University of Richmond
Robins School of Business™

Stock Valuation

FIN 360: Principles of Financial Management

Common Stock Valuation

Much like we've seen with the valuation of projects and bonds, we can determine the value of a share of common stock using time value of money and present value techniques.

Yet, determining the value for a share of common stock is challenging in that the cash flows to which stocks are entitled to receive are not guaranteed like the cash flows for bonds (dividends vs. coupon payments). Further, there is no "maturity". But the intuition remains the same: *the security's value is determined by the cash flows the security is entitled to receive.*

The Dividend Discount Model

The **Dividend Discount Model (DDM)** equates the **intrinsic value** or "true" value of a stock to the present value of all future dividends paid to the stockholder of that stock. We'll consider multiple cases:

I. Dividends over a discrete period (one → many)
II. Constant dividend growth
III. Multistage growth (begins as I., then becomes II.)

I. Dividends over a discrete period

Recall the present value of a future cash flow in one period is:

$$PV = \frac{FV}{(1+r)^t}$$

Let's say we own a share of common stock that will pay us a \$10 dividend in one year. Once we collect that dividend in one year, we will immediately sell the stock. Based on our economic and market forecasts, we think the stock will be selling for \$70 at that time. Given this stock is relatively risky, we have a **required return** of 25%. How much is this stock worth today?

$$PV = \frac{FV}{(1+r)^t} = \frac{10+70}{(1+0.25)^1} = \$64$$

Or, $\boxed{\textbf{N}}$ = 1, $\boxed{\textbf{FV}}$ = 10 + 70, $\boxed{\textbf{I/Y}}$ = 25, <$\boxed{\textbf{CPT}}$> $\boxed{\textbf{PV}}$ = -64

This stock, given our dividend, time period, and required rate of return assumptions, is worth $64 today.

We can rewrite the formula as:

$$V_0 = P_0 = \frac{D_1 + P_1}{(1+k)^t}$$

Where:

V_0 = the estimate of the intrinsic value of the share

P_0 = the price of the share

D_1= the dividend at the end of the period

P_1 = the estimate of the price you can sell the stock for in the future

k= the required rate of return

t= the number of discount periods

If we wanted to hold this stock for three years, selling it at a forecasted $90 at that time, assuming the stock pays dividends of $10, then $11, then $12 over the next three years:

$$V_0 = P_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3 + P_3}{(1+k)^3}$$

$$V_0 = P_0 = \frac{10}{(1+0.25)^1} + \frac{11}{(1+0.25)^2} + \frac{12+90}{(1+0.25)^3} = \$67.264$$

Or, $\boxed{\textbf{CFo}}$ = 0, $\boxed{\textbf{C01}}$ = 10, $\boxed{\textbf{C02}}$ = 11, $\boxed{\textbf{C03}}$ = 102, $\boxed{\textbf{I}}$ = 25, <$\boxed{\textbf{CPT}}$> $\boxed{\textbf{NPV}}$ = $67.264

By market efficiency, Price = Value. If we find price < value, there is a potential buying opportunity. The shares are **undervalued** by market participants. If we find price > value, perhaps the shares should be sold. The shares may be **overvalued** by market participants.

We can expand this formula for as many periods as we like:

$$V_0 = P_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \cdots + \frac{D_t + P_t}{(1+k)^t}$$

Which simplifies to

$$V_0 = P_0 = \sum \frac{D_t}{(1+k)^t}$$

Implying that the value of stock today is equal to the present value of all future dividends.

Where's P_t? By the formula above, notice that the value of a stock is the infinite sum of the dividends a stock pays. The stock's price in the future doesn't appear in the formula. This does not imply that the stock's future price doesn't matter. The stock price at any point in time is, *itself*, the sum of all the future dividends. Thus, the stock price in the future is *embedded* in the formula above.

II. Constant Dividend Growth

If a firm pays a dividend that is not fixed or constant, but grows at a constant growth rate *g*, we may determine the value of the shares as:

$$V_0 = P_0 = \frac{D_0(1+g)}{k-g} = \frac{D_1}{k-g}$$

We divide the dividend in the *next period* by the required rate of return minus the growth rate. This method is known as the **Gordon Growth Model**, after Professor Myron Gordon.

For example, if a firm *just paid* a dividend of $10, and it expects to grow that dividend at 3% forever, assuming a discount rate of 15% implies the stock is worth:

$$V_0 = P_0 = \frac{D_0(1+g)}{k-g} = \frac{D_1}{k-g} = \frac{10 \times 1.03}{0.15 - 0.03} = \frac{10.30}{0.15 - 0.03} = \$85.83$$

> Note that in the Gordon Growth Model, you use the *next* dividend paid, not the most recent dividend in the numerator. If given the dividend just paid, you must compute the dividend in the *next* period.

III. Multistage Growth

In practice, common stock valuation usually combines the method shown in **I.** with the method shown in **II.** That is, the financial analyst will forecast the dividends for the near term, and then assume some constant growth rate into the future thereafter. Begin with the formula from **I.**:

$$V_0 = P_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3 + P_3}{(1+k)^3} \tag{1}$$

At time 3, we can assume that dividends will begin to grow at a constant rate. Using the Gordon Growth Model from **II.**, we know that:

$$P_0 = \frac{D_1}{k-g} \tag{2}$$

Implying that at time period 3,

$$P_3 = \frac{D_3(1+g)}{k-g} = \frac{D_4}{k-g} \tag{3}$$

Putting it all together, we plug in Equation (3) into Equation (1) to get:

$$V_0 = P_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3 + \frac{D_4}{k-g}}{(1+k)^3}$$

PRACTICE: You forecast T. Rowe Price, a financial services firm, will pay dividends of \$6, \$7.50, \$9.40, and \$11.72 over the next four years, at which point they will grow their dividends at 3% forever. Assuming a discount rate, or **required rate of return** given your perception of T. Rowe Price's risk, of 12%, how much are these shares worth? T. Rowe shares currently trade for about \$109 in markets, so should you buy or sell these shares based on your calculation?

SOLUTION: We have the formula

$$V_0 = P_0 = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \frac{D_4 + \frac{D_5}{k-g}}{(1+k)^4}$$

$$V_0 = P_0 = \frac{\qquad\qquad}{\qquad\qquad} + \frac{\qquad\qquad}{\qquad\qquad} + \frac{\qquad\qquad}{\qquad\qquad} + \frac{\qquad\qquad + \qquad\qquad}{\qquad\qquad\qquad\qquad\qquad\qquad}$$

Or, $\boxed{\text{CFo}}$ = , $\boxed{\text{C01}}$ = , $\boxed{\text{C02}}$ = , $\boxed{\text{C03}}$ = , $\boxed{\text{C04}}$ = , $\boxed{\text{I}}$ =

<$\boxed{\text{CPT}}$> $\boxed{\text{NPV}}$ =

INTERPRETATION: We computed that these shares are worth _____________, but they trade in markets for \$109. By our calculations, these shares are **undervalued**/**overvalued** in markets, and we should **buy**/**sell** them. In perfectly efficient markets, we would expect the intrinsic value and price to be the same.

Valuation by Comparables

About 50% of publicly traded companies do not pay dividends. For these firms, financial analysts may employ a market-based approach to determine the value of the firms' common stock. A popular approach is determining a stock's **implied price** based on the average or median **price-to-earnings (PE) ratio** in its industry (or of comparable companies) multiplied by the firm's own **earnings per share (EPS)**.

$$Implied\ Price = Industry\ PE\ Ratio \times Firm's\ EPS$$

recalling that

$$PE\ Ratio = \frac{Price\ Per\ Share}{Earnings\ Per\ Share} = \frac{Price\ Per\ Share}{Net\ Income/Shares\ Outstanding}$$

Example: Assume a firm does not pay dividends, and its EPS over the last year was \$2. The average PE ratio in its industry is 30, meaning on average the firms in its industry trade at "30 times earnings." This firm's implied price is:

$$Implied\ Price = 30 \times 2 = \$60$$

The firm's stock should trade around \$60. The stock may be under (over) valued if you can buy for less (more) than \$60.

In practice, investors and financial analysts use *many* approaches, including the DDM and valuation by comps, to estimate the true or **intrinsic value** of a share. These methods don't always "agree" with one another, and different analysts can arrive at different answers if their inputs and assumptions in their models differ. Stock valuation is as much of an art as it is a science!

Required Rate of Return

To this point, we have assumed discounting dividends at a **required rate of return**, or the return investors require from an investment in order for them to commit money, given the investment's level of risk. The higher the risk, the higher the required return.

One way in which we can determine the required rate of return is to rearrange the formula:

$$P_0 = \frac{D_1}{k-g} \quad \rightarrow \quad k = \frac{D_1}{P_0} + g$$

That is, the return we "require" of a stock is a function of the stock's expected **dividend yield**, D_1/P_0, and **capital gains yield** g, or expectation of the growth in the security's price.

> Think about the return an investment provides or "delivers" through its dividends and its capital gains as the return we as investors "require" of the security. If the stock is risky, investors will pay *less* for it such that its potential gain g is greater.

THE CAPITAL ASSET PRICING MODEL

We can also determine the required rate of return by using a formula known as the **Capital Asset Pricing Model**, or **CAPM**. The expected return on a stock, and therefore our required return is:

$$E(R) = k = r_f + \beta(E(R_M) - r_f)$$

where

r_f is the **risk-free** rate of return, or the yield on 90-day T-bills.

$E(R_M)$ is the **expected return of the stock market** overall, which has averaged about 8-12% per year.

β is a stock's **beta**, a measure of the stock's risk.

We can find the current **risk-free rate** on the St. Louis Fed's FRED website: https://fred.stlouisfed.org/series/TB3MS. The **expected return of the market** can be estimated based on market research, forecasts, and projections, keeping in mind that historically the market overall returns about 8-12% per year, and is on average about 5% more than the risk-free rate.

Beta tells us how much a stock moves *relative* to the market overall. You multiply a stock's beta by the expected return of the market to get an estimate of what a stock returns given the market return.

EXAMPLE: Below are betas of popular stocks, which you can find on websites like www.finance.yahoo.com and www.finviz.com:

Stock	Beta
Allstate	0.59
Citigroup	1.60
Morgan Stanley	1.35

Historically and on average:

- If the market goes up (down) 1%, Allstate stock goes up (down) 0.59%.
- If the market goes up (down) 1%, Citigroup stock goes up (down) 1.60%.
- If the market goes up (down) 1%, Morgan Stanley stock goes up (down) 1.35%.

The average beta of the market is 1, with typical stock betas between 0 and 2. Therefore, stocks with betas greater than (less than) 1 "swing" with greater (less) magnitude than the market overall. Stocks with betas near zero don't appear to be correlated with the market, while stocks with betas less than zero (which are rare) move in the *opposite direction* of the market. We'll return to a more formal definition of beta later.

PRACTICE: Given the betas above, determine the appropriate discount rate to use in these stocks' DDMs by the CAPM. Assume the yield on 90-day T-bills is 4% and that you forecast the market overall will return 10% this year.

SOLUTION: Given the CAPM formula

$$E(R) = k = r_f + \beta(E(R_M) - r_f)$$

the required rate of return to use in Allstate's dividend discount model if you wished to value Allstate's shares would be:

$$E(R) = k = r_f + \beta(E(R_M) - r_f)$$
$$E(R) = k = 0.04 + 0.59(0.10 - 0.04) = 7.54\%$$

For Citigroup:

For Morgan Stanley:

INTERPRETATION: The CAPM produces an expectation of what a stock should return, *given its level of risk*. We can therefore use these values in the dividend discount model as an appropriate discount rate *k* for each stock to compute the intrinsic value for each share. Notice that the higher the beta, the greater the risk and expected return, all else equal.

For additional practice and a DDM calculator, see the Excel file *Dividend Discount Model* at www.josephfarizo.com/fin360.html.

Closing Thoughts

Stock prices reacting to information in efficient markets is the result of millions of traders and investors interpreting information and recomputing appropriate valuations for securities. Investors then buy and sell on their information, such that their buying and selling of the stock reflects the valuation in their models.

Markets exist *because* different investors reach different conclusions as to whether a stock is undervalued or overvalued. Some traders believe a stock is "priced correctly" while others may believe it to be far from its intrinsic value. The models and math are the same from investor to investor. It is the *inputs and assumptions* to the models that result in different conclusions among different investors.

These valuation techniques are just a few of the many tools used to determine the value of equity securities.