

# A practical comparison of firm valuation models: cash flow, dividend and income

Our research, based on a sample of listed Australian firms, indicates that the residual income model provides better estimates of firm value than two other commonly used models. It also provides advantages in that there is less need to forecast returns as far into the future and, with this model, a terminal value based upon a constant future return (or relatively low growth rates) can be used. This obviates the need to estimate an expected long-term growth rate, which is always problematic.



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**ACCOUNTING PRACTITIONERS** and financial analysts are often required to prepare (and review) estimates of firm value for a variety of different types of firms. However, there are many different valuation models that can be used, and it is not always obvious which one is the most appropriate. This paper is the first to use Australian data to compare three of the most commonly used models – dividend discount model (DDM), residual income model (RIM) and discounted cash flow model (DCF). It shows that the RIM provides better estimates of firm value compared with DDM and DCF.

## Models for firm valuation

Estimating the value of a firm typically involves forecasting expected future returns, and then discounting those returns. Not surprisingly, given the economic importance of determining firm value, this has been the subject of much empirical investigation. Most attention has been directed towards the measurement of the risk that is required to be captured in discount rates (Fama and French, 1993; Fama and French, 1996; Easton, 2004; Francis, Lafond, Olsson and Schipper, 2005; Core, Guay and Verdi, 2006; Dhaliwal, Krull and Li, 2007). The issue of how alternative return measures can be used to estimate firm value has also been addressed (Dechow, 1994;

Dechow, Hutton and Sloan, 1999; Cheng, 2005). However, practical issues arising from the use of alternative returns measures, and comparison of the reliability of the resultant valuations have received limited attention.<sup>1</sup> This paper considers issues arising from the use of dividends, income and cash flows as measures of returns in firm valuation.

Forecast dividends have traditionally been identified as a measure of returns for equity valuation purposes. Dividend valuation models generally take the form:

$$P_0 = \sum_{t=1}^{\infty} \frac{Div_t}{(1+r_e)^t}$$

where:

- $P_0$  : Price of security at time 0
- $Div_t$  : Dividend paid by firm in period t
- $r_e$  : Cost of equity

While this model has some intuitive appeal, as dividends are the obvious returns to equity holders, it is not without problems. One issue is that the model values equity on the basis of dividends, when dividend policy irrelevance is widely accepted (Miller and Modigliani, 1961). Another concern is that the model requires summation to infinity. This latter problem is typically addressed by assuming the investment in the equity will be liquidated and including a terminal value in the valuation. Accordingly a revised model format is as follows:

$$P_0 = \sum_{t=1}^T \frac{Div_t}{(1+r_e)^t} + \frac{TV_T}{(1+r_e)^T}$$

Determining terminal values requires assumptions about the pattern of expected future returns. The following models for estimating terminal values are based on these different assumptions:

Pattern of future returns	Model
a. No future returns	$TV_T = 0$
b. Future returns at a constant level	$TV_T = \frac{Div_{T+1}}{r_e}$
c. Future returns growing at rate $g$ , <sup>2</sup>	$TV_T = \frac{Div_{T+1}}{r_e - g}$

**Free cash flow models are typically firm valuation rather than equity valuation models and hence require the deduction of the value of debt to calculate the value of equity.**

Addressing the concern that dividends are a distribution of value rather than a measure of wealth creation, it has been advocated that income should be substituted for dividends when valuing firms. Furthermore, it can be demonstrated algebraically that income valuation models or, more specifically residual income models (with certain conditions such as clean surplus accounting), are mathematically equivalent to dividend valuation models.<sup>3</sup> The following model is representative of residual income valuation models:

$$P_0 = BV_0 + \sum_{t=1}^T \frac{ResInc_t}{(1+r_e)^t} + \frac{TV_T}{(1+r_e)^T}$$

While this model avoids the need to specify firm value in terms of dividends, it still requires an estimation of terminal values. Solutions similar to those used for dividend valuation models can be used.

A further transformation of the dividend discount model to derive a free cash flow valuation model is possible. With the additional assumption of not recognising accruals, it can be demonstrated that this is mathematically equivalent to the original dividend valuation model.<sup>4</sup> Free cash flow models are typically firm valuation rather than equity valuation models and hence require the deduction of the value of debt to calculate the value of equity. Accordingly, the following is representative of free cash flow valuation models:

$$P_0 = \sum_{t=1}^T \frac{FCF_t}{(1+r_f)^t} + \frac{TV_T}{(1+r_f)^T} - Debt_0$$

Again, the need to estimate a terminal value remains, and the solutions are similar to those used for dividend valuation models.

Notwithstanding the mathematical equivalence of the above valuation models based on alternative return metrics, a practical issue is whether any one specification is easier to use, and whether it results in more reliable estimates of firm value.

## Research design

As the aim of this study was to provide practical insights into issues arising from the application of models for firm valuation, it focused on the accuracy of predicted values derived from each of the three models. This was evaluated by estimating firm value with each of the models and determining a valuation error, calculated as the differences between actual and estimated price divided by actual price:

$$Val\_Error = \frac{(P_{Act} - P_{Est})}{P_{Act}}$$

It is well established in the analytical valuation literature that firm value is sensitive to firm growth estimates (e.g. Penman and Sougiannis 1998; Ohlson and Zhang 1999). Accordingly, it is likely that the accuracy of estimated firm values will be affected by both the period for which returns are forecast, and the assumptions made on terminal value. To evaluate the sensitivity of the valuation error to these implementation decisions, each model was estimated with varying forecast periods (one to five years) and terminal value assumptions. This helped to determine how these decisions impact on the valuation errors of each model, and which models require the adoption of less problematic assumptions.

Each of the valuation models requires the determination of future returns, and there is the potential for valuation error to be influenced by inconsistencies in the forecasting of these returns. To avoid both this problem and forecast bias, an approach similar to that in Penman and Sougiannis

(1998) was adopted, whereby the returns used for each of the valuation models are those actually reported in subsequent periods to that for which the value is estimated. Specifically, firm values were estimated for 2000, with future period returns being the actual return measures obtained from financial reports for the years 2001 to 2005. Consequently, the valuations were based on returns impacted by events and circumstances that could not realistically have been anticipated at the valuation date and this is a limitation of this study. However, it is not expected that this would systematically advantage a particular valuation model and the relative performance of the models would not be changed.

In the interests of simplicity a constant cost of equity (12%) was assumed. This rate – a government risk-free rate<sup>5</sup> of 6% plus an equity premium of 6% (Ibbotson and Sinquefeld, 1983) – is the same as that adopted in Dechow, Hutton and Sloan (1999) and is consistent with one of the rates adopted in Penman and Sougiannis (1998). It is notable that Penman and Sougiannis also consider individual firm cost of capital estimates and a constant rate of 10%. Their results are consistent across the various cost of equity estimates. Importantly, the use of a constant cost of equity should not bias the results as it was applied consistently across the models, and the focus was on mean valuation errors. Notwithstanding this, the sensitivity of the results to the choice of 12% as the cost of equity was considered by repeating the analysis with assumed rates of 10%, and 14%. The results (unreported) were consistent.

A potential issue in the cash flow valuation is the use

TABLE 1: Descriptive statistics

Variable	Year	Mean	Std. Dev.	Maximum	Median	Minimum
Share price	2000	7.03	8.57	49.55	3.95	0.07
Book Value	2000	2.80	2.72	15.32	2.04	0.08
Debt	2000	11.09	32.02	212.81	2.13	0.14
Dividends	2001	0.45	1.72	17.75	0.15	0.00
Dividends	2002	0.40	1.34	14.34	0.17	0.00
Dividends	2003	0.66	2.72	28.69	0.18	0.00
Dividends	2004	0.38	0.68	5.25	0.19	0.00
Dividends	2005	0.46	0.84	6.40	0.20	0.00
Residual Income	2001	-0.06	0.39	0.98	-0.01	-1.97
Residual Income	2002	-0.07	0.77	1.25	-0.01	-7.64
Residual Income	2003	-0.03	0.56	1.65	0.00	-3.91
Residual Income	2004	0.09	0.38	1.58	0.00	-1.03
Residual Income	2005	0.22	0.59	3.69	0.00	-0.88
Free Cash Flows	2001	0.11	2.43	17.75	0.05	-9.17
Free Cash Flows	2002	0.07	2.22	14.34	0.04	-10.84
Free Cash Flows	2003	0.28	3.31	28.59	0.08	-12.83
Free Cash Flows	2004	-0.22	2.63	5.25	0.07	-20.55
Free Cash Flows	2005	-0.05	2.18	6.40	0.00	-15.50

All data is per share

of the cost of equity rather than weighted average cost of capital. Accordingly, valuations with an appropriately lower discount rate were undertaken (unreported), but this did not change the tenor of the results. Rather, it highlighted the valuation problems caused by the nature of free cash flows that would not be addressed by adjusting the discount rate. For reasons of consistency, the discount rate of 12% was maintained in the reported results.

### Sample and data description

Sample firms were identified from lists of the largest 100 firms on the Australian Stock Exchange as at 30 June for each of the years 2000 to 2005. This identified a potential sample of 155 firms. Firms were deleted if data were not available for the entire period, which typically occurred if the firm listed subsequent to 2000 or delisted before 2005. Firms that reported in a foreign currency were also deleted to avoid translation of financial data. This left a final sample of 129 firms.

Financial report data were obtained from the Aspect Financial Database, and stock prices were obtained from the Securities Industry Research Centre of Asia Pacific. An overview of the data is provided in Table 1. It is notable from the relations between mean and median values that the distribution of all variables is skewed. Furthermore, there are incidences of firms not paying dividends, and reporting negative values for residual income or free cash flows. A review of the data revealed that six firms did not pay dividends during the period,

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**It suggests that traditional discounted cash flow valuations should be supplemented with residual income model valuations when valuing firms where there are expectations of substantial long-term growth in sales and earnings.**

while 13 firms had negative aggregate residual income and 54 firms had negative aggregate free cash flows. As this creates problems for the application of the models, the results were calculated for both the full sample of firms (ensuring comparability), and a sample that did not include those firms where the valuation was problematic due to the nature of the returns.

**TABLE 2: Valuation errors – no terminal value assumed**

Estimation of dividend, cash flow and residual income values without the inclusion of terminal values (i.e., TV=0)

<b>Panel A : Consistent Sample</b>							
		<b>n</b>	<b>T+1</b>	<b>T+2</b>	<b>T+3</b>	<b>T+4</b>	<b>T+5</b>
DDM	Mean	129	0.944	0.881	0.726	0.670	0.614
	Std Deviation		0.137	0.232	0.912	0.918	0.925
RIM	Mean	129	0.354	0.382	0.317	0.328	0.317
	Std Deviation		0.721	0.719	1.139	1.150	1.159
FCF	Mean	129	2.174	2.097	1.856	1.978	1.955
	Std Deviation		1.791	1.874	2.031	2.896	3.015
<b>Panel B : Restricted Sample: Div or FCF or Inc &gt;0</b>							
		<b>n</b>	<b>T+1</b>	<b>T+2</b>	<b>T+3</b>	<b>T+4</b>	<b>T+5</b>
DDM	Mean	123	0.941	0.876	0.713	0.654	0.595
	Std Deviation		0.140	0.236	0.932	0.937	0.944
RIM	Mean	116	0.337	0.345	0.263	0.261	0.243
	Std Deviation		0.752	0.746	1.187	1.192	1.196
FCF	Mean	75	1.807	1.623	1.297	1.503	1.358
	Std Deviation		1.152	1.207	1.695	3.164	3.223

Where:

$$P_{Est} = \sum_{t=1}^T \frac{Ret_t}{(1+r)^t} \quad Val\_Error = \frac{(P_{Act} - P_{Est})}{P_{Act}}$$

The mean growth in earnings (dividends) of 6.8% (9.85) over the period 2001 to 2005 suggests that determining firm valuation as a multiple of current period earnings is inappropriate. Rather, valuations should be based on expected future period returns, which is consistent with the research design adopted.

## Results

Valuation errors were investigated when firm values were estimated without terminal values, and the results are presented in Table 2. For the full sample of firms (Panel A) it is clear that in the absence of terminal values, the dividend discount model requires returns to be forecast significantly into the future. Discounting only one year of dividends results in a mean valuation error of 94.4%, and this reduces to 61.4% if valuation is based on returns for five years. Furthermore, even after including five years of returns in the valuation, a material valuation error occurs if a terminal value is not included. In comparison, for the residual income model, the mean valuation error is only 35.4% when valuation is based on one year's return. This reduces to 31.7% when the valuation is based on five years of returns. It is apparent that with a residual income model, the results are less sensitive to the number of periods of returns that are included in the valuation, and that while the omission of a terminal value is still problematic, the magnitude of the problem is less than for dividend valuations.

The results from the valuations based on free cash flows are problematic, and this is likely to be a consequence of their nature and the research design adopted. Free cash flows are highly volatile, and are frequently negative.<sup>6</sup> This is largely because expenditures incurred from expanding operating assets are recognised as reductions in returns. This problem is exacerbated by the current research design, which fully incorporates the actual growth experienced by the firm in free cash flow forecasts. In practice, this problem is mitigated by imposing conservative growth assumptions, limiting forecast outflows on operating assets to those necessary to maintain the existing level of operations, and calculating the terminal value as a book value or a multiple of earnings. Accordingly, the forecast free cash flows are less likely to be negative, and the impacts of negative free cash flows are compensated for with higher terminal values. Simply stated, a bias is introduced into the forecasting of returns to avoid problems inherent in free cash flow valuation and this requires considerable professional judgement. Such adjustment is beyond the scope of this paper.

The results in Panel A may be influenced by the inclusion of observations where the application of that particular model is clearly inappropriate because of a lack of dividends, loss making or negative free cash flows. Reflecting this, the valuation errors were therefore re-estimated with sample firms restricted to exclude firms with

TABLE 3: Valuation errors – terminal value based on constant future returns

Estimation of dividend, cash flow and residual income values with the inclusion of terminal values based on the assumption of future returns at a constant level.

Panel A : Consistent Sample							
		n	T+1	T+2	T+3	T+4	T+5
DDM	Mean	129	0.674	0.595	0.446	0.389	0.376
	Std Deviation		0.238	0.312	0.914	0.937	0.945
RIM	Mean	129	0.273	0.284	0.192	0.145	0.145
	Std Deviation		0.732	0.757	1.208	1.227	1.248
FCF	Mean	129	1.603	1.766	1.573	1.615	1.671
	Std Deviation		2.431	1.936	2.070	3.336	3.435
Panel B : Restricted Sample: Div or FCF or Inc >0							
		n	T+1	T+2	T+3	T+4	T+5
DDM	Mean	123	0.658	0.575	0.419	0.360	0.346
	Std Deviation		0.232	0.306	0.928	0.949	0.957
RIM	Mean	116	0.248	0.238	0.125	0.060	0.053
	Std Deviation		0.760	0.781	1.254	1.263	1.280
FCF	Mean	75	0.991	1.163	0.908	0.959	0.941
	Std Deviation		2.334	1.233	1.666	3.760	3.811

Where:

$$P_{Est} = \sum_{t=1}^T \frac{Ret_t}{(1+r)^t} + \left( \frac{Ret_{T+1}/r}{(1+r)^T} \right) \quad Val\_Error = \frac{(P_{Act} - P_{Est})}{P_{Act}}$$



those characteristics. The results are presented in Panel B. The results are substantively the same for both the dividend and residual income valuation models, albeit with slightly smaller valuation errors. The problem associated with the variability of free cash flows is unresolved.

Arguably, the omission of terminal values (see Table 2) influences the relative performance of the alternative valuation models. To address this, terminal values, based on the capitalisation of constant future returns, were added to the valuation models. The resultant valuation errors are presented in Table 3. As before, the results for the full sample are presented in Panel A. The inclusion of terminal values materially reduces the mean valuation errors of the dividend discount model, with the mean valuation error falling to 67.4% when the price estimate is based on only one future return (compared with 94.4% in Table 2). Furthermore, this falls to 37.6% when the valuation is based on returns for five periods (compared with 61.4% in Table 2). However, there are similar reductions in the mean valuation errors with the residual income model (27.3% based on one year's returns and 14.5% based on five years). Accordingly, the dividend valuation model again benefits from the inclusion of a greater number of years of returns, and while there are benefits from including a greater number of returns in the residual income model, these are not as great. While the inclusion of a terminal value improves the accuracy of the dividend valuation model, it

still does not achieve the same level of forecast accuracy as a residual income model. The problems apparent with negative free cash flows persist. In Panel B the results are presented for the restricted sample of firms and the results are substantively the same.

Finally, the impact of including terminal values based on the capitalisation of increasing future returns was considered, and the resultant valuation errors are presented in Table 4.<sup>7</sup> For the full sample of firms (Panel A), there is a further reduction in the valuation errors compared with the results in Tables 2 and 3. The dividend discount model benefits from the inclusion of more returns. When the valuation is based on five returns, the valuation error falls to 24.3%. This compares favourably with the corresponding values of 61.4% in Table 2 and 37.6% in Table 3. This suggests that the dividend discount model is best estimated with a large number of future period returns and a terminal value assumption including growth. In comparison, the mean valuation errors for the residual income model are again materially lower. However, it is notable that neither the improvement in valuation error from including more returns in the valuation, nor the benefit of including a terminal value with growth is as great. This again suggests that a residual income model can be used more reliably with fewer future period returns, and the inclusion of growth in terminal value calculation is less important.

**TABLE 4: Valuation errors – terminal value growth**

Estimation of dividend, cash flow and residual income values with the inclusion of terminal values based on the assumption of future returns with growth.

<b>Panel A : Consistent Sample</b>							
		<b>n</b>	<b>T+1</b>	<b>T+2</b>	<b>T+3</b>	<b>T+4</b>	<b>T+5</b>
DDM	Mean	129	0.539	0.452	0.305	0.263	0.243
	Std Deviation		0.326	0.401	0.944	0.990	0.994
RIM	Mean	129	0.257	0.268	0.167	0.096	0.106
	Std Deviation		0.739	0.774	1.234	1.265	1.281
FCF	Mean	129	1.396	1.646	1.471	1.482	1.553
	Std Deviation		2.919	2.002	2.129	3.651	3.738
<b>Panel B : Restricted Sample: Div or FCF or Inc &gt;0</b>							
		<b>n</b>	<b>T+1</b>	<b>T+2</b>	<b>T+3</b>	<b>T+4</b>	<b>T+5</b>
DDM	Mean	123	0.516	0.425	0.272	0.227	0.206
	Std Deviation		0.317	0.391	0.954	1.000	1.003
RIM	Mean	116	0.230	0.220	0.098	0.006	0.011
	Std Deviation		0.768	0.798	1.281	1.301	1.313
FCF	Mean	75	0.694	0.996	0.766	0.761	0.766
	Std Deviation		3.083	1.335	1.740	4.203	4.243

Where:

$$P_{Est} = \sum_{t=1}^T \frac{Ret_t}{(1+r)^t} + \left( \frac{Ret_{T+1}/r-g}{(1+r)^T} \right) \quad Val\_Error = \frac{(P_{Act} - P_{Est})}{P_{Act}}$$

The results from the estimation of the free cash flow model remain problematic with the current research design. Furthermore, the results for the reduced sample of firms are substantively the same.

## Conclusion

The objective of this paper is to provide practical insights into issues arising from the application of three alternative models for firm valuation, and to identify the reliability of values generated. Based on a sample of firms listed on the Australian Stock Exchange, the paper provides evidence that the dividend discount model requires forecasts of future returns for a significant number of periods and/or terminal values to provide relatively reliable estimates of firm value. Valuation errors are minimised when the terminal value is based on future dividends with growth. In contrast, the benefit of extending the number of periods of forecast returns is more limited when adopting a residual income model, with relatively small reductions in valuation error when increasing the number of period future returns from one to as many as five. Furthermore, while there is a reduction in valuation errors when terminal values are included in the model, there is little difference in the performance of the model when constant future returns and growing future returns are included.

The results for valuations using the free cash flow valuation model are persistently poor and difficult to interpret. This is doubtless a consequence of the research design, which

is based on return measures taken directly from subsequent annual reports with free cash flow influenced by actual future period investments. This could be addressed by subjectively eliminating investments in growth from the measure of free cash flows, which would result in a measure that practitioners are likely to forecast. However, the basis on which this would be undertaken is not clear and would have introduced considerable subjectivity into return calculations. Accordingly, this was not pursued in this paper.

The first practical implication of these results is that with a residual income model there is no need for forecast returns as far into the future. Given that the difficulties of forecasting future returns increases materially as the forecast period increases, this is a significant advantage of the residual income model in firm valuation. The second practical implication of these results is that a terminal value based on a constant future return (or relatively low growth rates) can be used with the residual income model. This obviates the need to estimate an expected long-term growth rate, which is always problematic. It suggests that traditional discounted cash flow valuations should be supplemented with residual income model valuations when valuing firms where there are expectations of substantial long-term growth in sales and earnings.

A limitation of this study is that it does not consider the magnitude or nature of returns captured by the terminal value assumptions in the respective models. This is beyond the scope of the current paper. ●

## Notes

- 1 An exception would be Penman and Sougiannis (1998).
- 2 The dividend valuation model with this terminal value assumption is traditionally referred to as the Gordon Growth Model.
- 3 See Feltham and Ohlson (1995). Furthermore, EVA®, promoted by Stern Steward and Co, is a variant of the residual income model.
- 4 See Feltham and Ohlson (1995).
- 5 The risk free rate taken is the Reserve Bank of Australia cash rate as at 30 June 2000.
- 6 This is evidenced by valuation errors in excess of one.
- 7 A growth rate of 4% was adopted for dividend and free cash flow terminal value calculations, while a 2% growth rate was used for the residual income model. The lower rate was used for the residual income model as in competitive markets this should trend to 0.

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