Calculating the Intrinsic Value of a Company

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Abstract

Buying stock of a company is equivalent to becoming part-owner in the company. Determining if the price is "right" can, in some cases, be reduced to simple calculations for valuating the entire company. The realities of economies and the markets can often throw such calculations off, but, quoting Warren Buffett, "It's better to be approximately right than precisely wrong."

The Math

Let *cash flow* (CF) be the total of net income plus non-cash charges (depreciation, amortization, and depletion) minus preferred dividends (if any.) *Free cash flow* (FCF) is CF minus capital expenditures, it's essentially the money the company can return to shareholders without affecting its ability to operate.

For companies with steady FCF we can predict the FCF growth rate g_1 for y_1 years (stage-1) after which we can adapt a conservative terminal growth rate g_t in line with GDP growth (stage-2.)

If we think of a company as a FCF generating machine, we can value it by summing its predicted future FCFs. Because of the time value of money, we have to discount the FCFs by some discount rate r_d when calculating their present value.

Let

$$
\begin{aligned}
&f_p = \text{current FCF}\\
&v_p = \text{present value}\\
&v_f = \text{future value}\\
&r = \text{annual growth rate expressed in decimal form}\\
&y = \text{number of years}\\
&g_1 = \text{annual growth rate for stage-1 expressed in decimal form}\\
&y_1 = \text{number of stage-1 growth years}\\
&g_t = \text{annual growth rate for stage-2 expressed in decimal form (terminal growth)}\\
&r_d = \text{annual discount rate expressed in decimal form}\\
&FutureValue(v_p, r, y) = v_p(1+r)^y\\
&PresentValue(v_f, r, y) = \frac{v_f}{(1+r)^y}\\
&GeometricSeries(a, r, m, n) = \sum_{k=m}^{n} a(1+r)^k\\
&\qquad = \begin{cases} a(n-m+1) & \text{if } r = 0,\\ a\frac{r^{n+1}-r^m}{r-1} & \text{if } r > 0. \end{cases}
\end{aligned}
$$

then the present value of the stage-1 FCF is

$$v_{p1} = GeometricSeries(f_p, \frac{1+g_1}{1+r_d}, 1, y_1)$$

the future value, at the end of stage-1, of the stage-2 FCF is

$$v_{f2} = FutureValue(f_p, g_1, y_1)\frac{1+g_t}{r_d - g_t}$$

the present value of the stage-2 FCF is

$$v_{p2} = PresentValue(v_{f2}, r_d, y_1)$$

finally, the present value of the sum of the stage-1 and stage-2 future FCFs is

$$v_{p1} + v_{p2} = \begin{cases} f_p \frac{\left(\frac{1+g_1}{1+r_d}\right)^{y_1+1} - \frac{1+g_1}{1+r_d}}{\frac{1+g_1}{1+r_d} - 1} + f_p \frac{(1+g_1)^{y_1} \frac{1+g_t}{r_d-g_t}}{(1+r_d)^{y_1}} & \text{if } r_d > g_t \text{ and } g_1 \neq r_d,\\ f_p \cdot y_1 + f_p \frac{(1+g_1)^{y_1} \frac{1+g_t}{r_d-g_t}}{(1+r_d)^{y_1}} & \text{if } r_d > g_t \text{ and } g_1 = r_d,\\ \infty & \text{if } r_d \leq g_t \end{cases}$$

Adding Assets and Subtracting Liabilities

The valuation formula can not be applied blindly. What if a company has zero liabilities along with $30 billion of cash in the bank and loses two million dollars a year? it's certainly worth a lot more than the valuation formula would suggest. What if a company has two million dollar per year FCF but a very unappetizing $30 billion debt liability?

There are various opinions on how to incorporate assets and liabilities into the valuation. My preference is to add the *cash* assets and subtract the *total debt* to the discounted cash flow valuation. Often, it is necessary to also add other "hard" assets the company has. For example, large oil companies have substantial assets in the form of proved oil reserves in the ground.