Book values in company valuation

The article by Miller & Modigliani, “Dividend policy, growth and the valuation of shares”, *Journal of Business*, October 1961 (MM) emphasises the role of earnings and investment in valuation. More recently Ohlson has developed a model of valuation which gives a role to the book value of assets.

This is important for a number of reasons:

- In the Fama-French models of security pricing the book to market ratio plays an important role;

- The framework for reporting the performance of companies adopted by most accounting regulators (such as FASB, IASC and ASB) is heavily related to assets and liabilities, rather than earnings. For example, in the ASB Draft Statement of Principles (March 1999) the first two items mentioned in the list of elements, or building blocks, of financial statements are assets and liabilities (ch 4). If such items are so important, it is essential to know how they affect the valuation of the company.

Although Ohlson’s ideas were initially explored in a number of working papers, the first journal article was published in 1990:

Ohlson, “A synthesis of security valuation theory and the role of dividends, cash flows and earnings”, *Contemporary Accounting Research*, 1990, 648-676

Ohlson starts with the PV of dividends model, just as Miller-Modigliani do. Also, there is no treatment of risk, just as in MM; the assumption of risk neutrality is made. What distinguishes the Ohlson model from the MM one is that there is a clearer link with accounting numbers. In particular, the book value of assets has a key place in the Ohlson model.

1. Building blocks

There are a number of building blocks.

- The value of the company is determined by the present value of dividends

- R is used for the discounting factor and is defined as $(1 + R_f)$

Therefore $P_t \quad = \quad R^{-1}.d_{t+1} + R^{-2}.d_{t+2} + R^{-3}.d_{t+3} + R^{-4}.d_{t+4} + ...$ Equation (1)

where

P_t = the price of the company at time t, and
d_{t+j} = the expected dividend to be paid at time t+j, j=1 ... ∞
R = $1 + R_f$
R_f = the return on the riskless (or zero beta) asset

- Clean surplus accounting

One of the key ideas behind Ohlson's model is that all gains made by the company go through the profit and loss account. That is, there is no reserve accounting. If this is the case, then the book value of assets at t is equal to

$$b_t = b_{t-1} + x_t - d_t \qquad \text{Equation (2)}$$

where

b_t = the book value of assets at t

x_t = earnings at t

This means that earnings is equal to the change in the book value of the assets + any dividends paid out

$$x_t = b_t - b_{t-1} + d_t$$

- Residual income

$$x^a_t = \text{residual income}$$

$$= x_t - (R_f \,.\, b_{t-1}) \qquad \text{Equation (3)}$$

Residual income is defined as current earnings less the required rate of return on the previous period's book value of assets. This is very similar to the concept of abnormal profits in standard microeconomics and is used extensively in the divisional performance literature.

2. The valuation model

Given these building blocks we can now specify the value of the company.

From the clean surplus relation (equation 2), we know that

$$d_t = x_t - b_t + b_{t-1} \qquad \text{Equation (4)}$$

From the residual income (equation 3) we know that

$$x_t = x^a_t + (R_f \,.\, b_{t-1}). \qquad \text{Equation (5)}$$

If we insert equation (5) into the dividend definition we get

$$d_t = x^a_t + (R_f \,.\, b_{t-1}) - b_t + b_{t-1} = x^a_t + R.b_{t-1} - b_t \qquad \text{Equation (6)}$$

Equation (1) is

$$P_t \quad = \quad R^{-1}.d_{t+1} + R^{-2}.d_{t+2} + R^{-3}.d_{t+3} + R^{-4}.d_{t+4} + \ldots\ldots \qquad \text{Equation (1)}$$

Since

$$\begin{aligned}
R^{-1}.d_{t+1} &= R^{-1}\,[\,x^a_{t+1} + R.b_t - b_{t+1}\,] &&= R^{-1}.x^a_{t+1} + b_t - R^{-1}.b_{t+1} \\
R^{-2}.d_{t+2} &= R^{-2}\,[\,x^a_{t+2} + R.b_{t+1} - b_{t+2}\,] &&= R^{-2}.x^a_{t+2} + R^{-1}.b_{t+1} - R^{-2}.b_{t+2} \\
R^{-3}.d_{t+3} &= R^{-3}\,[\,x^a_{t+3} + R.b_{t+2} - b_{t+3}\,] &&= R^{-3}.x^a_{t+3} + R^{-2}.b_{t+2} - R^{-3}.b_{t+3} \\
R^{-4}.d_{t+4} &= R^{-4}\,[\,x^a_{t+4} + R.b_{t+3} - b_{t+4}\,] &&= R^{-4}.x^a_{t+4} + R^{-3}.b_{t+3} - R^{-4}.b_{t+4}
\end{aligned}$$

etc..

P_t may be expressed as follows:

$$\begin{aligned}
P_t \quad = \quad & R^{-1}.x^a_{t+1} + b_t - R^{-1}.b_{t+1} \\
+ \quad & R^{-2}.x^a_{t+2} + R^{-1}.b_{t+1} - R^{-2}.b_{t+2} \\
+ \quad & R^{-3}.x^a_{t+3} + R^{-2}.b_{t+2} - R^{-3}.b_{t+3} \\
+ \quad & R^{-4}.x^a_{t+4} + R^{-3}.b_{t+3} - R^{-4}.b_{t+4} \\
+ \quad & \text{etc..}
\end{aligned}$$

All the items in the third column cancel out with items in the second column, leaving only b_t. In the second column. The price of the company is then the book value of the assets plus the discounted stream of future abnormal returns (residual income):

$$P_t \quad = \quad b_t + R^{-1}.x^a_{t+1} + R^{-2}.x^a_{t+2} + R^{-3}.x^a_{t+3} \;\; R^{-4}.x^a_{t+4} \ldots\ldots \qquad \text{Equation (7)}$$

3. The relationship between Ohlson's model and MM

Equation 7 is the Ohlson model based on the present value of dividends, but with the added assumption of clean surplus accounting (all changes in wealth go through the profit and loss account).

The MM model in equation 8 is different and emphasises sustainable cash flow from existing assets (the first term) and also from future assets (the second term):

$$V_0 \quad = \quad \frac{X_0}{r} \quad + \quad \sum_{t=0}^{t=\infty} \left\{ \frac{(r^* - r)I_t}{r. \quad (1+r)^{t+1}} \right\} \qquad \text{Equation (8)}$$

It should be noted however, that the assumptions of MM are different from those of Ohlson, in two respects:

- In MM, there are no accounting assumptions. Indeed there is no mention of accounting at all. It is a conjecture that the term X_0, the sustainable cash from existing capital, is similar to accounting earnings.

- In MM there is an economic assumption that capital generates yields in perpetuity. Once capital is invested (either current capital or future capital) then the returns are fixed in perpetuity. In this sense, the MM model is optimistic.

In Ohlson , there are no economic assumptions about how cash flows will be generated over time, simply that whatever returns are generated, they are captured by the profit and loss account. The Ohlson model is then quite attractive since it gives book value a role in valuation without placing any economic assumptions on the cash flows.

However, the price to be paid for this is the second part of the model, the discounted stream of future residual income. What are these terms? What sense can we make of them? This issue is called the information dynamics issue, because we need to find current information which can be used to estimate future residual income. This is discussed next.

4. Information dynamics

I - RESIDUAL INCOME AS A RANDOM WALK

Different writers use different assumptions about the information dynamics. However, a popular one is that abnormal returns follow a random walk:

$$x^a_{t+1} \quad = \quad x^a_t + v_{t+1}$$

This is an optimistic assumption, since economic intuition suggests that excess returns are eventually eliminated, whereas a random walk is a non stationary series. If abnormal returns are specified as a random walk there is no tendency for them to go to zero over time. However, the specification is attractive because it gives simple mathematical solutions; one of its properties is that, at time t, the expected residual income for all future periods is the current value, x^a_t. That is:

$$E_t[\, x^a_{t+j} \,] \quad = \quad x^a_t \qquad\qquad \text{for } j = 1,2,3 \ldots.$$

From equation (7), this gives the expected price as:

$$P_t \quad = \quad b_t + R^{-1}.x^a_{t+1} + R^{-2}.x^a_{t+2} + R^{-3}.x^a_{t+3} \;\; R^{-4}.x^a_{t+4} \ldots.. \qquad \text{Equation (7)}$$

$$P_t \quad = \quad b_t + R^{-1}.x^a_t + R^{-2}.x^a_t + R^{-3}.x^a_t \;\; R^{-4}.x^a_t \ldots..$$

$$= \quad b_t + x^a_t \,/\, R_f \qquad \text{(the residual can be summed as a geometric series)}$$

which from the definition of residual income in equation (3)

$$= \quad b_t \;+\; [x_t \,/\, R_f] \;-\; b_{t-1}$$

$$= \quad [x_t \,/\, R_f] \;+ [b_t \;-\; b_{t-1}] \qquad \text{Equation (9)}$$

This equation is the value of the company in the Ohlson model when residual income is a random walk; we shall refer to it as Ohlson-RW. It gives the price of company as the discounted current earnings + the change in book value from the previous period.

Curiously enough the first term in Ohlson-RW looks very similar to the first term in MM (equation 8) the value of the company from its existing assets. The only difference is that the term X_0 in MM is next year's earnings whereas the term x_t in Ohlson-RW is *this year's* earnings.

Therefore the second term of Ohlson-RW, the change in book value ($b_t - b_{t-1}$), can be seen as an estimate of value from future assets (the second component of MM), since both valuation equations are derived from the discounted dividend model.

In fact this result is quite informative. Recall that equation 9 is an optimistic version of Ohlson, since abnormal profits do not tend to zero. And yet, the equation is still likely to give lower estimates of company value than the MM model. Comparing the change in book value in Ohlson-RW with the second term of the MM model (the excess profits from future assets), it seems likely that MM model will give a larger value for the company. The discounted excess profits from all future investments are likely to be larger than just the change in the book value of assets in one period.

This means that whilst the random walk version of Ohlson is optimistic, the MM model is "super optimistic"! This makes sense; if a series is a random walk, then next period's value can be larger or smaller than the current value (and both are equally likely). In the MM model, excess profits (and losses for that matter) go on for ever.

II - Ohlson's information dynamics

So far, we have viewed Ohlson's contribution as simply a rearrangement of the terms in the dividend discount model. However, it is more than that. He also suggests how the terms of his valuation equation (equation 7) will behave. This is as follows

$$x^a_{t+1} = \omega x^a_t + v_t + e_{1,t+1}$$

$$v_{t+1} = \gamma v_t + e_{2,t+1}$$

where

$e_{i,t+1}$ are zero mean disturbances

v_t is the information about future abnormal earnings which is not contained in current abnormal earnings

ω and γ fixed parameters, which are non negative and less than unity.

When this model of information dynamics is combined with equation 7, the price of the share is given by:

$$P_t = b_t + \alpha_1 x^a_t + \alpha_2 v_t$$

where

$$\alpha_1 = \omega / (1 + R_f - \omega)$$

$$\alpha_2 = (1 + R_f) / [(1 + R_f - \omega)(1 + R_f - \gamma)]$$

This gives an equation for share price which can be estimated from current information. Of course, a key question is “how realistic is this specification of the information dynamics and how does this model compare with the prediction of perpetuity models like the MM one?” This is discussed briefly next.

III - HOW VALID ARE PERPETUITIES?

Both Ohlson and MM models are derived from the discounted dividend model. They differ only in the assumptions they make. So one obvious question is how well do they each predict actual company values. This is investigated at length in two papers:

- Dechow, Hutton and Sloan (1999), “An empirical assessment of the residual income valuation model”, Journal of Accounting & Economics, 26/1-3 January,1-34.

- Myers (1999), “Implementing residual income valuation with linear information dynamics”, Accounting Review, 74/1 January, 1-28

Both papers find that the residual income approach tends to understate company valuations. The Dechow et. al. paper further finds that Ohlson’s model provides only a minor improvement over the perpetuity approach(such as the MM one) in explaining stock prices. But why might perpetuities work in practice; surely excess returns made by companies are eventually competed away?

One answer might be that the stock market overestimates company value.

Another might be that the pace of competition is slow and therefore, given that future cash flows are discounted, the eventual erosion of competitive advantage is not a significant component of company valuation.

Yet another is that whilst the cash flows from individual projects are themselves subject to decline from competitive forces, an important function of managers is to seek to replace declining projects with those that are on the upswing of their product life cycle.