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Linking Bank Efficiency and Share Price Performance: Evidence from the Singaporean Banking Industry#

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Abstract : The non-parametric frontier approach, Data Envelopment Analysis (DEA) with a variant of the intermediation approach to two models, was employed to detect for any efficiency gains (loss) resulting from the mergers and acquisitions together with a three-year event window among the domestic incorporated Singapore banking groups. The results from both models suggest that the mergers have resulted in higher mean overall efficiency of Singapore banks post-merger relative to pre-merger. Although mergers have resulted in a more efficient Singapore banking system, we found that size has become the biggest factor resulting in the inefficiency of the Singapore banking system. Henceforth, size will not support further consolidation in the Singapore banking sector. The results also support the hypothesis that the acquiring banks' efficiency improved (deteriorated) post-merger resulting from the merger with a more (less) efficient bank. We have further established the relationship between cost efficiency and share price performance by employing panel regression analysis. The evidence seems to indicate that the excess market returns tend to reflect stock performance rather than changes in cost efficiency.

Keywords: Banks efficiency, data envelopment analysis, mergers, stock market, Singapore

1. Introduction

Examining banking performance has been a common practice among banking and finance researchers for a number of years following the deregulation of banking and financial services industries.[1] Many countries that adopted financial deregulation policies are now experiencing competitive banking practices. In response to this competitive pressure, banking firms are actively looking for alternative ways to reduce their production costs by enhancing production efficiency and exploiting scale and scope economies.

According to a major stream of financial literature, in an efficient market, stock prices incorporate all relevant publicly known information (Fama 1976). An efficient stock market should consider operating efficiency measures in the price formation process as they

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#All findings, interpretations, and conclusions are solely those of the authors and do not necessarily reflect the views of the institutions.

represent public information. All things being equal, cost efficient banks should be able to raise capital at a lower cost. On the other hand, in a semi-strong, efficient market where most of the information is incorporated into prices, stock value performance is, as it is widely accepted (Brealey and Myers 1991), the best measure of estimating whether firms are creating value for shareholders. Studies on the stock market have found that stock prices do incorporate relevant publicly known information (Ball and Kothari 1994). It may be expected that efficient firms perform better than inefficient firms do and this fact will be reflected in market prices (directly through lower costs or higher output or indirectly, through higher customer satisfaction and higher prices which in return may improve stock performance).

This paper attempts to combine these two streams of literature to explain and understand the relationship between estimated bank's efficiency and its share price performance in the marketplace. Specifically, working within the Singapore domestic banking arena, we investigated the influence of X-efficiencies derived from Data Envelopment Analysis (DEA) on the share prices of Singapore commercial banks listed on the Stock Exchange of Singapore (SES).

The motivation for this study comes first from the fact that despite the importance of the Singapore banking sector to the domestic, regional, and international economy, there are only a few micro-economic studies performed in this area of research. The present study thus addresses an important gap in the literature. Second, in order to appraise the effectiveness and success of mergers and acquisition activities among the domestic-incorporated Singapore commercial banks, it is essential to conduct a formal analysis. This study attempts to provide empirical evidence on the evolution of efficiency of Singapore commercial banks arising from mergers and acquisitions over the past decade. To the best of our knowledge, this will be the first study in the literature to examine this important issue within the context of the Singapore banking sector. Finally, an understudied, but important issue is whether changes in a bank's efficiency are reflected in its share performance in the marketplace. The relationship between changes in a bank's efficiency and its share price performance in the marketplace is assessed using a method that appears to be superior to that previously adopted. Chu and Lim (1998) found that changes in profit efficiency, as measured by DEA, are reflected in stock returns. We have built upon their approach by taking into account market returns when considering this relationship.

Utilising the non-parametric DEA methodology, the overall, pure technical and scale efficiency estimates of all domestic-incorporated Singapore commercial banks that were involved in mergers and acquisitions were investigated. The role of mergers in efficiency changes was probed by comparing the relative efficiency scores of the acquirers and targets ex-post and ex-ante. The analysis was conducted between 1998 and 2004 for the 7 domestic-incorporated Singapore banks listed on the SES.

The research paper raises four important fundamental questions: (1) Did the mergers and acquisitions result in an improvement of mean overall efficiency levels of the Singapore banking system post-merger? (2) Did a less efficient bank become the target for acquisition? (3) Did a less (more) efficient target result in the deterioration (acceleration) in the acquirer's

[1] For an overview,see Berger *et al.* (1993), Berger and Humphrey (1997).

mean overall efficiency level post-merger? (4) Did a more efficient bank's share price result in a higher share price in the long-run?

This paper has been designed to answer each of these questions in the order they have been presented. After a brief overview of the Singapore banking system in Section 2, survey of the literature devoted to mergers and bank efficiency as well as earlier works on Singapore banks' efficiency is presented in Section 3. Section 4 outlines the approaches to the measurement and estimation of efficiency change. Questions 1, 2, 3, and 4 are answered in Section 5 and finally, Section 6 provides some concluding remarks.

2. Brief Overview of the Singapore Banking System

Singapore's development into a financial centre was the result of deliberate government policy in the 1970s to broaden the country's economic base. With the introduction of the Monetary Authority of Singapore (MAS) in 1970, the government introduced fiscal incentives, removed exchange controls, and encouraged competition to spur financial sector development. Supported by its sound macro-economic fundamentals and prudent policies, Singapore has emerged as an established financial centre. Today, Singapore ranks among the leading international financial centres and is one of the key centres in Asia. Singapore lags behind only London, New York and Tokyo in foreign exchange trading. Growth in the financial services sector has contributed significantly to economic growth and development, which today accounts for approximately 13 to 15 per cent of the city-state's GDP. This is evidenced by the presence of a wide network of financial institutions providing a range of services that facilitate domestic, regional, and international flow of funds for trade and investment.

The Singapore domestic banking sector was closely regulated and largely protected until the later half of the 1990s. Since 1971, the entry of foreign banks has been restricted to wholesale banking markets. While the locally incorporated banks are given permission to expand their branch networks, foreign-incorporated full licensed banks, admitted prior to 1971, are subjected to restrictions on opening up new branches and re-locating existing branches. As such, locally incorporated banks are relatively sheltered from foreign competition. This has resulted in a banking industry with many international players but where domestically incorporated commercial banks dominate the local banking market.

During the Asian Financial Crisis of 1997-1998, Singapore's sound economic and financial fundamentals enabled the banking sector to weather the crisis relatively well. Despite incurring losses from defaulted loans, which escalated during the crisis, Singapore commercial banks were adequately capitalised and insolvency was not an issue. Nonetheless, the immediate lesson from the financial turmoil for the local financial institutions was the need for strong incentives for banks to merge, creating large institutions to cope with international competition.

2.1 Mergers and Acquisitions in the Singapore Banking Sector

A regional financial centre can be defined as a central location where there is a high concentration of financial institutions and capital markets that allow financial transactions in the region to take place efficiently. Singapore has been a remarkable success as a regional financial centre. In just over three decades, the city-state has become one of the world's leading financial centres. The Singapore government has been actively undertaking financial

liberalisation and reforms since the 1960s. Resulting from its endeavours, Singapore has become a leading financial centre, serving both the domestic as well as neighbouring economies of South East Asia. As a financial centre, Singapore has facilitated greater financial intermediation in the region, contributing to the development of capital markets to cross-border trade and business investment.

Although Singapore was affected the least during the Asian financial crisis, the crisis exposed Singapore's vulnerability to external shocks and financial contagion. Rather than becoming more inward looking, as did some of the crisis affected countries, Singapore hastened financial liberalisation in order to create a more resilient financial sector with the capacity to compete in an increasingly globalised environment. The liberalisation has involved strengthening domestic banks through consolidation and increasing foreign participation in the financial sector.

Since 1998, when the Development Bank of Singapore (DBS) acquired the Post Office Savings Bank (POSB) and Keppel Bank merged with Tat Lee Bank, the Singapore government has encouraged domestic banks to consolidate to prepare them for stiffer competition from foreign banks. In fact, for Singapore banks to compete successfully in the new era of globalisation, the government intended to eventually merge the domestic financial institutions into two 'super banks.'

The recent mergers and acquisition activities among the domestic incorporated Singapore banks[2] were as follows:

- On 12 June 2001, Singapore's third largest bank, Overseas-Chinese Banking Corporation (OCBC), announced a S$4.8 billion bid (voluntary general offer) for Keppel Capital Holdings (KCH), which owns Singapore's smallest bank, Keppel Tat Lee Bank.
- On 29 June 2001 Singapore's second largest lender, United Overseas Bank (UOB) made a competing bid for Overseas Union Bank (OUB), Singapore's fourth largest bank, after DBS Holdings Group's unsolicited bid of S$9.4 billion for OUB. UOB's bid succeeded in August 2001 resulting in the formation of Singapore's largest bank in terms of assets.

3. Related Studies

Bank mergers and acquisitions may enable banking firms to benefit from new business opportunities created by changes in the regulatory and technological environment. Berger *et al.* (1999 : 136) pointed to the consequences of mergers and acquisitions which may lead to changes in efficiency, market power, economies of scale and scope, availability of services to small customers and payments systems efficiency.

[2] Characteristics of Singapore's commercial banks after the M & As in 2001

	DBS	UOB + OUB	OCBC + KEP
Total sssets (S$ billion)	111.0	113.7	83.0
Total loans (S$ billion)	54.2	61.5	50.4
Total deposits (S$ billion)	92.8	96.6	71.1
Total shareholders fund (S$ billion)	8.4	13.1	8.3
Number of branches	107.0	93.0	74.0
Number of ATMs	900.0	426.0	381.0

Besides improvements in cost and profit efficiency, mergers and acquisitions could also lead banks to earn higher profits through the bank market in leveraging loans and deposit interest rates. Prager and Hannan (1998) found that bank mergers and acquisitions have resulted in a higher concentration of banks which in turn leads to significantly lower rates on deposits. Some evidence also suggests that US banks involved in M & As have improved the quality of their output in the 1990s in ways that increased costs, but still improved profit productivity by increasing revenue over costs (Berger and Mester 2003: 88).

Earlier studies examining efficiency effects on bank mergers and acquisitions in the US banking sector involved a large number of M & As. However, a growing number of empirical studies have been undertaken to analyse a small number of M & As using a non-parametric DEA method. The DEA method has increasingly been the preferred method to investigate the impact of mergers and acquisitions on bank efficiency, in particular if the sample size is small. Avkiran (1999) states that it is advisable to work with a sample size substantially larger than the product of number of inputs and number of outputs if the analysis is to discriminate effectively between efficient and inefficient decision making units (DMUs). Previous studies undertaken to analyse a small number of M & As include among others Avkiran (1999), Liu and Tripe (2002), and Sufian (2004).

Avkiran (1999) employed DEA and financial ratios to a small sample of 16 to 19 Australian banks during the period of 1986-1995, studied the effects of four mergers on efficiency and the benefits to the public. He adopted the intermediation approach and two DEA models. He reported that acquiring banks were more efficient than target banks. He also found that the acquiring banks do not always maintain their pre-merger efficiency, but that, during the deregulated period, overall efficiency, employee productivity and return on assets (ROA) improved. There was mixed evidence from the four cases on the extent to which the benefits of efficiency gains from mergers were passed on to the public.

Liu and Tripe (2002), using a small sample of 7 to 14 banks, employed accounting ratios and two DEA models to explore the efficiency of six bank mergers in New Zealand between 1989 and 1998. They found the acquiring banks to be generally larger than their targets, although they were inconsistently more efficient. They found that five of the six merged banks had efficiency gains based on the financial ratios while another only achieved a slight improvement in operating expenses to average total income. Based on the DEA analysis, they found that only some banks were more efficient than the target banks pre-merger. The results suggest that four banks had obvious efficiency gains post-merger. However, they could not decisively conclude on possible benefits of the mergers to the public.

Using a small sample size of 10 banks, Sufian (2004) investigated the impact of the mega merger programme among the domestically incorporated Malaysian commercial banks. He found Malaysian banks to exhibit an average overall technical efficiency level of 95.9 per cent during the period of study. He found that inefficiency among Malaysian banks was

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Note: DBS is Development Bank of Singapore; UOB is United Overseas Bank; OUB is Overseas Union Bank; OCBC is Overseas-Chinese Banking Corporation; and KEP is Keppel Capital Holdings (which owns Keppel Tat Lee Bank).
Source: Banks Annual Reports

largely due to scale rather than pure technical factors, suggesting that Malaysian banks were operating at a non-optimal scale of operations. He concluded that the merger was particularly successful for the small and medium-sized banks, which benefited the most from expansion and via economies of scale.

A note of caution however; encouraging or forcing banks to merge in times of severe banking crisis as a measure to reduce banks risk of failure, would not only possibly create a weaker bank, but could also worsen the banking sector crisis. As shown by Shih (2003), merging a weaker bank with a healthier bank in many cases would result in a bank that is even more likely to fail than both the predecessors' bank. On the other hand, he found that mergers between relatively healthy banks would create banks that are less likely to fail.

3.1 Studies on Efficiency of Singapore Banks

Despite substantial studies performed in regard to efficiency and productivity of financial institutions in the US, Europe and other Asia-Pacific banking industries, the Singapore banking industry has not followed suit partly due to the lack of available data sources and the small sample of banks. Among the notable micro-economic research studies performed on efficiency of Singapore banks was by Chu and Lim (1998), Rezvanian and Mehdian (2002), and Randhawa and Lim (2005).

Using DEA with three inputs and two outputs, Chu and Lim (1998) evaluated the relative cost and profit efficiency of a panel of six Singapore listed banks during the period 1992-1996. They found that during that period, the six Singapore listed banks exhibited a higher overall efficiency of 95.3 per cent compared to a profit efficiency of 82.6 per cent. They also found that large Singapore banks reported a higher efficiency of 99.0 per cent compared to 92.0 per cent for the small banks. The also suggested that scale inefficiency dominated pure technical inefficiency during the period of study.

Rezvanian and Mehdian (2002) used a parametric and non-parametric approach to examine the production performance and cost structure of a sample of Singaporean commercial banks. The results of the parametric methodology suggest that the average cost curve of these banks is U-shaped and there are economies of scale for small and medium-sized banks. Further analysis provides evidence of economies of scope for all banks regardless of their size. The non-parametric results indicate that the Singaporean banks could have reduced cost by 43 per cent had they all been efficient generally. The sources of this cost inefficiency appeared to be caused equally by allocative and technical inefficiencies.

More recently, Randhawa and Lim (2005) utilised DEA to investigate the X-efficiencies of the locally incorporated banks in Hong Kong and Singapore during the period 1995 to 1999. They found that during the period, the seven domestic incorporated Singapore banks exhibited an average overall efficiency score of 80.4 per cent under the intermediation approach and 97.2 per cent under the production approach. They suggest that the large Singapore banks reported higher overall efficiency compared to the small banks under the production approach while on the other hand, the small banks exhibited higher overall efficiency under the intermediation approach.

4. Methodology

4.1 *Data Envelopment Analysis (DEA)*

The majority of studies on efficiency of Singapore banks use DEA, largely because of the small number of banks that may be included in the sample. Among the advantages of using DEA is that no functional form needs to be specified[3], which is ideal in the Singaporean case because although some banks operate a typical intermediation service, others offer a greater range of services.

The theoretical development of DEA was initiated by Farrell (1957) who suggested constructing the frontier as a piecewise linear combination of the most efficient units. He also defined the most efficient DMUs to be those for which no other DMU or a linear combination of DMUs has as much or more of every output (given a fixed amount of inputs, for an output-oriented model) or as little or less of every input (given a fixed amount of outputs, for an input-oriented model). The efficiency frontier formed by connecting these best practice observations would yield a convex production possibility set. The DMUs falling inside the frontier were termed inefficient, and their performance would be measured vis-à-vis the frontier DMUs. Thus this method provides a measure of relative efficiency.

In practice, this was first introduced by Charnes *et al.*(1978) who used a linear-programming method to identify the efficient DMUs and coined the term Data Envelopment Analysis (DEA).[4] The DEA has since been used extensively in studies of the banking industry in developed and developing market economies, for individual countries as well as inter-country comparisons. To arrive at basic specifications of a linear-programming model underlying the DEA, we assume that there are K inputs and M outputs for every DMU.

For the i^{th} DMU, the inputs and outputs are represented by vectors x_i and y_i, respectively.

For each DMU, the method aims to obtain a measure of the ratio of all outputs over all inputs, such as $u_i' y_i / v_i' x_i$, where u_i and v_i are vectors of weights. To select the optimal weights, the following linear-programming problem is typically proposed:

$$\max_{u_{ik}, v_{im}} \frac{u_i' y_i}{v_i' x_i}$$

$$\text{subject to } \frac{u_i' y_j}{v_i' x_j} \leq 1$$

$$u_{ik}, v_{im} \geq 0$$

$$i, j = 1, 2, \ldots N$$

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[3] See Evanoff and Israelvich 1991; Grifell-Tatje and Lovell 1997; Bauer *et al.* 1998.

[4] Their method is based on the assumption that the production units have constant returns to scale. Banker *et al.* (1984) later relaxed the assumption and proposed a model with units of production with variable returns to scale. Theoretical extensions of this method and empirical applications are discussed in Cooper *et al.* (2000).

$$k = 1, 2, \ldots K$$
$$m = 1, 2, \ldots M \quad (1)$$

A problem with this formulation is that it has an infinite number of solutions. This may be avoided by introducing a constraint $v_i x_i = 1$ and obtaining the multiplier form of the linear programming problem:

$$\max_{\mu_{ik}, \sigma_{im}} \quad \mu_i' y_i$$

$$\text{subject to} \quad \sigma_i' x_i = 1$$

$$\mu_i' y_j - \sigma_i' x_j \leq 0$$

$$\mu_{ik}, \sigma_{im} \geq 0$$

$$i, j = 1, 2, \ldots N$$
$$k = 1, 2, \ldots K$$
$$m = 1, 2, \ldots M \quad (2)$$

where vectors u_i and v_i are replaced with μ_i and σ_i. Using the duality property of this linear programming problem, Charnes *et al.* (1978) derived an equivalent envelopment form as

$$\max_{\mu_{ik}, \sigma_{im}} \theta_i$$

$$\text{subject to} \quad -y_{ik} + Y\lambda \geq 0$$

$$\theta_i x_{im} - X \quad \lambda \geq 0$$

$$\lambda_i \geq 0 \quad (3)$$

where λ is a $(N \times 1)$ vector; and $\theta, \in [0,1]$ a scalar, is the efficiency score i^{th} for the DMU.[5] Essentially, θ_i is an indicator of how close a bank is to the efficiency frontier, with $\theta_i < 1$ implying that the bank is inside the frontier (that is, it is an inefficient bank), while $\theta_i = 1$ implying that the bank is on the frontier (that is, it is an efficient bank). Due to a fewer number of constraints, the formulation presented in Equation 3 is typically used for computations.

The efficiency indexes calculated in such a way are termed overall technical efficiency (OTE) index. The index can be subsequently decomposed into pure technical efficiency (PTE) and scale efficiency (SE) indices, to help identify the source of inefficiency of each DMU in the sample. Skipping the details of the formulation, this relationship may be presented as

$$OTE_t = PTE_t - SE_t \quad (4)$$

To conceptualise this, note that the PTE index is calculated relative to a frontier characterised by variable returns to scale (that is, either increasing, decreasing, or constant), while OTE is calculated relative to a frontier characterised by only constant returns to scale.

[5] For functional forms as well as definition of PTE, SE and inefficiencies of scope, refer to Rezvanian and Mehdian (2002), who utilised the framework developed in Fare *et al.* (1985).

Consequently, the SE index captures the scale efficiency (that is, due to increasing or decreasing returns to scale), while the PTE index captures non-scale and non-scope inefficiencies.[6]

4.2 *Linking Bank Efficiency to Stock Returns*

In recent years, many DEA applications have employed a two-stage procedure linking bank efficiency and stock market performance. Among others, Chu and Lim (1998), Sufian and Majid (2006), and Beccalli *et al.* (2006) have performed both DEA and regression analyses in banking sector applications to estimate bank efficiency and its share price performance in the marketplace.

Estimates obtained using panel data estimation procedures have a number of advantages over the simply pooled ordinary least squares (OLS) procedures. Simply pooled OLS estimation procedures do not adjust for firm specific and time specific (that is, year specific) effects, which, if correlated with other explanatory variables, would produce omitted variables bias and mis-specified models. This problem is serious as it produces flawed estimates.

The panel data model can be estimated by using a fixed effects estimator or a random effect estimator (feasible GLS) depending on the nature of individual effects μ_j. Following the panel data literature, we used the Hausman Test to determine the appropriate estimate (Baltagi 2001). This is based on the assumption that there are statistically significant bank-specific effects in the sample. If there are no bank-specific effects, we can pool the banks together and estimate the model using OLS. To test the pooling restriction, we used an *F*-test that all $\mu_j = 0$.

The relationship between X-efficiency and share performance can be examined by regressing the bank share returns against X-efficiency estimates by employing both estimators (fixed effects and random effects); we ultimately chose the fixed-effects specification on the basis of Likelihood Ratio Test and Hausman Test results. We specified a model of stock returns, which included X-efficiency as an explanatory variable. We built upon a theoretical model of stock returns, derived from the capital asset pricing model (CAPM). The model took the following form:

$$ER_{jt} = \alpha_0 + \beta_1 EM_{jt} + \beta_2 EFF_{jt} + \epsilon_{jt}$$
$$\varepsilon_{jt} = \mu_{jt} + v_{jt} \qquad (5)$$

where ER_{jt} is the bank j's annual share excess returns less the risk free rate in t; α_0 are bank j's fixed effects, EM_{jt} is the excess market return, EFF_{jt} is bank j's mean annual percentage change in X-efficiency in period t; β_j is a parameter excluding the constant; and ϵ_j is a normally distributed error term. The error term is assumed free of autocorrelation. Heteroskedasticity, though allowed, was corrected in the estimations by using the robust variance covariance matrix.

[6] There are five widely recognised functions performed by banks: profit maximisation, risk management, service provision, intermediation, and utility provision (Bergendhal 1998).

4.3 Inputs and Outputs Definition and the Choice of Variables

The definition of measurement of inputs and outputs in the banking function remains a contentious issue among researchers. To determine what constitutes inputs and outputs of banks, one should first decide on the nature of banking technology. In the banking theory literature, there are two main approaches competing with each other in this regard: the production and intermediation approaches (Sealey and Lindley 1977).

Under the production approach, a financial institution is defined as a producer of services for account holders, that is, they perform transactions on deposit accounts and process documents such as loans. Hence, according to this approach, the number of accounts or its related transactions is the best measure for output, while the number of employees and physical capital are considered as inputs. Previous studies that adopted this approach, among others, are Sherman and Gold (1985), Ferrier and Lovell (1990) and Fried *et al.* (1993).

The intermediation approach on the other hand assumes that financial firms act as an intermediary between savers and borrowers and posit total loans and securities as outputs, whereas deposits along with labour and physical capital are defined as inputs. Banking efficiency research studies that adopted this approach, among others, are Charnes *et al.* (1990), Bhattacharyya *et al.* (1997), and Sathye (2001).

For purposes of this study, a variation of the intermediation approach or asset approach originally developed by Sealey and Lindley (1977) was adopted in the definition of inputs and outputs used.[7] According to Berger and Humphrey (1997), the production approach might be more suitable for branch efficiency studies, as at most times, bank branches basically process customer documents and bank funding, while investment decisions are mostly not under the control of branches.

The aim in the choice of variables for this study is to provide a parsimonious model and to avoid the use of unnecessary variables that may reduce the degree of freedom.[8] All variables are measured in millions of Singapore Dollars (SG$). Given the sensitivity of efficiency estimates to the specification of outputs and inputs, for purposes of the study, we estimated two alternative models. In Model 1, we modelled Singapore banks as multi-product firms, producing two outputs by employing one input. Accordingly, *Total Deposits* ($x1$) was used as an input vector to produce *Total Loans* ($y1$) and *Interest Income* ($y3$).

In an analysis of profit efficiency of banks, Fare *et al.* (2004) found that using bank equity capital as a quasi-fixed input is sufficient to account for both risk-based capital requirements and the risk-return trade-off that bank owners face. Hence, in Model 2, we followed the work of Fare *et al.* (2004) and included shareholders equity ($x2$) as an input variable along with *Interest Income* ($y2$) as an output variable. To recognise that banks in recent years have been increasingly generating income from 'off-balance sheet' business and fee income generally, following, among others, Drake and Hall (2003), and Isik and Hassan (2003), *Non-Interest Income* ($y3$) would be incorporated as a proxy to non-traditional activities as output in Model 2.

[7] Humphrey (1985) presents an extended discussion of the alternative approaches over what a bank produces.

[8] For a detailed discussion on the optimal number of inputs and outputs in DEA, see Avkiran (2002).

Table 1: Descriptive statistics

Variable	Mean	Std. Dev	Minimum	Maximum
Total loans ($y1$)	45,348.21	18,845.16	12,713.56	71,021.0
Non-interest income ($y2$)	727.26	477.50	73.31	2,153.0
Interest income ($y3$)	3,201.95	1,153.90	944.39	5,298.0
Total deposits ($x1$)	56,598.01	30,090.08	12,089.23	113,206.0
Shareholders equity ($x2$)	9,417.43	4,314.58	2,518.63	17,630.0

Note:
Model 1 -Outputs=($y1$,$y3$), Inputs($x1$)
Model 2- Outputs=($y3$, $y2$), Inputs($x2$)

4.4 *Data*

For the empirical analysis and in the spirit of maintaining homogeneity, only domestically incorporated commercial banks that make commercial loans and accept deposits from the public were included in the analysis. Therefore, Investment Banks were excluded from the sample. The annual balance sheets and income statements used to construct the variables for the empirical analysis were sourced from published balance sheet information in annual reports of each individual bank from 1998 to 2004. Three banks were omitted from the study, namely, Bank of Singapore, Far Eastern Bank and Industrial and Commercial Bank, which are all wholly owned subsidiaries of the OCBC and UOB groups.

As for the panel regression, we used excess returns consisting of two components; the annual stock returns and the risk-free returns. The annual stock returns were obtained from Bloomberg and DataStream. The annual stock returns were calculated as a sum of *daily* returns for each year. This measure is believed to be a better measure than calculating a point increase with data from the first and the last day of the period under investigation. Daily returns have smaller standard deviations than do annual and monthly returns.[9] The risk-free return is the average monthly return on 3-month Treasury Bills for the banks' financial year. Excess return on the market is composed of the market return less a risk-free component. The Singapore Straits Times Index (STI) was used as the market portfolio and the return on this portfolio was calculated in the same manner as for the individual stock returns.

5. Empirical Results

In the spirit of Rhoades (1998), we developed a [-3, 3] event window to investigate the effects of mergers and acquisitions on the efficiency of Singapore banking groups. The choice of the event window was motivated by Rhoades (1998 : 278), who pointed out that there have been unanimous agreement among the experts that about half of any efficiency gains should be apparent after one year and all gains should be realised within three years after the merger. The whole period (that is, 1998-2004) is divided into three sub-periods:

[9] The mean standard deviation of monthly returns for randomly selected securities is about 7.8 per cent, while the corresponding mean standard deviation of daily returns will be approximately 1.8 per cent if daily returns are serially independent (Fama 1976:123).

1998-2000 refers to the pre-merger period, 2001 is considered as the merger year and 2002-2004 represents the post-merger period, when the mergers and acquisitions are expected to have some impact on the efficiency of the Singapore banking groups. We expected to capture the effects of mergers and acquisitions on the efficiency of Singapore banks during this period. The mean overall efficiency of the targets and acquirers during all periods were compared, along with its decomposition of pure technical and scale efficiency scores. This could help shed some light on the sources of inefficiency of the Singapore banking system in general as well as differentiate between the efficiency scores of target and acquirers.

5.1 Pre-Merger – Model 1

In Table 2, the overall efficiency estimates are presented, along with its decompositions into pure technical and scale efficiency estimates for Model 1. It is apparent that during the pre-merger period, Singapore banks exhibited mean overall efficiency scores of 88.59 per cent, suggesting that the Singapore banking system has performed relatively well in its basic function – transforming deposits to loans, with relatively minimal mean input waste of 11.41 per cent. Similar studies by Chu and Lim (1998) found that Singapore banks exhibited a mean overall efficiency of 95.30 per cent during the period from 1992-1996, while Randhawa and Lim (2005) found 19.60 per cent input waste among seven Singapore domestic banks during the period from 1995-1999. The results also compare favourably with the study of Fukuyama (1993) on Japanese banks (14 per cent) and the 14 to 25 per cent averages of Indian commercial banks (Bhattacharyya *et al.* 1997). The decomposition of overall efficiency into its pure technical and scale efficiency components suggests that during the pre-merger period, efficiency of Singapore banks was largely due to scale (7.14 per cent) rather than pure technical efficiency (6.31 per cent).

Table 2. Summary of mean efficiency levels of Singapore banks (Model 1)

Bank	Pre-Merger*			During merger**			Post-merger***		
	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE
KEP	99.23	100.0	99.23	-	-	-	-	-	-
OCBC	96.23	100.0	96.23	100.0	100.0	100.0	100.0	100.0	100.0
OUB	100.0	100.0	100.0	-	-	-	-	-	-
UOB	76.40	78.43	97.73	88.80	100.0	88.80	100.0	100.0	100.0
DBS	71.10	100.0	71.10	88.20	100.0	88.20	75.53	100.0	75.53
Mean	**88.59**	**93.69**	**92.86**	**91.82**	**100.0**	**92.33**	**91.84**	**100.0**	**91.84**

1998-2000; **2001; ***2002-2004
OE-Overall Efficiency, PTE-Pure Technical Efficiency, SE-Scale Efficiency

5.2 Post-Merger – Model 1

From Table 2, it is clear that the merger resulted in the improvement of mean overall efficiency of Singapore banks for Model 1. During the post-merger period, the results seem to suggest that Singapore banks exhibited 75.53 per cent (DBS) to 100.0 per cent (OCBC and UOB) overall efficiency levels. During the post-merger period, the results suggest that DBS, which is the largest bank in the sample in terms of total assets, exhibited the lowest overall efficiency with mean input waste of 24.47 per cent, while OCBC's overall efficiency

improved post merger, and thus has consistently been operating at CRS. Interestingly, the findings suggest that UOB exhibited significant improvement in its overall efficiency levels, operating at CRS during the post-merger period compared to the pre-merger period when the bank was operating at 76.40 per cent overall efficiency levels. The decomposition of overall efficiency into its pure technical and scale efficiency components suggest that DBS, the only bank in the sample which was found to be inefficient, was operating on a wrong scale of operations during the post-merger period.

5.3 Pre-Merger – Model 2

In Table 3, the overall efficiency estimates along with their pure technical and scale efficiency decomposition for Model 2 is presented. It is apparent that during the pre-merger period, Singapore banks exhibited a higher mean overall efficiency score of 91.72 per cent compared to 88.59 per cent reported for Model 1, suggesting a mean input waste of 8.28 per cent (11.41 per cent for Model 1). This implies that banks could have reduced their inputs by 8.28 per cent and still be able to produce the observed levels of output, without any adjustment in input, output volumes, or the branching network.

Three banks, namely, KEP, OCBC, and OUB, exhibited lower overall efficiency scores in Model 2 compared to Model 1, while overall efficiency of UOB and DBS was higher in Model 2 compared to Model 1 estimates. It is also interesting to note that different factors have resulted in the lower overall efficiency of Singapore banking groups in Model 2 relative to Model 1. The results from Model 2 suggest that while OUB's inefficiency was due to both scale and pure technical, OCBC, on the other hand, exhibited a higher scale efficiency of 98.47 per cent in Model 2 compared to 96.23 per cent in Model 1, while its pure technical efficiency level declined to 91.43 per cent in Model 2 compared to 100 per cent in Model 1. The results from Model 2 also suggest that KEP's pure technical efficiency level remained the same in both models. However, the bank's scale efficiency deteriorated significantly from 99.23 per cent in Model 1 to 78.47 per cent in Model 2. The results from Model 2 also reveal interesting findings. While UOB was ranked among the least efficient banks in Model 1, the bank was the most efficient bank in Model 2, suggesting the sensitivity of input-output modelling in DEA. Further, it is also apparent from Table 3 that UOB's overall efficiency improvement my be attributed to both scale and pure technical, which increased by 2.27 per cent and 21.57 per cent respectively.

5.4 Post-Merger – Model 2

From Table 3, it is clear that during the post-merger period, the Singapore banking groups exhibited a higher mean overall efficiency of 98.59 per cent, compared to the pre-merger period mean overall efficiency of 91.72 per cent, and Model 1 post-merger mean overall efficiency of 91.84 per cent. As shown in Model 1, all Singapore banking groups were found to be pure technically efficient during the post-merger period and that the inefficiency was solely due to scale. In contrast to Model 1 which suggests UOB and OCBC as the fully efficient banking groups, the results from Model 2 identify DBS as the only efficient bank during the post-merger period. The results from Model 2 suggest UOB and OCBC as being scale inefficient banks during the post-merger period.

Table 3. Summary of mean efficiency levels of Singapore banks (Model 2)

Bank	Pre-Merger*			During Merger**			Post-Merger***		
	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE
KEP	78.47	100.0	78.47	-	-	-	-	-	-
OCBC	90.07	91.43	98.47	100.0	100.0	100.0	96.10	100.0	96.10
OUB	95.27	98.57	96.67	-	-	-	-	-	-
UOB	100.0	100.0	100.0	75.70	76.20	99.30	99.67	100.0	99.67
DBS	94.77	100.0	94.77	97.40	100.0	97.40	100.0	100.0	100.0
Mean	**91.72**	**98.0**	**93.68**	**91.03**	**92.07**	**98.90**	**98.59**	**100.0**	**98.59**

1998-2000;**2001;***2002-2004

OE-Overall Efficiency, PTE-Pure Technical Efficiency, SE-Scale Efficiency

5.5 Is the Acquirer a More Efficient Bank?

We now turn to the assessment of how the mergers and consolidation process affected the mean overall efficiency of the involved banks. First, we analysed the pre-merger performance of the banks concerned. Theoretically, the more efficient banks should acquire the less efficient ones. A more efficient bank is assumed to be well organised and has a more capable management. The idea is that since there is room for improvement in relation to the performance of the less efficient bank, a takeover by a more efficient bank would lead to the transfer of better management quality to the inefficient bank. This in turn would lead to a more efficient and better performing merged unit. In order to assess whether it is indeed the case that the more efficient banks acquire the inefficient ones, we calculated the difference in overall efficiency between the acquiring and the acquired banks. The efficiency difference was measured as the mean overall efficiency of the acquirers, minus the mean overall efficiency of the target banks for the last observation period before consolidation.

For Model 1, it is clear from Table 2 that during the pre-merger period KEP's (the target) overall efficiency level of 99.23 per cent was higher compared to OCBC's (the acquirer) overall efficiency of 96.23 per cent. It is also apparent that during the pre-merger period, KEP's scale efficiency was higher compared to that of OCBC, which could be because KEP's size was smaller compared to OCBC. Similarly, from Table 2 it is clear that during the pre-merger period, in Model 1, UOB exhibited a lower mean overall efficiency level of 76.40 per cent compared to, its target, OUB's mean overall efficiency of 100 per cent. Thus, the results from Model 1 reject the hypothesis that the target is a less efficient bank.

Conversely, it is apparent from Table 3 that the results from Model 2 suggest that KEP's overall efficiency was lower at 78.47 per cent compared to OCBC's overall efficiency level of 90.07 per cent. The results imply that during the pre-merger period, KEP could have produced the same amount of outputs with only 78.47 per cent of the amount of inputs used. In other words, the bank could have reduced its inputs by 21.53 per cent and still produced the same amount of outputs during the pre-merger period. Similarly, for Model 2, it is clear from Table 3 that during the pre-merger period, UOB's overall efficiency of 100 per cent was higher than its target, OUB's overall efficiency of 95.27 per cent. In contrast to Model 1, the results from Model 2 support the hypothesis that the acquirers are more efficient than the targets.

Table 4. Summary of mean efficiency levels of the acquirers post merger (Model 1)

Bank	Pre-Merger*			During Merger**			Post-Merger***		
	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE
OCBC	96.23	100.0	96.23	100.0	100.0	100.0	100.0	100.0	100.0
UOB	76.40	78.43	97.73	88.80	100.0	88.80	100.0	100.0	100.0

*1998-2000; **2001; ***2002-2004
OE-Overall Efficiency, PTE-Pure Technical Efficiency, SE-Scale Efficiency

5.6 Implications of Mergers on Acquiring Banks' Efficiency

Next, the ex-post performance of the merged banking groups is discussed. Here the issue at hand is whether there exists a positive (negative) relationship between the difference in the efficiency before the merger and the performance of the institutions after the consolidation. In other words, we want to find out whether there has been any transfer of better management quality from the acquiring bank to the one acquired. Conversely, we would also like to find out whether a less efficient target would consequently result in the deterioration of the mean overall efficiency levels of the acquirers. This is done by computing the difference between the acquirers' mean efficiency levels (overall, pure technical and scale) during the post-merger period compared to the pre-merger period.

For Model 1, KEP's (the target) overall efficiency level of 99.23 per cent was higher compared to OCBC's (the acquirer) overall efficiency of 96.23 per cent during the pre-merger period. It is apparent from Table 4 that the merger between OCBC and KEP resulted in an improvement of OCBC's mean overall efficiency during the merger and subsequently post-merger, when OCBC had been operating at CRS. Similarly, from Table 4, it is clear that during the pre-merger period, UOB exhibited a lower overall efficiency level of 76.40 per cent for Model 1 compared to its target, OUB's overall efficiency of 100 per cent. Again, the results suggest that UOB's overall efficiency improved to 88.80 per cent during the merger year and subsequently operating as a fully efficient bank, post-merger. Based on the results for Model 1, we can conclude that, a more efficient target resulted in the improvement of the acquirer's mean overall efficiency, post-merger.

Conversely, it is apparent from Table 5, that the results for Model 2 suggest that KEP's mean overall efficiency was lower at 78.47 per cent due mainly to lower scale efficiency compared to OCBC's mean overall efficiency level of 90.07 per cent. The implication is that although the acquirer's (OCBC) mean overall efficiency improved to 96.10 per cent, post-merger, compared to 90.07 per cent during the pre-merger period, its scale efficiency deteriorated to 96.10 per cent from 98.47 per cent during the pre-merger period, resulting from the target's (KEP) lower scale efficiency.

As in the merger between KEP and OCBC, for Model 2, it is clear from Table 5 that during the pre-merger period, UOB's mean overall efficiency of 100 per cent was higher compared to its target, OUB's overall efficiency of 95.27 per cent. The results suggest that, UOB's mean overall efficiency level deteriorated drastically to 75.70 per cent during the merger year. Despite its mean overall efficiency improving to 99.67 per cent during the post-merger period, the results suggest that UOB's mean overall efficiency was still lower compared to the pre-merger period of 100 per cent. The findings thus support the hypothesis that the

Table 5. Summary of mean efficiency levels of the acquirers post merger (Model 2)

Bank	Pre-Merger*			During Merger**			Post-Merger***		
	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE
OCBC	90.07	91.43	98.47	100.0	100.0	100.0	96.10	100.0	96.10
UOB	100.0	100.0	100.0	75.70	76.20	99.30	99.67	100.0	99.67

1998-2000; **2001; ***2002-2004

OE-Overall Efficiency, PTE-Pure Technical Efficiency, SE-Scale Efficiency

acquirer's efficiency tends to deteriorate post-merger resulting from the acquisition of a less efficient target.

5.7 Results of Share Prices and Banks' Efficiency Panel Regression

To further link efficiency of banks and stock market returns over time, Equation (5) was performed using a panel regression model. Share performance may be expected to be the ultimate measure of efficiency. If share prices reflect almost all the information about the past, present, and expected future performance of firms, then this measure would be the more reliable indicator of a bank's efficiency. If such a statistical link can be established, it would afford an alternative explanation for bank share price fluctuations. However, even if the choice of the measure is correct, the previously described measures of efficiency may only be related to share price performance in the long-term. Short-term variations may not be explained by efficiency measures. In this case, individual bank effects may explain the majority of total variations in share price performance.

Though the regression results displayed some shortcoming due to the relatively small sample (only 26 observations), it would appear that the explanatory variables do posses some power. The variation in stock return was 66 per cent and 64 per cent (adjusted variation was 54 per cent and 52 per cent) explained by excess market return and bank's efficiency respectively. Table 6 presents the results of estimating the model by fixed-effect estimators for Model 1 and Model 2 as suggested by Hausman specification test (Prob>Chi^2=0.26 and 0.41 respectively). The estimated coefficients of the X-efficiency score had the expected positive sign but was insignificant at any conventional level for both models. These suggest that improvements in cost efficiency of a bank do not reflect its share price performance in the long term. One possible explanation is that the cost efficiency of a bank's operations does not have any significant information about its excess returns and share prices where earnings expectations may have already been incorporated by the Singapore stock market. This finding is consistent with Chu and Lim (1998) that the percentage change in the price of bank shares reflects percentage change in profit rather than cost efficiency.

An interesting observation from the results is that excess market returns do have a significant effect on the bank's share price performance. The 'beta value' of the bank return is more than unity which implies that bank returns are much more sensitive to overall market movements. The higher beta also reflects that the portfolio consisting of commercial banks' stock is aggressive. This result is against the general belief that blue-chip stocks like those of big commercial banks are not so sensitive to market movements. Nevertheless,

Table 6. Second stage panel regression of the efficiency measures and stock returns

	Model 1 (Fixed Effects)	Model 2 (Fixed Effects)
Excess market returns	1.057***	1.131***
	(4.380)	(4.624)
Bank cost efficiency	0.508	0.317
	(0.727)	(0.152)
Constant	6.643	5.307
	(0.898)	(0.484)
R^2	0.66	0.64
Adjusted R^2	0.54	0.52
Hausman Test	2.71	1.76
Prob>Chi^2	0.26	0.41

Note: *t*-statistics are in parenthesis.

*** indicates significance at 1 per cent confidence level.

generalisation of this conclusion would require more studies involving the whole range of industries and the banking sector.

5. Discussion

Although Singapore banks have become much bigger resulting from mergers and acquisition activities, size alone is not a sufficient condition to guarantee higher efficiency in terms of economies of scale. This is consistent with prior studies that have found the small and medium sized banks to be more scale efficient compared to their large counterparts (Mester 1987; Humphrey 1990; Berger *et al.* 1993). The findings suggest that during the period of 1998-2004, Singapore banking groups were experiencing the post-merger 'blues'. Bank takeovers, in general, are complex and a certain amount of disruptions is expected in the short-term. Problems are likely to occur as a consequence of having to integrate different systems. Moreover, takeovers usually result in staff layoffs and bank branch closures and could have a negative impact on staff morale. The bank's business may need to be refocused before overall confidence returns. The issue of human capital is also crucial in the early stages after a takeover has taken place and incidental redundancies may lead to inferior service delivery and the exit of customers.

Furthermore, during the period of study, it was observed that in terms of scale efficiency, larger banks lagged behind their smaller counterparts. The optimal size for a firm would be at a point where it reaches constant returns to scale (CRS). To recap, a DMU operating under increasing returns to scale (IRS) needs to expand its operations, while a DMU, which is operating at decreasing returns to scale (DRS) would, on the contrary, experience downsizing. Perhaps the reason why larger banks underperformed in comparison to their smaller peers could be that their size had become more of a burden than an advantage arising from mergers and acquisition activities. Considerable costs are associated with the management of a large organisation and making sure that these costs do not outweigh the size benefits is of great importance. The findings could be a reflection of the belief that

scope economies, rather than economies of scale, are often viewed as the main benefit banks derive by merging, particularly within the context of the Singapore banking sector.

On the other hand, over the long-term, improvements might arise arising from a more progressive bank developing and introducing new products and services with the help of advanced technologies. Such innovative banks may acquire improved status and benefit from scale operations. Although size alone is not sufficient to guarantee efficiency, nonetheless being a large bank is an important aspect to achieving sufficient scale to be able to invest in the identification and development of cutting-edge technology and management systems. This certainly applies where there has been significant progress in enhancing the network of delivery channels, including optimising the number of branches within the bank's network. Local full licence banks now offer a very broad range of services through the Internet, as do the foreign full licence banks. Moreover, some of the foreign banks have been authorised to extend their branch networks beyond their 1990 basis, thereby allowing them to have a presence in areas such as new towns and business parks, which have developed over the last thirty years.

The findings from this study are in line with earlier findings by Liu and Tripe (2002) on New Zealand bank mergers, who adopted the same non-parametric DEA technique. To recapitulate, Liu and Tripe (2002) found that the acquiring banks were unnecessarily more efficient than the target banks during the pre-merger period. On the other hand, the study of Avkiran (1999) on Australian bank mergers reported that the acquiring banks were relatively more efficient than the target banks. In general, our findings congregate with those of Avkiran (1999) and Liu and Tripe (2002) which suggest that the acquiring banks do not always maintain their pre-merger efficiency levels during the post-merger period.

Likewise, empirical results, which suggest that the Singapore banking groups have been operating at a non-optimal scale of operations are in line with the study by Sufian (2004) on Malaysian bank mergers. In his study, Sufian (2004) found that during the post-merger period, the inefficiency of Malaysian banks was largely due to scale rather than pure technical reasons. He also suggests that the mergers were particularly successful for the small and medium-sized banks which have benefited the most from expansion and via economies of scale. Given that Malaysian banks were operating in a similar oligopolistic environment, the similarities of these findings could offer some useful insights to the regulators for their 'going forward' policy-making decisions, that is, in practice, within the context of an oligopolistic market environment, the small and medium-sized banks stand to gain most from mergers and acquisitions via economies of scale. If anything could be delved from the results, policy makers ought to be more cautious in promoting mergers as a mean to achieve greater efficiency in the banking sector. Thus, the empirical findings do not support further consolidation in the Singapore banking sector to create 'two super banks'. However, as mentioned earlier, the findings above could be a reflection of the belief that scope economies, rather than economies of scale, are often viewed as the main benefit banks derive by merging, particularly within the context of the Singapore banking sector.

The empirical findings from this study, which suggest that the share price performance of Singapore banking groups reflects excess market returns better, seems to indicate that the Singapore stock market may have already incorporated any benefits expected to arise from the mergers and acquisition activities. In other words, during the period of study, the Singapore stock market could be in a strong form, which may already have incorporated

expected changes in earnings arising from the mergers and acquisitions. Nevertheless, bank efficiency is reflected in share price performance of Singapore banks in the marketplace, evidenced by the positive coefficients, albeit at a lesser degree. Hence, from the policy-making perspective, during the period of study, the Singapore stock market regarded mergers and acquisitions in the banking sector as positive, and value enhancing to shareholders.

6. Conclusions

Applying an event window analysis to a non-parametric frontier approach, DEA, the paper attempts to investigate the effects of mergers and acquisitions on the efficiency of domestic incorporated Singapore banking groups. The sample period is divided into three sub-periods, that is, pre-merger, during merger and post-merger periods, to compare the difference in efficiency of Singapore banking groups during all periods. Given the sensitivity of efficiency estimates to the specification of inputs and outputs used, we adopted a variant of the intermediation approach to two models.

For Model 1, the results suggest that, Singapore banking groups exhibited a mean overall efficiency level of 88.59 per cent suggesting mean input waste of 11.41 per cent. We found that, during the pre-merger period, scale inefficiency dominated pure technical inefficiency. Interestingly, the results from Model 1 suggest that, despite merger complications, mean overall efficiency level of Singapore banking groups improved since the year of the merger and improved further during the post-merger period. Again, the results suggest that scale inefficiency dominated pure technical inefficiency in the Singapore banking sector post-merger.

As in the case of results from Model 1, the results from Model 2 suggest that Singapore banking groups were relatively efficient in their intermediation role, exhibiting a minimal input waste of 8.28 per cent during the pre-merger period. Consistent with the results from Model 1, the results from Model 2 suggest that although the efficiency level of Singapore banking groups deteriorated during the merger year, the efficiency level improved substantially during the post-merger period.

Although mergers resulted in a more efficient banking system, it appears from the results of Model 1 and Model 2, that size has become the biggest factor resulting in inefficiency of the Singapore banking system. From the scale efficiency perspective, the findings from both models do not support further consolidation in the Singapore banking sector to create two 'super banks'. The results from Model 1 and Model 2 suggest that a further increase in size would only result in a smaller increase in outputs for every proportionate increase in inputs, resulting from the fact that Singapore banking groups have been operating at declining returns to scale (DRS), and constant returns to scale (CRS) during the post-merger period.

We have found mixed evidence on the characteristics of the acquirers and targets. The results from Model 1 do not support the hypothesis of a less efficient bank becoming a merger target, as both the targets were found to be more efficient relative to the acquirers. On the other hand, the results from Model 2 suggest that both the acquirers exhibited higher efficiency levels compared to the target during the pre-merger period. Generally, the findings support the hypothesis that the efficiency of acquiring banks improved (deteriorated) post-merger resulting from the merger with a more (less) efficient bank.

The explanation of the efficiency scores using panel regressions offers useful economic insights. It was found that changes in cost efficiency are not statistically significant in determining share price excess returns of banks. One implication of the findings is that the STI equity market appears to be in a strong form efficient market. That is, all publicly known available information regarding the prospects of the banks involved in mergers and acquisitions is fully reflected in the share prices. Nevertheless, generalisation of this conclusion would require more studies involving the whole range of industries and the banking sector.

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