# 5.1: Stock Valuation

When we developed the formula to price bonds, it was a straight-forward application of the time value of money concepts. The bond produces a series of simple cash flows – fixed interest payments twice per year and a maturity value of $1000 at the end of the bond's fixed life span. However, stocks have no expiration or maturity date. Therefore (at least theoretically) the cash flow (dividend) stream extends into infinity. Also, the dividends are MUCH more difficult to project than are the interest payments as dividends can increase, decrease or be stopped entirely (although corporations are reluctant to lower or stop dividends unless absolutely necessary for their survival). Therefore, stocks require a slightly different application of the time value of money concept.

While it is not likely that any person will hold a stock forever (unless that person has discovered the secret of immortality), the valuation process using an infinite cash flow stream remains appropriate. If I buy a stock today based on the present value of the expected cash flows and only plan to hold the stock for three years, why am I concerned with the dividends that will be paid after year three? The answer is simple. If I plan to sell the stock after the three years, I'm going to have to find a buyer. How much will that buyer pay me? According to our framework, the buyer will pay the present value (at the time she buys the stock) of the expected cash flow stream. Therefore, what the buyer will be willing to pay me depends upon the expected dividends from years 4 and on. Since those later dividends will affect the price at which I can sell the stock, I must factor them into my analysis. By finding the present value of ALL expected cash flows (dividends) that the stock will pay, my holding period becomes irrelevant. Whether I want to hold the stock for one day or twenty years, it is worth the same to me.

Stock valuation based on the dividend discount model typically takes one of three forms depending on what pattern we expect the dividends to follow. These three model variations are (1) the no-growth case, (2) the constant-growth case, and (3) the non-constant-growth (or supernormal-growth) case. There are a couple of other variations, but these three provide a solid foundation. Remember, all three methods do the same thing — forecast a cash flow stream (dividends) that will be paid to stockholders and then discount that cash flow stream back to the present to see what the stock is worth today.

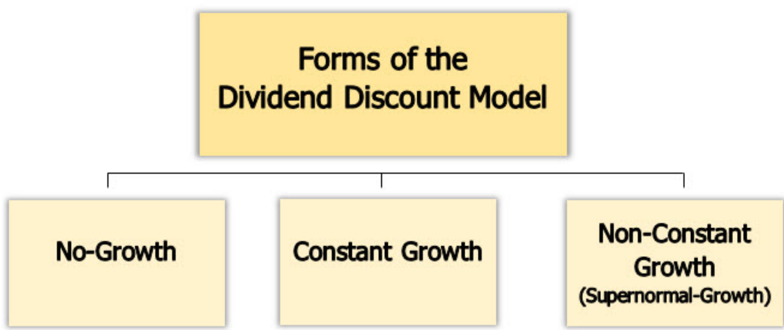


Figure 5.1.1: Discount dividend models for no growth, constant growth and supernormal growth

In all models below, we assume that the current dividend has just been paid (immediately before we buy the stock) and our first dividend received will be one year from today. We also assume that dividends are paid annually instead of quarterly or semi-annually. These assumptions make the application of time value of money simpler. While they may not be realistic, they do not greatly alter the results and therefore are worthwhile simplifications.

## No Growth

If we have a stock with no growth in its dividends over time, the infinity issue is solved with a perpetuity. The stockholder will receive the same dividend every year (an annuity) that lasts forever. This is the perpetuity concept that was introduced in the Time Value of Money chapter. The most common example of a no growth stock is a PREFERRED STOCK.

Preferred Stock is somewhat of a hybrid between a common stock and a bond. Preferred stock typically has (a) no voting rights, (b) an infinite maturity, (c) pays dividends as a percentage of par value, and (d) falls between bonds and common stock in the priority of claims. Preferred pays a dividend (which unlike interest can be skipped if the firm needs to preserve capital in hard times), which creates more risk than bonds. However, these dividends are fixed and must be paid before dividends on common, which creates less risk than common. Many firms do not issue preferred stock.

A preferred stock typically pays a fixed dividend (a percentage of its par value), that does not change over time. However, there are some instances where a common stock at least approximates the no-growth pattern.

According to the no-growth model, to find the value of the stock, we just take the current dividend and divide by the required return (remember, it's just a perpetuity — an infinite annuity — since the stock has no maturity date and the dividend is not expected to increase or decrease in value). This is written below

$$P_0 = \frac{D_1}{k}$$

where

$P_0$ represents the current value (price today)
k represents the required return and
$D_1$ represents the dividend

Note: While we designate next year's dividend in the formula, this is just to be consistent with the later models. Since there is no growth, all the dividends are the same regardless of which year we are referring to.

**Example 5.1.1**

**Preferred Stock Valuation Using the No Growth Model**

Consider the following example with a preferred stock. Assuming that a preferred stock has a par value of $75, pays a 10% dividend and you have an 8% required return, what is this stock worth to you?

**Solution**

$$P_0 = \frac{D_1}{k} = \frac{\text{ParValue} * \text{DividendRate}}{k} = \frac{\$75 * 0.10}{0.08} = \frac{\$7.50}{0.08} = \$93.75$$

### Video Preferred (No Growth)

### Constant Growth

While it is possible for a common stock to have a constant dividend over time, it is not likely. Companies tend to grow and expand, which usually results in dividends growing over time. However, if dividends don't remain constant we can no longer use a perpetuity formula. Also, since the dividend stream doesn't end, we can't use the standard time value of money process. Luckily, as long as the growth rate remains constant over time and is less than the required return, there is a simple formula we can use to find the present value.

$$P_0 = \frac{D_1}{(k - g)}$$

or

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

where

> g is the growth rate in dividends
> $P_0$ represents the current value (price today)
> k represent the required return and
> $D_0$ and $D_1$ represent the dividend paid today ($D_0$) or the forecasted dividend next year ($D_1$) respectively

Note: $D_0(1 + g)$ and $D_1$ are the same thing. They both represent the forecasted dividend next year. The only difference is that sometimes you will be given the current dividend and sometime you will be given the forecasted dividend next year. Since the present value formula needs the forecasted dividend next year, $D_0(1 + g)$ just gives us that value based on the current dividend and the dividend growth rate.

**Example 5.1.2**

### Common Stock Valuation Using the Constant Growth Model

For a quick example, consider a stock that just paid a dividend ($D_0$) of \$5.00 per share with dividends growing at a constant 4% per year. If my required return is 13%, what is the stock worth to me?

**Solution**

$$P_0 = \frac{D_0(1+g)}{(k-g)} \tag{5.1.1}$$

$$P_0 = \frac{\$5.00(1+.04)}{(.13-.04)} \tag{5.1.2}$$

$$P_0 = \frac{\$5.20}{.09} \tag{5.1.3}$$

$$P_0 = \$57.78 \tag{5.1.4}$$

Three points on this model. First, while it may not look like the present value formulas that we did in Chapter Three, that is all it is. The constant-growth model is not magical; it’s just a special case of present value and could be used to find the present value of any cash flow stream that is growing at a constant rate. Second, growth rates rarely remain constant over time. However if growth rates are relatively stable, this can be a close approximation. Third, this model only works when the required return exceeds the growth rate. This is not usually critical as it is impossible to maintain a growth rate higher than the required return indefinitely, but if you try applying this model when the growth rate exceeds the required return, you will get a negative value – which does not make sense as stock prices will not fall below \$0.00 due to the limited liability concept introduced in Chapter One.

**Video** [Constant Growth]

## Supernormal (Non-Constant) Growth

This is where things get a little tricky. However, it is the most common situation. The solution is not a simple formula, but instead a three-step process.

The 3-step solution

- Step 1 – Forecast the dividends during the non-constant growth period up to the first year at which dividends grow at a constant rate.
- Step 2 – Once a constant growth rate is reached, use the constant growth pricing model to forecast the stock price. This stock price represents the PV of all dividends beyond the non-constant growth period.
- Step 3 – Discount the cash flows (dividends found in step one and price found in step two) back to year zero at the appropriate discount rate. This is the current value of the stock.

### Example 5.1.3

### Common Stock Valuation Using the Supernormal Growth Model

This is a tricky one, so again, let's do an example. Consider a firm that just paid a dividend of $2.60. They plan to increase dividends by 5% in year one, 10% in year two, 20% in year three, 20% in year four, and then 3% per year thereafter. You feel that a 16% required return is appropriate. What is this stock worth to you?

#### Solution

*Step 1* — Forecast the Dividends
$D_1$ = $2.60*(1.05) = $2.73
$D_2$ = $2.73*(1.10) = $3.00
$D_3$ = $3.00*(1.20) = $3.60
$D_4$ = $3.60*(1.20) = $4.32
$D_5$ = $4.32*(1.03) = $4.45

Note: We stop in year five because that is the first year of constant growth. There is no need to forecast dividends any further since once they are growing at a constant rate (in the timeline below, you can see that after year 4, all dividends are growing at 3% per year through infinity), we can apply the Constant Growth Model discussed above which leads to Step 2.

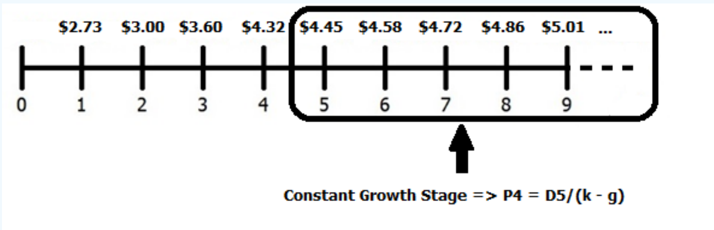


Figure 5.1.2

*Step 2* — Use the Constant-Growth Model to Forecast Price

$$P_4 = \frac{\$4.45}{.16 - .03} = \$34.23$$

Note: Be careful here as this is a confusing, but critical detail. When we apply the constant-growth model we use next year's dividend to get this year's price. Since we are using year five's dividend, the first dividend of the constant-growth stage, it will tell us the price in year four – not year five. **This price represents the present value of all dividends paid from year five and beyond as of year four.**

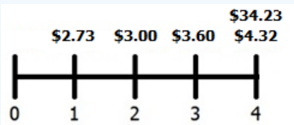


Figure 5.1.3

*Step 3* — Discount Cash Flows Back to Today

Use your financial calculator to find the net present value of the cash flows.

### Calculator Steps to Compute NPV of the Uneven Cash Flow Stream:

| HP10BII | TI-BAII+ | TI-83/84 |
|---|---|---|
| Step 1: 2nd Clear All<br>Step 2: 0 CFj<br>Step 3: 2.73 CFj<br>Step 4: 3.00 CFj<br>Step 5: 3.60 CFj<br>Step 6: 38.55 CFj<br>Step 7: 16 I/YR<br>Step 8: 2nd NPV ⇒ $28.18 | Step 1: CF 2nd CLR Work<br>Step 2: 0 ENTER ↓<br>Step 3: 2.73 ENTER ↓↓<br>Step 4: 3.00 ENTER ↓↓<br>Step 5: 3.60 ENTER ↓↓<br>Step 6: 38.55 ENTER<br>Step 7: NPV 16 ENTER<br>Step 8: CPT ⇒ $28.18 | Go to APPS⇒Finance⇒<br>Step 1: Select npv(<br>Step 2: Enter the given information npv(16,0,{2.73,3.00,3.60, 38.55}<br>*Note that we do not need to put in the CF frequencies as they are all 1<br>Step 3: Press the SOLVE key |

Note: A couple of comments here. First, the year four cash flow ($38.55) represents both the year four dividend and the price in year four. If you try to enter them separately, the calculator will think the dividend comes in year four and the price in year five, giving you the wrong answer. Second, you may be wondering what happened to the year five dividend. The answer is that it is included in the year four price. To include it again would be double-counting. Remember what the year four price represents — the present value (as of year four) of all dividends paid in years five and beyond. Third, as with the first two models, this is just another application of time value of money, specifically present value. We forecast the cash flows and then discount them back to today.

**Video** [Supernormal Growth Part 1]

**Video** [Supernormal Growth Part Two]

**Video** [Supernormal Growth Part Three]

**Video** [Supernormal Growth Part Four]