Fundamental Valuation and Financial Statement Analysis

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Valuation: Dividend Discount Model

The dividend discount model of stock valuation implies that

$$p_t = \frac{\tilde{d}_{(t+1)} + p_{(t+1)}}{(1+\rho_E)} \qquad Eq.(1)$$

where p_{t+1} represents market value of the stock at time t+1, $\tilde{d}_{1+1}$ represents the forecast dividend at time t+1, ρ_E is the appropriate time non-varying discount rate used to capitalize the future stream of benefits to the stockholders.

$$p_{t+1} = \frac{\tilde{d}_{(t+2)} + p_{(t+2)}}{(1+\rho_E)}, \cdots, p_{t+\tau} = \frac{\tilde{d}_{(t+\tau+1)} + p_{(t+\tau+1)}}{(1+\rho_E)}$$

Iterating and replacing $p_{t+\tau}$ into Eq.(1) will produce the following dividend discount model for equity valuation.

$$p_t = \sum_{\tau=1}^{\infty} (1+\rho_E)^{-\tau} \tilde{d}_{t+\tau} \qquad Eq.(2)$$

For a going concern and given the estimate of the required rate of return, the formula requires forecasting dividends to 'infinity."

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Valuation: Dividend Discount Model

For a going concern and assuming no growth in dividend, the model solution will be as follows:

$p_o = \frac{\tilde{d}}{\rho_E}$. This is case of perpetual bond offering fixed income.

Information requirement is the amount of fixed dividend over infinite period.

Should there be a constant growth in dividend, the forecasting job is again simple and it involves forecasting next period dividend and growth rate in the future dividends.

$p_o = \frac{\tilde{d}_1}{\rho_E - \tilde{g}}$. Information requirement is complicated.

Should there be abnormal growth in dividends over time T and after than a constant-growth dividend, the model will look as follows:

$p_o = \sum_{t=1}^{T}(1+\rho_E)^{-t}\,\tilde{d}_{t+1} + (1+\rho_E)^{-T} E_t(\tilde{p}_T)$

Information requirement is further complex.

Is dividend payout is constant? What if management defers dividend payment to a future period? What if management combines cash dividend with stock dividend? Can we predict management's dividend policy?

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Valuation: Residual Income Valuation Model (1)

Consider the clean surplus relation that $B_t = B_{t-1} + x_t - d_t$.

A rearrangement of this clean surplus relation shows that the future dividend is tied to earnings after taxes and the evolution of book value of equity as follows:

$\tilde{d}_{t+\tau} = \tilde{x}_{t+\tau} - (\tilde{B}_{t+\tau} - B_{t+\tau-1})$

Following the clean surplus relation (CSR) and substituting $\tilde{d}_{t+\tau}$ by $\tilde{d}_{t+\tau} = \tilde{x}_{t+\tau} - (\tilde{B}_{t+\tau} - B_{t+\tau-1})$, it can be shown that

$P_t = \sum_{t=1}^{\infty} \rho_E^{-\tau}[\tilde{x}_{t+\tau} - (\tilde{B}_{t+\tau} - B_{t+\tau-1})]$

$P_t = \rho_E^{-1}(\tilde{x}_{t+1} - (\tilde{B}_{t+1} - B_t)) + \rho_E^{-2}(\tilde{x}_{t+2} - (\tilde{B}_{t+2} - B_{t+1}))$
$+ \rho_E^{-3}(\tilde{x}_{t+3} - (\tilde{B}_{t+3} - B_{t+2})) + \cdots\infty$

$P_t = B_t + \sum_{t=1}^{\infty} \rho_E^{-\tau}[\tilde{x}_{t+\tau} - (\rho_E - 1)B_{t+\tau-1}]$ $\quad Eq.(4)$

where P_t represents the value of the common equity at time t, B_t is the book value of the common equity, ρ_E is one plus the required rate of return for common equity, $\tilde{x}_{t+\tau}$ represents the expected comprehensive net income and $[\tilde{x}_{t+\tau} - (\rho_E - 1)B_{t+\tau-1}]$ represents the forecast residual income.

Let us denote this $\tilde{x}^R_{t+\tau}$.

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Valuation: Residual Income Valuation Model (2)

Since $\tilde{x}_{t+\tau} - (\rho_E - 1)B_{t+\tau-1} = \widetilde{ROCE}_{t+\tau} - (\rho_E - 1)]B_{t+\tau-1}$, it is shown that the forecast residual earnings depends on the forecast return on common equity and the book value of common equity $B_{t+\tau-1}$. Note that the variable $B_{t+\tau-1}$ is predetermined in the model and so weakly exogenous.

An assumption that after some terminal date T a going concern will earn a steady state firm-specific growth $(\bar{g}_i)$ in its profitability will produce the following model solution:

$$P_t = B_t + \sum_{\tau=1}^{\infty} \rho_E^{-\tau} \tilde{x}_{t+\tau}^R = B_t + \sum_{\tau=1}^{T} \rho_E^{-\tau} \tilde{x}_{t+\tau}^R + \rho_E^{-T} \cdot \frac{\tilde{x}_{(t+T+1)}^R}{(\rho_E - \tilde{g})}$$

For a business with no abnormal stream of earnings over the terminal period T, the model solution is

$$P_t = B_t + \frac{\tilde{x}_{(t+1)}^R}{(\rho_E - \tilde{g})}$$

For a business with no steady state growth in residual earnings after the terminal date *T*, the model solution will be simply

$$P_t = B_t + \sum_{\tau=1}^{T} \rho_E^{-\tau} \tilde{x}_{t+\tau}^R + \rho_E^{-T} \cdot \frac{\tilde{x}_{(t+T+1)}^R}{\rho_E}$$

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Valuation: Residual Income Valuation Model (3)

Thus the valuation job involves a reliable forecast of $\tilde{x}_{t+\tau}^R$ and $\tilde{g}$, that are respectively one period ahead forecast of residual earnings and growth in expected residual earnings. The term $\tilde{x}_{t+\tau} - (\rho_E - 1)B_{t+\tau-1}$ represents the expected residual earnings defined as the expectation of the comprehensive net income (CNI) minus the cost of common equity $(\rho_E - 1)B_{t+\tau-1}$.

Since $\tilde{x}_{t+\tau} - (\rho_E - 1)B_{t+\tau-1} = \widetilde{ROCE}_t - (\rho_E - 1)]B_{t+\tau-1}$, it is shown that the forecast residual earnings depends on the forecast return on common equity and the book value of common equity $B_{t+\tau-1}$. Note that the variable $B_{t+\tau-1}$ is predetermined in the model and so weakly exogenous.

It can be easily shown that

$$\widetilde{ROCE}_t = \widetilde{RNOA}_t + \text{Flev}_{it-1} \cdot \left(\widetilde{RNOA}_t - \widetilde{NBC}_t\right) \qquad (6.1)$$

$$\widetilde{RNOA}_t = \widetilde{ROA}_t + \text{Ollev}_{it-1} \cdot \left(\widetilde{ROA}_t - i_t\right) \qquad (6.2)$$

$$\widetilde{ROCE}_t = \widetilde{ROA}_t + \text{Tlev}_{it-1} \cdot \left(\widetilde{ROA}_t - \widetilde{TBC}_t\right) \qquad (6.3)$$

$$\widetilde{\text{RNOA}}_t = \frac{\text{NOI}_t}{\text{NOA}_{t-1}} = \frac{\text{NOI}_t}{\text{Sales}_t} \times \frac{\text{Sales}_t}{\text{NOA}_{t-1}}$$

$$= \widetilde{\text{PM}}_t \times \widetilde{\text{ATO}}_t \qquad (6.4)$$

The equations (6.1) through (6.4) identifies a set of derivers of ROCE and those can be employed to forecast future residual earnings.

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(RIV) Model: Identification of Financial Ratios

Thus the valuation job involves a reliable forecast of $\tilde{x}^{R}_{t+\tau}$ and $\tilde{g}$, that are respectively one period ahead forecast of residual earnings and growth in expected residual earnings. The term $\tilde{x}_{t+\tau} - (\rho_E - 1)B_{t+\tau-1}$ represents the expected residual earnings defined as the expectation of the comprehensive net income (CNI) minus the cost of common equity $(\rho_E - 1)B_{t+\tau-1}$.

Since $\tilde{x}_{t+\tau} - (\rho_E - 1)B_{t+\tau-1} = \widetilde{ROCE}_t - (\rho_E - 1)]B_{t+\tau-1}$, it is shown that the forecast residual earnings depends on the forecast return on common equity and the book value of common equity $B_{t+\tau-1}$. Note that the variable $B_{t+\tau-1}$ is predetermined in the model and so weakly exogenous.

It can be easily shown that

$$\widetilde{ROCE}_t = \widetilde{RNOA}_t + \text{Flev}_{it\text{-}1} \cdot \left(\widetilde{RNOA}_t - \widetilde{NBC}_t\right) \qquad (6.1)$$

$$\widetilde{RNOA}_t = \widetilde{ROA}_t + \text{Ollev}_{it\text{-}1} \cdot \left(\widetilde{ROA}_t - i_t\right) \qquad (6.2)$$

$$\widetilde{ROCE}_t = \widetilde{ROA}_t + \text{Tlev}_{it\text{-}1} \cdot \left(\widetilde{ROA}_t - \widetilde{TBC}_t\right) \qquad (6.3)$$

$$\widetilde{\text{RNOA}}_t = \frac{\text{NOI}_t}{\text{NOA}_{t\text{-}1}} = \frac{\text{NOI}_t}{\text{Sales}_t} \times \frac{\text{Sales}_t}{\text{NOA}_{t\text{-}1}}$$

$$= \widetilde{\text{PM}}_t \times \widetilde{\text{ATO}}_t \qquad (6.4)$$

The equations (6.1) through (6.4) identifies a set of derivers of ROCE and those can be employed to forecast future residual earnings.

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(RIV) Model: Forecasting Growth in Residual Income

Scenario 1: Constant RNOA
Growth Rate in Residual Earnings is growth rate in NOA.

Scenario 2: Constant RNOA, Constant PM and Constant ATO
Growth Rate in Residual Earnings is only forecast growth in Sales.

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Application of (RIV) Model: Coca Cola Company

Appendix. A valuation of the Coca-Cola Company based on historical cost information

At the close of trading on 8 December 2006, the Coca-Cola Company's shares traded at $48.91 each. The price-to-book ratio was 6.3, indicating a lot of value missing from the balance sheet, largely because US GAAP does not allow Coke's intangible (brand) assets to be booked to the balance sheet. The forward P/E was 19.3, based on analysts' consensus EPS forecast for 2007.
The following valuation yields a value of $49.09 per share using only information available in the historical cost financial statements. The valuation is crude (and can be refined), but the point is that we get close to the market price by using historical cost information and, indeed, with three line items.

The historical cost numbers
Here are the relevant line items for years 2002–2005 ($m):

	2005	2004	2003	2002
Sales (1)	21,962	21,044	19,656	17,545
Operating income, after tax (2)	5,065	4,427	4,192	3,841
Net operating assets (average) (3)	16,985	16,006	15,220	14,526

The financial statement analysis
From these line items, the following valuation inputs can be calculated:

	2005	2004	2003	2002
Operating profit margin (2 ÷ 1)	23.1%	21.0%	21.3%	21.9%
Asset turnover (1 ÷ 3)	1.29	1.31	1.29	1.21
Average operating profit margin	21.8%			
Average asset turnover	1.28			
Average sales growth rate, on a base of 2001 sales of $17,354m)	6.6%			

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Application of (RIV) Model: Coca Cola Company

The valuation model
We employ a standard residual income valuation model that calculates missing value in the balance sheet from a forecast of forward (2006) operating income:

$$Value\ of\ Equity_{2005} = Book\ Value\ of\ Equity_{2005} + \frac{Residual\ Income\ from\ Operations_{2006}}{Required\ Return - Growth\ Rate}$$

where

$$Residual\ Income\ from\ Operations_{2006} = Forecasted\ Operating\ Income_{2006} - (Required\ Return \times Net\ Operating\ Assets_{2005})$$

Only the residual income from operations is forecasted because residual earnings from interest on net debt are usually close to zero.

The forecast
As the book value of equity and net operating assets for 2005 are in the 2005 financial statements, we need only a forecast of operating income for 2006, the required return, and the growth rate for residual income.

- For the required return, we will use 10% which is approximately the current Treasury rate of 4.6% plus a risk premium of 5.4%.
- If both the profit margin and the asset turnover are constant, then residual operating income grows at the sales growth rate.[16] The condition is approximately satisfied for Coke, so we set the growth rate at the sales growth rate of 6.6%.
- The historical financial statements supply a forecast of operating income and residual operating income:

Forecasted sales for 2006	= Sales for 2005 x (1 + Average sales growth rate) = $21,962 x 1.066 = $23,411
Forecasted operating income for 2006	= Sales for 2006 x Average profit margin = $23,411 x 0.218 = $5,104
Forecasted residual operating income for 2006	= $5,104 – (0.10 x 17,113) = $3,392

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Application of (RIV) Model: Coca Cola Company

Appendix. A valuation of the Coca-Cola Company based on historical cost information (continued)

The valuation

With a 2005 book value of equity of $15,935, the calculated value with these inputs is

$$\textit{Value of Equity}_{2005} = \$15{,}935 + \frac{3{,}392}{0.10 - 0.066}$$

$$= \$115{,}700\text{m, or } \$49.09 \text{ per share}$$

The valuation is crude, by design, to make a point. It uses *only* information in the historical financial statements (plus as assumed required return). Yet is comes quite close to the market price of $48.91. Adding more information (about sales growth rates) and a different required return will change the valuation, but the historical cost financial statements yield considerable insights. Most importantly, it challenges the notion that one needs to have fair values on the balance sheet to value equity claims. Indeed, it is hard to see how fair value estimates of assets and liabilities would enhance the valuation.

In choosing Coca-Cola, I am of course being selective; not all firms are as easy to value as Coke. The historical cost information for a bio-tech start-up with no product yet out of R&D is not much use for valuation, for example. The financial reports would report losses and, possibly, negative book values. However, again, it is difficult to see how exit prices would redeem the accounting. Better for the analyst to get a biochemistry degree.

[16] See S. Penman, *Financial Statement Analysis and Security Valuation*. 3rd ed. (New York: The McGraw-Hill Companies, 2007), p. 523.

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