OUTSIDER ESTIMATION OF THE FAIR VALUE OF BANK STOCKS: COMPUTATIONAL AND CONCEPTUAL ISSUES

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Abstract

This paper attempts to fill a void in the finance literature by reporting the reliability of theoretical valuation models against the market values of banking corporations. The dividend, operating cash flow and the free cash flow valuation approaches are operationalised to estimate fair values of banks. These values are then compared with market values. The results, using the Theil's U-coefficient, show that the operating cash flow approach provides estimates that are better than the naïve model estimates. The other two approaches produced results no better than a naïve model. A probable reason for the poor performance of the free cash flow approach is suggested. Outsider's estimation of investment values needed for free cash flow calculation is likely to introduce serious errors irrespective of the theoretical bases of models widely used in the industry.

1. Introduction

"Valuing banks is conceptually difficult" for an outsider: Copeland *et al.* (1994: p. 497). Yet there is no shortage of outsiders specialising in providing estimates of fair values of banks, thus fulfilling a growing demand in the securities industry for independent information about the worth of banks. In fact a number of highly reputable consulting firms specialise in proffering valuation services to investors in the financial industry. The difficulty of finding a reliable fair value of bank stock is due to a number of conceptual issues that beset an outsider measuring cash flow items involved in a bank's creation of value. It is widely accepted that placing a fair value on any business's net worth to shareholders is merely an expression of opinion rather than calculation of arithmetic exactness. But there are a number of studies comparing these estimated fair values with market values of *non*-financial firms, but not

banks. There is a paucity of publications documenting how such fair value estimates of bank values by outsiders compare with the actual market's collective valuation at a time.

Hence the motivation of this study is to compare how the fair values from different valuation models widely used in the industry perform relative to the market's valuation. This paper is a modest attempt at investigating how close the fair value estimates of banks are to the actual market values in the Australian stock exchange. The fair values estimated in this study applied three popular valuation models used in teaching and practice of investment valuation. The models investigated are the dividend valuation model (Gordon and Shapiro, 1962), operating cash flow model, using profits adjusted for non-cash operating cash incomes, and the free cash flow model (Copeland *et al.*, 1994 and Damodaran, 1996).

The contents of this study are presented in five sections. Section 2 provides a brief description of relevant valuation theories used in this study along with a brief summary on the reliability of these theories as tested for *non*-financial firms. The data sources of financial firms used in this study and the test procedures are explained in Section 3 after a brief description of the finance industry performance over a ten-year period. The results are presented in Section 4 in two subsections: accounting performance of the selected banks are described first before presenting how the estimated values using these models perform relative to the market values. Theil's U-coefficient is computed to enable a valid comparison. Section 5 ends with a discussion on the significance of these findings for continuing research on this important applied issue of bank valuation modelling.

2. Valuation Theories and Evidence

2.1 *Theories*

The Oxford Dictionary defines "value" as "the material or monetary worth of a thing; the amount at which it may be estimated in terms of some medium of exchange or other standard of a like nature.". In practice, valuation is a process of estimating the monetary worth of a business as an entity belonging to the debt and equity providers (valuing the firm) or as the net worth to the shareholders only (valuing the stocks). The important questions therefore are: what models to apply to generate a value? and how the chosen models perform relative to the market's valuation.

Current literature suggests three basic modelling approaches are available for valuation: Damodaran (1996). *Discounted cash flow*, DCF, *valuation* estimates the value of a bank as the present value of expected future cash flows created for the owners by the business (the banks in this study). This

approach uses three models either as single growth to perpetuity or a two-stage growth: (a) Gordon-Shapiro dividend discount model; (b) the discounted operating cash flow; and (c) the discounted free cash flow.[1]

Compared with the theoretical modelling using the DCF, many market specialists use the *relative valuation* approach, which values a business or the shareholders' worth by comparing market's prices relative to a set of common variables. The most commonly used values are earnings (giving price-earnings multiples), book value (giving price-book multiples) or sales that yields price per dollar of sales of the firm. The industry average of comparable firms on these price- to earnings, to book and to sales is then taken as the fair value of a target firm being valued. Finally, the *contingent claim valuation*, which uses option pricing models, may also be used (Avram and Kulatilaka, 1998). In this study of banking valuation, the fair value estimation uses the DCF approach only, which relies on widely acknowledged theoretical models.

2.2 *Discounting the Dividends*

Gordon-Shapiro dividend discount model is the basic model widely recognised in accounting and financial practices as being the most relevant model for finding the long-run values. The model provides the present value of all the future dividend flows and capital gains as the fair value of the stock investors holds (or is intending to hold). That is, the fair value is the present value of the dividend stream as well as the capital gains coming from the potential dividends from retained earnings reinvested to earn more future dividends. The discounting is done using a market-relevant discount rate and growth factor to represent the reinvestment returns from retained earnings.

This model is applied in two versions. The first is a steady state model with dividends growing at a constant rate to the future, represented as this simple model:

Eq. 1 $$V_0 = DPS_1 (K_e - g)^{-1}$$

The share price is represented by V, the fair value to be estimated for each bank in this study. DPS_1 is the expected dividends one period hence, K_e is the discount or the required rate of return appropriate for the riskiness of the stock under valuation and g is the expected growth rate in earnings from the retained earnings. Computing the DPS, the discount rate and the g for a typical bank poses problems, which are addressed in a later section of the paper.

The second version of this model assumes that reinvestment opportunities are such that there is a period of high growth opportunity that pro-

duces larger dividend flows over a finite period of time, after which the dividend growth to perpetuity is smaller. As the business loses its potential to earn high profits with entry of more competitors, it is reasonable to assume that the dividend stream grows at lower growth. Also, this assumption in banking industry is valid since banks have high growth opportunities during the uptick of the business cycles whereas growth may dwindle to a low growth thereafter.

Eq. 2 $$V_0 = \sum_{j=1}^{N} \frac{DSP_t(1-g_s)^{t-1}}{(1+K_e e)t} + \frac{DPS_{n+1}(1+g)^1}{(K_e - g)} .(1+K_e)^{-(n+1)}$$

In addition to the terms defined before, the finite period growth is represented as g_s to indicate high growth over a finite horizon from t = 1, ..., N, after which the constant growth to perpetuity at a steady state with normal "g" growth is assumed. There are other models such as the H-model and three-stage model. To maintain simplicity and to conform to the known qualities of banking firms, only the above two models will be used in this study.

2.3 *Discounting the Operating Cash Flows*

If one accepts the above two versions of valuation modelling, the next step is to replace the DPS with more meaningful variable since dividend, though it represents the cash flow over a long period of time, is not exactly equivalent to cash that is available to the shareholders. After all, the bank is worth a fair value for the cash flows it represents. Hence the third model is one where, as in the next equation, the DPS is replaced by operating cash flows.

Eq. 3 $$V_0 = CF_1 (K_e - g)^{-1}$$

If the operating cash flows have reached a steady state, then Eq. 3 is appropriate. If the cash flows are generated over two periods characteristically different as explained in connection with Eq. 2, this situation can be modelled with operating cash flows replacing the DPS. Hence the fourth model is for a two-stage growth.

2.4 *Discounting the Free Cash Flows to Equity*

Miller and Modigliani's (1958) argument that the valuation is on the cash flows *after reinvestment* has been given an operational meaning in Copeland *et al.* (1994) and Damodaran (1996) as the free cash flows. The free cash is the residual cash flow left over after meeting all financial obligations,

including debt payments, and after covering capital expenditure. Thus, in Eq. 4, the operating cash flow is replaced with the free cash flow.

Eq. 4 $$V_0 = FCFE_1 (K_e - g)^{-1}$$

The free cash flow to equity is defined as $FCFE_1$ as the expected cash flow after all claims, not just claims arising from operating the business. Again two models can be developed depending on whether or not the free cash flow has reached a steady state or not as in the previous equations. Eq. 2 can be again respecified with FCFE to estimate the cash flows arising from a two-stage cash flow model.

The foregoing discussion of the modelling process is widely applied in the banking sector. It is also true that there are specialised modelling approaches such as the relative market valuation or EVA™ models to estimate a fair value. The latter approaches are not as widely practised as are the models suggested by the DCF approach. These latter models are also equivalent to the basic DCF approach (see Weston *et al.* 1999). Therefore, the six versions of the DCF approach to arriving at fair value are the ones applied in this study based on these theories in practice.

2.5 *Evidence*

A good valuation model not only should be simple and understandable, but also should be able to be tested and refined against historical data (Wilcox, 1984). Despite the widespread application of these models in practice, there is a paucity of published evidence in support of these models. The models appear to be justified based on their logical structure much more than is the case with evidence strongly supporting the validity of these models. The few studies showing evidence in support of some of these models are summarised here. All these studies are on non-financial firms.

The finding from a simple study of dividend valuation model is found in Sorensen and Williamson (1985). This study valued 150 stocks included in the S&P 400 Index as at 1980. They used the difference between the market price at that time and the model value to form five portfolios based on the degree of under or overvaluation compared with the fair value of the model. The returns on these portfolios were estimated for the following two years, and the excess returns were estimated relative to the S&P return using the beta values estimated at the first stage using the CAPM. The fair value estimation was fairly accurate. Other studies also come to similar conclusions, that in the long term, undervalued (overvalued) stocks from this model outperform (underperform) the market index on a risk-adjusted basis.

Although the model provides impressive results in the long term, there have been individual years when the model significantly underperform against the market: Haugen (1993). In his study of 250 large capitalisation firms, Haugen reported that the undervalued portfolio earned significantly higher returns than the overvalued portfolio in the period 1979-1991. The model underperformed against the market in five of the twelve years. The overvalued portfolio underperformed in four of the twelve years.

On the other hand, according to McCormack (1997), Ford Investor Services, a San Diego-based stock research firm, believes its dividend discount model has the ability to forecast earnings and dividends in the future. It can also gauge how big the year-to-year swings in earnings are going to be. Ford Investor Services projects a year-end stock price for each company based on the company's "intrinsic" value from the model. A company's intrinsic value is the present value of all the dividends it expects the company to pay over the next ten years plus any price appreciation. McCormack conducted a study to test this in 1996. She recommended 66 stocks using Ford's model. The results show that on average, this group posted a total return of 28.1 compared with 24.9 for the 3,360 stocks in Ford's database.

Another study also provides some evidence. The "Financial World" projects year-end stock prices for each of the largest 500 companies using Ford's forecasts. The results show that Ford's buy candidates gained an average of 39.7 per cent (including dividends) while its sell candidates rose only 23.7 per cent. The entire group of 500 companies was up an average of 35.5 as documented in Owens (1996).

Copeland *et al.* (1994) argues that the operating cash flow model is an important decision-making tool that is being increasingly used around the world. It has been used to value companies in over two dozen different countries for activities as diverse as privatization, merger, value-based management, joint venture and divestiture. In 1988, McKinsey examined the accuracy of the operating cash flow model. The result showed 93.6 per cent correlation between DCF value and market value. In 1990, McKinsey conducted another study that showed a 95.4 per cent correlation between DCF value and market value.

3. The Banking Sector, Data Sources and Methodology

3.1 *The Banking Sector and the Sample*

The banking industry in Australia is relatively more developed than is the case with banking industry in neighbouring countries. Not only are banks relatively more competitive despite the presence of four large dominant banks, the prudential supervision of the banks is said to be of high standard. The

total revenue of the banking industry in a typical year in the recent past was $60 billion in an economy with $700 billion. The average return to equity in the banking sector has been steady over the recent years at about 14 per cent. At the close of the last decade, there were 44 licensed banking groups, with a total asset base of $590 billion. That number is about 110 per cent of the GDP, and excludes assets of non-bank subsidiaries owned by the banks. Total employment in the banking industry is estimated to be 152,000.

Though competition among the banks is quite substantial, the industry has a high level of concentration. The top four banks control 63.5 per cent of assets of the banking industry. These four generate in excess of 70 per cent of the of industry turnover. The major players in the industry are the National Australia Bank with 18 per cent market share, Commonwealth Bank of Australia with 17 per cent, Westpac with 15 per cent and the ANZ with 14 per cent. The banking industry has a low level of global presence, perhaps. This is evident from the data that only 17 per cent of the bank assets are from outside the country.

According to one source, there are moderate barriers to entry to this industry. First, the cost of acquiring a license is prohibitive since the minimum Tier 1 capital required is $50 million: IBIS (1999).[2] Next, the costs of establishing infrastructure, brand name and market penetration are also high since labour costs is very high. The four dominant banks can often put up a high level of competition to other financial institutions entering the market. Investment banks such as Merrill Lynch are entering the personal banking market, which is quite inadequately developed by the existing major banks. The existing banks have responded to this entry by forming separate units to service this market. Banks are also forming strategic alliances with other organisations to provide full range of financial services.

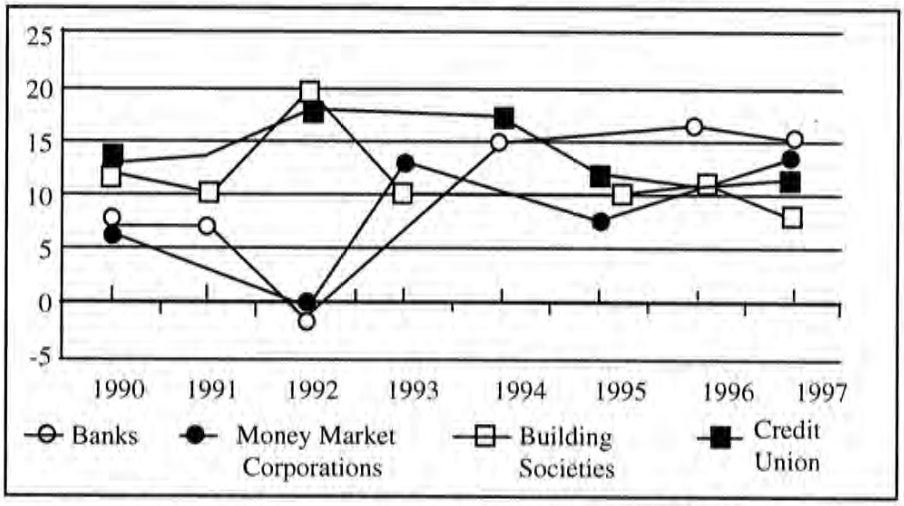
The banking industry is a mature industry, because in the five years to 1994-1998, industry gross product grew at a slower rate than the overall economy. There is also little product innovation in this industry, partly due to regulations. In addition, the competitive factors within and outside the industry are reducing lending margins and technology is reducing the cost of delivering banking services. The banking industry exhibits moderate volatility. Also, the real gross product vary between 3 to 10 per cent. Volatility arises from high debt leveraging and the associated bad debt problems. Further the volatility in interest rates affects revenues and costs in these situations.

Industry performance has been quite stable over 1994-1999. After the recovery from the recession in 1992, improved return on equity has been observed, principally due to a reduction in paid up capital due to share buy back, low bad and doubtful debt provisions, the beneficial impact on interest margins (largely coming from reduction in non-accrual loans), and assets growth. Further beneficial impact came from increased interest margins from

a steadily falling interest rates right up to the middle of 1999. The profitability of the banking industry is compared with other industries in the following Figure 1.

It is evident from the return on equity of the four sectors that the banks experienced a more volatile earning over the period. In fact the banks had serious earnings problem during 1991 to 1993 both ahead of the recession in 1992 and for a period thereafter. The health of the banking system was

Figure 1
Profit Ability of Banks vs Other Sectors



restored after the reforms undertaken in 1993 onwards. The ROE thereafter improved steadily recording a 15 or higher per cent since 1994. The credit unions appear to have done very well in the period of recession as these provided a ready funding source when the banks were badly affected, and had to curtail lending activities. Hence, the ROE of the credit unions was in excess of 10 per cent over the recession period. Building societies enjoyed a similar boom but over a longer period, but their performance declined with the banks aggressively entering the mortgage market in the years since economic recovery in 1993. The performance of the money market fund sector was poor during the recession but was just below that of the banks in the subsequent years.

In the forward five years, industry gross product is expected to grow at an average annualised real rate of 0.8 per cent per year on the back of the forecast average real growth in GDP of 2.7 per cent per year. This slow growth is mainly the result of the narrowing interest margin. Banks will lose market

share in lending, deposit taking and financial transactions as more new entrants are entering the market following the Ralph reforms in mid-1999. The industry's total assets will grow at an annual average rate of 3 per cent per year. The banks' bad debts will also rise as higher interest rates begin to affect highly geared borrowers. A slowdown in mortgage demand on the back of a slowing down in housing demand is expected to reduce the profitability of banks.

3.2 *Computing the Variables*

This study uses ten listed banks to estimate in each case six different fair values suggested by the three DCF valuation models using (a) dividends, (b) operating cash flows and (c) free cash flows to equity. Two variations of each model are used to accommodate the constant growth to perpetuity and the two-stage growth. Only ten banks were selected as information going back to about 10 years for setting up the variables were available for these banks, and there are not many more listed banks.

Some of the principal sources of information used in this paper are as follows:

- The annual reports and audited accounts for the last five financial years of the ten banks.
- Industry statistics and economic data relevant from the Australian Bureau of Statistics.
- Share market statistics published by the Australian Stock Exchange Limited.

The inputs needed are dividend per share (DPS), free cash flow to equity (FCFE), cost of equity (K_e) and the growth rate (g). Unlike dividend per share, which is easy to calculate, free cash flow to equity is obtained from a more complex set of assumptions, for which more *insider* information is needed to obtain reliable numbers. Since insider information is unavailable, there is a greater degree of inaccuracy originating from this. Free cash flow to equity is net income plus non-cash charges, less cash flow needed to grow the balance sheet in the form of reinvestments and new sources of funds. The free cash flow estimation is customised for banks in Copeland *et al.* (1994; p. 500), which is faithfully followed. The operating cash flow is relatively easier to compute following the established accounting guidelines adding to net income cash flows from (a) depreciation and (b) changes in net working capital items. Since these procedures are well entrenched in valuation literature, no further details are given as to the exact procedures followed.

The growth rates for the models are derived from the information provided in the past companies annual reports. The calculation of the growth rate in this paper follows the standard practice in the industry (Damodaran, 1996):

Eq. 5 g = Retention Ratio X ROE

Eq. 6 Retention Ratio = 1 – (DPS/EPS)

Eq. 7 ROE = Net Income/Average Shareholders' Equity

The information needed for estimating the cost of equity are obtained from the database in the library. The following sections will disclose and describe the sources of information and the calculation used to obtain these variables.

The CAPM suggests a procedure for estimating the cost of equity:

Eq. 8 $$K_e = R_f + b\,[\,E(R_m) - R_f]$$

Where,

K_e : Cost of equity or expected return on the investment,

R_f : Risk-free rate of return,

β : Systematic (non-diversifiable) risk,

$E(R_m)$: Expected return on the market, and

$E(R_m) - R_f$: Risk premium, or expected market return over risk free rate.

The β value for each firm is computed using the standard Market Model (Sharpe 1963) using 60 monthly adjusted returns of the bank and the market returns from the accumulation index. The returns are set up as excess returns over the estimation period: that is as $R_i - R_f$ and $R_m - R_f$. CAPM is expected to give a good approximation of the cost of equity. The risk free rate is the yield on long term government securities at least with 10 years to maturity.

The market risk premium or the price of risk in the market is the difference between the expected rate of return on the market portfolio and the risk free rate. The yearly market index values over a 20-year period is used to set up the data using the monthly All Ordinaries Index.

3.1 Test Models

There are three basic models, each with a perpetuity or a two-stage version, thus giving six estimates of fair values for each bank. The valuation is done for one financial year ahead of the current report in 1998/99. Hence the fair

value estimates are for a year in 1999/2000. For the perpetuity model, a growth rate of 4 per cent (this is the rate predicted a year ahead for the economy) is used. For the two-stage model, the bank's actual growth rate for the high-growth period is used with stable-growth using the normal growth of 4 per cent in line with the path of the economy at the time of valuation. Unlike the non-financial firms, the growth rate in banking is very much constrained by the economy, the growth rate of which is possibly the attainable growth for banking firms in the long run. Since the actual growth of each firm varied for each bank, and hence, in the two-stage model, the super growth is specified as the actual growth and the normal growth of 4 per cent is assumed to perpetuity after a 5-year period of super growth. The five-year is used as representing half the business cycle.[3]

The fair values computed by the models are then compared with the actual average price over the prediction period in the market. The average prices over about 3 months are used for this comparison so as to avoid errors from using a single market price for each bank. The deviations of the actual average price against the fair value from the models are re-estimated as Theil's U-coefficient so as to compare the error in the estimation: a perfect model will have a coefficient of zero, and a bad one, a coefficient of unity.

The main hypothesis of this study is that the U-coefficients for the values computed by the three models will be quite different. Further, the lowest deviation is expected to be from the operating cash flow estimation procedures for two reasons. The dividends is an inaccurate indicator of cash flows as it is quite evident that dividend decision is a managed affair; it is not fully related to the capacity of the firm to generate cash flows. The free cash flow estimation by outsiders as in this study is very likely to be quite off the mark because of the lack of reliable insider information on reinvestment rate. Therefore, the operating cash flow models are more likely to produce the least error in the estimation of the fair values of banks.

4. Findings

4.1 *Accounting Performance of Banks*

The ten banks selected for this study are among the larger ones in the sector. Some information is given in Table 1.

The statistics in the table shows that the ten banks to be included in this study are quite large ones. Further, the top four banks have a disproportionate share of the sector compared with others. The six non-big-four banks hold a mere 11 per cent of the total assets of the ten banks. The gross income generated by the six banks also represents 11 per cent of the total gross incomes of the ten banks.

Table 1
Total assets and gross incomes of ten banks in the study

Company Name	Company Size				
	Major Activity (by broad services)	Total Assets Income 1998 ($M)	Gross Operating 1998 ($M)	Gross Operating Income 1999 ($M)	Total Assets 1999 ($M)
National Australia Bank	Retail & institutional banking	251,714	18,441	250,630	18,285*
ANZ Bank	General banking	149,720	11,005	148,789	10,404
Westpac Banking Corporation	Institutional banking	137,319	9,931	138,536	10,036**
Commonwealth Bank	Retail & institutional banking	130,544	8,807	138,096	9,026**
St. George Bank	Retail banking	44,261	3,237	44,735	3,188**
Bank of Western Australia	Retail & institutional banking	13,972	1,019	16,008	1,138
Macquarie Bank	Investment banking	7,929	872	9,251	1,059
Adelaide Bank	Retail banking	3,980	278	4,864	309
Bendigo Bank	Retail banking	3,171	216	4,204	257
Bank of Queensland	Retail banking	2,847	212	n/a	n/a

Source: Companies Annual Reports & web pages.
* Data over quarters annualised. ** Half -yearly data annualised.

Further statistics on the performance of the 10 banks are given in Table 2.

Table 2
Comparative performance of selected banks

Bank	ROE	Tax Burden	Interes Expense Burden	Margin	Turnover	ROA	Compound Leverage Factor
NAB	0.1727	0.6716	0.8247	0.2551	0.0870	0.0222	11.6247
ANZ	0.1660	0.6858	0.8479	0.1659	0.0878	0.0146	16.6098
WBC	0.1367	0.7131	0.8331	0.1896	0.0841	0.0160	11.9912
CBA	0.1504	0.6804	0.8874	0.1875	0.0821	0.0155	14.4620
SGB	0.1140	0.5994	0.6287	0.2103	0.0908	0.0191	9.8965
BWA	0.1769	0.6402	0.4400	0.3312	0.0931	0.0309	9.0187
MBL	0.2566	0.8459	0.9351	0.1659	0.1471	0.0244	12.4453
ADB	0.1518	0.7237	0.3945	0.3186	0.0911	0.0289	7.5609
BEN	0.1065	0.6858	0.7114	0.1332	0.0933	0.0125	12.8247
BQD	0.1240	0.6589	0.7356	0.1913	0.0944	0.0182	10.5514
Average	**0.1556**	**0.6905**	**0.7238**	**0.2149**	**0.0951**	**0.0202**	**11.6985**

These numbers are obtained from financial statements of the banks using an extended version of the Dupont formula widely used to decompose the ROE into components.

As evident, the 10 banks have very high ROE (see column 2) that averages to 15.56 per cent in the tested period just ahead of the year for which the fair value is estimated. The ROE ranges between 25.66 per cent to 10.65 per cent in one case. By examining the other figures, the reader could notice the strength and weaknesses of these banks.

The first factor, the ratio of net income after taxes to pretax profits, is the tax burden ratio. Its value reflects both the government's tax code and the policies pursued by the firm in trying to minimise tax burden. The interest burden ratio is the ratio of pretax profits to EBIT. EBIT is calculated by adding interest expense on only long-term debts to pretax profits. The higher the degree of second tier financing, the lower the ratio. It can bee seen that Bank of Western Australia with a second tier capital ratio of 20.47, has 0.44 burden compared with the Macquarie Bank with a lower debt ratio has an higher ratio of 0.94.

The third factor is margin, which shows operating profit per dollar of revenue. The fourth factor is the ratio of sales to assets, or turnover, which indicates the efficiency of asset usage by banks. The compound leverage factor is calculated my multiplying the interest burden ratio with leverage ratio. If this ratio is greater than 1, it indicates positive contribution to ROE from financial leverage.

4.2 *Valuation Results*

The growth rates, the beta of the stocks and the cost of equity of the banks are presented in Table 3.

Table 3
Estimated parameters for bank valuation as at 1999

Company Name	Estimated Growth Rate	Estimated Beta	Estimated Cost of Equity
National Australia Bank	6.38%	0.87	13.76%
ANZ Bank	6.93%	1.08	15.90%
Westpac Banking Corporation	5.69%	0.96	14.62%
Commonwealth Bank	2.75%	0.92	14.33%
St. George Bank	1.03%	0.53	10.30%
Bank of Western Australia	4.03%	0.89	14.00%
Macquarie Bank	10.95%	1.42	19.05%
Adelaide Bank	3.73%	0.70	11.91%
Bendigo Bank	2.38%	0.72	12.31%
Bank of Queensland	2.98%	0.36	8.61%

The average values of the three key variables for the sample are: growth rate of 4.7 per cent; systematic risk of 0.85; and required rate of return or cost of capital of 13.5 per cent.

The estimated values are similar to the industry-revealed information available in this market. The average bank has a beta of about 0.7 whereas the wholesale bank has the highest beta. The small banks in retailing business have the lowest beta values. The cost of capital takes into account the recent upsurge in the yields of Treasuries, and hence is slightly higher than would have been the case if these numbers were calculated in 1998.

The results from outsider valuation of fair values are grouped according to the theories operationalised for this purpose. The first set of results is for the dividend DCF models as in Table 4.

Table 4
Findings from applying the dividend valuation model

Company's Name	Actual Price	Gordon Growth Model		Two-Stage Model	
		Predicted Price	Variance	Predicted Price	Variance
NAB	24.64	14.70	-40.34%	12.87	-47.77%
ANZ	10.58	6.20	-41.32%	5.52	-47.80%
WBC	10.24	5.09	-50.30%	4.73	-53.82%
CBA	23.38	9.23	-60.52%	9.88	-57.76%
SGB	10.57	5.67	-46.38%	7.50	-29.01%
BWA	3.03	1.62	-46.59%	1.62	-46.66%
MBL	15.56	6.99	-55.07%	6.62	-57.41%
ADB	6.05	3.68	-39.26%	3.77	-37.79%
BEN	5.15	2.22	-56.94%	2.50	-51.43%
BQD	5.80	4.39	-24.34%	5.13	-11.51%

The fair values are for the perpetuity in column 3; in column 5 are the fair values for the two-stage model. The variations from the fair values are given in the next columns respectively for the two versions of the model.

Surprisingly, the fair values are quite far from the market average values calculated over a 3-month period following the financial statement year end. This suggests that the dividend valuation model in its two versions performs very poorly against the market's indicated value.

The findings from applying the operating cash flows in two versions again yielded the following results in Table 5:

Except in the cases of two banks namely the CBA and BQD, the fair values from the operating cash flow model are much closer to the market's valuation. The average variance is about 10 per cent. This small variance could easily be explained as the sentimental over- or unde-estimation often found in the market when values are compared over a short time horizon such as the three months used in this study.

The third and final finding refers to the fair values using the currently very popular model, the free cash flow estimation procedure. As pointed out earlier, a great deal of error is introduced by an outsider estimating the future reinvestment rates of each of the banks. The future investment estimated from historical information introduces errors, which the insider is able to eliminate. The results are in Table 6.

Table 5
Findings from applying the operating cash flows model

Company's Name	Actual Price	Stable-Growth Model		Two-Stage Model	
		Predicted Price	Variance	Predicted Price	Variance
NAB	24.64	27.74	12.60%	24.29	-1.42%
ANZ	10.58	11.78	11.40%	10.48	-0.89%
WBC	10.24	9.97	-2.66%	9.26	-9.54%
CBA	23.38	14.00	-40.13%	14.98	-35.94%
SGB	10.57	7.54	-28.63%	9.99	-5.51%
BWA	3.03	2.76	-8.99%	2.75	-9.12%
MBL	15.56	11.93	-23.33%	11.30	-27.33%
ADB	6.05	6.60	9.04%	6.76	11.68%
BEN	5.15	4.22	-18.06%	4.76	-7.58%
BQD	5.80	8.14	40.33%	9.52	64.14%

Table 6
Findings from applying the free cash flow model

Company's Name	Actual Price	Stable-Growth Model		Two-Stage Model	
		Predicted Price	Variance	Predicted Price	Variance
NAB	24.64	10.82	-56.06%	9.48	-61.53%
ANZ	10.58	6.06	-42.70%	5.39	-49.02%
WBC	10.24	3.43	-66.48%	3.19	-68.85%
CBA	23.38	8.51	-63.62%	9.10	-61.08%
SGB	10.57	9.81	-7.14%	12.99	22.93%
BWA	3.03	1.58	-47.96%	1.57	-48.03%
MBL	15.56	8.56	-44.99%	8.11	-47.85%
ADB	6.05	4.23	-30.17%	4.33	-28.48%
BEN	5.15	1.41	-72.68%	1.59	-69.18%
BQD	5.80	9.90	70.78%	11.59	99.75%

These results are as variable as the results using the dividend valuation model. The model appears to over-estimate the values of the banks simply because the outsider estimation of the investment rates are underestimated.

5. Reliability of the Findings and Conclusion

These findings appear to point to the conclusion that despite errors in the fair valuation from the three models, the operating cash flow model estimates of fair values appear to be closer to the market's perceptions of values of these banks. To conduct a formal test of their reliability, Theil's U-coefficients was used to determine the average reliability, of these results. The U-coefficient is interpreted as follows:

- $U = 1$: the naïve method is as good as the forecasting technique being evaluated.
- $U < 1$: the forecasting technique being used is better than the naïve method. The smaller the U-statistic, the better the forecasting technique is relative to the naïve method.
- $U > 1$: there is no point in using a formal forecasting method, since using a naïve method will produce better results.

The average U-coefficients of the six modelling approaches are in Table 7.

Table 7
Mean absolute error and Theil's U-Coefficients

Basic Models	Mean Absolute Error Perpetuity Modelling		Theil's U-coefficient Two-Stage Modelling	
Model 1: Dividend Cash Flow	0.4611	0.4410	0.7614	0.7452
Model 2: Operating Cash Flow	0.1952	0.1731	0.3745	0.4132
Model 3: Free Cash Flow	0.5026	0.5560	0.8692	0.9593

Note: Detailed computations of these numbers will be presented.

These numbers suggest the fair value estimations by Model 3 are no better than estimates from a naïve model. This is because this model's U-coefficient score is close to unity. At the other extreme are the numbers from the Model 2. Theil's U-coefficients for these estimates are closer to zero, far away from unity. That means that the operating cash flow model is more

reliable for an outsider estimation of fair values of banks while the popular free cash flow - though it may provide accurate estimates to insiders - is unlikely to do better than a naïve model. Predictably, the dividend valuation model, which is good at estimating the long-run value, performs almost as bad as the free cash flow model in that the U-coefficient is closer to 1 than being far away from 1 in the other direction.

These results should be treated as preliminary in that the fair value estimation was attempted for only one forward period. A possible extension of this study is to use the data set to estimate fair values over more years and then compare the average performance of the listed banks. These results should not be interpreted as attempting to find the true or intrinsic values of the stocks since the thrust of this investigation is the reliability of the model against the market's values. It is admitted that the technology to estimate the intrinsic value by outsiders is still in its infancy, and this paper is not advocating the use of the operating cash flows as a means to finding the intrinsic value.

Endnotes

1. These models can be expressed in more comp-lex ways to represent the actual behaviour of the cash flows. This study only examines the constant growth and the two-stage growth models.

2. The minimum capital required for applying for licence in Singapore is $800 million.

3. The horizon over the high growth may last could also be computed, and that horizon used as the period for high growth. The results from this procedure are not included in this paper.

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