

THE EVIDENCE ON EFFICIENCY GAINS: THE ROLE OF MERGERS AND THE BENEFITS TO THE PUBLIC

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Abstract

Operating efficiencies, employee productivity, profit performance and average relative efficiency (using Data Envelopment Analysis) were measured for Australian trading banks from 1986 to 1995. Changes in a bank's market share of deposits is explored as a means of determining the extent to which efficiency gains are passed on to the public. In general, efficiencies rose in the post-deregulation period. Evidence from the merger cases studied supports the reports of others that acquiring banks are more efficient than target banks. However, the acquiring bank does not always maintain its pre-merger efficiency. Decision-makers ought to be more cautious in promoting mergers as a means to enjoying efficiency gains. There is mixed evidence on the extent to which the benefits of efficiency gains are passed on to the public.

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1. Introduction

The three key objectives of this study were to investigate the empirical evidence on the efficiency gains of the Australian trading banks during the deregulated period, examine the role of mergers in efficiency gains, and provide an answer to the perennial question on mergers of 'to what extent gains in operating efficiencies are passed on to the public'. The evidence on efficiency gains was examined by measuring overall operating efficiency, employee productivity, profit performance and the industry mean relative efficiency scores. The role of mergers in efficiency gains was probed by comparing relative efficiency scores before and after a merger. The extent to which efficiencies are passed on to the public is measured through the per cent change in bank's share of deposits in the market.

The main motivation for this study was the Wallis Inquiry¹ which was charged with reporting on the outcomes of the deregulated period, and more importantly, make further recommendations on regulation of mergers. There is no consensus in banking literature about the benefits of mergers to the merging entities or to the public, a situation which is even less clear in Australia due to the small market and the difficulty of conducting empirical research with small sample sizes. Most mergers undertaken are based on perceived economic and political benefits rather than conclusive mathematical calculations. The relative efficiency scores reported in this

¹ Wallis Inquiry was set up by the Australian Federal Treasurer on 30 May 1996 and has since delivered a stocktake of the Australian financial system in the deregulated period. Its key terms of reference include regulation of the financial system, competition, and technological development. The Inquiry recommended the lifting of the blanket ban on mergers among the largest banks and life companies. It also recommended that no part of the financial system should be protected from foreign acquisition.

study can help decision-making by banks intending to take over other banks by providing a comparative performance analysis. Comparison of overall efficiencies and market shares following mergers will contribute to discussions on public benefits of mergers often engaged in by policy makers such as the members of the Federal Treasury, the Reserve Bank of Australia, and the Australian Competition and Consumer Commission (ACCC)².

The beginning of deregulation of the Australian finance sector can be traced to December 1983 when the dollar was floated and exchange controls lifted. Australia entered the deregulated period with 24 banks (excluding merchant banks and foreign banks). Deregulation continued in the following years with lifting of deposit controls, authorisation of savings banks to provide chequing facilities, invitation of foreign banks to operate in Australia, changes in ownership of authorised money market dealers, expansion of services by credit unions and building societies, and so on. For example, in 1985-86 alone, seventeen new banks (mostly foreign banks) started business and fifty-five proposals for the establishment of merchant bank operations were approved. These changes in the composition of the finance sector make it difficult to set up a comparative pre-deregulation and post-deregulation look at banks.³

Major trading banks are facing more competition from local banks, building societies, credit unions and mortgage originators. Particularly in the last few years, there has been a blurring of lines separating the domain of major banks and others. Taking advantage of legislative and technological changes, the so-called state banks and building societies are competing head-on with larger banks both across geographical boundaries and product range.

² ACCC monitors anti-competitive and unfair market practices, mergers and acquisitions, and product safety. It is responsible for the enforcement of legislation in these areas.

³ An excellent historical perspective on the Australian financial system can be downloaded from the web site http://www.treasury.gov.au/Publications/FSI/final_report/ (see Chapter 14).

Effectively, the Australian banking sector is experiencing a convergence. For example, major trading banks that traditionally relied on their deposit base to lend are increasingly financing their home loans through securitisation. This has come about as a direct result of mortgage originators' success in providing low-cost home loans. Similarly, non-bank institutions are increasingly packaging their services with products traditionally offered by banks. In the next few years, major banks in particular are expected to undergo further restructuring with emphasis on generating revenue from fees rather than the interest spread.

In a low-growth population, maturing markets are likely to lead to fiercer competition. As banks come to terms with free market conditions, rationalisation of the banking industry will continue. Similarly, the increased scrutiny of the industry by the Federal government, for example, the Martin Inquiry⁴, has put more pressure on the banks in terms of profitability, effectiveness of competition, product innovation, and information to users (Australian Bankers' Association 1990). The pressure on banks has also been maintained by the investigation of the former Prices Surveillance Authority (PSA)⁵ into bank fees and charges.

Rationalisation of the existing branch networks is a reflection of each bank's efforts to achieve competitiveness, a process that has also been assisted by technological developments. For example, the Australia and New Zealand Banking Group (ANZ) has been implementing a major restructuring of its branch network to reduce operating costs and increase efficiency.

⁴ Martin Inquiry was convened in 1983 to assess the Campbell Report published in 1981 that recommended the abolishment of direct interest rate and portfolio controls imposed on financial institutions, and removal of barriers of entry to the financial system. In 1984, Martin Inquiry endorsed the Campbell Report, effectively enabling banks to determine interest rates on their deposit and cheque accounts, relaxing foreign ownership of merchant banks, and deregulating the Australian stock exchanges and the securities industry.

⁵ Currently known as the Australian Competition and Consumer Commission (ACCC), PSA was responsible for enforcing the Prices Surveillance Act of 1983. The Act enables ACCC to monitor prices and curb anti-competitive price hikes.

Central to this exercise are staff redundancies, branch closures, and in some cases, re-engineering of retail delivery channels aimed at improving efficiency and customer service. With in-market mergers and takeovers, closing overlapping or non-performing branches can greatly reduce operating costs as well as provide more branches for the combined customers of both banks. In-market mergers are usually justified on the argument that the same number of customers can be served at a lower cost (Houston and Ryngaert 1994).

"...benefits of in-market consolidation should be at least a 25% cost savings and possibly as much as 75% cost savings, as measured by the reduction of the acquiree's non-interest expenses" (Bowen 1990, p.18).

A study by Keefe, Bruyette and Woods Inc. (1990) reports an average of 35% savings in operations costs of target banks within 6-9 months following a merger. However, these arguments ignore the larger component of total expenses, namely, interest expense.

The Australian Competition and Consumer Commission (ACCC) has been against merging of major trading banks or acquisition of a last substantial regional bank by a major bank. The ACCC's approach may be in conflict with that of the current Federal Treasurer who appears to be more open to the arguments of the banking industry. This study provides an objective look at the operating efficiencies that are often used as a justification for proceeding with mergers (Berger, Hunter and Timme 1993). A further aim of the study is to assess the extent to which operating efficiencies are passed on to the public in the form of improved services.

The empirical evidence in this study reveals that there has been a slow but steady rise in bank efficiencies between 1986-1995, interrupted briefly in 1990-1991 by the bad debts resulting from the imprudent lending during the late 1980s. By enhancing competition and scrutiny of banking, deregulation has forced banks to better their efficiencies. Ostensibly, mergers have emerged as one method of striving for operating efficiencies, mainly focused on

the cost side. While three of the four merger cases studied lend support to the hypothesis that acquiring banks are more efficient, the acquiring bank does not always maintain its pre-merger efficiency. There is also mixed evidence on public benefits of efficiency gains following mergers. A rise (drop) in operating efficiency is not always accompanied by a rise (drop) in market share as one would expect.

2. Conceptual Framework

2.1 Measuring Bank Efficiency

Unfortunately, there is little reliable empirical research on bank efficiency in Australia and what little there is deals only with economies of scale (that is, operating expenses) and is inconclusive (Edgar, Hatch and Lewis 1971; Hatch and Lewis 1973; Burgess and Walker 1978; Valentine and Williamson 1982; Swan and Harper 1982; Swan and Simmonds 1989). The small number of Australian banks and the generally inaccessible bank-generated data make it difficult to conduct econometric analysis. Nevertheless, one study concludes that there is evidence for economies of scale, supporting claims of over-staffing in Australian banks (Walker 1994).

The literature on bank efficiency is dominated by studies from the USA, where the larger market and number of banks have traditionally facilitated econometric modelling. Most of the efficiency literature is on cost effects of economies of scale (size) and scope (product mix) (Hunter and Timme 1986; Berger, Hanweck and Humphrey 1987; Elyasiani and Mehdiian 1990; Ferrier and Lovell 1990; Noulas, Ray and Miller 1990; Hunter and Timme 1991; Berger and Humphrey 1991; Fields, Murphy and Tirtiroglu 1993; McAllister and McManus 1993; Rhoades 1993).

Unfortunately, the conventional studies on scale and scope economies are beset by a number of problems. For example, the translog cost function generates a poor approximation

when banks of assorted sizes are used. Another potential problem is that scope economies can be confounded with x-efficiency differences when applied to banks *off* the efficient frontier. In response to these problems, alternative research designs have emerged. For example, in some studies the translog cost function has been replaced by non-parametric estimation procedures such as the kernel regression technique (McAllister and McManus 1993). Yet other researchers have moved away from the cost function, focusing on the profit function instead, in an effort to estimate optimal scope economies (Berger, Hancock and Humphrey 1993). The theoretical appeal of working with the profit function is that it accounts for the revenue effects as well as the cost effects of operating at incorrect levels or mixes of inputs and outputs (Akhavain, Berger and Humphrey 1997).

More recently, the focus has shifted to x-efficiencies, that is, the ability of management to control costs and generate revenues (Elyasiani and Mehdian 1990; Ferrier and Lovell 1990; English et al. 1993; Allen and Rai 1996; Mester 1996). X-efficiency comprises allocative and technical efficiencies of banks, where allocative inefficiency is defined as a decline in performance from selecting an ineffective production plan, and technical inefficiency is defined as the poor implementation of this production plan (Berger, Hancock and Humphrey 1993). In this study, measurement of x-efficiency is not separated into its allocative and technical components. Existing studies indicate that x-inefficiencies constitute 20% or more of costs, while scale and scope inefficiencies account for less than 5% of costs in banking (Berger, Hunter and Timme 1993).

There is no consensus on the best procedure for measuring x-efficiencies. The principal measurement problem is distinguishing variations in x-efficiency from random error. Examples of different procedures are the econometric frontier approach (EFA), the thick frontier approach (TFA), the distribution-free approach (DFA), and the data envelopment analysis (DEA). Each of these four approaches makes different assumptions

about the distribution of x-efficiency differences and random error (Berger, Hunter and Timme 1993). DEA, the procedure adopted in this study, usually assumes no random error, thus implying that all deviations from the estimated efficient frontier actually constitute x-inefficiencies. Other researchers who have recently used DEA in measuring relative bank efficiency include Berg et al. (1993), Drake and Howcroft (1994), Favero and Papi (1995), Haag and Jaska (1995), Sherman and Ladino (1995), Wheelock and Wilson (1995), Miller and Noulas (1996) and Resti (1997).

DEA, a non-parametric method, is particularly suited to working with limited sample sizes (Evanoff and Israilevich 1991). Nevertheless, 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). A significant advantage of DEA is that it does not superimpose a particular functional form on the data in determining the most efficient DMUs, and so captures the interplay between various inputs and outputs of different dimensions. On the other hand, DEA's major shortcoming is that it assumes data to be free of measurement error (Mester 1996), and could therefore give unreliable results if the integrity of data is not assured.⁶

It was possible to collect data on 4 inputs (staff numbers, deposits, interest expense, and non-interest expense) and 3 outputs (net loans, net interest income, and non-interest income). The proposed model of inputs and outputs follows the *intermediation* approach to modelling bank behaviour in which deposits are regarded as being converted into loans (Mester 1987). The alternative is the production approach in which banks are regarded as using labour and capital to generate deposits and loans (outputs are measured in number of

⁶ For a more in-depth discussion of DEA, see Oral and Yolalan (1990), Colwell and Davis (1992), Al-Faraj, Alidi and Bu-Bshait (1993), and Haag and Jaska (1995). An informative DEA site on the Internet is <http://www.csv.warwick.ac.uk/~bsrlu/index.html>.

accounts rather than dollars). The intermediation approach is preferable since it normally includes interest expense, a large proportion of any bank's total costs (Elyasiani and Mehdiian 1990; Berger and Humphrey 1991).

This study provides an overall ranking of banks on relative efficiency, where the focus is on x-efficiency, that is, the success of management in controlling costs and generating revenues. Equally important, perusal of relative efficiency rankings for banks engaged in a merging exercise allows further testing of the traditional merger theory which stipulates that the acquiring entity is more efficient than the target entity (Houston and Ryngaert 1994).

2.2 Evidence on Mergers Leading to Operating Efficiencies

The argument of cost savings (efficiency gains) often advanced in support of bank mergers includes excess capacity (outlets or staff numbers). Other motivations for mergers are scale economies arising from technological change (say, in back-office processing), and excess capital looking for investment opportunities (although this is not an efficiency issue).⁷

Once again, most of the evidence is from the USA, and it indicates that there are few efficiency gains from mergers. Furthermore, literature indicates that there are no efficiency gains from in-market mergers if the acquiring bank is the more efficient (Berger and Humphrey 1992; Srinivasan and Wall 1992; Rhoades 1993). In instances when efficiency gains do arise after mergers, they come from the revenue (output) side rather than the cost (input) side (Cornett and Tehranian 1992; Spindt and Tarhan 1992; Fixler and Zieschang 1993). Thus, the implied direction for future research is to concentrate on profit functions that account for revenue generation and expense control.

2.3 Public Benefits of Mergers

Traditional merger theory stipulates that merging is a transfer of scarce corporate resources from a firm of lesser capability to one that is able to operate more efficiently and is able to put those resources to better use (Ravenscraft and Scherer 1987). That is, a merger is regarded as a purging exercise where incompetent management is removed and usually translates into a search for cost savings (efficiency gains) from the merger. However, this approach can be misleading. For example, while an in-market merger is expected to result in

⁷One of the disadvantages of a merger is the potential loss of customer loyalty in the new entity. The Reserve Bank of Australia has recently allowed the retention of bank brand names after a takeover. This change effectively minimises the potential loss of market share following a takeover or merger due to existing customers migrating to competitors.

cost savings when neighbouring branches are closed down, this does not necessarily indicate improved efficiency in the long-run. Unless cost savings arise from improved institutional efficiency, the public may not benefit from the merger and any improvement to the bottom line is likely to be short-lived. Taking this point a step further, while a merger leads to concentration of resources and a faster capital growth normally favoured by regulatory agencies, it could be followed by reduced operating efficiency unless changes are re-engineered into the merged entity by correcting the design inefficiencies inherent in the acquiring and target banks (Allen 1994). Such a scenario would mean that the public could be paying for services at prices in excess of competitive norms (Rhoades 1986) e.g. if a town's only bank is closed, inhabitants are forced to travel 100km to the nearest town.

In determining what public benefits are, the ACCC considers the precedents set by the Australian Competition Tribunal⁸. Specific examples of public benefits considered by ACCC include enhanced customer service, greater efficiencies, protection of employment, environmental benefits, and “anything which leads to a better utilisation of resources” (Woodward 1996, p.5). It can be seen that even with the more specific definitions of public benefits, the ACCC operates within wide terms of reference in evaluating a merger. The ACCC's preferred attitude to mergers is to evaluate each application on its own merits rather than trying to assess the fit to a prescribed outcome (Woodward 1996).

⁸ The Tribunal is entrusted with reviewing ACCC's authorisation and notification decisions. It is effectively an appeals court for those unhappy with the decisions handed down by the ACCC, where the affected party is allowed a re-hearing of the matter.

3. Research Design

3.1 Measuring the Evidence on Efficiency Gains During the Deregulated Period

Australian trading banks in the deregulated period form the population under study. Between 1986-95, most foreign banks have operated as subsidiary banks with restrictive capital adequacy requirements and have operated mainly in wholesale banking, so they have been omitted from this study.

Overall operating efficiency is defined as the ratio of *non-interest expense* (input) to *operating income* (output), where non-interest expense is defined as before-tax total expenses less interest expenses and charges for bad and doubtful debts, and operating income is defined as net interest income plus non-interest income (Srinivasan 1992; Johnson 1993). Under this definition, lower ratios represent higher efficiencies. The accounting measures required to calculate the operating efficiency as defined above have been obtained from the Reserve Bank of Australia. Examination of the overall operating efficiencies over the ten-year study period (1986-1995) provides a picture of the efficiency gains. Employee productivity was probed by calculating the operating income for the industry per employee.

Further evidence on efficiency gains can be found by examining profit performance as measured by return on assets. Return on assets is a key ratio used by managers, investors and business analysts in evaluating overall performance of a firm. “The best measures of a firm’s [bank’s] overall performance are the profitability ratios ROE [return on equity] and ROA [return on assets]” (Sinkey 1983, p.201). ROA is defined as operating profit after tax but before abnormal and extraordinary items divided by total assets.

Due to a small sample size that varies between 16-19 DMUs across 1986-1995, it was decided to reduce the number of variables entering DEA analysis (the sample membership across 1986-1995 is depicted in Table 1). This enhanced the discrimination between efficient and inefficient DMUs.

[insert Table 1 here]

Sample size in this study compares favourably with some of the other small sample sizes in the DEA literature (see Table 2).

[insert Table 2 here]

In the spirit of measuring, as directly as possible, management's success in controlling costs and generating revenues (that is, x-efficiencies), net loans, deposits, and staff numbers were dropped from the analysis, leaving two (2) input and two (2) output variables.

Assuming constant returns to scale and modelling input minimisation, the first DEA analysis was run with *interest expense* and *non-interest expense* as input variables, and *net interest income* and *non-interest income* as output variables (hereafter referred to as DEA Model A).^{9,10} To test the sensitivity of results to the three variables omitted in the Model A, a second DEA analysis was run with *deposits* and *staff numbers* as inputs, and *net loans* and *non-interest income* as outputs (hereafter referred to as DEA Model B). In the analysis of DEA Model B, where a less direct approach is taken to measuring x-efficiencies, deposits replace

⁹ Constant returns to scale is a common assumption in DEA analysis. The alternative assumption, variable returns to scale, compares each unit only against other units of similar size, instead of against all other units. As such, an assumption of variable returns to scale is more suitable for large samples. Under the assumption of constant returns to scale, input minimisation and output maximisation models give the same relative efficiency scores.

¹⁰ Input minimisation looks at how much inputs can be reduced while maintaining the output levels of each DMU. The opposite is output maximisation where the model estimates how much output can be increased given the current level of inputs.

interest expense, staff numbers replace non-interest expense, and net loans become a proxy for net interest income. The two DEA models are summarised below. The results of the analysis are discussed in the next section.

	DEA Model A	DEA Model B
Inputs	<i>interest expense</i>	<i>deposits</i>
	<i>non-interest expense</i>	<i>staff numbers</i>
Outputs	<i>net interest income</i>	<i>net loans</i>
	<i>non-interest income</i>	<i>non-interest income</i>

3.2 Assessing the Role of Mergers in Efficiency Gains

Acquiring banks are more efficient than target banks (Berger and Humphrey 1992; Rhoades 1993). For the merger cases identified in this study, the relative efficiencies of the acquiring bank and the target bank were monitored for a period of 2 years prior to the merger and that of the merged entity for 3 years following the merger. Merger cases have been carefully selected to exclude any other merger activities by the acquiring banks during the five years to prevent confounding of observations (Rose 1995). In the study population, there were four mergers that fulfilled this selection criterion:

Case 1: National Australia Bank acquired Australian Resources Development Bank on 1st October 1989.

Case 2: Australia and New Zealand (ANZ) Banking Group merged with National Mutual Royal Bank in September 1990.

Case 3: Commonwealth Bank of Australia acquired State Bank of Victoria on 1 January 1991.

Case 4: Savings Bank of Tasmania acquired Tasmania Bank to form Trust Bank on 1 September 1991 (in-market merger).

3.3 Determining the Extent Efficiency Gains are Passed on to the Public

The extent to which operating efficiencies are passed on to the public following a merger is assessed by a more indirect measure; the proxy measure proposed is the *change in market share* (Rhoades 1986). If the price of banking and quality of service improves as a result of operating efficiencies, then it is reasonable to expect the banks' post-merger market share to rise. This change in market share is measured by the annual *per cent change in the merged banks' share of total deposits in the market* in the three year period following the merger.

4. Results and Analysis

The overall operating efficiency of the banking industry appears to have improved during the post-deregulation period, only to stall in 1989-1991 when the failed lending practices of the late 1980s were factored in (see Figure 1). Bad debts reduced interest income and net loans where net loans is defined as gross loans less provisions for bad and doubtful debts. For ease of interpreting, reciprocal of the overall operating efficiency ratio has been plotted in Figure 1.

[insert Fig.1 here]

Between 1986 and 1995, there was no significant correlation between bank size (total assets) and overall operating efficiency ($r = 0.0374$). This contradicts the finding of Miller and Noulas (1996) who report a significantly positive correlation between bank size and pure technical efficiency.

A clearer picture emerges in Figure 2, which shows a steady rise in employee productivity. This is a reflection of the Australian banks restructuring themselves in response to local and overseas competitive market forces, as well as the impact of technology. This process continues.

[insert Fig.2 here]

Measure of overall profit performance, return on assets (ROA), behaved similarly to operating efficiency depicted in Figure 1. This is further evidence of efficiency gains during the deregulated period (see Figure 3).

[insert Fig. 3 here]

Results of the DEA Model A reveal that those banks that performed efficiently across the study period were Bank of Queensland (except in 1994-95), Macquarie Bank, and National Australia Bank (except in 1991). Consistently poor performers relative to their peers were Bank of South Australia, Bank of Western Australia, and State Bank of New South Wales. The annual mean DEA scores ranged from 78.99% in 1991 to 91.48% in 1986 (see Figure 4).

[insert Fig.4 here]

The DEA Model B, where the input/output variables were changed, yielded much lower and variable scores. Annual mean scores ranged from 37.23% in 1986 to 79.43% in 1994 (see Figure 4). Clearly, DEA analysis is sensitive to the choice of variables. Nevertheless, this is also the strength of the technique as it provides management-specific

information on where to start improving the efficiency of DMUs under scrutiny. It allows efficiency measurement from various perspectives depending on the decision-making requirements. For example, if management is interested in the contribution of staff to a particular set of outputs, staff numbers become an input variable.

Before moving on to the analysis of merger cases, can the discrepancy between the results of the two DEA models be explained? Knowledge of what transpired in the Australian banking sector between 1986-95 would help. Looking at Figure 4, while the two curves are rising in early 1990s, they appear to be moving in opposite directions in the late 1980s. What were the highlights of the late 1980s? The interest rates had peaked by 1989, some of the large property driven corporate loans were either in arrears or being written off, and banks had started restructuring and making plans for shedding staff. Mean DEA scores from Model A show a gradual decline in this period because of rising non-interest expenses (input inefficiency) due to banks' efforts to recover loans in arrears, and interest income dropping (output inefficiency) for the same reason.

Continuing to look at late 1980s, when non-interest expense is substituted with staff numbers in the DEA Model B, the increasing non-interest expense due to efforts to recover loans in arrears is no longer reflected in the analysis, ostensibly creating an input efficiency. Also, large loans in the late 1980s that are still on the banks' books become a source of output efficiency. We should note that large loans were a source of output inefficiency in the DEA Model A where interest income is used instead, because banks were unable to collect repayments due long before such loans were classified as bad.

By 1990, those loans that had been in arrears were being classified as bad debts. It took at least two years for major trading banks to rid themselves of the bulk of bad debts, at the end of which they emerged as more efficient institutions. In the early 1990s, banks used

the bad loans experience to justify larger redundancies and restructuring, which is reflected in rising mean DEA scores on Models A and B after 1991 (Figure 4).

The sharp drop in efficiency between 1989-90 (see Model B) can be explained by the more immediate impact of bad debts on net loans compared to its impact on net interest income. This impact would be particularly pronounced given the large nature of most failed loans.¹¹ However, this output inefficiency was amply compensated by gains on the input side of the analysis. For example, as of 1991 staff numbers have been steadily declining as banks complete different stages of restructuring their branch networks. The rise in efficiency in the early 1990s is not as pronounced in Model A mainly because the majority of those losing their jobs were low-paid clerical staff employed to look after transactions processing and back office administration. Clearly, while this is picked up in Model B by staff numbers, it is not reflected to the same extent in Model A in non-interest expense.

Is there any evidence to suggest that the acquiring banks are more efficient than the target banks? Table 3 summarises the DEA scores for the four (4) merger cases identified under Research Design. Three out of the four cases lend support to the hypothesis that acquiring banks are more efficient. However, the evidence on whether the acquiring bank maintains its pre-merger efficiency is less clear. Case 1 appeared to maintain its pre-merger efficiency whereas Case 2 displayed a drop in efficiency beginning in the year prior to the merger and continuing to drop in the year following the merger. Case 3 indicates a rise in efficiency in the first year of merger, only to fall behind in subsequent years. In Case 4, the in-market merger, a gradual rise in relative efficiency can be seen following the merger, which appears to contradict Berger and Humphrey (1992), Srinivasan and Wall (1992) and

¹¹ The most publicised cases of two large failed loans are monies lent to entrepreneurs Alan Bond (in prison) and Christopher Skase (on the run in Spain).

Rhoades (1993) who report that there is no efficiency gains from in-market mergers where the acquiring bank is more efficient.

[insert Table 3 here]

The extent to which operating efficiencies are passed on to the public is measured by the change in market share of deposits for the merged entity. This proxy measure assumes a positive correlation between change in market share and change in overall operating efficiency when the benefits of the gains in operating efficiencies are actually passed on to the public. Results shown in Table 4 display a mixed relationship. Cases 1 and 4 appear to support the contention of a positive correlation, whereas Cases 2 and 3 do not. Furthermore, Case 1 shows a steady rise in market share of deposits over the first three years following the merger.

[insert Table 4 here]

One way of interpreting the mixed results is that the variable ‘change in share of deposits’ is not a good proxy measure of the extent to which operating efficiencies are passed on to the public. It is possible that the underlying assumption that ‘the price of banking and quality of service improves as a result of gains in operating efficiency’ does not always hold. In this case, reasoning in reverse, a decline in operating efficiency does not always lead to a decline in price of banking and quality of service.

Another possible explanation is that increased market penetration following a merger could create monopoly power. Under such circumstances the merged entity would be less inclined to pass on to the public any operating efficiency in the form of better prices and

improved services. In Table 4, none of the merger cases are between two large banks. That is, there is no evidence of a market concentration that can be deemed a monopoly. In fact, the Big Four banks in Australia are still not permitted to merge among themselves for fear of creating monopoly power.¹²

5. An Application of DEA

The year of 1995 is chosen to illustrate the potential use of DEA results (from Model A). A commercially available DEA software was used for the analysis. National Australia Bank emerges as the global leader in the sample since it is the most frequently sighted efficient DMU in reference sets (nine times). National Australia Bank can thus be emulated by others in an effort to raise their efficiency scores. On the opposite extreme, State Bank of New South Wales is the least efficient bank in the sample for 1995 (see Table 5). Assuming constant returns to scale and input minimisation, the potential improvements that can be pursued by the State Bank of New South Wales are 39% reduction in interest expenses and 24% reduction in non-interest expenses.

[insert Table 5 here]

A comparison between the National Australia Bank and the State Bank of New South Wales indicates why National Australia Bank is the efficient bank and helps in setting new performance targets for the inefficient bank. For example, National Australia Bank uses 505% of interest expense of the State Bank of New South Wales to generate 1110% of net interest income of State Bank of New South Wales. That is, National Australia Bank is about

¹² This is known as the four pillars merger policy and its abolition has been recommended by the Wallis Inquiry. So far, this recommendation has not been adopted by the Federal Treasurer for fear of a political backlash. However, the four pillars merger policy is widely expected to be lifted after the next Federal elections.

twice as efficient converting interest expense into net interest income. Similarly, National Australia Bank uses 930% of non-interest expense of the State Bank of New South Wales to produce 1338% of non-interest income of the State Bank of New South Wales. When the ‘input minimisation’ assumption is changed to ‘output maximisation’, a new set of potential improvements emerge. These are, a 20% reduction in interest expense, and a 31% rise in net interest income and a 31% rise in non-interest income.

Table 6 provides a comparison of relative efficiencies across 1986-95 for the four major Australian trading banks. The leading bank among the Big Four emerges as the National Bank of Australia, followed by the Commonwealth Bank of Australia, and rather lacklustre overall performances by the ANZ Banking Group and the Westpac banking Corporation. ANZ, given its smaller size compared to the other major banks and its troubled performance, is probably a good takeover target for National Australia Bank.

[insert Table 6 here]

6. Conclusion and Discussion

Measures of overall operating efficiency, employee productivity and return on assets point to an overall improvement in performance of Australian trading banks during the deregulated period. Mean DEA scores from the Model A indicate a gradual decrease in relative efficiency until 1991, followed by a steady increase thereafter. This is a manifestation of the banks becoming more adept in controlling expenses, particularly after the imprudent lending practices of the late 1980s. The bad debts that were carried on the books of most banks in the early 1990s have further stimulated banks into searching for areas of cost reduction, a process still in effect today.

Mean DEA scores from Model B draw a different picture for the late 1980s. This has been explained by the events of that period and the choice of input and output variables. It has been demonstrated that DEA analysis can be used to measure relative efficiency across different dimensions of banking, and as such, DEA can be a powerful managerial tool.

Relative efficiencies can be indicators of likelihood of bank failure or becoming a takeover target (Wheelock and Wilson 1995). The relative efficiency scores reported in this study and further application of data envelopment analysis can assist decision-making regarding mergers. Observing a bank's relative efficiency on a selection of variables over a number of years provides an insight into the performance of that bank compared to its peers. Those banks that have steadily lost ground to others are likely to become takeover targets if would-be acquiring banks can identify potential synergies.

Evidence as observed from the four merger cases studied adds credence to the reports of others that acquiring banks are more efficient than target banks. However, the acquiring bank does not always maintain its pre-merger efficiency. If this is the case, then the role of mergers in efficiency gains is not necessarily positive, a sentiment shared by most other researchers in this field. Decision-makers ought to be more cautious in promoting mergers as

a means to enjoying efficiency gains. With the in-market merger (Case 4) where the acquiring bank is more efficient, there is a gradual rise in efficiency after the merger, which appears to contradict the findings reported previously in the literature.

There is mixed evidence on the extent to which the benefits of efficiency gains are passed on to the public. Only half the cases support the proposition that change in market share and change in overall operating efficiency are positively correlated. It is necessary to undertake further research on whether the public benefits from gains in operating efficiencies. The small number of Australian merger cases available for study means the conclusions based on the analysis of mergers can at best be considered tentative.

Australia belongs to the group of countries with the most efficient cost structures, alongside Japan, Austria, Germany, Denmark, Sweden and Canada (Allen and Rai 1996). Allen and Rai's study develops a global cost function to compare the efficiency of banks around the world relative to each other. However, these relative measures do not imply that there are no efficiency gains to be made in Australian banks. What is required is further research in this area to establish a means of measuring the profit function which allows probing of efficiencies on the cost as well as the revenue side of business. From a policy standpoint, as deregulation of the banking industry in Australia continues to unfold, competition will force banks to merge with other banks or financial institutions, cut costs, innovate in such areas as service delivery and revenue generation, or even exit the industry if the former strategies are not successfully implemented.

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References

- Akhavein J.D., A.N. Berger and D.B. Humphrey, 1997, The Effects of Megamergers on Efficiency and Prices: Evidence from a Bank Profit Function, *Review of Industrial Organization*, 12, 95-139.
- Al-Faraj T.N., A.S. Alidi and K.A. Bu-Bshait, 1993, Evaluation of Bank Branches by Means of Data Envelopment Analysis, *International Journal of Operations and Production Management*, 13, 45-52.
- Allen, L. and A. Rai, 1996, Operational Efficiency in Banking: An International Comparison, *Journal of Banking and Finance*, 20, 655-672.
- Allen, P.H., 1994, Making Consolidation Work, *Bankers Magazine*, 177, 32-37.
- Australian Bankers' Association, 1990, Submission to the Parliamentary Inquiry into the Australian Banking Industry, December, Melbourne.
- Berg S.A., F.R. Forsund, L. Hjalmarsson, and M. Suominen, 1993, Banking Efficiency in the Nordic Countries, *Journal of Banking and Finance*, 17, 371-388.
- Berger A.N., G.A. Hanweck and D.B. Humphrey, 1987, Competitive Viability in Banking: Scale, scope and product mix economies, *Journal of Monetary Economics*, 20, 501-520.
- Berger A.N., W.C. Hunter and S.G. Timme, 1993, The Efficiency of Financial Institutions, *Journal of Banking and Finance*, 17, 221-249.
- Berger, A.N. and D.B. Humphrey, 1991, The Dominance of Inefficiencies over Scale and Product Mix Economics in Banking, *Journal of Monetary Economics*, 28, 117-148.
- Berger, A.N. and D.B. Humphrey, 1992, Megamergers in Banking and the Use of Cost Efficiency As an Antitrust Defense, *The Antitrust Bulletin*, Fall, 541-600.
- Berger, A.N., D. Hancock, and D.B. Humphrey, 1993, Bank Efficiency Derived from the Profit Function, *Journal of Banking and Finance*, 17, 317-347.

- Bowen, J.W., 1990, The Changing Face of Consumer Banking, *Journal of Retail Banking*, 12, 9-18.
- Burgess J. and G. Walker, 1978, Scale Economies in Australian Banking and Insurance: Preliminary Results, paper presented at the ANZAAS Conference Auckland, N.Z.
- Colwell R.J. and E.P. Davis, 1992, Output and Productivity in Banking, *Scandinavian Journal of Economics*, 94, 111-129.
- Cornett M.M. and H. Tehranian, 1992, Changes in Corporate Performance Associated with Bank Acquisitions, *Journal of Financial Economics*, 31, 211-234.
- Drake L. and B. Howcroft, (1994), Relative Efficiency in the Branch Network of a UK Bank: An Empirical Study, *Omega International Journal of Management Science*, 22, 83-90.
- Edgar R.J., Hatch J.H. and Lewis M.K., 1971, Economies of Scale in Australian Banking 1947-1968, *Economic Record*, 47, 17-37.
- Elyasiani E. and S. Mehdian, 1990, Efficiency in the Commercial Banking Industry, a Production Frontier Approach, *Applied Economics*, 22, 539-551.
- English M., S. Grosskopf, K. Hayes, and S. Yaisawarng, 1993, Output Allocative and Technical Efficiency of Banks, *Journal of Banking and Finance*, 17, 349-366.
- Evanoff D.D. and P.R. Israilevich, 1991, Productive Efficiency in Banking, *Econometric Perspectives*, 15, 11-32.
- Favero C.A. and L. Papi, 1995, Technical Efficiency and Scale Efficiency in the Italian Banking Sector: A Non-parametric Approach, *Applied Economics*, 27, 385-395.
- Ferrier G.D. and C.A.K. Lovell, 1990, Measuring Cost Efficiency in Banking, *Journal of Econometrics*, 46, 229-245.
- Fields J.A., N.B. Murphy and D. Tirtiroglu, 1993, An International Comparison of Scale Economies in Banking: Evidence from Turkey, *Journal of Financial Services Research*, 7, 111-125.

- Fixler D.J. and K.D. Zieschang, 1993, An Index Number Approach to Measuring Bank Efficiency: An Application to Mergers, *Journal of Banking and Finance*, 17, 437-450.
- Giokas D., 1991, Bank Branch Operating Efficiency: A Comparative Application of DEA and the Loglinear Model, *Omega International Journal of Management Science*, 19, 549-557.
- Haag S.E. and P.V. Jaska, 1995, Interpreting Inefficiency Ratings: an Application of Bank Branch Operating Efficiencies, *Managerial and Decision Economics*, 16, 7-14.
- Hatch J.H. and M.K. Lewis, 1973, Economies of Scale in Australian Banking: A Reply, *Economic Record*, 49, 481-484.
- Houston J.F. and M.D. Ryngaert, 1994, The Overall Gains from Large Bank Mergers, *Journal of Banking and Finance*, 18, 1155-1176.
- Hunter W.C. and S.G. Timme, 1986, Technical Change, organizational form, and the structure of bank productivity, *Journal of Money, Credit and Banking*, 18, 152-166.
- Hunter W.C. and S.G. Timme, 1991, Technological change in large U.S. commercial banks, *Journal of Business*, 64, 339-362.
- Johnson, R., 1993, Bank Mergers and Excess Capacity: A Study of the Relative Operating Performance of Four Multi-Bank Holding Companies, Federal Reserve Bank of New York, Research Paper No.9305, May.
- Keefe, Bruyette, and Woods Inc., 1990, The Economic Effects of Mergers and Acquisitions on Consolidating Data and Operations Centers.
- McAllister P.H. and D. McManus, 1993, Resolving the Scale Efficiency Puzzle in Banking, *Journal of Banking and Finance*, 17, 389-405.
- Mester L., 1987, Efficient Production of Financial Services: Scale and Scope Economies, *Business Review of Federal Reserve Bank of Philadelphia*, January/February, 15-25.

- Mester L.J., 1996, A Study of Bank Efficiency Taking into Account Risk-Preferences, *Journal of Banking and Finance*, 20, 1025-1045.
- Miller S.M. and Noulas A.G., 1996, The Technical Efficiency of Large Bank Production, *Journal of Banking and Finance*, 20, 495-509.
- Noulas A.G., S.C. Ray and S.M. Miller, 1990, Returns to Scale and Input Substitution for Large U.S. Banks, *Journal of Money, Credit and Banking*, 22, 94-108.
- Oral M. and R. Yolalan, 1990, An Empirical Study on Measuring Operating Efficiency and Profitability of Bank Branches, *European Journal of Operational Research*, 46, 282-294.
- Ravenscraft D.J. and F.M. Scherer, 1987, *Mergers, Sell-Offs, and Economic Efficiency*, Washington: Brookings Institution.
- Resti A., 1997, Evaluating the Cost-efficiency of the Italian Banking System: What Can be Learned from the Joint Application of Parametric and Non-Parametric Techniques, *Journal of Banking and Finance*, 21, 221-250.
- Rhoades S.A., 1993, Efficiency Effects of Horizontal (in-market) Bank Mergers, *Journal of Banking and Finance*, 17, 411-422.
- Rhoades, S.A., 1986, *The Operating Performance of Acquired Firms in Banking Before and After Acquisition*, Board of Governors of the Federal Reserve System, Washington, D.C., April.
- Rose P.S., 1995, The Distribution of Outcomes from Corporate Mergers: Evidence from Commercial Bank Acquisition Strategies, *Journal of Accounting, Auditing & Finance*, 10, 343-364.
- Sherman H.D. and G. Ladino, 1995, Managing Bank Productivity Using Data Envelopment Analysis (DEA), *Interfaces*, 25, 60-73.

- Sinkey, Jr. J.F., 1983, Commercial Bank Financial Management, McMillan Publishing Company, New York.
- Spindt P.A. and V. Tarhan, 1992, Are There Synergies in Bank Mergers? Tulane University, New Orleans, LA.
- Srinivasan A. and L.D. Wall, 1992, Cost Savings Associated with Bank Mergers, Federal Reserve Bank of Atlanta, Working Paper Series, 92-2, February.
- Srinivasan, A., 1992, Are there Cost Savings from Bank Mergers? Federal Reserve Bank of Atlanta Economic Review, March/April, 17-28.
- Swan P.L. and D. Simmonds, 1989, Costs and Technology in Australian Branch Banking, paper presented at 2nd Australasian Finance and Banking Conference, UNSW.
- Swan P.L. and I.R. Harper, 1982, Economies of Scale in Australian Branch Banking, AGSM Working Paper Series, 82-021, November.
- Valentine T.J. and Williamson P.J., 1982, A Note on Economics of Scale in Australian Banking, in Australian Financial System Inquiry, Commissioned Studies and Selected Papers Part 1, Australian Government Publishing Service, Canberra.
- Vassiloglou M. and D. Giokas, 1990, A Study of the Relative Efficiency of Bank Branches: An Application of Data Envelopment Analysis, Journal of the Operational Research Society, 41, 591-597.
- Walker, G., 1994, Scale and Scope Economies in Australian Banking, Paper Presented at the 1994 Conference of Economists.
- Wheelock D.C. and P.W. Wilson, 1995, Evaluating the Efficiency of Commercial Banks: does our view of what banks do matter? Federal Reserve Bank of StLouis Review, 77, 39-52.
- Woodward L., 1996, Mergers in the Finance Industry, IIR Finance Law Conference, Sydney, 18-19 March.

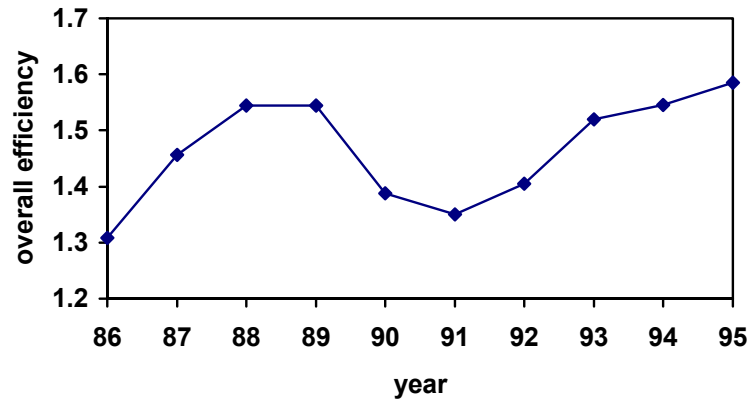


Fig. 1. Increasing Mean Overall Operating Efficiency as Measured by the Ratio of Non-Interest Expense to Operating Income 1986-1995 (Australian Banks only)

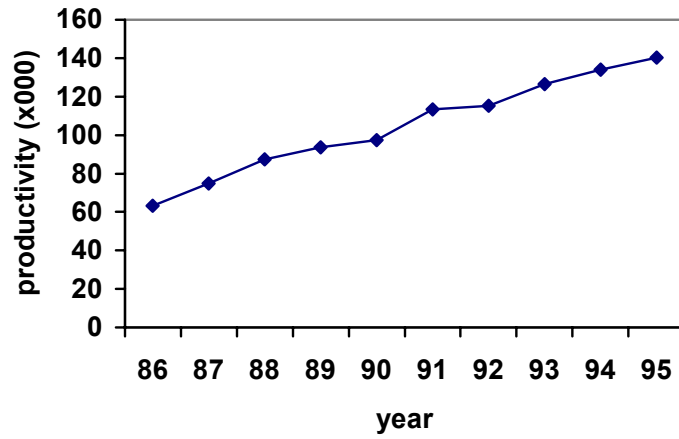


Fig. 2. Increasing Mean Employee Productivity As Measured by Operating Income per Employee 1986-1995 (Australian Banks only)

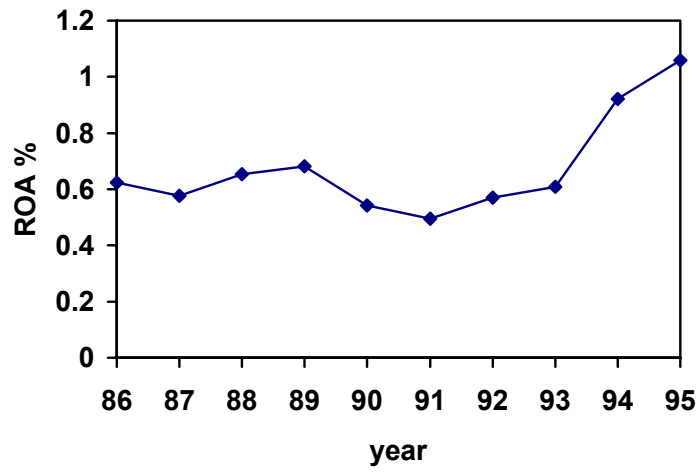


Fig. 3. Increasing Mean ROA Measuring Overall Profit Performance 1986-1995 (Australian Banks only)

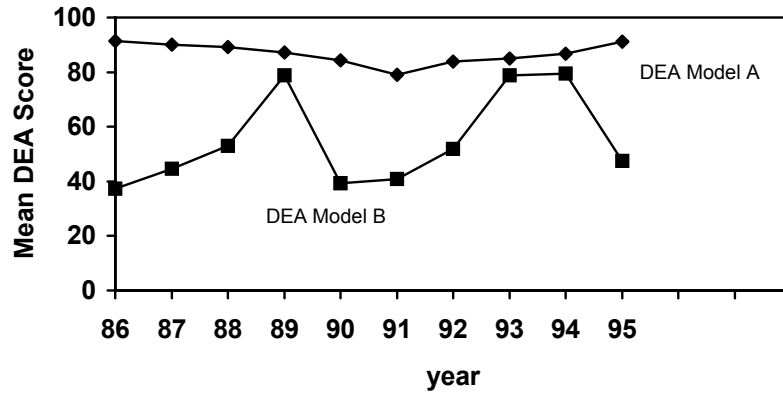


Fig. 4. Industry Mean DEA Scores Across 1986-1995 for Two Different Sets of Variables

Table 1
Changes in Membership of Study Sample (a shaded cell indicates presence of bank in that year)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Adelaide Bank										
Advance Bank Australia										
ANZ Banking Group										
Australian Bank										
Australian Resources Development Bank ¹										
Bank of Melbourne										
Bank of Queensland										
Bank of South Australia										
Bank of Western Australia										
Challenge Bank										
Commonwealth Bank of Australia ²										
Macquarie Bank										
Metway Bank										
National Australia Bank										
National Mutual Royal Bank ³										
Primary Industry Bank										
Savings Bank of Tasmania										
St. George Bank										
State Bank of New South Wales										
State Bank of Victoria										
Tasmania Bank										
Trust Bank ⁴										
Westpac Banking Corporation										

¹ Australian Resources Development Bank acquired by National Australia Bank on 1/10/89.

² Commonwealth Bank of Australia took over State Bank of Victoria and its wholly owned subsidiary Australian Bank on 1/1/91.

³ ANZ Banking Group took over National Mutual Royal Bank in September 1990.

⁴ Savings Bank of Tasmania and Tasmania Bank merged to form Trust Bank.

Table 2
Examples of Small Sample Size in DEA Literature

Reference	Sample Size	Inputs x Outputs*
<i>This Study</i>	16-19	2 x 2 = 4
Oral and Yolalan (1990)	20	5 x 4 = 20
Vassiloglou and Giokas (1990)	20	4 x 4 = 16
Giokas (1991)	17	3 x 3 = 9
Haag and Jaska (1995)	14	3 x 4 = 12

*The product of inputs and outputs should be less than the sample size for the analysis to discriminate between the units.

Table 3
Relative Efficiency Scores (%) for Two Years Pre-Merger Date and Three Years Post-Merger Based on DEA Model A

	Acquiring Bank	Year	Target Bank
	Case 1	National Australia Bank	
	100	1988	100
	100	<i>1989*</i>	100
	100	1990	n.a.
	100	1991	n.a.
	94.61	1992	n.a.
Case 2	ANZ Banking Group		National Mutual Royal Bank
	87.53	1989	64.43
	84.42	<i>1990</i>	n.a.
	76.79	1991	n.a.
	84.34	1992	n.a.
	81.49	1993	n.a.
Case 3	Commonwealth Bank of Australia		State Bank of Victoria
	100	1989	77.14
	94.88	<i>1990</i>	42
	100	1991	n.a.
	89.90	1992	n.a.
	85.74	1993	n.a.
Case 4 (in-market merger)	Savings Bank of Tasmania**		Tasmania Bank
	85.77	1990	71.63
	81.07	<i>1991</i>	67.29
	80.20	1992	n.a.
	82.65	1993	n.a.
	98.52	1994	n.a.

* The year of the merger is shown in italics throughout the table.

** Name changed to Trust Bank after merger.

Table 4
An Apparent Drop in Overall Efficiency and Market Share of Deposits In the Three Years Following Merger

	Total Deposits* in the market starting in the year of merger (\$x000)	Merged banks' Deposits for three years following merger (\$x000)	Change in merged banks' share of Total Deposits in market (%)	Change in Overall Operating Efficiency for merged banks (%)
Case 1: National Australia Bank merges with Australian Resources Development Bank in 1989	206,914.5 228,172.9 231,196.6 245,911.4	41,550.20 45,740.30 47,676.30 56,451.50	-0.17% 2.87% 11.32%	-5.051 0.274 -3.880
Case 2: ANZ Banking Group merges with National Mutual Royal Bank in 1990	228,172.9 231,196.6 245,911.4 271,739.2	41,909.60 41,862.70 44,780.90 48,450.50	-1.42% 0.57% -2.09%	7.636 -7.146 -2.836
Case 3: Commonwealth Bank of Australia merges with State Bank of Victoria in 1990	228,172.9 231,196.6 245,911.4 271,739.2	52,874.90 51,752.70 52,745.10 62,498.40	-3.40% -4.18% 7.23%	21.012 -24.690 -5.922
Case 4: Savings Bank of Tasmania merges with Tasmania Bank to trade as Trust Bank in 1991 (in-market merger)	231,196.6 245,911.4 271,739.2 279,747.2	1,183.20 1,132.50 1,106.70 1,081.40	-10.01% -11.57% -5.08%	-5.674 -1.793 17.345

*For Australian trading banks only.

Table 5
DEA Scores based on Model A for Australian Trading Banks Sorted in Descending
Order, 1995

Decision Making Unit	Score (%)
Trust Bank	100.00
Macquarie Bank	100.00
National Australia Bank	100.00
Primary Industry Bank	100.00
Commonwealth Bank	100.00
Bank of Melbourne	100.00
Bank of Queensland	96.08
Advance Bank Australia	91.25
ANZ Banking Group	89.80
Westpac Banking Corporation	89.30
Bank of Western Australia	88.07
Challenge Bank	85.39
St. George Bank	84.67
Bank of South Australia	83.75
Adelaide Bank	82.30
Metway Bank	81.65
State Bank of NSW	76.43

Table 6
DEA Scores based on Model A for the Four Major Australian Trading Banks, 1986-
1995

Year	ANZ Banking Group	Commonwealth Bank of Australia	National Australia Bank	Westpac Banking Corporation
1986	95.99	100.00	100.00	100.00
1987	100.00	97.38	100.00	96.55
1988	93.09	97.97	100.00	95.81
1989	87.53	100.00	100.00	87.81
1990	84.42	94.88	100.00	98.31
1991	76.79	100.00	94.61	84.72
1992	84.34	89.90	100.00	76.60
1993	81.49	85.74	100.00	89.05
1994	87.46	84.07	100.00	84.64
1995	89.80	100.00	100.00	89.30