Performance and Stock Return in Australian Banking

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This paper examines the relationship between the total shareholder return (TSR) and performance of Australian banks over the period 2001-2010. In particular, it investigates whether returns of banks in the stock market can be explained by changes in their performance. First, we use a weighted financial ratio-based Data Envelopment Analysis (DEA) model to estimate the performance of banks. We then regress changes in performance against the total shareholder returns to investigate their relationship. The results indicate that changes in performance are reflected in TSR. That is, well-performed banks tend to generate more return for their stockholders.

Keywords: performance, data envelopment analysis (DEA), shareholder return, banks

Introduction

A well-performed banking system is critically important for businesses development, given the role it plays in the economy of nations. In Australia, in March 2011, the financial sector was the largest industry sector by 32% of the whole capital in the market with value of $480 billion. Additionally, caused by compulsory superannuation Australia has the 4th largest pension fund pool in the world which highlights the role of banking industry in this country. Due to this key position, measuring banks and financial institutions’ performance is an issue of major interest for academics and policy makers (e.g., Avkiran, 1999, 2000, 2004; Kirkwood & Nahm, 2006; Moradi-Motlagh, Saleh, Abdekhodaee, & Ektesabi, 2011; Neal, 2004; Paul & Kourouche, 2008; Sathye, 2001, 2002; Sturm & Williams, 2004; Walker, 1998; Wu, 2008).

Recent competitive pressures have progressively driven banks to strategically focus on generating returns to shareholders. Therefore, the investigation of the determinants of bank performance and their relationship with share prices has become increasingly important (Beccalli, Casu, & Girardone, 2006). However, only very limited studies have examined the relationship between bank performance and stock performance in Australia and to our knowledge, Kirkwood and Nahm (2006) have conducted the only study which uses non-parametric techniques to measure the performance and examines this relationship for the time period between 1995-2002.

Due to the lack of any recent studies and after gathering through the literature as well as industry reports, it is clear to us that there is a need not only to measure the performance of Australian banks using non-parametric techniques but also to examine its relationship with stock performance. In this study, Data Envelopment Analysis (DEA) as a non-parametric technique is applied to aggregate four main dimensions of the performance namely profitability, growth, efficiency, and marketability to construct the performance measure. This approach can give us a wider view for better understanding of Australian banks performance in

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performance and stock return in Australian banking

comparison with other studies in this area where they consider one or two aspects of the performance as discussed in the following sections. Additionally, to examine the relationship between the banks performance and their stock performance, banks total shareholder returns are regressed against the performance indexes measured by a weighted financial ratio-based DEA model.

This study makes four main contributions. It is the first study in the Australian banking industry which measures the performance using a financial ratio-based DEA model. Second, the study period is unique and distinct from other studies in Australia and includes recent years. Third, this selection of financial ratios has not been implemented in the previous bank performance studies in the international literature. Fourth, it is the only study that the relationship between the performance induced from a ratio-based DEA model and the total shareholder return has been examined in the banking industry across countries.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature, and the methodology is discussed in Section 3. Empirical results are detailed in Section 4, and the summary and conclusion are given in Section 5.

Literature Review

In recent years, DEA has been increasingly applied to evaluate banks performance in most counties (see Fethi & Pasiouras, 2010). However, based on the current literature, studies on the relationship between stock return and bank performance are limited. Although, there is only one study focused on such a relationship in the case of Australian banking, but there are a number of studies that use DEA based models to examine the performance of Australian banking (Avkiran, 2004; Kirkwood & Nahm, 2006; Neal, 2004). However, as Paul and Kourouch (2008) explained the studies that have focused on banking efficiency are limited and all have applied input oriented DEA to data relating primarily to the pre-Willis period.

Avkiran in a series of papers (1999, 2000, 2004) applied DEA to analysis the efficiency of Australian banks. In 1999, he measured operating efficiencies, employee productivity, profit performance, and average relative efficiency for Australian trading banks from 1986 to 1995. In his investigations on the role of the mergers and the benefit to publics, he concluded that the role of mergers in efficiency gain is not necessarily positive, a sentiment share by most other researchers in this field. Avkiran (2000) examined the change in productivity of the retail banking in the deregulated period 1986-1995. His findings indicated an overall rise in total productivity (on average 3.2% per year) driven more by technological progress than technical efficiency. Finally for the same study period, in 2004 by decomposing the technical efficiency, he discussed that pure technical inefficiency emerges as a greater source of inefficiency than scale efficiency.

Avkiran studies in Australian banking were followed by other academics after 2000. Sathye (2002) measured productivity changes in Australian banks by the Malmquist index using DEA technique during the period 1995 to 1999. He concluded that there is a decline in technical efficiency and total productivity factor during the study period and also no correlation was found between size and productivity which is important in the context of bank merger debate in Australia. Neal (2004) investigated X-efficiency and productivity changes in Australian banking between 1995 and 1999. His study differed from the earlier studies by examining efficiency by bank type and finds the regional banks are less efficient than other banks.

More recent study in Australia by Paul and Kourouch (2008) examined the technical efficiency of Australian banks during the post-Wallis period (1997-2005). The results based on DEA reveal that the extent of
technical efficiency varies across the banks and over the years. As on one side, the National Australia Bank, Commonwealth Bank and Macquarie Bank were found to be technically efficient, and on the other side, Adelaide Bank, the Bank of Queensland and Westpac Bank are found to be prominently inefficient. To sum up, more details about different approaches are provided in Table 1 to present a summary of studies in banking industry using DEA.

Table 1
A Summary of Bank Performance Studies Using DEA Technique in Different Countries

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Country</th>
<th>Method</th>
<th>Inputs</th>
<th>Outputs</th>
<th>Indexes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halkos and Salamouris (2004)</td>
<td>Greek</td>
<td>Profitability and efficiency ratios</td>
<td>RDIBA, ROE, ROA, profit/loss per employee, Efficiency ratio, net interest margin</td>
<td>Performance</td>
<td></td>
</tr>
<tr>
<td>Sathye (2001)</td>
<td>Australia</td>
<td>Intermediation</td>
<td>Labor, capital, loanable funds</td>
<td>Loans, demand deposit</td>
<td>Technical efficiency/allocative efficiency</td>
</tr>
<tr>
<td>Luo (2003)</td>
<td>USA</td>
<td>• Production, • Market</td>
<td>• Stage 1: Employees, assets, equity • Stage 2: Revenue, profit</td>
<td>• Revenue, profit • Market value, stock price, EPS</td>
<td>• Profitability efficiency • Marketability efficiency</td>
</tr>
<tr>
<td>Asmild, Paradi, Aggarwall, and Schaffnit (2004)</td>
<td>Canada</td>
<td>Production</td>
<td>Employees, book value of physical; Assets, other non-interest expense</td>
<td>Deposits, loans, securities, deposits with other banks, other non-interest income</td>
<td>Productivity</td>
</tr>
<tr>
<td>Ho and Zhu (2004)</td>
<td>China</td>
<td>• Production, • Profitability</td>
<td>• Stage 1: Capital stocks, assets, branches, employees • Stage 2: Sales, deposit</td>
<td>Sales, deposits • Net income, interest income, non-interest income</td>
<td>• Efficiency • Effectiveness</td>
</tr>
<tr>
<td>Angelidis and Lyroudi (2006)</td>
<td>Italy</td>
<td>Value added</td>
<td>Total earning assets, loans, deposits</td>
<td>Personnel expense, other operating expense, total fixed assets</td>
<td>Productivity</td>
</tr>
<tr>
<td>Beccalli et al. (2006)</td>
<td>Europe</td>
<td>Intermediation</td>
<td>Deposits, labor, capital</td>
<td>Total loans and securities</td>
<td>Efficiency</td>
</tr>
<tr>
<td>Kirkwood and Nahm (2006)</td>
<td>Australia</td>
<td>Intermediation</td>
<td>• Model A: Employees, property, plant and equipment, interest-bearing liabilities • Model B: Employees, property, plant and equipment, interest-bearing liabilities</td>
<td>Interest-bearing assets, non-interest income • Profit before tax</td>
<td>• Efficiency • Profit efficiency</td>
</tr>
<tr>
<td>Paul and Kourouche (2008)</td>
<td>Australia</td>
<td>Intermediation</td>
<td>Interest expense, non-interest expense</td>
<td>Net interest income, non-interest income</td>
<td>Technical efficiency</td>
</tr>
</tbody>
</table>

In comparison with all mentioned studies in the banking industry performance, a small number of them investigate the relationship between their results and the stock performance (e.g., Beccalli et al., 2006; Fiordelisi & Molyneux, 2010; Pasiouras, Liadaki, & Zopounidis, 2008). Kirkwood and Nahm (2006) conducted the only study in Australia which examined the relationship between changes in efficiency and stock returns. Their results indicated that changes in bank efficiency are reflected in stock return. The reported coefficient of determination (R-squared) in their study was 29.2%.

Beccalli et al. (2006) linked changes in efficiency to changes in stock performance of European banks across five countries using DEA and Stochastic Frontier Analysis (SFA). They concluded that results derived
from DEA are reflected in changes in stock prices while this trend is less clear for SFA. The coefficient of
determination for DEA is reported 14.6% while this measure for SFA is only 0.01%.

Sufian and Majid (2007) investigated the long efficiency change of Singapore commercial banks during
the period of 1993-2003. They established statistical relationship between cost efficiency and share price
performance by employing regression analysis. The results suggested that cost efficiency explain the share
price performance of Singapore banks with determination coefficient of 47%.

In order to advance the aforementioned literature, we made several contributions by developing a
weighted financial ratio DEA model with unique combination of financial ratios. Additionally, it is the first
study that the result of a financial ratio DEA model is examined and linked to the total shareholder return as a
reliable performance measure which has been noted by Neslihan (2007) as a measure that cannot be
manipulated by executives in the same way that earnings can.

Methodology and Model

Performance Measurement

Performance measurement is the process whereby an organization establishes the parameters within which
programs, investments, and acquisitions are reaching the desired results (Thompson, Strickland, & Gamble,
2007). Although, in general a number of studies have been conducted related to the performance measurement,
but Carton and Hofer (2006) believed that despite the importance of accurately measuring organizational
performance in most areas of academic research, there have been very few studies that have directly addressed
the question of how overall organizational performance is or should be measured.

There is no doubt that the performance is a multi-dimensional concept. However, the earlier studies have
been conducted on the banking industry focus mostly on one or two aspects of the performance as
demonstrated in Table 1 which is in line with the finding of Murphy, Trailer, and Hill (1996). They asserted
that the frequently analysis shows an overwhelming proportion of studies are measuring only one or two
dimensions of performance predominantly efficiency and profitability measures.

Traditionally, due to simplicity and ease of understanding of financial ratios, they have been applied in
banks’ performance analysis. Although the use of financial ratios assists the evaluation of bank performance,
but there are several limitations that must be considered. Unlimited number of ratios that can be created from
financial statement data are often contradictory and confusing, thus ineffective for the assessment of overall
performance (Paradi, Vela, & Yang, 2004). Additionally, failure to account for generating an overall measure,
combined with the inability to distinguish the best performers makes financial ratios analysis inadequate as a
sole tool for performance measurement. Moreover, one bank might be strong on one ratio and poor on
another one.

Not only DEA does not have the mentioned drawbacks but also as a frontier method it has several
advantages like, dealing with multi input and output processes, no need for assigning a weight for inputs or
outputs and the ability of constructing an overall relative measure based on the distance to frontiers in the
sample. As a result, there is a consensus between academics that frontier approaches (parametric or
non-parametric) have preference than financial ratios as Berger and Humphrey (1997) emphasized that
although partial performance ratios are informative, they are not as broadly-based as frontier analysis.
DEA Models

DEA is a non-parametric linear programming technique that estimates the relative performance of the decision making units (DMUs) based on the observations in the sample. Since DEA was initiated by Charnes, Cooper, and Rhodes (1978), it has been widely applied to measure the performance of organizations in both public and private sectors (see Emrouznejad, Parker, & Tavares, 2008). Although DEA applications in multiple-input and output environment has spread rapidly but the capability of this technique in aggregating ratios has been neglected for many years. Fernandez-Castro and Smith (1994) reformulated DEA to introduce a ratio-based model to aggregate a set of financial ratios to a single measure which is called the General Non-Parametric Corporate Performance (GNCP). The mathematical formula of their model is as follows:

$$\text{max } \alpha_i$$

Subject to:

$$\sum_{n=1}^{N} \lambda_n R_{in} \geq \alpha_i R_{il}$$

$$\sum_{n=1}^{N} \lambda_n = 1$$

$$\alpha_i \geq 0, \lambda_n \geq 0 \ (n = 1, 2, ..., N)$$

where $R_{in}$ is the $i$th ratio of the $n$th DMU, and $\lambda_n$ is the $n$th DMU weight value.

Not only a review of the literature indicates that few studies have focused on financial ratio DEA models across countries but also specifically, it is worth mentioning that this model has not been applied in Australian banking industry beforehand.

Halkos and Salamouris (2004) conducted the first study applying the GNCP model proposed by Fernandez-Castro and Smith (1994) in measuring the performance of the Greek commercial banks. They used six financial ratios which are profitability and efficiency ratios. Neglecting to cover the other aspects of bank performance such as growth and marketability and lack of clear explanation about the selection process of financial ratios in similar studies were the key motivations for us to introduce a multi-dimensional model based on performance studies which will be explained in details in this section.

Proposed Model

Three main gaps in the literature are as follows: (1) the selection process of financial ratios is poorly explained. For example, Fernandez-Castro and Smith (1994) remarked that the selection of ratios in their studies is not of any particular significance. (2) Ignoring the use of value judgment and prior knowledge about the importance of ratios associated in the model. This draw back exists in all similar previous studies. For instance, Halkos and Salamouris (2004) used six financial ratios to measure the performance of Greek commercial banks without considering any assumption about their importance. (3) Almost all of the studies which estimate efficiency and then regress it on sets of explanatory variables have been unable to explain more than just a small proportion of its total variation (Berger & Humphrey, 1997). For example, Kirkwood and Nahm (2006) in case of Australian banks, reported an R-squared of 0.29 that although it demonstrates a positive relationship but it is not able to explain a high proportion of changes in stock returns.

In the present paper, we are driven by all the above issues to develop an overall and comprehensive model...
to assess the banking industry in Australia by formulating the preference of financial ratios, constructing weight restrictions to our multiplier model and examining the result to investigate the capability of the model to explain stock return.

The advantage of full flexibility in identifying inefficiency can be seen as a disadvantage of DEA where there is value judgments which can reflect known information about how the factors used by DMUs behave, and/or accepted beliefs or preference on the relative worth of inputs, outputs or even DMUs (Thanassoulis, Portela, & Allen, 2004). In GNCP model, the full flexibility of weight has been considered, therefore, to avoid the mentioned problem and to have a realistic result, we develop a weighted model which enables us to consider the importance of selected ratios as follows:

$$\max \sum_{n=1}^{N} \lambda_n R_{10}$$

Subject to

$$\sum_{n=1}^{N} \lambda_n R_{in} \leq 1$$

$$\lambda_n R_{in} \geq \lambda_n R_{jn}$$

$$\lambda_n \geq 0 \ (n = 1, 2, ..., N)$$

where $R_n$ = the $i$th ratio of the $n$th bank, and $\lambda_n$ = the $n$th ratio weight value.

The proposed model in this paper consists of four financial ratios related to four main different dimensions of the performance which have been selected based on their importance and findings of other studies. There is no doubt that the profitability is the primary dimension of the performance and among the profitability indexes the return on asset (ROA) commonly has been utilized. Murphy et al. (1996) demonstrated that ROA is one of the most frequently used measures in performance studies.

Murphy et al. (1996) showed that the growth is the second most common performance dimension used to measure the overall organizational performance. Typical growth measures are change in total assets and sales. We selected change in total asset which according to the finding of Carton and Hofer (2006), it provided the most relative information among other measures of growth.

The efficiency indexes have been measured in the most of bank performance studies as shown in Table 1. The total asset turnover is one of the key ratios used to determine how efficiently a firm is using its assets in generating sales, which is a major determinant of operating income (Keown, Martin, Petty, & Scott, 1994). Due to the importance of this measure, it has been selected as a proxy of the efficiency in this paper.

The marketability is the last, but not the least measure we consider. Recently, it is a dimension that has taken more attention of researchers. Luo (2003) measured marketability for the USA banks and concluded that the time is ripe for researchers and policy makers to place more emphasis on the marketability efficiency and marketability related issues. We chose price to book value as a proxy of market ratios due to the findings of other studies that mention price to book value is a useful predictor of future returns (Carton & Hofer, 2006; Fama & French, 1998; Malkiel, 2003).

Finally, the article highlights and examines the relationship of the performance and total shareholder return to compare the result of GNCP model and the proposed model which is presented in the next section.
Data

Observing a bank’s relative efficiency on a selection of variables over a number of years provides an insight into performance of that bank compared to its peers (Avkiran, 1999). In this study, we consider 10 years for seven Australian banks. As a result, there are 70 data observations. Due to limited sample size, we employ data pooling approach assuming there is no technical change during the study period similar to recent studies in Australia (Kirkwood & Nahm, 2006; Moradi-Motlagh et al., 2011; Paul & Kourouche, 2008).

Seven Australian banks based on the market value in the Australian Stock Exchange (ASX) are considered in this paper. Names and abbreviations used in this study are demonstrated in Table 2.

Table 2
List of Sample Banks

<table>
<thead>
<tr>
<th>DMU</th>
<th>Name of bank</th>
<th>Abbreviation used</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Commonwealth</td>
<td>CBA</td>
<td>Large</td>
</tr>
<tr>
<td>2</td>
<td>Westpac</td>
<td>WBC</td>
<td>Large</td>
</tr>
<tr>
<td>3</td>
<td>Australia and New Zealand Bank</td>
<td>ANZ</td>
<td>Large</td>
</tr>
<tr>
<td>4</td>
<td>National Australia Bank</td>
<td>NAB</td>
<td>Large</td>
</tr>
<tr>
<td>5</td>
<td>Macquarie Group</td>
<td>MQG</td>
<td>Medium</td>
</tr>
<tr>
<td>6</td>
<td>Bendigo and Adelaide</td>
<td>BEN</td>
<td>Medium</td>
</tr>
<tr>
<td>7</td>
<td>Bank of Queensland</td>
<td>BOQ</td>
<td>Medium</td>
</tr>
</tbody>
</table>

As described in the previous section, four financial ratios of ROA, change in total asset, asset turnover, and change in price to book value have been collected for seven sample banks. Data are obtained from FinAnalysis database and Table 3 demonstrates a descriptive statistics of these ratios from 2001 to 2010.

Table 3
Summary of Financial Ratios

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>1.07</td>
<td>1.18</td>
<td>1.20</td>
<td>1.19</td>
<td>1.54</td>
<td>1.07</td>
<td>1.10</td>
<td>1.08</td>
<td>0.79</td>
<td>0.95</td>
</tr>
<tr>
<td>Mean</td>
<td>0.90</td>
<td>0.92</td>
<td>0.90</td>
<td>0.89</td>
<td>1.02</td>
<td>0.87</td>
<td>0.88</td>
<td>0.74</td>
<td>0.58</td>
<td>0.76</td>
</tr>
<tr>
<td>SD</td>
<td>0.21</td>
<td>0.22</td>
<td>0.23</td>
<td>0.21</td>
<td>0.31</td>
<td>0.21</td>
<td>0.20</td>
<td>0.24</td>
<td>0.15</td>
<td>0.18</td>
</tr>
<tr>
<td>Min</td>
<td>0.53</td>
<td>0.61</td>
<td>0.62</td>
<td>0.62</td>
<td>0.66</td>
<td>0.52</td>
<td>0.53</td>
<td>0.43</td>
<td>0.37</td>
<td>0.53</td>
</tr>
<tr>
<td>Change in asset</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>1.42</td>
<td>1.25</td>
<td>1.36</td>
<td>1.38</td>
<td>1.18</td>
<td>2.15</td>
<td>1.28</td>
<td>2.82</td>
<td>1.34</td>
<td>1.13</td>
</tr>
<tr>
<td>Mean</td>
<td>1.16</td>
<td>1.08</td>
<td>1.13</td>
<td>1.22</td>
<td>1.10</td>
<td>1.33</td>
<td>1.20</td>
<td>1.46</td>
<td>1.09</td>
<td>1.07</td>
</tr>
<tr>
<td>SD</td>
<td>0.12</td>
<td>0.09</td>
<td>0.11</td>
<td>0.13</td>
<td>0.05</td>
<td>0.38</td>
<td>0.07</td>
<td>0.61</td>
<td>0.17</td>
<td>0.05</td>
</tr>
<tr>
<td>Min</td>
<td>1.06</td>
<td>0.99</td>
<td>1.05</td>
<td>1.03</td>
<td>1.02</td>
<td>1.12</td>
<td>1.12</td>
<td>1.15</td>
<td>0.89</td>
<td>0.98</td>
</tr>
<tr>
<td>Asset turnover</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>8.24</td>
<td>8.71</td>
<td>10.31</td>
<td>7.84</td>
<td>13.39</td>
<td>15.35</td>
<td>8.17</td>
<td>8.51</td>
<td>7.67</td>
<td>7.15</td>
</tr>
<tr>
<td>Mean</td>
<td>7.39</td>
<td>6.78</td>
<td>6.80</td>
<td>6.93</td>
<td>8.63</td>
<td>8.60</td>
<td>7.63</td>
<td>7.55</td>
<td>6.48</td>
<td>6.22</td>
</tr>
<tr>
<td>SD</td>
<td>0.59</td>
<td>0.90</td>
<td>1.60</td>
<td>0.53</td>
<td>2.21</td>
<td>2.99</td>
<td>0.40</td>
<td>0.78</td>
<td>0.74</td>
<td>0.51</td>
</tr>
<tr>
<td>Min</td>
<td>6.82</td>
<td>5.93</td>
<td>5.63</td>
<td>6.16</td>
<td>7.15</td>
<td>7.17</td>
<td>6.92</td>
<td>6.06</td>
<td>5.47</td>
<td>5.66</td>
</tr>
<tr>
<td>P/B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>3.64</td>
<td>3.26</td>
<td>2.31</td>
<td>2.75</td>
<td>3.01</td>
<td>3.35</td>
<td>3.34</td>
<td>2.28</td>
<td>2.23</td>
<td>2.14</td>
</tr>
<tr>
<td>Mean</td>
<td>2.33</td>
<td>2.31</td>
<td>1.99</td>
<td>1.97</td>
<td>2.15</td>
<td>2.58</td>
<td>2.69</td>
<td>1.58</td>
<td>1.48</td>
<td>1.46</td>
</tr>
<tr>
<td>SD</td>
<td>0.65</td>
<td>0.48</td>
<td>0.17</td>
<td>0.41</td>
<td>0.46</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.59</td>
<td>0.50</td>
</tr>
<tr>
<td>Min</td>
<td>1.69</td>
<td>1.74</td>
<td>1.84</td>
<td>1.52</td>
<td>1.67</td>
<td>2.03</td>
<td>2.14</td>
<td>0.93</td>
<td>0.7</td>
<td>0.79</td>
</tr>
</tbody>
</table>
Carton and Hofer (2006) emphasized in their key findings that growth rate of total asset does not provide statistically significant incremental information beyond that provided by the corresponding static financial performance measure. Moreover, they mentioned that the change in price to book value provides the best information about the return to shareholder after Alman’s Z score. Based on their finding and other mentioned studies in the previous section, we impose the following restrictions on model where $\lambda_1$, $\lambda_2$, $\lambda_3$, and $\lambda_4$ note the weight of change in price to book value, ROA, asset turnover and change in asset growth, respectively:

$$ R_1\lambda_1 \geq R_2\lambda_2 \geq R_3\lambda_3 \geq R_4\lambda_4 $$

**Bank Performance and Stock Performance**

In this study, stock performance is represented by total shareholder return, which has been used as the most appropriate comparative measure as it focuses on the delivery of shareholder value and is a well understood and tested mechanism to measure performance. Additionally, it has been applied as one of the main long term incentive criteria to pay reward to bank managers. For example, in the Commonwealth bank, the long term incentive that was granted under the Equity Reward Plan (ERP) in 2005 fully vested in July 2008, reflecting total shareholder returns from July 14, 2005 to July 14, 2008 that were above the 75th percentile of returns of companies within the peer group.

Following Chu and Lim (1998), we examine the relationship between performance and total shareholder return according to the following regression model:

$$ R_i = \beta_0 + \beta_1 P_i + \epsilon_i $$

where $R_i$ is the total shareholder returns and $\epsilon_i$ is the change in banking performance measured by our proposed DEA model. This regression model aims to establish the extent to which changes in the estimated performance scores influence total shareholder return.

**Empirical Result**

Derived from the proposed model the banks performances have been measured and demonstrated in Table 4. The results demonstrate that the average of the overall performance of the selected banks has decreased in the second half of the study period. Precisely, the average of the performance between 2001 and 2005 is greater than the period 2006 to 2010.

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.72</td>
<td>0.72</td>
<td>0.66</td>
<td>0.65</td>
<td>0.71</td>
<td>0.76</td>
<td>0.78</td>
<td>0.61</td>
<td>0.50</td>
<td>0.54</td>
</tr>
<tr>
<td>Average (2001-2005)</td>
<td>0.69</td>
<td>Average (2006-2010)</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The trend has been presented in Figure 1. Although the performance has an upward trend from 2003 to 2006, it has been fallen sharply after 2006. Moreover, there is an improvement in performance after recent financial crisis which is in line with Demirgüç-Kunt, Detragiache, and Gupta (2006) who found that banks enhance their operational efficiency after a crisis, on average during the following two years. Moreover, the results reveal that banks performance varies across the banks and over the years. While Macquarie bank has the best performance in 2006 and 2010, NAB has the least average score among the large banks and between the
smaller banks, Bank of Queensland has the least average score which are consistent with figures of total shareholder returns.

Figure 1. The trend of performance and TSR from 2001 to 2010.

Most performance studies utilize only one variable to represent organizational performance, and ROA is the most frequently used measure. However, ROA explain only 4% of the variation in market return to shareholder (Carton & Hofer, 2006). To investigate whether there is any relationship between the performance scores and the total shareholder return, we examine this relationship using regression analysis. As presented in Table 5 and Figure 2, these two indexes are positively correlated which means as we expected that the banks performance is reflected in their total shareholder returns. Specifically, Table 5 illustrates the result of regression analysis not only for changes in performance versus total shareholder return but also demonstrates the correlation of performance components in our model with total shareholder return.

Table 5

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Change in performance score</th>
<th>ROA</th>
<th>Asset turnover</th>
<th>Asset growth</th>
<th>P/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.148</td>
<td>-0.048</td>
<td>-0.027</td>
<td>0.158</td>
<td>-0.24</td>
</tr>
<tr>
<td>Independent variable</td>
<td>1.31</td>
<td>20.842</td>
<td>0.021</td>
<td>-0.025</td>
<td>0.179</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.77</td>
<td>0.21</td>
<td>0.14</td>
<td>0.028</td>
<td>0.47</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.60</td>
<td>0.04</td>
<td>0.02</td>
<td>0.0008</td>
<td>0.22</td>
</tr>
<tr>
<td>Significance level</td>
<td>&gt; 0.001</td>
<td>&gt; 0.1</td>
<td>&gt; 0.3</td>
<td>&gt; 0.8</td>
<td>&gt; 0.001</td>
</tr>
</tbody>
</table>

To be precise, $R$-square of 0.6 at a high level of significance proves a strong correlation between two measures. It is worth mentioning that if we use the GNCP model and recalculate the $R$-square again, it will be reached at 0.15. In other words, the much higher explanatory power of proposed model in comparison to the GNCP model implies that the effect of value judgment is higher that can be neglected. Finally, these results seem to suggest that total shareholder return can be explained better by performance changes using the proposed model than by financial ratios.
Conclusions

In this paper, we introduced a weighted financial ratio-based DEA model consist of four dimensions of performance namely, profitability, growth, efficiency, and marketability. On the contrary of previous studies that consider limited aspects of the performance, the proposed model in this paper covers four determinants of the performance which have been integrated and presented as an overall performance index. The results indicate during the 10 years study period, the average of the performance of Australian banks in the first half of the period is less than the second half which can be explained mostly due to the effect of the financial crisis. We also found that the performance changes has a positive and statistically significant relationship with the total shareholder return, and that this relationship is stronger for the proposed weighted model in this paper compare to the GNCP model which has been used in similar studies. This finding confirms Thanassoulis et al.’s (2004) arguments that DMUs have in some contexts value judgments that can be formalized, a priori, and therefore should be taken into account in the performance assessments.

This study makes several unique contributions and extends the literature by: (1) identifying the most important financial ratio from four main aspect of organizational performance which can explain the total shareholder return; (2) developing a weighed financial ratio-based DEA model to integrate mentioned ratios; and (3) investigating the ability of the model to explain the total shareholder return and comparing with the GNCP model. Moreover, this study can help banks to apply more practical non-parametric models to integrate traditional performance measures like financial ratios in a way that not only enables them to compare their positions in comparison with rivals but also gives them more knowledge about the stock return in market.

Finally, this paper suggests that using the proposed model has the capability to explain the total shareholder return better than financial ratios. Also it is worth mentioning that although the results from the proposed model are interesting, further studies are necessary to expand the result to other countries or industries.
References


