Accounting Based Valuation Formulae

James A. Ohlson[*]

1. Introduction

Equity valuation is a topic of great interest in practice and academia. The broad issue concerns the forecasting of future expected "payoffs" which are then converted to some intrinsic equity value via use of some discount-factor. In this context the word "forecasting" refers to a complex set of skills which are difficult to describe and even harder to teach, when implemented in a superior fashion. Academics have much more to say about how one identifies the appropriate "payoffs" and how these are fed into valuation formulae. Students typically encounter 3 approaches to valuation: The discounting of, (i) dividends, (ii) cash flows and, (iii) residual earnings.

Practitioners of equity valuation, often to the chagrin of academics, tend to rely on none of the above class-room techniques. As a core organizing principle they tend to focus instead on forward earnings and the growth in the subsequent expected earnings, i.e., the greater the growth, the great the price to forward earnings ratio. Exactly how such a relation actually reflects a valuation formula is more of a mystery, but it can be developed.

This paper will show, using a relatively little known but simple technique, how one unifies various equity valuation models. The framework will reconcile the cash flows and residual income approaches to the more fundamental dividends approach. Moreover, we will develop a formula that determines value on the basis of, (i) next-year expected *eps* /or "forward *eps*," (ii) short-term growth - year 2 vs. next-year - in *eps*, (iii) long-term growth in *eps* and finally, (iv) the discount factor which relates directly to cost-of-capital. We will argue that the last formula is useful as it connects with analysts' concepts of how to value equities.

2. The Valuation Attribute - A Quick Review

The theoretical starting point in equity valuation is the so-called PVED formula, i.e., PVED stands for the present value of expected dividends:

$$P_0 = \sum_{t=1}^{\infty} R^{-t} d_t$$

where

P_0 = the value of equity

$R = 1 + r > 1$ is the discount factor or 1 plus the cost-of-equity capital

$d_t =$ the expected dividend at date t.

The formula raises questions about the dividend policy. Who wants to forecast dividends if the dividend policy is irrelevant? Or, stated somewhat differently, should we not focus on the value creation rather than the value distribution? Finance text-books tend to deal with these questions by introducing the present value of "free cash flows" or FCF. Specifically, the formula is:

$$P_0 = -D_0 + \sum_{t=1}^{\infty} R^{-t} c_t$$

where

D_0 = the debt outstanding today

c_t = expected FCF, date t.

Text-book often motivates this scheme by the saying "cash is king!" As a practical matter, however, "cash" is a more ambiguous concept than one might think initially. And it is not so obvious that FCF reflects value-creation, a point that accountants surely appreciate.

To introduce accounting data as a valuation attribute, Financial Statement Analysis text-books generally introduce the so-called Residual Income Valuation, or RIV, formula:

$$P_0 = bv_0 + \sum_{t=1}^{\infty} R^{-t} RI_t$$

where

$RI_t = ear_t - r.bv_{t-1}$

bv_t = expected book value, date t

ear_t = expected earnings, date t.

Experienced practitioners who happen to get exposed to this formula do not generally react favorably when it is suggested to be a useful tool: Why the emphasis on book value? In other words, it is well to note that practitioners do not start with the current book value and then try to estimate the incremental value via a forecasting of future residual earnings. In other words, what is missing is the core principle: the growth in earnings should explain the price to forward earnings ratio.

To partially address the issue of growth in earnings, text-books generally develop the so-called constant growth formula:

$$P_0 = \frac{ear_1}{r-g} \times K$$

where

$ear_{t+1} = (1+g).ear_t$, $t \geq 1$, and the dividend payout is fixed according to $d_t = K.ear_t$.

But this approach is so obviously unsatisfactory that must be given short shrift. The dividend-policy is far too stringent. In addition, the same can be said for the requirement that there is one and only one growth-ratio. The near term is in this regard no different from the long term.

The state-of-the-art as described is not encouraging. What one would like to see is a unifying framework of equity-valuation, including the possibility of providing a model that shows how the growth in expected earnings explains the P_0/Ear_1 ratio, without placing unreasonable restrictions on the dividend policy. We will do so in the final part of the paper.

3. A General Framework for Equity Valuation

As always, we rely on PVED as a foundation. Thus the question becomes one of finding a scheme that gives equivalent representations, including PV of FCF and RIV.

The following scheme will prove to be exceedingly useful. Let $y_0, y_1, y_2, \ldots\ldots$ be any sequence of numbers, subject only to $y_t/R^t \to 0$ as $t \to \infty$ where the latter is merely a mild regularity condition. It follows immediately that

$$0 = y_0 + R^{-1}(y_1 - Ry_0) + R^{-2}(y_2 - Ry_1) + R^{-3}(y_3 - Ry_2) + \ldots\ldots$$

Adding this expression to PVED, one obtains

$$P_0 = y_0 + \sum_{t=1}^{\infty} R^{-t} z_t$$

where

$$z_t = y_t + d_t - R.y_{t-1}$$

In what follows, we have to keep in mind that the z_t - sequence depends directly on the y_t - sequence.

In applying the above mechanics, we put two central ideas into place. First, y_0 provides the starting-point in valuation. Second, we want to pick some accounting/economics constraint such that the z_t - sequence does *not* depend on the dividend policy. The last point is subtle: It allows us to shift the analysis away from the distribution of wealth to the creation wealth.

Next, we show how one applies the framework to the FCF and RIV approaches:

A. FCF

Put $y_t = -D_t =$ the negative of the expected debt at date t. Assume further that the debt incurs an interest expense according to the equation $int_t = rD_{t-1}$.

We partition activities into operating and financial activities. Thus, the balance sheet and the income statements can be summarized by

$$bv_t = oa_t - D_t$$
$$ear_t = opear_t - int_t$$

where

$oa_t =$ operating assets net of operating liabilities, date t

$opear_t =$ earnings due to operations, date t

Let

$$c_t \equiv d_t + int_t - \Delta D_t$$

Or, equivalently, per text-books,

$$c_t = opear_t - \Delta oa_t$$

Assume that the clean surplus relation holds, i.e., $\Delta b_t = ear_t - d_t$.

With respect to z_t, one obtains

$$z_t \equiv -D_t + d_t - R.D_{t-1}$$
$$= int_t + d_t - \Delta D_t$$
$$= c_t$$

Thus, we have identified the assumptions that equate the PVED approach to the FCF approach. Importantly, if one further assumes, reasonably, that the operating activities do not depend on the dividend policy - i.e., net borrowings can always finance a change in the dividend-policy, then z_t does *not* depend on the dividend policy.

B. RIV
In this case put

$$y_t = bv_t$$

so that

$$z_t \equiv bv_t + d_t - R.bv_{t-1}$$

Given clean surplus, it follows immediately that

$$z_t = ear_t - r.bv_{t-1},$$

i.e., the PVED and RIV are identical representations of value. And, again, under the same assumption as in the previous case (FCF), z_t will *not* depend on the dividend policy.

We next provide the scheme that focuses on forward earnings and their subsequent growth. I will refer to this approach as the Abnormal Earnings Growth (AEG) model.

C. AEG
In this case put

$$y_t = ear_{t+1} / r$$

so that

$$z_t = \frac{1}{r}\left(ear_{t+1} + r.d_t - R.ear_t\right)$$

$$= \frac{1}{r}\left(\Delta ear_{t+1} - r.(ear_t - d_t)\right)$$

One interprets $r.z_t$ as the expected increment in earnings, adjusted for expected earnings forgone due to the distribution of dividends. And, just like residual earnings, for a savings account $z_t = 0$, regardless of the dividends. More generally, one sees that under two reasonable assumptions, $\partial ear_{t+1} / \partial d_t = -r$ and $\partial ear_t / \partial d_t = 0$, does not depend on the dividend policy.

This framework would seem to be much more attractive that the RIV formula in that it focuses on next-period expected earnings, and their subsequent growth (adjusted for dividends) consistent with *analysts'* view of the world. We believe that RIV will never achieve the status of a premier valuation framework because it focuses, in essence, on the current book value and its subsequent growth as expressed by $z_t = bv_t + d_t - R.bv_{t-1}$. Earnings and their growth is the name of the game, not book values and their growth. It is really that simple!

4. A Parameterized Version of the Abnormal Earnings Growth Model

The formula related to earnings becomes more powerful if one adds an assumption. Specifically, consider:

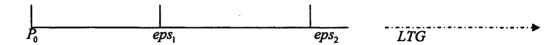$$z_{t+1} = \gamma z_t, \quad t \geq 1$$

where $\gamma \geq 1$ is some presumed growth parameter. The dynamic must also presume some initialization $z_1 > 0$. The case $z_1 = 0$ is of modest interest since it follows that $P_0 = ear_{t+1} / r$.

With these assumptions in place one obtains a formula that expresses value in terms of:

- eps_1 : Next-year expected or "forward eps."
- Year 2 vs. Year 1 growth (STG) in expected eps.
- A measure of long-term growth (LTG) in expected eps.
- Discount factor which reflects risk (Cost of Equity Capital).

Thus the investors' vision of the future is given by:

Some reasonably straightforward algebra results in the valuation formula

$$P_0 = \frac{eps_1}{r} \times \left[\frac{g_s - g_L}{r - g_L} \right]$$

where

r = cost of capital

$$g_s = \frac{eps_2 - eps_1}{eps_1} + \frac{r \times dps_1}{eps_1}$$

and

$$g_L = \frac{eps_t - eps_{t-1}}{eps_{t-1}} \quad \text{as} \quad t \to \infty \quad \text{(assuming full payout)}$$

Note that the correction to the short-term growth in eps, namely the term $r \times dps_1 / eps_1$ is typically small compared to $\Delta eps_2 / eps_1$. This term reflects the foregone year 2 earnings due to the distribution of wealth at the end of year 1.

In the very long run one can expect all firms to be identical. Hence, one can reasonably suggest that g_L is the same for all firms and the quantity will approximate the steady state growth of GNP such as 3-4%.

Every valuation formula leads to the familiar problem that the discount factor is not a "known quantity." Because of this somewhat grim reality, practical analysis engages in "reverse engineering." That is, one can take the current equity value, P_0, as a given and

solve for r. In the present case one obtains the following square root formula:

$$r = A + \sqrt{A^2 + \frac{eps_1}{P_0} \times \left(\frac{\Delta eps_2}{eps_1} - (\gamma - 1) \right)}$$

where

$$A \equiv \frac{1}{2}\left(\gamma - 1 + \frac{dps_1}{P_0} \right)$$

and

$$1 \leq \gamma < R$$

I believe this formula will be useful in practice and research. Specifically, serves as an indicator of the following possibilities:

(i)   A firm's risk

(ii)   An indication that eps_1 is not what the market really believes in pricing the security. That is if r is high - which makes the stock look "cheap" - then, eps_1 will be revised downward in the near future

(iii)   A firm's equity is mispriced and thus it potentially leads to an attractive investment opportunity.

More generally, I note that the valuation approach that focuses on earnings and their subsequent expected growth has a number of attractive features. Simple assumptions result in a formula expressing value as a function of four variables: (i) next year estimated *eps* (ii) short term *eps* growth (iii) long term *eps* growth and (iv) cost of capital. The valuation formula is easy to implement using *eps* forecasts. The valuation implies that P_0 / eps_1 increases if (i) short-term *eps* growth increases (ii) long-term *eps* growth increase and (iii) the cost-of-capital decreases. The valuation formula allows short-term *eps* growth to exceed cost-of-capital. The valuation formula is consistent with the fact that the P_0 / eps_1 ratio generally exceeds the inverse of the cost-of-capital. The "square-root" formula derives a firm's expected market return; it depends only on (i) P_0 / eps_1, (ii) the dps_1 / P_0 ratio, (iii) short-term *eps* growth and, (iv) long-term *eps* growth.