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The Wallis Report and Implications of Bank Mergers for Efficiencies

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Abstract:

This paper examines the competitive consequences of bank mergers and acquisitions with particular reference to the Wallis Inquiry into the Australian Financial System in 1996. The Government responded by adopting a four pillars policy preventing mergers among the four major banks. Using the super-efficiency data envelopment analysis model, the technical efficiencies of banks operating in Australia over the period from 1983 to 2001 are estimated. Two separate methods are employed to evaluate the characteristics and determinants of merger and acquisition activities in the sector. The first method examines economic performance of banks involved in merger activities. A second method is also used to determine program efficiency differences between banks of different entry types after adjusting for differences in intra-group managerial inefficiency. The empirical results demonstrate the role of takeover in improving efficiency performance of individual banks, banks of different types and the entire Australian banking sector. Conclusions and policy implications are drawn.

Key words: bank mergers, data envelopment analysis, technical efficiency, super efficiency

Introduction

Since the deregulation of the Australian financial sector, in particular, the entry of foreign banks and domestic building societies into the market, domestic banks have reacted to the intensified competition by performing more efficiently and engaging more actively in mergers and acquisitions. There have been an increasing number of merger and acquisition activities in the banking sector : 53 between 1990 and 1995 and 91 between 1996 and 2001.(Amel et al. 2002[1]). However, according to Westpac Banking Corporation's chief executive officer, David Morgan, the consolidation of the financial services industry has been made harder by a restrictive political and regulatory environment, such as the four pillars policy prohibiting mergers among the four major banks (Guy and Whyte, 2002). Similar view has been shared by other senior managers of the four major banks. In 2002, National Australia Bank's then chief executive officer, Frank Cicutto, stated that the "four pillars policy is an illogical policy and there is no doubt that it has lead to Australian financial institutions being left behind in scale terms when it comes to competing with offshore players" (Cicutto 2002).

Therefore, it is important to conduct some analysis on the competitive consequences of mergers and acquisitions, including the impact in terms of efficiency and productivity, with particular reference to the Wallis Inquiry. Whilst the Inquiry has focused on "enhancing competition and contestability in the Australian financial system" (Harper 1997), the final report for the Inquiry (thereafter called FSI) contained 115 recommendations in three broad categories; new regulatory structure to safeguard the financial system, consideration of mergers and acquisitions and recommendations concerning managing changes.

The Wallis Inquiry recommended the abolition of the "six pillars" policy, which had prohibited mergers among the four major banks and the two largest life insurance companies in Australia[2] (, FSI, 1997, p.429 Recommendation #83). Nevertheless, there has been no formal banking legislation backing the policy. Under the Banking Act and Trade Practices Act, a bank merger proposal required to obtain approval by the Australian Competition and Consumer Commission (ACCC) on

competition grounds[3], the Reserve Bank of Australia (and its successor Australian Prudential Regulation Authority) for prudential consideration and the treasurer under his reserve power to veto[4]. The Banking Act contains no specified guideline on when to exercise the veto power, but two government policies on bank mergers have been adopted in the past to shape the current structure of the banking sector. One is the six pillars policy, and the other is the "Fels Policy" of retaining at least one regional bank in each State.

The six pillars policy, in fact, was initiated by the Keating Government in 1990 when it decided to block the proposed merger between Australia and New Zealand Banking Group and National Mutual Life Association of Australia. In a released statement of 23 May 1990, the Government stated that the proposed merger would have reduced the "diversity of institutions and effective competition in banking, in life insurance, and more generally in the provision of financial services" and indicated that any mergers between any of the four major banks or the two largest life insurance companies would not be permitted[5]. The policy was then reiterated by Dawkins in 1993.

The "Fels policy" is the "four plus one" interpretation that ACCC placed on Section 50 of the Trade Practices Act which "prohibits merger and acquisitions that would have the effect, or be likely to have the effect, of substantially lessening competition in a substantial market in Australia". When assessing Westpac's acquisition of Challenge Bank in 1995, the Trade Practice Commission (predecessor of the ACCC) applied the "four plus one" rule and developed some policy guideline accordingly. Given the importance of regional banks in maintaining competition in the banking industry, any merger between a major bank and a regional bank needs to be examined very carefully, especially when the regional bank is the last remaining bank in a State. Such merger might be permitted if it does not significantly reduce local competition. The presence of another strong regional bank in Western Australia – BankWest led to a final decision by the commission not to oppose the Westpac/Challenge merger.

The Inquiry also recommended that limitations on shareholding remain at a 15% upper limit. This is based on the view that spread of ownership is itself a form of prudential regulation. The Inquiry

also supported the opening up of the banking system to new entrants such as mutuals and insurance companies and the formation of financial conglomerates. Some non-traditional financial providers, such as retailers and mortgage originators, have already supplied financial services in Australia. Although acknowledging foreign acquisitions of the big four should be allowed[6], the Inquiry still considered that some restrictions on foreign ownership might be imposed in the national interest. The Inquiry also advocated that financial mergers and acquisitions be subject to the same criterion as other sectors under the Trade Practices Act 1974, namely, whether the movement would substantially lessen competition. And merger among financial institutions should be assessed by the ACCC on a case-by-case basis.

Prudential supervision has been used to justify the adoption of the four pillars policy. In its submission to the Financial System Inquiry, the Reserve Bank of Australia (RBA) raised prudential concerns over the reduction of four major banks to two major banks as a result of the removal of the six-pillar policy (RBA, 1996, p.76). The "too big to fail" argument arises from the assumed guarantee by the RBA for meeting all the deposits liabilities in the event of a bank collapse. In case any two of the major banks merge, moral hazard may be a problem where the resultant 'mega' bank will inevitably be more risk-taking with the expectation that government will intervene if the business experiences difficulties. . When such a mega-bank experience problems , it is also difficult to arrange domestic takeover. However, the Inquiry did not support such an argument. It did not believe that the management of a failed mega- bank differed much from that of an existing major bank should it fails (FSI 1997, p428). Combining with other considerations, including competition policy, the Inquiry recommended the discontinuation of the six pillars policy, or any modified version of it.

The Government clearly took a different view. With strong public and political opposition to the mega-bank mergers, it decided to adopt a modified version of the six pillars policy instead (Bakir 2004). Since the release of the Wallis Report, the Government quickly announced that mergers among the four major banks would not be permitted until it was satisfied that there was greater

competition in the financial sector, particularly in respect of small business lending. The so-called four pillars policy was in place as of April 1997.

This paper examines the level and the impacts of post-deregulation merger and acquisition activities in the Australian banking sector during the period of 1983 to 2001 2005?. Two separate methods are employed to evaluate the determinants and outcomes of merger and acquisition activities in the sector. The first method examines the efficiencies of the sampled banks using data envelopment analysis (DEA) and/or ?window analysis technique. The derived efficiency scores are then used to compare performance between acquiring banks and acquired banks and to identify certain bank characteristics that determine post-merger outcomes. Then a second method is adopted to determine efficiency differences between banks of different groups after removing intra-group managerial inefficiency. Two sub-sample time periods from 1983 and 1995 and the other from 1996 through 2001are examined individually . The cut-off year is 1996 when the Wallis Inquiry was established.

The paper is divided into the following sections. The next section reviews the literature on rationale for, key driver for and impact of bank mergers. Section two outlines the first methodology used. Then section three presents bank mergers and acquisitions that have taken place in Australia during the post-deregulation period, examining the effects of mergers on banks' efficiency performance. The fourth section briefly reviews the second methodology and the following section presents and analyses the empirical results. Conclusions are drawn in the sixth section.

1. Rationale for, key driver for and impact of bank mergers

There has been a wave of bank mergers and acquisitions in the developed countries since the 1990s. Why do banks pursue mergers so vigorously? Theoretically, mergers are expected to deliver some positive gains from various sources, namely efficiency improvements (technical efficiency, economies of scale and scope) and cost reduction, increased market power (higher prices), or greater diversification (lower earning volatility), all leading to increased shareholder wealth.

However, empirical studies have shown that most of the bank mergers failed to achieve the expected or claimed gains in efficiency and profitability (Piloff and Santomero 1998).

Another plausible explanation is managerial utility-maximisation and hubris. The agency theory states that there is a fundamental conflict of interest between the goals of the principal (shareholders) and that of the agent (managers): the former is seeking to maximize wealth, while the latter prefers to maximise utility. In the presence of asymmetric information, the managers may pursue their own goals rather than acting in the shareholders' best interest. They may engage in mergers that do not increase shareholder wealth because there are both monetary and non-monetary rewards associated with firm size. For example, managerial remuneration may be positively related to the size of the bank. And the larger the bank gets the more prestigious and powerful their positions will be . Larger firms may also provide managers a higher degree of job securities. Roll (1988) reported that bidding firms tended to over-bid due to managerial hubris.

Nevertheless, the recent wave of bank mergers and acquisitions shows that financial institutions around the world are under competitive pressure to diversify and get larger. Key driving factors for such a trend include globalisation, deregulation and technological advances. The trend of globalisation and deregulation world-wide has enabled banks to engage in competition on a wider national or international scale. Banks are also forced to compete more intensively with other financial institutions as many new entrants entered the market. Rapid technological progress in computer and information systems has driven down the cost of managing, processing and recording information. And it has facilitated electronic delivery of innovative banking products. As a consequence, the barriers to entry are reduced substantially and the degree of competition is enhanced. The bank merger movement is a natural response to the changing structure of the banking market.

The Australian banking industry is modestly concentrated, with the four nationally-operated banks dominating the market. In anticipating the entry of foreign banks in 1986, Australian banks strategically formed larger banking operations, the four major banks, to compete against the

incoming banks (Wright 1999)[7]. In the 1990s, a number of mergers involving the regional banks occurred. These mergers were supported by Australian governments and regulators since they were expected to increase competition in the banking sector, particularly with and between the major four banks (Wright 1999). At times, bank mergers are a substitute for bank failures (Macey and Miller 1998). Some mergers involving virtually insolvent State banks have been conducted as a solution to bankruptcy. Nevertheless, with entry of foreign banks, transformation of building societies into banks and emergence of non-traditional financial suppliers in niche businesses, the market became more competitive over time.

According to contestable market theory, if the barriers to entry into a market are low, firms with substantial market power will behave competitively by charging a price close to its true cost. Otherwise, potential entrants will enter to take away the market. As early as mid-1980s, Harper (1986) argued that the Australian banking industry is contestable (Harper 1986). In recent years, natural barriers to entry continued to be reduced substantially in the presence of modern technology, globalisation and enhanced consumer awareness. A new entrant may not necessarily incur the cost of establishing an extensive branch network in order to penetrate into the market. Instead, the bank can set up its business via telephone banking and on-line banking[8]. Licensing requirements is one of the regulatory barriers to entry. Any applicant who satisfies certain criteria can obtain a licence for bank operation[9] (APRA，2000).

The threat of takeover is a major source of competitive pressure over existing firms in the market (Shranz 1993). Among many recommendations made in the Wallis Report that have been implemented by the Government, the removal of the policy that prohibits foreign takeover of Australian major banks would undoubtedly enhance the contestability of the market. As expected, the release of the Wallis report was to give an intense and lasting impulse to competitive forces in the banking market, pushing banks to operate more efficiently. However, the four pillars policy, which prevents mergers among the four major banks, is another remaining regulatory constraint

adopted by the Government. Nevertheless, under the threat of takeover by incumbents or potential entrants, existing banks are forced to operate competitively and efficiently. In addition, given the trend of enhanced contestability over time, banks are under pressure to become more efficient as long as there is room for it.

In regard to Australian bank mergers, the effects in terms of efficiency, market share, profitability, competition or social welfare, and sometimes a combination of them, have been examined in some empirical studies. Beal and Ralston (1998) found no evidence to suggest that Australian consumers adversely reacted to bank merger announcements by moving their business elsewhere due to relatively high concentration of the Australian banking market. Avkiran (1999) examined the efficiency gains from four cases of bank mergers in Australia and the benefits to the public. Evidence from the cases supported the hypothesis that acquiring banks are more efficient than target banks. However, the acquiring banks do not always maintain their pre-merger efficiency level. There was mixed evidence on whether some positive social gains in the form of increased market penetration by more efficient banks have been generated from bank mergers. Neal (2004) discussed the mergers with a regional bank as at least one of the parties to the merger and found that it was more efficient banks that take over less efficient banks.

What's more, as highlighted in FSI (1997, p.464), there might be some negative impact of bank mergers on employment and rural customers, which also needs to be examined and appropriately addressed. Branch closure and staff redundancies as a result of bank mergers may do harm to individual consumers, staff, as well as local communities. In their submissions to the Inquiry, the unions and the consumer groups expressed their respective concerns over such economic and social consequences of major bank mergers. They have explicitly called for the retention of the six-pillar policy or its modified version[10].

The efficiency effects of bank mergers should be examined because of its usefulness for antitrust policy purposes. One way to measure whether there is any adverse effect on competition for a proposed merger is to consider the potential change in efficiency. A decrease in efficiency at firm

level and industry level as a result of merger may indicate some degree of market power exploitation and consequently a reduction of competition in the market. In the current study we concentrate on assessing efficiency effects of bank mergers in Australia, using two separate DEA (data envelopment analysis) methods.

2. A traditional approach to study the effect of bank mergers

Two approaches have been commonly adopted for studying the effects of mergers and acquisitions on firm performance: firstly, ex-ante studies which assess merger performance by analysing the stock market reaction to merger announcements. It is also called event studies as the announcement of a merger is defined as an event in the stock price history of the merging entity. Under the assumption of efficient capital market, the effects of mergers are estimated by measuring changes in the share prices of the merging firms, both the acquiring and acquired firms, after controlling for market movement trend and the variations of the firms concerned. Secondly, ex-post studies which assess merger performance by examining the effects of mergers on firms' operating performance in terms of profitability and efficiency. Although there are variations in estimation techniques, it often involves comparing merging firms with a control group of non-merging firms over a given time period (e.g three years prior to and after merger) using accounting data[11].

Given data availability, we adopt the second approach to examine the effects of mergers on banks' efficiency. Findings of previous ex-post studies on bank mergers are consistently pessimistic. There was generally a lack of improvement in firm performance as a result of merger (Rhoads 1994). There were also some mixed results suggesting that target firms tended to be average performers while acquiring firms were generally better performers than target firms. The approach often uses unreliable accounting data, which may not give a true indication of the firms' financial performance in terms of profits or costs(Berger and Humphrey 1992). In view of the shortcomings, we apply DEA (data envelope analaysis) method to the data for estimating bank

efficiency, which is an improvement over the existing measures using traditional accounting figures.

The efficiency performance of banks operating in Australia between 1983 and 2001 are measured using DEA . DEA, pioneered by Farell(1957) and Charnes et al. (1978), is a non-parametric approach for measuring technical efficiency of firms. It involves an application of linear programming (LP) to observed data to form an industry production frontier, against which the efficiency of each firm is measured. Mathematically, efficiency of an individual firm can be calculated by solving a series of linear programs. Assume that there are K firms, each producing N outputs with M inputs. Denote the vectors of inputs and outputs as X and Y and the inputs and outputs for the i^{th} firm as x_i and y_i. Pure technical efficiency (PTE) under variable returns-to-scale technology is derived from solving the following linear program K times, once for each firm:

$$
\begin{aligned}
&\min_{\theta,\lambda_i} \theta, \\
&s.t.\ \ \theta x_i \geq \lambda X \\
&\qquad y_i \leq \lambda Y \\
&\qquad \lambda_i \geq 0, \ \ i = 1,...,k \\
&\qquad \sum \lambda_i = 1
\end{aligned}
\qquad (1)
$$

where θ is a scalar and λ is a $K \times 1$ vector of constants. This involves finding the smallest value of θ for projecting the firm onto the industry frontier formed by all the observations at the point $(\lambda X, \lambda Y)$. The vector λ is the weights of peer observations in producing the projected point on the industry frontier. The value of θ is between 0 and 1. Technical efficiency (TE) under constant returns-to-scale technology can be derived from solving equation (1) without the last constraint. Scale efficiency (SE) is then calculated as the ratio between TE and PTE.

Window analysis technique (WAT) is adopted in this study to relieve the small sample problem inherited in the population under study – banks in Australia. In DEA model where there are too few sampled firms relative to the number of outputs and inputs, the derived efficiency scores can be artificially inflated. Some firms are found to be efficient by default because there is no comparable

firm in one of the dimensions of outputs and inputs. The formed best-practice frontier may be well below the true industry frontier due to the limitation of sample data. To avoid such problem, data for three consecutive years are used to form one sub-panel set. And there are a successive series of such overlapping sub-panels. DEA is applied to each pooled sub-panel sequentially. The geometric mean of efficiency scores for individual bank at each year estimated against reference technologies in three consecutive sub-panel windows are then calculated[12].Based on these results, we examine the efficiency performance of those banks involved in mergers and acquisitions activities for a time period of 6 years (the year immediately preceding the merger and five years after the merger)[13].

3. Merger and acquisition scenarios in the banking sector

Appendix 1 lists all the bank mergers and acquisitions in Australia, to the best of our knowledge, which have taken place during the sample period of 1983 and 2001. The types of mergers can be roughly classified into the following categories:

(1) Domestic mergers targeting regional banks: there are in-market mergers and out-of-market mergers depending on whether the merging entities operate in the same market prior to merger. It is often expected that potential economies of scale and market power be exploited for in-market mergers. Banks may also pursue out-of-market mergers for market expansion and diversifications.

(2) Merger as a solution to bankruptcy;

(3) Foreign takeover of an Australian bank;

(4) Merger between non-bank financial institutions and banks;

(5) Branch consolidation as a result of foreign parent banks' merger;

(6) Target bank is a joint venture;

(7) Acquisitions at subsidiary level.

For each of the merger cases listed in Appendix 1, we report the category that it most likely falls into in column four of merger type. Some cases may naturally fall into more than one category. In the current study, we do not make any distinction between merger and acquisition[14].

Some special cases have been reported here, including multiple mergers and insolvent target bank. For instance, ANZ Bank purchased Town and Country Bank and National Mutual Royal Bank in 1990. Previous studies often exclude these types of mergers simply because they can potentially bias the results. For a highly acquisitive bank who is involved in multiple mergers over a short time period, there is repeated transaction costs incurred. It is often impossible to separate those costs in order to measure post-merger effect accurately for each merger transaction that takes place . In acquiring insolvent target banks, the loan losses were often absorbed by the State governments and only the good assets of the banks were sold. This might generate biased results which overstate post-merger efficiency gains. However, excluding these special cases will fail to represent a full picture of bank mergers and acquisitions in Australia and their consequences. Therefore, we opt to work on the entire sample of merged banks. Regression analysis is conducted to see whether there is a difference between acquisition-active banks and other banks, between insolvent target banks and solvent target banks, respectively.

Table 1 and 2 present the CRS pure technical efficiency scores of sampled domestic and foreign banks during the period of 1983 and 2001, respectively. Table 3 and 4 show the VRS technical efficiency scores for the two groups separately. Table 5 contains information for size (TA), growth rate (TAG), profitability (ROE), capital adequacy ratio (CA) and efficiency level (PTE, SE and TE) for acquiring and target banks at the year prior to merger. Means and standard deviations for the variables are calculated and presented in the table. Both parametric (paired t-test) and non-parametric (Wilcoxon signed rank test) tests are conducted to examine whether there is any difference for each variable between the acquirers and the targets. In this case, non-parametric test provides more reliable results as it requires less stringent assumptions, such as normality. The values of the variables examined here may not be normally distributed[15].

The mean bank size in terms of total assets is $51.16m for acquirers and $7.27m for targets. Both t-test and Wilcoxin test indicate that acquirers are statistically larger than targets in size. The average annual growth rate for acquirers is 13.55% while targets experiences a negative growth rate of 6.444% on average. The two tests show that at 10% level of significance acquirers are growing faster than targets. For both profitability and capital adequacy variables, they are not statistically different between the two groups of banks.

The mean technical efficiency level is 0.79 for acquiring banks and 0.905 for target banks. Both t-test and Wilcoxin test have shown that technical efficiency levels for acquirers and targets are statistically different at 5% level of significance. When technical efficiency is decomposed into pure technical efficiency and scale efficiency, we find that the major source of difference is scale efficiency rather than pure technical efficiency. The mean scale efficiency for acquirer at 0.80 is statistically lower than the 0.92 figure for target banks, while pure technical efficiencies for the two groups of banks are not statistically different. As the sizes of acquirers are much larger than those of targets, very often they are already operating over the range of decreasing economics of scale. The results have also indicated that both groups have operated fairly efficiently under variable returns-to-scale technology.

The statistical results show that the means of the following variables for acquirers are statistically different from the means of those for targets: size, growth rate, technical efficiency and scale efficiency. The data shows that on average the acquiring banks are larger in size and more aggressive in growth, achieving lower scale efficiency and technical efficiency, than the target banks. On the other hand, the means of profitability, capital adequacy and pure technical efficiency between acquirers and targets are either the same or very close.

Table 6 shows regression results that may be useful for predicting post-merger efficiency performance. The dependent variables are pooled post-merger efficiency scores derived from DEA models for merging banks within five years following mergers. Two types of efficiency scores are

to be regressed separately on a vector of explanatory variables; they are pure technical efficiency and technical efficiency.

The independent variables can be broadly classified into three categories. The first group of variables are all based on information available in the financial year immediately before merger, reflecting pre-merger characteristics of target and acquiring banks. WEFF is defined as the weighted-average of pre-merger efficiencies of the merging banks, using total assets of the two banks in the year preceding the merger as the weights. REFF examines relative efficiency between the two merging parties to a merger. It is calculated as the arithmetic difference in efficiencies between the acquiring bank and the target bank. The above two variables are used to test whether the average of or/and the difference in two merging banks' efficiency levels determine the post-merger efficiency performance[16]. RSIZE is the relative size measured by the ratio of the target bank's total assets to the acquiring bank's total assets. The variable is used to test the relative size effect hypothesis which states that the smaller the target bank relative to the acquiring bank, the higher the potential synergies from economies of scale. RROE denotes rate of return of the target bank relative to that of the acquiring bank.

The second group contains some control variables on size, profitability and other financial information in the same year as those post-merger efficiency scores that are entered in the left hand of a regression equation. The third group of explanatory variables are dummy variables on types of mergers. It is likely that merger between two independent banks would have different effects from acquisitions of a subsidiary bank. Therefore we include a dummy variable SUB (1 for acquisition of a subsidiary bank and 0 for merger between two independent banks) to capture the difference. As noted above, whether the target bank is virtually insolvent may have some impact on post-merger outcomes. A dummy variable BANKRUPT (1 for mergers as a solution to bankruptcy and 0 otherwise) is used here for this purpose. Another relevant issue is that acquisition-active banks are generally expected to differ from banks that are less acquisitive. So a dummy variable FREQ is set

to be one for merging banks were involved in multiple mergers within five years during the sample period and zero otherwise.

The results on estimated coefficients and the corresponding standard errors, t-ratios and p-values for regressing pure technical efficiency onto a vector of independent variables are presented in column 2 to 5 of table 6. The F-test of null hypothesis that all the slope coefficients are jointly zero is rejected at 1 percent significance level, indicating at least one of the independent variables is statistically relevant. As shown in the table, post-merger efficiency level of a merged bank is positively related to WEFF, the weighted average of pre-merger efficiency levels of the two merging banks. However, we fail to reject null hypothesis that the efficiency gap between an acquiring bank and a target bank has no impact on post-merger efficiency performance. Therefore, the empirical results from the data show that post-merger efficiency performance is largely determined by average pre-merger efficiency level, rather than the difference in managerial efficiencies between the two merging banks. Consider three hypothetical mergers, one for two efficient banks, one between a highly efficient bank and a slightly inefficient bank, and the other for two inefficient banks. We expect that high efficiencies are going to be achieved in the first two mergers, but not in the last merger case.

Other pre-merger characteristics of banks, RSIZE and RROE, are found to have affected post-merger efficiency performance. The coefficient of RSIZE is positive and statistically significant. The coefficient of RROE is negative and statistically significant. It appears that the smaller and the more profitable the target bank relative to the acquiring bank, the less efficiently the combined post-merger bank will operate. This may attribute to the fact that the consolidated bank is under little pressure for improvement in managerial efficiency when taking over a small and profitable bank. The consolidation itself brings in some small profitable business and therefore requires less restructuring to the merged entity. Consequently there is less incentive for the management team to further improve their managerial practice.

Two control variables, LSIZE and ROE, have some influence on bank's efficiency performance. Pure technical efficiency is positively related to firm size in a non-linear way. It is also related with firm's rate of return on equity. The larger and the more profitable the consolidated bank it is, the higher efficiency it achieves. These findings suggest that the large, ambitious and profit-driven banks are well equipped with managerial expertise and thus perform more efficiently than small banks. All the coefficients with dummy variables are found to be statistically insignificant.

The results on estimated coefficients and the corresponding standard errors, t-ratios and p-values for regressing technical efficiency onto a vector of independent variables are presented in column 6 to 9 of table 6. The null hypothesis (F-test) that all the slope coefficients are jointly zero is rejected at 1 percent significance level, indicating that at least one of the independent variables is statistically relevant. When bank efficiency is estimated under constant returns-to-scale technology, the key factor determining efficiency turns out to be bank size. Consistent with the findings with pure technical efficiency, technical efficiency is also positively related to RSIZE. Unlike what has been predicted according to the relative size effect hypothesis, sampled mergers between "the equals" tend to achieve higher efficiency than mergers between a large acquiring bank and a small target bank. In addition, there is no room for economies of scale to achieve for a large acquiring bank to take over other banks as the bank is already experiencing diseconomies of scale. Technical efficiency is generally low for large banks due to scale inefficiency. This is also confirmed by the negative coefficient with LSIZE variable, which shows that technical efficiency is declining at a decreasing rate when a bank gets larger.

We find that the dummy variables, SUB, BANKRUPT and FREQ, are also important in determining post-merger technical efficiency performance. Bank acquisitions at subsidiary level tend to achieve lower efficiency than bank mergers of two independent banks. It proves that pure ownership change without any corporate restructure is ineffective in managing the acquired firm efficiently. Acquiring a virtually insolvent bank is found to produce less desirable efficiency outcome than acquiring a healthy bank, indicating acquiring banks have generally failed to improve

the efficiency of acquired banks near bankruptcy. The highly acquisitive banks are found to perform better than other less acquisitive banks, suggesting that banks can learn from multiple mergers and thus improve their post-merger efficiencies. Thus different types of bank mergers may generate different efficiency outcomes.

4. A four-step DEA method to assess the impact of bank status on efficiency?

In this section we go beyond the existing approaches in this field by examining whether the Wallis Inquiry into the Australian Financial System improves domestic banks' efficiency performance. The implementation of the Wallis Report has seen a replacement of the six pillars policy with a modified four pillars policy, making mergers between large banks and insurance companies possible. It also allows foreign acquisitions of domestic banks, including the four major banks. If the threat of takeovers serves as an efficiency-enforcement mechanism, then higher level of pure technical efficiency of banks would be observed since the removal of the six-pillar policy[17]. DEA results presented in table 3 show that the former State banks on average were performing worse than newly-established regional banks during the early sample period. It is expected that such differences in efficiency performance would be smaller or disappear since the conduct of Wallis Inquiry in 1996, when regulatory policies over bank mergers were expected to be and later on were in fact further relaxed. We will conduct some non-parametric statistical tests to compare efficiency scores across banks of different organisational types before and after the conduct of the Wallis inquiry.

The data sets are broken into two time periods: 1986 – 1995 (pre-Wallis Inquiry period) and 1996 – 2001 (post-Wallis Inquiry period)[18]. Each bank is defined as either incumbent or entrant depending on whether it became a bank prior to the beginning of financial deregulation in Australia (here we take the year 1983 when the Martin Committee of Review was formed). Any bank operating in Australia can fall into one of the following five categories: major banks, existing regional banks, newly-established regional banks, foreign banks and specialised banks. Since

specialised banks have operated quite differently from other commercial banks and they are no longer in existence[19], we drop them from further analysis here. A general rule of thumb is that, major banks and existing regional banks are the incumbents while newly-established regional banks and foreign banks that entered into Australian banking industry since 1983 are the entrants.

We follow Charnes et al (1981) to apply DEA under variable returns-to-scale in four steps:

1. **Firstly** all banks are classified into two groups, namely incumbents and entrants. Apply standard DEA to banks within each group to identify their corresponding production frontiers.
2. **Secondly** project all the remaining inefficient banks to their corresponding best-practice frontiers formed in step 1.
3. **Thirdly** apply super DEA to the revised pooled data to compare efficiency of the two efficient frontiers derived in step 2.
4. **Fourthly** use some statistics test to assess any difference in terms of efficiency level between the two sub-samples.

In step 4, non-parametric rank statistics technique, Mann-Whitney test[20], is used to detect whether the two bank groups have the same distribution of efficiencies within a pooled DEA dataset. The Mann-Whitney U test examines the hypothesis that two independent samples come from populations having the same distribution. It is equivalent to the parametric independent group t-test, but requires less stringent assumptions, such as normality. It also reduces or eliminates the impact of outliers by using rank-order data. However, when numeric figures are transformed into rank-order data, some useful information may be lost.

It should be that the inefficiencies estimated from step 1 are managerial inefficiency while the inefficiencies identified in step 3 are program inefficiency due to entry type (entrant or incumbent). The purpose of the first two steps is to eliminate the type of managerial inefficiencies from the estimation. By projecting individual firms in each group onto their respective “best practice”

frontier, the inefficiencies of individual firms within each group, i.e., managerial inefficiencies are removed prior to an inter-group comparison of the two production frontiers. It is also worth notice that super efficiency is estimated in step 3 by excluding the observation under evaluation from forming the reference production frontier. By using the super-efficiency scores for ranking, we avoid the situation of having a tie for all the efficient observations on the production frontier[21].

5. Empirical Results

Descriptive statistics of DEA managerial efficiency scores and program efficiency scores are presented in table 7 and 8 respectively. As shown, the data are examined according to the time period and the bank type. Efficiency scores within each group have negatively skewed distribution. For both pre- and post- Wallis Inquiry periods, incumbents have higher mean managerial efficiency than entrants. And the distribution of the efficiency scores is less variable for the incumbents than the entrants. Once managerial inefficiency within each group has been removed, entrants exhibit higher mean program efficiency for both periods. Incumbents excluding major banks on average are the least efficient group, while incumbents including major banks perform slightly better. Efficiency distribution within the latter group is slightly less dispersed. Entrants are the most efficient but least dispersed group.

Table 9 reports the non-parametric statistical test results from step 4. Using a two-tailed test, we reject the null hypothesis and conclude that program efficiency levels significantly differ between the two bank groups during the time period of 1983 to 1995 with the mean rank figures indicating that the incumbents (major banks and existing regional banks) are less efficient than the entrants. Alternatively if the directional hypothesis H_0: $ES_{INC} \geq ES_{ENT}$ is employed, the null hypothesis is rejected as well. When the test is applied to the sample data for post-Wallis Inquiry period, the results from both one-tailed and two-tailed tests show that there are no significant differences in

efficiency between the two bank groups, indicating that entrants have lost their efficiency advantage over incumbent identified in the pre-Wallis Inquiry period.

As pointed out by Brockett and Golany (1996), there is still a possibility that one group outperforms the other up to a certain point (input level or size indicator), and then the frontiers intersect and the other group becomes the more efficient (see figure 2 of the paper). In that case, when Mann-Whitney test is applied to the whole range of data, it may fail to reject the null hypothesis of same distribution of efficiency, although the two groups exhibit different distributions of efficiency rankings over a certain range of data. Therefore, it is necessary to conduct further tests for sub-groups of the data categorised by magnitude of inputs or size. By truncating the sample data for post-Wallis period to those whose total assets are below $40million in real value[22], Mann-Whitney test result shows that at 1% level of significance of the two new groups of banks are statistically different in efficiency distribution. The mean rank results tell us that the incumbents are less efficient than entrants on average. One-tailed test confirmed the same conclusion.

We also use Kruskal-Wallis test[23] to see whether there is any difference in efficiency level among different types of banks during post-Wallis period: major banks, existing regional banks, newly established banks and foreign banks. Table 10 displays the statistical test results. As shown in the table, efficiency levels do no significantly differ across the four types of banks at 5% level of significance. When major banks are excluded from the data, test results show that efficiency levels exhibit statistically significant difference across the other three types of banks at 5% level of significance. This is consistent with the Mann-Whitney test results which indicate that the existing regional banks are statistically less efficient than the new entrants. However, we do not reject the hypothesis of no difference across bank types at 1% level of significance from the Kruskal-Wallis test.

The non-parametric statistical test results show that although entrants have advantage over incumbents in terms of program efficiency for both periods, we are less confident that the conclusion to reject the null hypothesis about the existence of inter-group efficiency difference

across bank entry types for the post-Wallis Inquiry period is correct. Combined with the information presented in table 8 which shows mean program efficiencies for entrants and incumbents in each period, we find that the magnitude of efficiency differences between entrants and incumbents are getting much smaller during the post-Wallis Inquiry period. The implications are that the banking sector is virtually under more pressure to improve efficiency performance since the release of the Wallis report. Any inefficient banks, particularly those of small or medium size, will eventually fall over as a takeover target. As a matte of fact, the group of incumbents has shrunk since the 1987 stock market crash and the 1991 recession. All the State banks, which were relatively inefficient, were either taken over or sold to other banks. Nowadays only one existing regional bank - Bank of Queensland, is still in operation.

6. Conclusion

A prosperous and healthy Australian economy needs a highly competitive financial market, where banks and other financial institutions are operating efficiently and at low cost. Deregulation has played an important role in improving the competitiveness and efficiency of the banking sector in the past. Bank mergers can significantly reduce production costs and achieve economies of scale in operation through branch rationalisation, staff redundancies and technology integration. However, they may also lead to increased market concentration since there is lesser number of banks operating in the market. That can substantially reduce the degree of competition and level of efficiency in the industry. Hence the impact of bank mergers on efficiency should be examined closely and under scrutiny.

As pointed out in FSI (1997, p.473), a key issue in the Australian banking sector is whether there should be merger between the existing four major banks. Among all the submissions to Wallis enquiry, there has been a unanimous support for its abolition from the four major banks and two largest insurance companies. They have argued that Australian banks need to be larger in order to compete in the world market. Nevertheless, the treasury and the RBA have raised some concerns on

the ground of prudential supervision. In view of massive branch and staffing rationalisation, the consumer groups and the unions also expressed their deep concerns over the mergers and called for the retention of six-pillar policy or its modified version. As a consequence, the Government adopted the four pillars policy, which still banned mergers among the four major banks. However, it is generally believed that sooner or later, the government will look at the issue of bank mergers again: should the policy be relaxed or removed? In the following we attempt to identify the policy implications from efficiency effects of bank mergers and acquisitions.

Our findings from examining the eighteen bank merger cases in Australia show that the acquiring banks are larger, more aggressive and less efficient than the target banks. The major source of inefficiency is scale inefficiency. The results cast some doubts on the true intentions of bank mergers: are Australian banks getting larger to be internationally competitive or simply to avoid being taken over by other competitors? For the four major banks that are found to operate over the range of diseconomies of scale, mergers among them will inevitably result in much lower efficiency and less competition in the market.

Regression results suggest that while post-merger pure technical efficiency is closely related to the merging entities' efficiencies prior to merger, it is also affected by other pre- and post-merger characteristics of banks, such as size and profitability. Generally an acquirer has little incentive to further improve efficiency when taking over a small and profitable bank. Technical efficiency of a merged bank is largely determined by size in relative and absolute senses. Larger banks, merging or non-merging, tend to have lower efficiencies than smaller banks in the industry. Different types of bank mergers may also have different technical efficiency outcomes.

DEA results validate the claim that newly-established banks have advantage over existing banks in terms of program efficiency. However, new entrants have lost much of their efficiency advantage since the conduct of 1996 Wallis Inquiry. In a more deregulated Australian banking industry, all banks are under enormous pressure to operate efficiently and competitively. If they do not run efficiently, they are most likely to be taken over by other firms within or outside the industry. Even

without actual mergers and acquisitions, the threat of takeover itself can serve to intensify competition. In addition, the actual takeover does facilitate the exit of relatively inefficient banks and increase efficiency at remaining banks.

In conclusion, mergers and acquisitions can be socially beneficial if the market is competitive and contestable. Financial deregulation, globalisation and technological advances have worked together to improve competitiveness in Australian banking industry in the past. These forces will continue to influence the industry to various degrees. Minimum efficient scale may get larger in the future, making it possible for major banks to benefit from economies of scale by merging with others. Nevertheless, with enhanced competition and contestability in the market, all banks are forced to improve their efficiencies. Therefore, the role of the government is to focus on promoting deregulation and competition in the banking industry and in the economy.

The present research has its own limitations. Without detailed price information, it fails to address that whether any efficiency gains will pass on to consumers and not just boost the remaining banks' profits. However, we believe that as long as there is sufficient competition, some cost-savings from a more productive and efficient industry may eventually benefit consumers. In general, the more efficient the banks operate, the more consumer groups will benefit, and the more the economy as a whole will be better off.

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Table 1 Efficiency performances of sampled domestic banks during the period of 1983 and 2001 - CRS efficiency scores

Name	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Adelaide Bank Limited							0.893	0.874	0.841	0.872	0.944	0.888	0.899	0.867	0.869	0.877	0.892	0.901	0.906
AMP Bank Ltd																0.994	1.000	1.000	1.000
ANZ Banking Group	0.859	0.744	**0.719**	**0.652**	**0.639**	**0.615**	**0.659**	**0.630**	**0.668**	**0.668**	**0.688**	**0.642**	**0.641**	**0.624**	**0.685**	**0.705**	**0.773**	0.744	0.739
Town & Country Bank of Australia			0.946	0.907	0.857	0.885	**0.789**	**0.661**	**0.822**	**0.874**	**0.949**	**0.999**							
National Mutual Royal Bank				**1.000**	**0.895**	**0.902**	**0.897**												
Bank of Queensland	1.000	0.922	0.870	0.930	1.000	0.967	0.921	0.930	0.958	1.000	1.000	1.000	0.998	1.000	0.992	0.982	0.990	0.936	1.000
Bank of Western Australia	0.801	0.775	0.766	0.779	0.778	0.749	0.802	0.633	0.714	0.750	0.784	0.813	0.779	0.771	0.844	0.886	0.903	0.901	0.900
Primary Industry Bank of Australia	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.991	1.000	0.987	1.000	1.000	
Bendigo Bank						0.934	0.953	0.970	0.988	1.000	1.000	1.000	1.000	1.000	0.929	1.000	0.993	0.991	1.000
Commonwealth Bank of Australia	0.732	0.665	0.674	**0.653**	**0.667**	**0.649**	**0.640**	**0.636**	**0.684**	**0.703**	**0.747**	**0.699**	**0.655**	0.673	0.732	0.737	0.796	0.705	0.688
State Bank of Victoria	0.851	0.807	0.760	**0.712**	**0.764**	**0.721**	**0.680**	**0.624**											
Australian Bank	1.000	1.000	1.000	**1.000**	**1.000**	**0.952**	**0.922**	**1.000**											
State Bank of NSW	0.791	0.650	0.614	0.623	0.671	0.692	0.746	0.760	0.782	0.794	0.778	0.794	**0.832**	**0.865**	**0.874**	**0.890**	**0.914**		
Trust Bank										0.975	0.992	**0.923**	**0.931**	**0.907**	**0.960**	**1.000**			
- Tasmania Bank	1.000	0.995	1.000	0.992	**0.846**	**0.950**	**0.944**	**0.971**	**0.993**										
- Savings Bank of Tasmania	0.969	0.987	0.976	0.937	**0.962**	**0.971**	**0.938**	**0.947**	**0.888**										
Macqurie Bank			0.845	0.847	0.744	0.735	0.650	0.723	0.765	0.802	0.697	0.767	0.730	0.761	0.877	0.783	0.798	1.000	0.886
Naitonal Australia Bank	0.790	0.729	0.727	0.683	0.720	0.643	0.683	0.606	0.650	0.706	0.750	0.697	0.689	0.684	0.711	0.733	0.793	0.683	0.694
AustralianResourcesDevelopmentBank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000									
St. George Bank					0.858	0.945	0.907	0.878	0.915	**0.941**	**0.932**	**0.884**	**0.887**	**0.890**	0.892	0.877	0.893	0.881	0.862
Advance Bank	0.973	9.972	0.950	0.836	0.862	0.940	0.948	0.948	0.954	**1.000**	**1.000**	**1.000**	**0.998**	**0.888**					
Bank of South Australia	1.000	0.878	0.974	0.823	0.857	0.850	0.780	0.719	**0.740**	**0.777**	**0.823**	**0.867**	**0.942**						
Suncorp-Metway Ltd			1.000	1.000	1.000	1.000	1.000	0.969	0.945	0.968	0.937	0.927	0.894	0.890	0.900	**0.931**	**0.941**	**0.975**	**0.981**
Westpac Banking Corporation	0.873	0.803	0.813	0.761	0.738	0.695	0.732	0.634	0.703	0.734	0.751	0.734	0.673	0.706	**0.740**	**0.800**	**0.842**	**0.825**	**0.840**
Bank of Melbourne			0.967	0.837	0.900	0.955	0.999	0.926	0.943	**0.960**	**0.987**	**0.975**	**0.941**	**0.916**					
Challenge Bank	1.000	1.000	1.000	1.000	0.847	0.897	0.822	**0.840**	**0.880**	**0.944**	**0.961**	**0.934**							

Table 2 Efficiency performances of sampled foreign banks during the period of 1986 and 2001 - CRS efficiency scores

Name	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Arab Bank Australia Ltd									0.996	1.000	1.000	1.000	1.000	1.000	1.000	0.990
Bank of America Australia	0.556	0.792	0.952	0.951	0.781	0.901	0.911	1.000	1.000							
Bank of Singapore Australia	1.000	0.981	0.891	0.868	0.905	1.000	1.000	1.000	1.000	0.977						
Bank of Tokyo-Mitsubish Ltd	1.000	0.932	0.780	0.829	**1.000**	**0.911**	**0.844**	**0.751**	**1.000**	**0.997**	**0.923**	**0.957**	**0.917**	**0.964**	**1.000**	**1.000**
Mitsubishi Bank of Australia	0.946	0.931	0.969	0.942	**0.930**	**1.000**	**0.973**	**0.998**	**0.996**	**0.982**						
Banker Trust Australia	1.000	0.970	0.961	0.936	0.825	1.000	0.854	0.895	0.912	0.931	0.973	0.712	0.885	0.815		
Barclays Bank Australia	0.996	0.955	0.944	0.783	0.653	0.709	0.769	0.780								
Chase Manhattan Bank Australia	0.979	1.000	0.864	0.873	0.652	0.854	0.878	0.973	0.943							
Citibank Ltd	0.829	0.716	0.614	0.579	0.722	0.706	0.727	0.717	0.801	0.757	0.935	0.928	0.982	0.967	0.955	0.908
Deutsche Bank Australia	0.984	0.975	1.000	1.000	1.000	0.927	0.939	0.960								
HSBC Australia Ltd	0.839	0.958	0.892	0.762	0.782	0.815	0.871	0.908	0.877	0.880	0.915	0.924	0.936	0.938	0.910	0.894
IBJ Australia Bank		0.999	1.000	0.997	1.000	1.000	0.996	0.969	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
ING Bank (Australia) Ltd										1.000	0.996	0.977	0.965	0.940	0.929	1.000
Lloyds Bank NZA	0.978	0.788	0.912	0.646	1.000	0.900	0.898	1.000	1.000	0.953	1.000					
Natwest Australia Bank	0.982	0.935	0.844	0.600	0.794	0.994	0.925	1.000	1.000	1.000	1.000					

Table 3 Efficiency performances of sampled domestic banks during the period of 1983 and 2001 - VRS efficiency scores

Name	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Adelaide Bank Limited							0.901	0.905	0.863	0.919	0.968	0.932	0.958	0.953	0.941	0.927	0.920	0.940	0.940
AMP Bank Ltd																1.000	1.000	1.000	1.000
ANZ Banking Group	1.000	0.992	0.977	1.000	0.950	0.949	0.999	1.000	0.940	0.951	1.000	1.000	0.949	1.000	0.982	0.903	0.972	0.999	1.000
Town & Country Bank of Australia			0.973	0.937	0.955	0.963	0.841	**0.762**	**0.882**	**0.922**	**0.971**	**1.000**							
National Mutual Royal Bank				**1.000**	**0.990**	**1.000**	**1.000**												
Bank of Queensland	1.000	0.995	1.000	0.949	1.000	0.984	0.957	0.940	0.963	1.000	1.000	1.000	1.000	1.000	1.000	0.991	1.000	0.970	1.000
Bank of Western Australia	0.804	0.803	0.797	0.952	0.952	0.934	0.970	0.853	0.889	0.902	0.900	0.931	0.911	0.924	0.953	0.965	0.998	0.995	1.000
Primary Industry Bank of Australia	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.992	1.000	0.988	1.000	1.000	
Bendigo Bank						0.970	0.989	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.974	1.000	0.995	0.999	1.000
Commonwealth Bank of Australia	1.000	1.000	0.971	0.985	0.989	0.985	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995	1.000	0.994	1.000
State Bank of Victoria	1.000	1.000	0.990	1.000	1.000	1.000	0.994	0.995											
Australian Bank	1.000	1.000	1.000	1.000	1.000	0.993	0.999	1.000											
State Bank of NSW	0.855	0.773	0.744	0.816	0.861	0.929	0.962	1.000	0.996	0.984	0.992	0.998	1.000	1.000	1.000	1.000	1.000		
Trust Bank										0.988	0.992	0.983	1.000	0.953	0.969	1.000			
- Tasmania Bank	1.000	1.000	1.000	0.994	0.920	0.990	0.947	0.972	1.000										
- Savings Bank of Tasmania	0.970	0.988	0.978	0.951	0.966	0.979	0.953	0.957	0.929										
Macqurie Bank			0.850	0.853	0.780	0.777	0.692	0.759	0.797	0.850	0.779	0.910	0.882	0.804	0.896	0.820	0.862	1.000	0.907
National Australia Bank	1.000	1.000	1.000	1.000	1.000	0.983	1.000	0.993	1.000	1.000	0.999	0.994	0.983	0.994	0.985	0.977	1.000	1.000	1.000
AustralianResourcesDevelopmentBank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000									
St. George Bank					0.986	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.991	1.000	1.000	1.000	1.000	1.000	1.000
Advance Bank	1.000	1.000	1.000	0.935	0.942	0.995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000					
Bank of South Australia	1.000	0.989	1.000	0.984	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.992	1.000						
Suncorp-Metway Ltd			1.000	1.000	1.000	1.000	1.000	1.000	0.994	1.000	0.992	0.991	0.977	0.989	1.000	1.000	1.000	1.000	1.000
Westpac Banking Corporation	1.000	0.991	1.000	1.000	1.000	0.997	1.000	1.000	0.994	1.000	1.000	1.000	1.000	0.996	0.990	1.000	1.000	0.991	1.000
Bank of Melbourne			0.982	0.931	0.966	0.991	1.000	0.995	0.997	0.999	1.000	1.000	0.999	1.000					
Challenge Bank	1.000	1.000	1.000	1.000	0.909	0.996	0.979	0.982	0.987	0.999	0.993	1.000							

Table 4 Efficiency performances of sampled foreign banks during the period of 1983 and 2001 - VRS efficiency scores

Name	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Arab Bank Australia Ltd									1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bank of America Australia	0.835	0.796	1.000	0.992	0.820	0.931	0.918	1.000	1.000							
Bank of Singapore Australia	1.000	0.993	0.903	0.887	0.927	1.000	1.000	1.000	1.000	1.000						
Bank of Tokyo-Mitsubish Ltd	1.000	0.952	0.791	0.847	1.000	0.914	0.854	0.751	1.000	0.998	1.000	1.000	0.957	1.000	1.000	1.000
Mitsubishi Bank of Australia	1.000	1.000	0.972	0.946	0.936	1.000	0.975	1.000	1.000	1.000						
Banker Trust Australia	1.000	0.990	0.996	0.961	0.909	1.000	0.977	1.000	1.000	1.000	1.000	0.772	0.965	0.938		
Barclays Bank Australia	0.997	0.980	0.981	0.856	0.790	0.839	0.862	0.877								
Chase Manhattan Bank Australia	0.988	1.000	1.000	1.000	0.879	0.855	0.882	0.987	0.975							
Citibank Ltd	1.000	1.000	0.831	0.873	1.000	1.000	1.000	0.956	0.977	0.919	1.000	1.000	1.000	0.999	0.984	0.948
Deutsche Bank Australia	0.986	0.978	1.000	1.000	1.000	1.000	0.982	0.976								
HSBC Australia Ltd	0.865	1.000	0.990	0.868	0.858	0.915	0.980	0.998	0.986	0.955	0.974	0.958	0.966	0.959	0.941	0.933
IBJ Australia Bank		1.000	1.000	1.000	1.000	1.000	0.998	0.987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
ING Bank (Australia) Ltd										1.000	1.000	1.000	0.966	0.955	0.995	1.000
Lloyds Bank NZA	0.981	0.792	0.935	0.656	1.000	0.929	0.940	1.000	1.000	0.954	1.000					
Natwest Australia Bank	1.000	1.000	0.982	0.811	1.000	1.000	0.948	1.000	1.000	1.000	1.000					
Standard Chartered (Aust) Bank	1.000	0.770	0.707	0.766	0.682	0.801	0.895	0.916	0.840	0.994	0.926	0.862	0.889	0.918	1.000	

Table 5: Summary of pre-merger comparisons between targets and acquirers

Variable	Acquirer		Target		T-test		Wilcoxin Test	
	Mean	Standard Deviation	Mean	Standard Deviation	t-value	Prob > F	z-score	Prob > χ^2
TA (in millions)	51.158	48.67	7.272	9.048	3.457	0.005	-2.900	0.002
TAG (%)	13.547	6.267	-6.444	37.314	1.882	0.082	-2.103	0.035
ROE (%)	21.888	7.688	17.236	14.743	1.000	0.337	-0.804	0.455
CA (%)	5.532	1.635	6.910	3.844	-1.081	0.301	-0.804	0.455
PTE	0.990	0.023	0.981	0.066	0.472	0.645	0.140	0.950
SE	0.799	0.136	0.922	0.100	-3.626	0.003	-2.411	0.013
TE	0.790	0.131	0.905	0.124	-3.458	0.005	2.411	0.013

Note 1: TA = total assets in $millions

TAG = year-to-year percentage change in total assets

ROE = net profits before taxes relative to total equity

CA = total equity relative to total asset

PTE = pure technical efficiency under VRS technology

TE = technical efficiency under CRS technology

SE = scale efficiency

Note 2: Only 13 cases are reported here.

There is incomplete information in 4 cases where outsiders as acquirers and 1 case of missing data for target.

Table 6: Regression of post-merger efficiency performance

Variable	PTE				TE			
	Coefficient	Standard Error	t-ratio	p-value	Coefficient	Standard Error	t-ratio	p-value
Constant	0.306	0.129	2.380	0.021	0.886	0.355	2.496	0.015
WEFF	0.531	0.130	4.078	***0.000***	0.367	0.359	1.022	0.311
REFF	-0.018	0.046	-0.384	0.702	-0.167	0.128	-1.304	0.197
RSIZE	0.023	0.010	2.403	***0.019***	0.197	0.027	7.383	***0.000***
RROE	-0.013	0.004	-2.953	***0.005***	0.012	0.012	0.963	0.339
LSIZE	0.009	0.003	3.051	***0.003***	-0.031	0.008	-3.924	***0.000***
ROE	0.062	0.019	3.255	***0.002***	0.079	0.053	1.503	0.138
CA	-0.033	0.034	-0.975	0.334	-0.068	0.095	-0.721	0.474
SUB	-0.005	0.006	-0.817	0.417	-0.042	0.016	-2.583	***0.012***
BANKRUPT	0.007	0.007	0.961	0.340	-0.047	0.020	-2.311	***0.024***
FREQ	-0.009	0.008	-1.068	0.290	0.060	0.023	2.574	***0.013***
N	70				70			
Adjusted R^2	0.512				0.777			

Note:

1. WEFF is defined as the weighted average of efficiencies for the merging banks in the year prior to merger, where weights are proportional to the total assets held by the two merging parties in the same year.
2. REFF is the efficiency difference between acquiring bank and target bank in the year prior to merger.
3. RSIZE is the relative size between target bank and acquiring bank in the year prior to merger.
4. RROE is the relative rate of return between target bank and acquiring bank in the year prior to merger.
5. LSIZE is the natural logarithmic of total assets held by the bank in year t.
6. ROE is the rate of return measured in terms of net profits before taxes as a percentage of equity in year t.
7. CA is capital adequacy ratio measured by equity as a share of total assets.
8. SUB is the dummy variable for merger type. It takes the value of zero for merger between two independent banks and one for acquisition of a subsidiary bank.
9. BANKRUPT is the dummy variable for whether the target bank is virtually insolvent (=1).
10. FREQ is the dummy variable for merger frequency. It is one for acquiring bank involving in multiple mergers within five years and 0 otherwise.

Table 7: Descriptive Statistics of DEA Managerial Efficiency Scores

Year	Bank Type	N	Mean	Median	Standard Deviation	Maximum	Minimum
1983 – 1995	Incumbent	142	0.946	0.966	0.064	1.000	0.723
1983 - 1995	Entrant	233	0.867	0.904	0.137	1.000	0.473
1996 – 2001	Incumbent	37	0.971	1.000	0.051	1.000	0.819
1996 - 2001	Entrant	93	0.956	0.989	0.074	1.000	0.621

Table 8: Descriptive Statistics of DEA Program Efficiency Scores

Year	Bank Type	N	Mean	Median	Standard Deviation	Maximum	Minimum
1983 – 1995	Incumbent[a]	142	0.926	0.998	0.125	1.000	0.533
1983 – 1995	Incumbent[b]	90	0.883	0.951	0.140	1.000	0.533
1983 - 1995	Entrant	233	0.993	1.000	0.018	1.000	0.823
1996 – 2001	Incumbent[a]	37	0.990	1.000	0.021	1.000	0.925
1996 - 2001	Incumbent[b]	13	0.981	0.991	0.024	1.000	0.925
1996 - 2001	Entrant	93	0.999	1.000	0.002	1.000	0.984

Note:

a. It contains both major banks and existing regional banks.

b. It contains existing regional banks only.

Table 9: Summary of the Non-parametric Mann-Whitney U Test Results

Data	Incumbent		Entrant		Mann-Whitney U Test	Exact Significance (2-tailed)	Exact Significance (1-tailed)
	N	Mean Rank	N	Mean Rank			
1983 – 1995[a]	142	157.58	233	206.54	12223.0	.000	.000
1996 – 2001[a]	37	59.08	93	68.05	1483.0	.211	.106
1996 - 2001[b]	13	33.54	93	56.29	345.0	.009	.004

Note:

a. It contains all the banks for the sample period between 1995 and 2001.

b. It excludes major banks from the full sample data.

c. Due to infeasibility problem with super-efficiency DEA model, mean and standard deviation statistics is calculated using standard efficiency scores. A full rank is ordered based on super-efficiency scores, following Xue and Harker (2002).

Table 10: Summary of the Non-parametric Kruskal-Wallis Test Results

Data	Major		ERegional		NRegional		Foreign		Chi-Square	Degree of Freedom	Asymp. Significance (2-tailed)
	N	Mean Rank	N	Mean Rank	N	Mean Rank	N	Mean Rank			
1996 – 2001[a]	24	68.92	13	40.92	36	64.72	57	70.16	6.945	3	.074
1996 – 2001[b]			13	33.54	36	53.42	57	58.11	7.243	2	.027

Note:

a. It contains all the banks for the sample period between 1996 and 2001.

b. It excludes major banks from the full sample data.

Appendix 1: Summary of Bank Mergers and Acquisitions, 1983 - 2001

Year	Selected Mergers and Acquisitions Events	Total Assets (in $000)	Merger Type	Date of Delist
1987	Primary Industry Bank was a wholly-owned subsidiary of Rural and Industries Bank of Western Australia during the period of 1987 and 1994.	7702969	7	
1989	Australia Resources Development Bank became a wholly-owned subsidiary of National Australia Bank;	94606900	7	
	State Bank of Victoria bought 100% of Australian Bank.	23859000	1	
1990	National Mutual Royal Bank was taken over by ANZ Banking Group;	993000000	6	
	Town & Country Building Society became a wholly-owned subsidiary of ANZ Bank and then converted to bank status.	98212000	7	
1991	State Bank of Victoria was acquired by Commonwealth Bank of Australia;	89292000	2	01/07/90
	Savings Bank of Tasmania and Tasmania Bank merged to form Trust Bank;	1367510	1	01/09/91
1994	Primary Industry Bank of Australia was acquired by Rabobank, Netherlands in October 1994 and renamed as Rabobank Australia Limited in 2003;	2586000	3	
1995	State Bank of South Australia was acquired by Advance Bank;	20218829	2	02/06/95
	Bank of Western Australia became a subsidiary of foreign bank as a result of takeover by Bank of Scotland;	10216900	3	
	Colonial Mutual Life Assurance Society acquired State Bank of NSW to hold Colonial State Bank**;**	17318700	4	
1996	Challenge Bank was acquired by Westpac;	121513000	1	18/01/96
	Bank of Tokyo Australia Limited and Mitsubishi Bank of Australia Limited merged as a result of the merger between their parent banks;	3597200	5	
1997	Advance Bank was taken over by St. George Bank;	45060173	1	24/01/97
	Bank of Melbourne merged with Westpac;	11896300	1	07/11/97
	Metway bank became Suncorp-Metway Ltd as a result of the merger of Suncorp, Metway bank and Queensland Industry Development Corporation;	19908000	4	
1999	Trust Bank was acquired by Colonial State Bank;	23140400	1	
2000	Colonial Ltd (including subsidiary Colonial State Bank) merged with Commonwealth Bank of Australia;	21825900	1	06/07/00

Note: 1. Total assets of a merger are measured for the consolidated entity in the immediate year after the merger. 2. Date of delist is only available for the mergers where the acquired bank has been publicly listed in the stock market.

Notes:

[1] It is sourced from Thomson Financial and SDC Platinum.

[2] References to the four major banks are ANZ, Commonwealth, NAB and Westpac; the two largest insurance companies are AMP and NML.

[3] Banks who want to engage in merger and acquisitions are governed by section 50 of the Trade Practices Act, as administered by the ACCC.

[4] Under Section 63 of the Banking Act 1959, the Treasurer has veto powers over bank mergers.

[5] Keating P.(1990), Pres Release on Proposal for Merger of ANZ Banking Group and National Mutual Life Association, Canberra;

[6] Surprisingly, so far no foreign banks have expressed interest in taking over any of the major banks.

[7] In 1981, National Bank of Australia and Commercial Banking Company of Sydney, and Bank of New South Wales and Commercial Bank of Australia merged.

[8] Examples include that the ING bank entered the market with direct banking in August 1999.

[9] The general criteria involve an applicant being able to demonstrate an on-going ability to meet APRA' prudential standards, such as a minimum capital base 50 million dollars, suitable legal and managerial structures, shareholders of appropriate quality (subject to approval under the Financial Sector (Shareholdings) Act), comprehensive risk management strategies, and suitable multi-year strategic and financial plans. Where the applicant is foreign-owned, confirmation that the home supervisor does not object to the granting of an authority is also sought.

[10] Financial Sector Union of Australia (1996), Financial System Inquiry Submission, Melbourne; and New South Wales Farmers' Association (1996), Financial System Inquiry Submission, Sydney;

[11] The performance of merging firms is measured against a control group of non-merging firms in order to account for general industry trends in such performance.

[12] For example, in window analysis, the observation of NAB in 1985 is included in three consecutive sub-panel: (1983 – 1985), (1984 – 1986) and (1985 – 1987). Therefore, three efficiency scores are derived for the observation estimated against three different reference technologies. We calculate geometric mean of these three scores as the final efficiency score for the observation. Please be noted that observations in 1983 and 2001 are only included in one panel while those in 1984 and 2000 are in two panels only. Their final efficiency scores are calculated accordingly.

[13] The original regression model also include pre-merger efficiency scores for up to three year prior to merger as explanatory variables for banks' post-merger performance, but F-test shows that there is no difference in their individual effects. Therefore, we choose to report a simplified model with only one variable on pre-merger efficiency: the one in the year immediately before the merger.

[14] Merger can be defined as consolidation of previously distinct banks into one institution. Acquisition refers to ownership changes of a subsidiary bank or a group of subsidiaries held by holding companies, where the subsidiary banks may continue to operate as separate entities under new ownership. Studies on mergers examine the impact of changing organisational structure. Studies on acquisitions are useful in showing the effects of ownership changes (Piloff and Santomero 1998 and B.E. Gup 1989).

[15] According to Kolmogorov-Smirnov and Shapiro-Wilks test, only TE, SE and CA for acquirers and TAG and ROE for both groups are normally distributed.

[16] The two tests are similar to the tests on low efficiency hypothesis and relative efficiency hypothesis respectively. However, traditional low efficiency hypothesis and relative efficiency

hypothesis look at how pre-merger bank characteristics affect the magnitude of the change in post-merger efficiency while our tests adopted here examine the impact on the level of post-merger efficiency.

[17] Scale efficiency may not necessarily be improved as some banks may choose to get larger in order to avoid being the target of takeover.

[18] The Inquiry was established in May 1996 under the chairmanship of Mr. Stan Wallis.

[19] Primary Industry Bank became a subsidiary of foreign bank – Rabobank in October 1994, and therefore is re-classified as a foreign bank then.

[20] The test is available from SPSS11.0.

[21] However, the super-efficiency DEA model's ability of differentiating efficient DMUs is restricted by the presence of infeasibility problem when the model is estimated under variable returns-to-scale. The work done by Xue and Harker (2002) concluded that those DMUs with infeasibility problem are in fact super efficient. Here we follow their work to assign observations with infeasibility problem (labelled as "big" in EMS program) the highest ranking.

[22] The truncated sample data contains all the existing regional, newly established regional and foreign banks during the sample period. All the major banks are excluded from the new subset of data.

[23] The Kruskal-Wallis test is employed with rank-order data for hypothesis testing involving two or more independent samples. The null hypothesis involved is that the samples medians are equal for all the samples. The alternative hypothesis is that at least two of the sample medians will not be equal.