terms of its market structure, regulation policies, and types of business since post-WTO accession.[1] This article examines whether the bank efficiency and ownership structures are related to their stock return for the listed banks in China and Taiwan. This study used a sample of 34 listed banks over a period from 2005 to 2010, the Distribution Free Approach (DFA) and the Data Envelopment Analysis (DEA) are employed to measure cost efficiency scores, while controlling for ownership structure and other specific characteristics. The rest of the study is organised as follows. Section 2 presents a review of relevant Literature. Section 3 illustrates the methodological approaches and defines the variables for the empirical analysis. Section 4 reports the results of the banks' efficiency and empirical regression results. Finally, conclusions from the empirical results are drawn, and practical suggestions are offered.

2. LITERATURE REVIEW

Most studies examine whether earnings reflect some of the information in stock price process or stock returns. The relationship between stock returns and publicly available accounting and finance information has attracted considerable attention in the previous literature. Only a few studies attempt to link banks' efficiency to their stock performance. Parametric and non-parametric approaches have been applied to estimate banks' efficiency and test whether a link the between efficiency and stock performance existed, such as Chu and Lim (1998) with Singapore, Kirkwood and Nahm (2006) with Austalian, Erdem and Erdem (2008) with Turkish, Guzman and Reverte (2008) with Spanish. Chu and Lim (1998) find that percentage changes in the prices of the bank shares reflect percentage changes in profit rather than cost efficiencies. Kirkwood and Nahm (2006) used DEA to evaluate the cost efficiency of Australian banks, and empirical results indicate that the major banks have improved their efficiency in producing banking service and profit. Erdem and Erdem (2008) employed the DEA to estimate Turkish banks' efficiency, to determine whether efficiency scores help explain stock price returns. Changes in the economic efficiency have not been found to be statistically significant in explaining the stock price return movements under the CAPM model. On the contrary, some studies employ the parametric approach, such as Liadaki and Gaganis (2010) who used a stochastic frontier approach to estimate cost efficiency and profit efficiency relationships to stock returns for 15 EU countries. They found profit efficiency has a significantly positive impact on stock return, but found no relationship for change in cost efficiency. Furthermore, one study used both the parametric and non-parametric approaches to measure banks' efficiency. Beccalli *et al.* (2006) suggest that changes in efficiency are reflected in changes in stock prices and that stock of cost efficient banks tend to outperform their inefficient counterparts. To further analysis bank performance associate with stock return, they use malmquist index to measure bank productivity, such as

[1]On December 2001, China and Taiwan joined the world trade organization (WTO), implying that restrictions on the operations of foreign financial institutions in the number of the association would be relaxed.

Guzman and Reverte (2008) they find that Spanish banks with higher efficiency and productivity changes have a higher shareholder value, even after controlling for the impact of traditional measures of performance, such as return on assets. In summary, most studies found that efficiency indicators appropriately explains variations in stock returns, regardless whether studies used the parametric or non-parametric approach to efficiency. Thus, I expected that the banks' efficiency would play an important role in stock performance.[2]

Do stock prices reflect the ownership structure variations? The better-governed firms achieve higher valuations does not necessarily imply that governance quality is fully reflected in firm value. Gompers *et al.* (2003) find that corporate governance rating contains information not entirely impounded in stock price might due to investors underestimate the negative effects of weak corporate governance. However, Aman and Nguyen (2008) illustrate that corporate governance indicators are positively associated with firms' performance, and their main finding is that poorly governed firms significantly outperform better-governed firms, and stock prices appear to fairly reflect the higher risk associated with poor corporate governance. Bauer *et al.* (2004) found that governance-sorted portfolios yield negligible excess returns in EU; these results do not necessarily imply that a better-governed firm achieves higher valuations, and this shows that governance quality is not fully reflected in a firm's value. Thus, I expected that ownership structure would not be linked with stock return.[3]

3. DESCRIPTION OF METHODOLOGY AND DATA

3.1. Measuring Efficiency by Parametric Approach

To measure the banks efficiency for previous empirical literature by the parametric and non-parametric approach, but they usually used single approach to measure banks efficiency, it may be to integrate two models estimated banks efficiency, the results should takes a more informative and completely analysis better than single model. Thus, this study employs the distribution free approach method and data envelopment analysis to measure banks efficiency, respectively. First, to briefly describe the distribution free approach, cost efficiency measures the extent to which a banks cost approach the costs for a "best practice" banks under the ceteris paribus assumption. In general version of this cost function can be written as:

$$TC = C(y, w)$$

where TC denotes total variable cost, y denotes variable output(s), w denotes a vector of variable input prices. Following Christensen *et al.* (1973) employs the a standard translog function to estimate the cost efficiency of banks, on which the banks' cost function can be based and written as:

$$\ln TC = \alpha_0 + \sum_{i=1}^{3}\alpha_i y_i + \sum_{j=1}^{3}\beta_j w_j + \frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3}\alpha_{ij}\ln y_i \ln y_j + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3}\beta_{jk}\ln w_j \ln w_k$$

$$+\sum_{i=1}^{3}\sum_{j=1}^{3}\rho_{ij}\ln y_i \ln w_j + \varepsilon_{it}, \qquad (1)$$

[2]Some studies use non-financial institution sample to investigate that relationship between firm efficiency and stock returns, Frijns, Margaritis and Psillaki (2012). investigate the role of firm efficiency in asset pricing using a sample of US publicly listed companies, this finding that firm efficiency plays an important role in asset pricing and that efficient firms significantly outperform inefficient firms.

[3] In general, the governance index is constructed to cover several concepts: board structure, ownership structure, disclosure policy, and board and CEO compensation. This study investigates the relationship between ownership structure and stock performance due to limited data collection.

where lnTC is the total variable cost, y_i is the ith banks' output, w_j is the jth input price, ε_{it} is the error term, and $\varepsilon_{it} \sim^{iid} \mathrm{N}(0, \sigma_{it}^2)$. The usual symmetry restrictions are imposed, such as $y_{ij} = y_{ji}$; $w_{jk} = w_{kj}$.

In general terms, empirical approach has been used to disentangle the composite error term using a free distribution assumption, the banks cost equation is specified as:

$$\ln TC_{it} = \ln C_t(y_{it}, w_{jt}) + \ln x_i + \ln v_{it} \qquad (2)$$

where $\ln TC_{it}$ is the total variable cost, $C(y, w)$ is a cost function with output quantity and input price vector, and the error term is $\varphi_i = x_i + v_i$ and decomposes into two parts, of which v_{it} is the conventional white noise and a mean-zero random error, while x_{it} is a multiplicative X-inefficiency factor. Inefficiency $\ln \ddot{x}_i$ is estimated econometrically, and the residual is calculated as $\ln \hat{x}_t^{\min} - \ln \hat{x}_{it}$. The function $\ln \ddot{x}_i$ is transformed into a normalised X-efficiency measure as follows:

$$XEFF_{it} = \exp(\ln \hat{x}_t^{\min} - \ln \hat{x}_{it}) \qquad (3)$$

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

3.2. Measuring Efficiency by Non-Parametric Approach

On the other hand, this study used the data envelopment analysis to measure banks efficiency, developed by Charnes *et al.* (1978). DEA is a non-parametric approach that uses a linear programming technique to construct an envelope for the observed input-output combinations of all market participants under the constraint that all best practice banks support the envelope, whereas all inefficient banks are kept off the frontier. I briefly describe how one could estimate efficiency using the linear programming approach known as DEA. Within the DEA framework, it is possible to decompose relative efficiency performance into the categories initially suggested by Farrell (1957). The constructed relative efficiency frontiers are non-parametric in the sense that it is constructed through the envelopment of decision marking units (DMUs) with the best-practice. The use of unit isoquant implies the assumption of constant returns to scale (CRS), but it is only valid when all DMUs are operating is an optimal scale, the CRS linear programming problem is defined below:

$$\min_{\theta,\lambda} \theta \qquad (4)$$

$$s.t. \quad -y_i + Y\lambda \geq 0$$

$$\theta x_i - X\lambda \geq 0$$

$$\lambda \geq 0$$

where θ is a scalar and λ is a $N\times1$ vector of constants, Y indicates all input and output for N firms, x_i are the individual inputs and the y_i outputs for the i th firms. Banker *et al.* (1984) point out an extension of the CRS model to account for variable return to scale situations, thus, I can decompose overall technical efficiency(OTE) into the scale efficiency (SE) and pure technical efficiency (PTE) for each firms, the efficiency indictors is follow as:

OTE=PTE×SE and SE=OTE/ PTE

If one has price of input and is willing to consider a behavioural objective, such as cost minimisation, for the case of various return scale cost minimizations, the input-oriented model for the solution of the cost minimization DEA is defined below:

$$\min_{\lambda,xi*} w_i' x_i^*, \qquad (5)$$

$$st \quad -y_i + Y\lambda \geq 0,$$

$$x_i^* - X\lambda \geq 0,$$

$$N1'\lambda = 1$$

$$\lambda \geq 0,$$

where λ is a $N\times1$ vector of constants, w_i is a $N\times1$ vector of input prices for the i-th firm, and x_i^* (calculated by the linear programming) is the cost-minimising vector of input quantities for the i-th firm; given the input prices w_i and the output levels y_i, the $N\times I$ input matrix X, and the $M\times I$ output matrix Y, represent the data for all i firms.

The total cost efficiency of i-th banks is calculated as

$$\text{CE}= w_i' x_i^* / w_i' x_i. \qquad (6)$$

where CE is the ratio of minimum cost to observed cost for the i-th firm.

The allocative efficiency is then calculated residually as

$$AE = CE / TE \qquad (7)$$

These three measures can take values ranging from 0 to 1, where the value of one indicates a fully efficient bank.

3.3. Stock Performance

In general, stock performance should reflect banks' operating performance and create value for shareholders. Investors depend on individual corporate performance when making stock trading decisions, so it may be expected that corporate performance is positively associated with stock return. Most investors make decisions about stock trading by single accounting ratios, such as return of asset, PE ratio proxy the ratio between stock price and company's earning. Previous studies attempt to adopt individual methods to calculate stock performance such as cumulative annual stock returns (Liadaki and Gaganis, 2010) market adjusted returns, Fiordelisi and Molyneux (2010) and market excess return (Kirkwood and Nahm, 2006).

Following Liadaki and Gaganis (2010) this study defined stock performance as being calculated on the basis of monthly returns using the following equation, where *CASR* stands for *cumulative annual stock returns* as follow:

$$CASR\ in\ year\ t = ((1+\text{month 1 return})\times(1+\text{month 2 return})\times(1+\text{month 3 return})\ldots$$

$$\times(1+\text{month 12 return})\text{-}1) \quad (8)$$

The stock price information is published monthly by the Taiwan Economics Journal (TEJ). The stock returns are regressed against the annual change in efficiency to explore whether stock returns reflect changes in banks' efficiency.

3.4. Regression Model Determination

Our empirical analysis focuses primarily on relationships between the stock performance, banks' efficiency, and ownership structure variables. Following Beccalli *et al.* (2006); Chen and Zhang (2007) and Liadaki and Gaganis (2010) I established three models estimating individual research purpose. Model 1 aims to establish the extent to which changes in efficiency scores impact stock returns. Model 2 aims to establish the extent to which ownership structure variables impact stock returns. To further test the relationship between banks' efficiency and stock return, in model 3, I combined model (9) and (10) and controlled for other factors which have been known to impact stock return. According to the above description, the empirical function can be written as:

Model 1: Stock performance and banks' efficiency

$$R_{it} = \beta_0 + \beta_1 \Delta EFF_{it} + \varepsilon_{it} \quad (9)$$

Model 2: Stock performance and ownership structure

$$R_{it} = \beta_0 + \beta_1 \Delta STA_{it} + \beta_2 \Delta FI_{it} + \beta_3 \Delta BS_{it} + \varepsilon_{it} \quad (10)$$

Model 3: Stock performance, banks' efficiency, ownership structure, and proxies for size and profit

$$R_{it} = \beta_0 + \beta_1 \Delta EFF_{it} + \beta_2 \Delta STA_{it} + \beta_3 \Delta FI_{it} + \beta_4 \Delta BS_{it} + \beta_5 \Delta ROE_{it}$$

$$+\beta_6 \Delta SIZE_{it} + \beta_7 \Delta EA_{it} + \varepsilon_{it} \quad (11)$$

where R_{it} is the stock return of banks j in year t, measured from cumulative annual stock returns. ΔEFF_{it} is the change in banks' efficiency of banks i in year t, Control variables of banks j in year t: ΔSTA_{it} is the change in percentage of equity owned by the state owners, ΔFI_{it} is the change in percentage of equity owned by the foreign investors, ΔBS_{it} is the change in percentage of equity owned by block shareholders, $\Delta SIZE_{it}$ is the change in natural logarithm of banks assets, ΔROE_{it} is the changes in return of equity by years, ΔEA_{it} is the change in equity to asset ratio.

Efficiency indicators are proxy for efficiency scores: x-efficiency, cost efficiency, technical efficiency, and allocative economics. The x-efficiency and scale economics are estimated by DFA, and cost efficiency, technical efficiency, and allocative efficiency are estimated by DEA. The efficiency change value in each year is estimated as: efficiency change in year t= (efficiency value $_t$ – efficiency value $_{t-1}$)/ efficiency value $_{t-1}$ .Ownership structure

variables include the percentage of equity owned by the state owners, block shareholders, and foreign investors. The change value in each year is estimated the same as the change in efficiency.[4] The change in banks' asset is proxy of the impact of the banks' size, and the change in equity to asset ratio is proxy for the banks' risk such as Sun and Chang (2011) and Liao (2018). In addition, I used a traditional financial ratio: the change in return of equity is proxy for profitability. The primary data source for this study was the Taiwan Economics Journal (TEJ); the samples included 34 listed banks during the period from 2005 to 2010. Descriptive statistics of the empirical variables are provided in Table 1.

Table-1. Descriptive statistics of variables employed in this study

	Mean	**Std.**
Input-output variables		
Investments	566,506	1,133,996
Loans	544,149	579,187
Non-interest income	19,248	34,629
Salary	83,504	12,279
Capital expense	11,726	21,303
Fund expense	22,573	31,607
Total cost	42651	64,390
Wage of labor	806	453.14
Wage of capital	0.8051	0.7457
Wage of fund	0.0205	0.0067
Regression variables		
R	0.1465	0.581
ROE	0.504	0.3137
STA	0.1336	0.203
FI	0.1622	0.1771
BS	0.3361	0.2613
SIZE	20.5159	1.0984
EA	0.056	0.0193

Note: The samples include the listed 13 China banks and 21 Taiwan banks over the period 2005 to 2010, total observations is 194. Input-output variables unit is million, besides, wage of labor, wage of capital and wage of fund is percentage. Regression variables unit is percentage.

4. EMPIRICAL RESULTS

4.1. Results of Banks' Efficiency

This section reports the results of estimating banks' efficiency using input-oriented DEA and the translog cost function by the DFA model. The DEA results of the banks' efficiency are presented in Table 2. The mean cost efficiency score is 0.3229, which is significantly lower than these found for previous studies—for instance, Yao *et al.* (2007) and Ariff and Can (2008)—these studies found a mean efficiency of 0.63 and 0.798 in the Chinese banking industry for the study period, respectively. Liao (2009) shows that the mean technical efficiency is 0.7103 for 2002-2004 in Taiwan. This finds that cost efficiency is 0.4631 and 0.257 for China and Taiwan, respectively. This indicates that the man ager could be saved costs of about 53.69% and 74.3% levels to improve banks' efficiency for China and Taiwan.[5] Ariff and Can (2008) who argued for stronger reform and more foreign bank entries under the WTO commitments, may have pushed the domestic banks to become more efficient. China and Taiwan in the same time for WTO accession, but it have a contract effect for their banks efficiency. The banking industry experienced a smaller credit loans default crisis in Taiwan in 2005, when a large number of non-performance loans deteriorated banks' profitability and asset quality. On the other hand, this implies that a large gap in efficiency score differences among banks is significant.

[4] Most studies used the percentage of equity owned by board in their regression analysis; unfortunately, I cannot collect a complete data of board shareholder ratios.

[5] The T-test result shows the China banks' efficiency is significantly higher than Taiwanese banks, t value is -4.241. This study also tests the technical efficiency and allocative efficiency, and found TE is significantly different, but AE result is not.

This study broke down cost efficiency into the technical and allocative efficiency components. I then found that the mean technical efficiency (0.5833) is slightly higher than allocative efficiency (0.5489) over the period 2005-2010, implying that allocative inefficiency is a major source of cost inefficiency. This suggests that a manager must understand how to make sure their resources are being effectively utilized. Technological efficiency can be deconstructed into pure technological efficiency and scale efficiency. The mean PTE (0.6282) is lower than the SE (0.821); the results reflected that pure technological efficiency is a more important source of banks' inefficiency than scale efficiency, implying that the banks' inefficiency would be attributed to under-utilization of inputs or the incorrect selection of input combinations. But scale efficiency value has a slight decreasing tendency from 2005 to 2010, showing that the banks' returns to scale are unimproved, and they are gradually deviating from operating in the appropriate scale.

This study used the distribution free approach to estimate x-efficiency for banks over the 2005-2010 period. Table 3 presents the x-efficiency scale economies score and the mean banks X-efficiency is 0.5048, the results consistent with our prior empirical results. This result suggests more similar levels of efficiency than previous studies, for instance, Fu and Heffernan (2007) estimated the x-efficiency to be 0.52 under the stochastic frontier model. Comparing the bank efficiency between parametric and non-parametric approaches, the mean efficiency from the DFA method is more than the cost efficiency derived from the DEA. Previous studies found that the efficiency score found by the parametric approach was higher than in the non-parametric approach, such as demonstrated by Bauer *et al.* (1998) and Delis *et al.* (2009) and this finding is consistent with previous studies. Scale efficiency is less than one, implying that banks have diseconomies of scale. Previous empirical results on the scale efficiency are mixed, which suggest that level of outputs, a reflection of banks operating activities, help the banks catch-up on the best-practice frontier.

Table-2. Results of Efficiency by DEA

	TE	AE	CE	PTE	SE
2005	0.719	0.387	0.3	0.817	0.87
2006	0.452	0.566	0.226	0.508	0.823
2007	0.515	0.626	0.33	0.6	0.839
2008	0.557	0.543	0.307	0.715	0.783
2009	0.538	0.575	0.34	0.653	0.806
2010	0.71	0.572	0.415	0.8	0.805
mean	0.5833	0.5489	0.3229	0.6282	0.821

Note: TE is the overall technological efficiency, PTE is the pure technological efficiency, SE is the scale efficiency, AE is the Allocative efficiency, and CE is the Cost efficiency.

Table-3. Results of Efficiency by DFA

	XEFF	SE
2005	0.3145	0.0469
2006	0.3492	0.046
2007	0.5537	0.0457
2008	0.4407	0.0452
2009	0.643	0.0468
2010	0.6819	0.0455
Mean	0.5048	0.046

Note: XEFF is the banks X-efficiency; range from 0 to1, SE is the banks scale efficiency.

$SE = \left[\sum(\partial \ln TC / \partial \ln y_i)\right]^{-1} = (\sum E_{y_i})^{-1}$, E_{y_i} indicate the cost elasticity of the *ith* output. If SE is greater than one indicates scale economies; SE is less than one indicate diseconomies of scale, SE equal one indicate constant return of scale, respectively.

4.2. Results of Regression Analysis

4.2.1. Relation between Stock Performance and Banks Efficiency

This section report the results of the regression equation (9) to (11), by which I attempt to explore whether banks' efficiency could reflect the stock return or stock price formation process. Table 4 presents the regression results by the OLS method, where the sign of efficiency only has a partial significance, and these results seem to show that stock returns are better captured by the efficiency estimates of a parametric approach (DFA) than by a non-parametric approach (DEA).[6] The coefficients of technical efficiency, allocative efficiency, and cost efficiency are insignificant, indicating the banks' efficiency cannot reflect the stock returns when efficiency is estimated by DEA. These results are inconsistent with Beccalli *et al.* (2006) who found that efficiency is significantly relation to stock return, regardless of which one econometric approach is employed. In our case, DFA is preferred to DEA due to the model of distribution free approach which considers for exogenous effects in a single frontier.

As can be seen in Table 4 within model A and C, this study finds that change in banks' efficiency could be impacting the stock return, and the coefficient of return of equity is significantly positive. The change in x-efficiency seem has a larger explanatory power of stock performance than the change in financial ratio (change in ROE) compared with levels of statistics and coefficients. The slope coefficient is 0.3328 for ROE and 0.7463 for DFA, implying that the expected increase in stock return is more than double the financial ratio measurement for a point increase in DFA x-efficiency. In summary, this suggests that banks have a greater efficiency then this, which is directly reflected in enhanced expectations for the performance of the banks in the stock market, although the change in ROE has a weaker impact on banks' stock performance. This results show that x-efficiency scores are a better indicatory index than traditional financial ratios when investors would like to invest in the stock market.

Table-4. Results of regression analysis: stock return

	Model A	**Model B**	**Model C**	**VIF**
Constant	0.0146 (0.341)	0.1819 (4.6146)***	-0.0969 (-2.116)**	
XEFF	0.6082 (5.6455)***		0.7463 (5.4513)***	1.062
TE	-0.0015 (-0.0896)		0.0086 (0.5456)	1.864
AE	0.0116 (0.7949)		0.0098 (0.7151)	4.462
CE	0.0003 (0.4106)		-0.0007 (-0.8014)	6.42
ROE			0.3328 (1.8824)*	1.811
STA		-0.0416 (-1.2109)	-0.0129 (-0.7576)	1.044
FI		-0.0318 (-1.5576)	-0.0293 (-1.6747)*	1.336
BS		-0.0459 (-1.219)	-0.0316 (-0.9523)	1.049
SIZE			21.955 (4.7398)***	1.159
EA			-0.0118 (-0.1486)	1.132
R^2	0.2002	0.0176	0.3376	
D-W	2.1407	2.576	2.3584	

Note: EFF is the banks efficiency including x-efficiency, technical efficiency, allocative efficiency and cost efficiency, which ROE is return of equity, STA is the percentage of equity owned by the state owners, FI is the percentage of equity owned by the foreign investors, BS is the percentage of equity owned by outside block shareholders, SIZE is the log banks assets, EA is the equity to asset ratio. The Durbin-Watson statistic is indicates the null hypothesis of no autocorrelation cannot be rejected.

[6] Using the Variance Inflation Factor (VIF) to test whether collinearity problem is significant, as can be see Table 4, the column 5 shows all variables of VIF less than 10, this implies there are no collinearity problems in the regression analysis.

4.2.2. Relationships between the Stock Performance and Ownership Structure

This section reports the results of regression equation stock performance and ownership structures, and this study attempts to explore whether stock return is linked to ownership structure, as can be seen in Table 4 in column 2 and 3. The coefficient of STA and BS is insignificant, indicating that there is no relationship between state owners, block shareholders, and stock returns; this result is inconsistent with our expectations. Bureaucratic power still plays an important role in developing countries, such as China and Taiwan, while state owners are large shareholders, so these banks may not have a hard time obtaining excess efficiency and profitability. Although the mean state owners have a large share, increasing 169.32 percentages over the study period, the mean change in ownership by state owners is merely 13 percentages in study sample, which is a smaller stockholder share compared to foreign investors and block stockholders. This implies that government is increasing the listed banks of stock holding ratios.

The sign of BS is negative, but the coefficient is insignificant. The change in the percentage of block stockholders does not impact the stock return. If banks are more profitable and efficient, then insiders have an incentive to buy banks' stock themselves. These good signs relative to banks' operating condition may encourage investors to purchase company stock. The mean change in block stockholders has increased 33.24 percentages over the study period, which implies that it does not affect the excitement investors to buy while block stockholders increase their holder ratios. The coefficient of FI is negative and significant in column 3, except with column 2. It appears that the change in foreign investors is significantly related to stock returns, but the evidential power is weak. This finding suggests that foreign investors do not invariably invest high returns on stock, and most domestic investors like to follow foreign investors. They believe foreign investors have a higher stock return in the stock market, such as in China and Taiwan's stock markets, but this phenomenon is not supported in this study. Our results show ownership characteristics are not fully reflected in banks' stock prices process, which implies that ownership structure variations do not influence the stock's performance. To compare the explanatory power of two models, the model that includes banks' efficiency estimates explain around 20.02% (R^2 =0.2002) of the variability in stock returns but only 1.76% of the explanatory power of the ownership structure variable model (R^2 =0.0176), and this finding suggests the great explanatory power of this model in comparison to the ownership structures variables model.

4.2.3. Further Discussion: is there a Relationship?

To further explore the relationship between efficiency and stock return, the dependent variable is banks' efficiency, including x-efficiency, technical efficiency, and allocative and cost efficiency. Regression analysis is used to determine whether the bank efficiency derived from the pooled sample is related to ownership structure factors. Specifically, the empirical equation can be written as follows:

$$EFF_{jt} = \beta_0 + \beta_1 R_{jt} + \beta_2 STA_{jt} + \beta_3 FI_{jt} + \beta_4 BS_{jt} + \beta_5 SIZE_{jt} + \beta_6 EA_{jt} + \varepsilon_{jt} \quad (12)$$

Where EFF is the banks' efficiency of banks i in year t, and R is the stock return of banks i in year t, measured from cumulative annual stock returns. The control variables of banks i in year t are as follows: STA is the percentage of equity owned by the state owners, FI is the percentage of equity owned by the foreign investors, BS is the percentage of equity owned by outside block shareholders, SIZE is the natural logarithm of banks' assets, and EA is the equity to asset ratio. Table 5 presents the results of equation (12), and the results of AE and CE regression are similar the TE regression; for brevity, I have not listed the results of AE and CE regression in Table 5. The coefficient of R is positive and significant in column 1. This implies that stock return plays an important role for determining banks' efficiency, and it is consistent with our expectations. The coefficient of R is insignificant with

the TE regression; this result is consistent with prior result, and these results to seem confirm that stock return is better captured by a parametric approach—DFA—than a non-parametric approach—DEA again. A positive reciprocal effect is observed between banks' efficiency and stock return, implying that stock returns increase when banks' efficiency is raised. The coefficient of STA is negative and significant in column 1, but insignificant in column 2. This finding shows that state owned banks' efficiency is not more than other types of banks. Jiang *et al.* (2009) found that efficiency of state-owned banks is lower than joint stock commercial banks, due to the fact that they are subject to less government intervention and have no historical financial burden as do state-owned banks. On the contrary, Chiu and Chen (2009) found that state owned banks' efficiency higher than in mixed banks and privately owned banks under the traditional DEA and the super-slack based DEA technique in Taiwan. The coefficient of BS is positive and significant in all models, implying that block shareholders would have a positive impact on banks' efficiency. This result is consistent with Lemmon and Lins (2003) whose results showed that firm values are higher when the cash flow rights held by block shareholders are higher. The coefficient of FI is insignificant with all models, implying that percentage of equity owned by the foreign investors does not affect banks' efficiency. Post-WTO accession, most foreign investors to became shareholders with banks for China and Taiwan through acquisition and stock trading, and these activities suggest that the banks' efficiency has improved, but this effect does not seem capable in the short run. The estimates of SIZE show conflicting results. The coefficient of SIZE is significantly negative in column 1, but it is significantly positive in column 2, which is consistent with Kwan (2006). These results may be affected by different efficiency estimate techniques, and the technical efficiency assumed constant returns to scale (CRS); all banks are operating at an optimal scale. Previous studies on the effect of size on banks' efficiency are mixed. Liao (2009) suggests that the banks to diverge from the best-practice frontier by merger activities cause the manager to be unable to effectively utilize bank resources. The coefficient of the equity-asset ratio is insignificant, implying that equity risk indicator has no significant impact on banks' efficiency. Mukherjee *et al.* (2001) provides another explanation: when banks have higher equity and other things are constant, there will be lower bank profitability, and they discover a negative relationship between productivity growth and the equity-to-asset ratio. In summary, I confirm the existence of a relationship between banks' efficiency and stock return. Our results show that there is a positive reciprocal effect between banks' efficiency and stock return. Ownership structure played an important role in determining banks' efficiency, but had no critical part in stock return.

Table-5. Results of regression analysis: bank efficiency

Dep.=	**XEFF**	**TE**	**VIF**
Constant	1.048 (3.1115)***	-0.4845 (-1.359)	
R	0.1366 (7.5306)***	0.0182 (0.3918)***	1.036
STA	-0.003 (-3.831)***	0.0014 (1.4777)	1.042
FI	0.0001 (0.0116)	-0.0025 (-1.555)	1.13
BS	0.004 (6.4407)***	0.0032 (3.2936)***	1.045
SIZE	-0.031 (-1.928)*	0.0488 (2.8235)***	1.105
EA	-0.4453 (-0.5839)	-0.5384 (-0.4318)	1.117
R^2	0.3725	0.1936	
D-W	1.3442	1.9002	

Note: EFF is the banks efficiency, EFF is the banks efficiency including x-efficiency, technical efficiency, allocative efficiency and cost efficiency, which R is the stock return of banks, STA is the percentage of equity owned by the state owners, FI is the percentage of equity owned by the foreign investors, BS is the percentage of equity owned by outside block shareholders, SIZE is the log banks assets, EA is the equity to asset ratio.The Durbin-Watson statistic is indicates the null hypothesis of no autocorrelation cannot be rejected.

4.3. Efficiency Relationship to Stock Performance: CAPM Version

To further study the relationship between stock performance and banks' efficiency, and, this study attempts to adopt the Sharper-Lintner excess-returns version of the capital asset pricing model (CAPM) to test the share performance relation to banks' efficiency. Previous studies also use the CAPM model to analyse this, such as Kirkwood and Nahm (2006) and Erdem and Erdem (2008). The empirical model can be written as:

$$ER_{it} = \alpha_i + \beta_i EM_{it} + \delta_i EFF_{it} + \varepsilon_{it} \qquad (13)$$

where ER_{it} is the excess return on stock i, the excess return estimate by return on stock i minus the risk-free rate, indicating that risk-free rate is the proxy government bond rate,[7] EM_{it} is the excess market return, EFF_{it} is the change in banks' efficiency, banks' efficiency is indicated by the x-efficiency, technological efficiency, allocative and cost efficiency, respectively, and ε_{it} is a random error term.

Based on the above empirical model, this study also employs the OLS to estimate the equation (13), the results of the CAPM regression are presented in Table 6, the coefficient of EM and XEFF are significant, and other coefficients are insignificant. The coefficient EM is 1.1611 and significantly positive; the result is consist with Kirkwood and Nahm (2006). The CAPM stated a positive linear relationship between expected return and stock beta, which is stock with larger beta, which will demand higher expected returns than stock with smaller beta. Compared with previous results, the beta value is larger than one; thus, the banks' stock portfolio is "aggressive," implying that banks' stock portfolio have a slightly higher sensitivity to market movements.[8]

The result of CAPM regression has a similar result for the prior section, using the DFA efficiency estimates which have a more valuable function reflected in the stock return when compared to the DEA efficiency estimates. This study finds the coefficient of TE AE and CE is insignificant in Model E. The coefficient of XEFF is significantly negative in Model D and E, and it is consistent with our expected result, and at least an efficiency factor could explain the variation stock returns. In explanation of this finding, the results show that excess return was in decline while the percentage of change in efficiency was increasing. This study finds banks' efficiency has a decline tendency over the sample period in the prior section; most investors hold a pessimistic expectancy for stock price in the future, reflecting a result that the excess return relation to change in efficiency is negative. The coefficient of α and efficiency term is significant, implying that the market portfolio may not be mean-variance efficient. This result is consistent with Kirkwood and Nahm (2006) and it indicates the beta is not a unique factor and can explain their excess return.[9]

[7] This study used the government bond rate, which is trading 10-yearrs bond yield rate in second market of Taiwan and one-year government central bond of China. Data source from Taiwan Economic Journal and China bond website, http://www/chinabond.com.cn, respectively.

[8] The empirical results are mixed. Erdem and Erdem (2008) found the beta is 0.714, indicating that banks' stock portfolios are less sensitive to market movements. But Kirkwood and Nahm (2006) results had shown that the beta value is greater than one.

[9] Kirkwood and Nahm (2006) illustrates that this finding should require a joint significance test including other stock as well as banking stocks, while making a more conclusive statement.

Table-6. Results of CAPM regression

	Model A	Model B
Constant	0.1158 (2.3668)**	0.094 (1.862)*
EM	1.1611 (9.5602)***	1.1852 (9.182)***
XEFF	-0.3344 (-2.3093)**	-0.3837 (-2.3812)**
TE		0.0184 (1.3178)
AE		0.0071 (0.8089)
CE		-0.0001 (-0.2938)
R^2	0.5104	0.5273
D-W	1.2046	1.2584

Note: EM is the excess market return; XEFF is the change in banks efficiency. TE is Overall technological efficiency, AE is Allocative efficiency, CE is Cost efficiency. The Durbin-Watson statistic is indicates the null hypothesis of no autocorrelation cannot be rejected.

5. CONCLUDING REMARKS

This article's aim is to examine whether the banks' efficiency and ownership structure is related to their stock performance in the listed banking industry for China and Taiwan. In addition, this study also tests whether efficiency indicators are better than traditional accounting ratios in explaining stock return. The results of efficiency by DEA are related-low, implying that a manager should be saving more than 50% of cost to improve bank efficiency. The mean efficiency from the DFA method is more than the cost efficiency derived from the DEA, and it is consistent with previous studies.

Is there a relationship? Empirical results show that banks have a greater efficiency then this, directly reflected in enhanced expectations for the performance of the banks in the stock market, although the change in ROE has a weaker impact on banks' stock performance. Unfortunately, ownership structure does not play an important role in stock return. To compare the explanatory power of banks' efficiency and ownership structure, this finding suggests that the great explanatory power of this model compares to the ownership structures variables model. The result of CAPM regression have a similar result for the prior section, using the DFA efficiency estimates which have a more valuable function reflected in the stock return when compared to the DEA efficiency estimates. This suggests that x-efficiency scores are a better indicatory index than the DEA model and traditional financial ratios when investors make stock market investment decisions.

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