WealthCE

Discounted Cash Flow

The primary method of evaluating a firm's intrinsic value is the present valuation of future free cash flow to the company. Free cash flow can actually be removed from the business for the profit of shareholders without effecting company operations. It is derived as the actual value of investment.

You need to realize that money received in the future is worth less than money invested today. Since future money can't be invested now, it cannot earn returns until it is received. The money earned today, if invested and reinvested, will be worth more money in the future due to interest. That means a dollar earned 5 years from now is worth less than the dollar now. How much less? That depends on the likeliness to receive it and how much money must be invested to earn it. A reliable dollar earned at low cost is better than an unreliable dollar. Stable returns at low costs and high rates are valuable in the present, and unstable returns or high cost returns are not.

Since future dollars are worth less, future cash flows must be discounted to get their present value. The most risk free dollar consists of the government bond rate, since stable long term governments have very little risk of disappearing at the AAA rating level. These rates are heavily used when picking discount rate, which is used in determining intrinsic value.

The actual process of determining intrinsic value consists of 7 steps in an extremely simplified discounted cash flow model. As an early warning, this is a LOT of math. However, you should always use a calculator or construct a spreadsheet for this process. This will save you a large amount of time and potential errors.

Step 1: Selecting Firm & Forecast Duration

The first step is selecting the firm, doing basic analysis, and acquiring the necessary data for your discounted cash flow model. Before this, you should have ensured your selected firm is financially viable, has a business strategy advantage, low debt, and long term stability. If you suspect you've successfully identified a firm, you will need the company's Financial Statements, Current Share Price, Shares Outstanding, Risk Free Rate, Market Rate, and Share Beta for a Discounted Cash Flow valuation.

Next we determine how long your forecast duration will be. This is length of time you will directly forecast the growth rates of free cash flow.

The length of time you actually forecast depends on the firm's strength. Your forecast duration is the period that returns will deliver returns that give substantial free cash flow. This depends on the company's strength. Your forecast period should be short if a firm is financially poor, has no competitive edge, high competition, low margins, and poor branding. You should have a maximum duration of 1 to 3 years.

If your firm has financial stability, a slight competitive advantage, moderate competition, decent margins, and moderate branding, your forecast duration can be slightly longer. You may be able to forecast reliably for 2 to 4 years.

If your firm has financial strength, a strong competitive advantage, low competition, high margins, strong branding, high entry barriers, and a business model an idiot could run successfully, your forecast duration can continue longer. You can forecast reliably for a longer period, between 3 and 5 years.

Your forecast will reflect anticipated continuations or changes. If it changes, your analysis should indicate why and precisely how this change is represented in your valuation. This is only truly relevant to short or moderate term

valuations. Forecasting durations beyond 6 or more years is typically a waste. It's difficult to accurately estimate business events after 3 years and nearly impossible after 5 years.

After Forecast Duration, you will project the firm's growth using a perpetuity rate. The perpetuity growth rate determines free cash flow infinitely after the forecast time. This growth rate is static and remains flat. In reality, some of these years would be higher than the assumed perpetuity rate; some of them would be lower. To reflect this reality, your estimate will be the average growth rate you expect after forecast duration.

Step 2: Estimate Revenue Growth

SSince the future is uncertain we don't know exactly how the company will perform. Revenue earned in the future must be estimated. However, you can create a rough estimation based on historical growth averages, financial analysis, and the economic and market conditions. There are several concerns you should resolve before estimating revenue growth. Based on your answer to these considerations your growth rate will rise, fall, or maintain pace. This part of valuation can wildly affect your final numbers. Unfortunately, it's more of a general art than a precise science.

Firstly, the company's ability to grow its revenue is directly related to the national, regional, or global economy. If the economy is growing and more customers can afford to purchase your firm's products, sales revenue grows easier. If the economy is contracting firms are more likely to have revenue growth slow, stop, or reverse.

This concept also applies to the industry. If the industry is growing, the firm can capture additional revenue growth from customers purchasing from the industry for the first time. These customers will have no previous product bias or loyalties. If the industry is static or decreasing, it will be hard for the firm to acquire revenue growth. They must steal existing business from other companies who have built branding and service connections with consumers. It's harder to capture revenue growth from a mature industry than a young or growing industry with incoming consumers.

If the industry is highly competitive expanding revenue growth will be difficult. In competitive industries company advantages are difficult to create, and firms are forced to compete openly. In these cases growing revenue will be difficult for firms. Highly competitive industries also make it difficult to retain revenue growth, since a mere price change can affect which customer purchases from whom. An industry where competitive advantage is easily maintained allows revenue retention and growth.

Revenue Growth is also limited in industries with monopolies. A firm which owns the vast majority of market share will have little space to grow unless the industry is growing. If the industry size is static or decreasing, they will find it hard to increase revenue growth. If a firm has monopoly level market share, competing firms will find it difficult to grow, overpowered by their competitor's strength. If the firm is a duopoly, or an oligopoly, the major firms will simply trade market share or revenue growth until one gains a strong upper hand. Unless the market is growing it will be difficult to increase revenue growth, and easy for each competitor to lose it.

Revenue Growth requires an increase in the number of customers, an increase in prices, or both. If your firm's customer base is increasing revenue growth will occur. Increases in the number of customers equal higher revenue growth. You need to answer these questions: Is the firm likely to acquire new customers at a faster rate than in the past? If yes, by how many? Are currently customers likely to keep buying or buy more often? If the answers to these questions are yes, revenue growth will occur. As a precaution, you can identify events that would cause customers to abandon the firm's product or services. If you think these events are likely to occur in the future, you can estimate the rate that revenue growth would slow or stop.

Since we've covered Revenue Growth from Customers, this leaves only the price. The rule for price and revenue is very simple: If a firm can keep customers while raising prices, revenue will grow. If they can keep customers and attract new ones while raising prices, revenue will grow faster. This works best when the firm is in a low competition environment, has low product or service substitutes, has a high competitive advantage compared to competitors, or has a monopoly. This does not work well in duopolies, oligopolies, or highly competitive environments, since customers can take their

purchases elsewhere. It also won't work if the firm has a low competitive advantage.

After resolving these issues you can now begin to determine if the revenue growth will begin to increase or decrease over time. Look at revenue from previous years and decipher the revenue growth the firm has had in the past. Apply these factors to your firm. Begin with your firm's size or age, a small young firm grows substantially faster than larger older firms, and then apply the rest. Do you think the firm will increase actual revenue growth? What impact will these factors have on actual growth itself? These will narrow down your rates and answers.

Lastly, revenue growth over time may slow down to an average, especially for young companies. If your forecast duration is long you will have to determine when revenue growth will slow down. Your revenue growth may start at 20% for three years and then decline to 15%. You will have to determine which year's growth slows down, and the final growth rate that will serve as your average long term growth after the forecast period.

Step 3: Calculate Free Cash Flow

Your first financial step is calculating Free Cash Flow. You will need your firm or company's Income Statement. You start selecting by current annual revenue and subtracting the following financial expenses. Note you will need to calculate margins and rates to apply them to future years.

Free Cash Flow = Revenue - Operating Costs - Taxes - Net Investment - Change in Working Capital

Your first step is to project Revenue for each year using the revenue growth rate selected in step 2. Use the revenue from the latest fiscal year of your financial statement, and use this equation to adjust it for each year. Continue for your entire forecast period.

Year After Revenue = Current Year Revenue * (1 + Revenue Growth Rate)

You will use revenue from every year's ending as the next year's starting revenue and calculate growth for your entire forecast length. This will give you top line growth for your entire forecast duration. You must be sure that you remember to adjust the equation's Revenue Growth Rate if you are not using a constant rate. If the "Revenue Growth Rate" for your third projected year decreases from 15% to 10%, remember to change the growth rate for that year and any changes afterwards. Your last rate sets your perpetuity growth, which forecasts growth after your forecast duration. This rate will be the average sustainable rate your firm could grow forever, and is usually lower than previous years. After you've calculated revenue growth for the entire duration, you can move on to projecting operating costs and operating profit for your forecast duration.

The Operating costs consist of "Sales, General, and Administrative", "Salary", "Research and Development", and "Cost of goods sold". If you are lazy subtract Net Operating Profits from Revenue to quickly get Operating costs.

Operating Cost Ratio = Operating Costs / Revenue

Be Careful: You are assuming that this cost margin ratio will continue into the future. If the Operating Cost Ratio is irregularly high or low for the year, it will be the norm throughout your forecast duration. Calculating the cost ratio for several years before the current fiscal year and averaging will correct this problem.

Projected Operating Profit = Revenue * (1-Average Operating Cost Ratio)

If forced to choose between the annual cost ratio and the average cost ratio, select the average. The average cost ratio will most likely be the truth. There are exceptions: If the industry is highly competitive, or firm is reliant on resources trending upwards in real pricing, you can expect cost ratios to rise. If management says the cost ratio will decrease, they're usually puffing up expectations. Occasionally, but rarely, they will have a justifiable reason that decreases cost ratios. You should typically ignore them. To apply operating cost ratio, first apply growth rates to revenue throughout

the forecast period, and then multiply each year by the Operating Cost Ratio. This will give you each year's Projected Operating Profit.

You can now begin calculating taxation. First, you will need to calculate the rate and apply it to projected operating profits, to get each year's taxes paid. Then you will subtract that from projected operating profit to get the actual taxation.

Tax Rate = Annual Income Tax Paid / Profit Before Income Tax
Projected Taxes Paid = Projected Operating Profits * Tax Rates
Projected Post-Tax Profit = Projeced Operating Profit * (1-Tax Rate)

You should calculate the actual tax rate and taxation paid, since firms receive a tax break on their capital expenses. Additionally, all firms do not always pay a steady tax rate, assuming they pay 35% is not always correct. To calculate the actual taxation, divide Annual Income Taxes Paid by Profit before Taxes. To increase accuracy, calculate the tax rate for several years and average the rates. Be careful: You should exclude past years in which the firm received a temporary cut or tax break that has since ended.

After you've calculated the tax rate, you will need to apply it to each year's Projected Operating Profit to acquire your Projected Taxes Paid. Finally, subtract each year's Projected Taxes Paid from its Projected Operating Profits.

This will give you Projected After-Tax Profits for each year in your forecast period. You can now move on to calculating net investment. Net investment is your firm's capital expenditures, or purchase of plant, property, and equipment, after removing depreciation.

Net Investment = Capital Expenditures - Non-Cash Depreciation
Net Investment Ratio = Net Investment / Revenue
Estimated Capital Expense = Net Invstment Margin * Projected Post Tax Profit
Projected Post Investment Profit = Projected Post Tax Profit * (1-Net Investment Ratio)

This calculation will give you year by year Capital Expenditure levels. It is helpful to calculate Net Investment Ratio for several years before, and determine if this year is above, or below average. For true accuracy, your Net Investment Ratios should return to the average over the forecast duration. They will remain roughly at average in perpetuity. If your firm is in an industry that has growing competition, or will likely purchase capital expenditures in the future, this ratio should increase when calculating free cash flow for each year. After calculating Net Investment Profit, you can calculate working capital.

Working capital is necessary for all of your firm's short term interactions. This cash is needed for any daily company function. As the business grows, it will need to grow working capital or the firm will run dry in the short term.

Staring Working Capital = Current Assets - Current Liabilities

Note that the Free Cash Flow equation calls for changes in working capital. To calculate changes in working capital, increase working capital at the same rate as revenue, and subtract the previous year's working capital from the year following. Working capital will need to be maintained or grow as a percentage of revenue as the firm grows over time. When revenue grows, working capital often grows with it. If your growth rate for a firm's revenue is 10%, the working capital will increase 10% as well. You will insert actual change in working capital into the free cash flow equation.

Year End Working Capital = Starting Working Capital * (1+Year's Revenue Growth Rate)

Change in Working Capital = Year End Working Capital - Starting Working Capital

As an example, if you project revenue will grow by 10%, and you have $1,800 working capital, you will calculate change in working capital as follows: 18,000 * (1+.10) = 19,800 – 18,000 = $1,800

You will actually substitute $1,800 into the change in working capital equation. Once you have acquired this data, you can calculate the Free Cash Flow for each year during your Forecast. When this is done use the formula below to calculate Free Cash Flow.

Free Cash Flow = Projected Post-Investment Profit - Change in Working Capital

This completes the first formula we presented, calculating free cash flow:

Free Cash Flow = Revenue - Operating Costs - Taxes - Net Investment - Working Capital Change

Start with revenue adjusted growth for each year, and calculate each year of Free Cash Flow separately. After you've finished calculating Free Cash Flow for each year, you can move on to calculating the Discount Rate. This process is substantially easier if you use spreadsheet equations or applications.

Step 4: Calculate Discount Rate

The Discount Rate will be equal to the firm's Weighted Average Cost of Capital or "WACC". This will require using the Capital Asset Pricing model to acquire the cost of equity, and researching risk free debt rates. While it's possible to estimate discount rates without using Weighted Average Cost of Capital or the Capital Asset Pricing Model, these both reduce assumptions in the model. Their use increases the accuracy of your valuation. There are even more precise ways of calculating discount rates, but they usually involve software with dozens of inputs for minor financial incomes and expenditures. To calculate the discount rate, you will need to first identify these variables: Total Financing, Cost of Debt, Cost of Equity, and Tax Rate. Some of these variables must be researched, others must be calculated.

The tax rate for the company was acquired during your calculation of Free Cash Flow, and comes from using this equation.

Tax Rate = Annual Income Tax Paid / Profit Before Income Tax

"Total Financing" is the sum of Market Value of Total Debt plus the Market Value of Total Equity. You will need both of these variables for the WACC equation later on. You will use a combination of the balance sheet, shares outstanding, and bonds outstanding to find the market values of both equity and debt. To find the market value of debt you have to identify two values: Total Bond debt and Total Market Value of debt. These values require research for the projected firm. For total bond debt, simply add the short term and long term bonds to acquire Total Bond Debt.

Total Bond Debt = Short Term Bonds Outstanding + Long Term Bonds Outstanding

After completing the Total Bond Debt you need the Market Value of Debt. This debt is technically the amount of book debt in banking loans. In order to properly identify this value you'd have to have the internal financial statements of the company or firm. Since you don't, you will have to construct an estimate of it. You can also use the market value of total debt as a substitute for Book Value, but this will skew your results. First, sum up the rough par value of all bond debt on the market (Total Debt Par Value). Next, find the firm's interest expenses in the Income Statement. Lastly, acquire the average maturity of debt in years ("Years"). Lastly, acquire the interest rate cost of debt ("Rate"). Substitute all of them into this equation:Substitute all of them into this equation for the **Estimated Market Value of Book Debt**.

Estimated MVBD = Interest Expenses*(1-(1/(1+Interest Rate)^{Year})/Interest Rate)+(Book Value of Debt/(1+Interest Rate)^{Year})

Note that Interest Expenses, Market Value, and the final value of the market value of debt must all be in the same terms. Be sure they are in thousands, millions, or billions. After you've found the true Book Value of Debt, or have "estimated"

the value, you can add it to the Total Value of Bond Debt, found below. Save Total Financing for the WACC equation.

Total Market Value of Debt = Total Value of Bond Debt + Book Value of Debt
Total Financing = Total Market Value of Debt + Market Value of Total Equity

The Cost of Debt is the market rate the firm pays for its bonds. If you cannot find this exact number, find your company's current credit rating. Use the credit rating to find the average corporate interest rate for bonds sharing that rating, and use that as your cost of debt. Your Cost of Debt must be adjusted for taxation since corporations receive tax deductions on interest paid. Adjust cost of debt for taxation use this equation, and save the Tax Adjusted Cost of Debt for the WACC Equation.

Tax Adjusted Cost of Debt = Cost of Debt (1-Tax Rate)

The Cost of Equity is derived from the Capital Asset Pricing Model. The CAPM calculates the required return on equity from the investment, the return the firm must clear to be considered for investment. For the firm this is a performance hurdle, for the investors this is a performance requirement. Failure to reach this return results in shareholders abandoning the company. The equation for CAPM is as follows:

Cost of Equity = Risk Free Rate + Share Beta * (Market Rate - Risk Free Rate)

The Risk Free Rate is the rate given by the lowest risk investment available. This is typically found in government short term bills. The Market Rate is the rate of return of the market for the shares being valued. The share beta is the risk of the shares in relation to the market. You can either calculate the share's beta itself, or you can simply identify the share beta using many available sources of investment news information. After you've found the Total Financing, Cost of Debt, Cost of Equity, and Tax Rate, you can calculate the Weighted Average Cost of Capital. Use this equation:

(Market Value of Total Debt/Total Financing)*Cost of Debt*(1-Tax Rate)
+(Market Value of Equity/Total Financing)*Cost of Equity from CAPM
= **Weighted Average Cost of Capital used for discount rate**

Note that the above equation is an extremely simplified version of the full WACC equation. For complete accuracy you would use the full scale equation. This requires far more research. It requires the values and costs of: Senior denominated debts, Subordinated denominated debts, preferred equity, and common equity.

(Market Value of Senior Debt/Total Financing)*Cost of Senior Debt*(1-Tax Rate)
+(Market Value of Subordinated Debt/Total Financing)*Cost of Subordinated Debt*(1-Tax Rate)
+(Market Value of Common Equity/Total Financing)*Cost of Equity from CAPM
+(Market Value of Preferred Equity/Total Financing)*Cost of Preferred Equity
= **Weighted Average Cost of Capital (used for discount rate)**

Once you've completed the calculation for Weighted Average Cost of Capital, you can move on to applying your discount rate to free cash flow.

Step 5: Solving for Value

In step four we calculated Free Cash Flow for each year, then we calculated the discount rate using the Weighted Average Cost of Capital for use as our discount rate. Now you actually apply the discount rate to free cash flow for each year, and then add them together. This is actually fairly simple. Start with the equation below which gives you the year's Discounted Free Cash Flow.

Year's Discounted Free Cash Flow = Free Cash Flow / $(1+WACC)^{Year}$

Your free cash flow and year must match: if you use the second year's free cash flow value, your exponent will be 2. As an example, if your third year projection for free cash flow is $200 and you have a WACC discount rate of 15%...

$$\$200 / (1+.15)^3 = \$131.50$$

…your third year projection is $131.50 discounted free cash flow. You will calculate each year with this equation for your entire forecasting duration, and add all the results for each year together. This value will complete your total discounted cash flow.

Total Discounted Free Cash Flow = Year 1 Discounted Cash Flow + Year two Discounted Cash Flow + Year 3 DCF + Year 4...

Total Discounted Cash Flow is saved and used for step 7.

Now you need to calculate the perpetuity value. The perpetuity value condenses the value from growth after the forecast duration ends. If you didn't calculate a perpetuity value, your valuation would ignore all potential earnings after the final forecast duration year. This requires assigning a perpetuity growth rate, which you assume will be the average growth rate as long as the company exists. You will use your WACC discount rate, and acquire a "Discounted Perpetuity value". The equation for the Perpetuity value is below:

Discounted Perpetuity Value = (Total Free Cash Flow*(1+Perpetuity Growth Rate)) / (WACC – Perpetuity Growth Rate)

If the last year in your forecast duration was 5, you would substitute year's 5 non-discounted free cash flow for "Final Free Cash Flow". If you substitute discounted free cash flow, the discount rate will be applied twice, and your valuation will double count the discount rate. Finally, add together your Total Discounted Cash Flow from Step six with the Discounted Perpetuity Value. This will give you Total Discounted Capitalization. Divide Total Discounted Capitalization by shares outstanding to receive the Discounted per Share Value.

Discounted Capitalization = Total Discounted Cash Flow + Discounted Perpetuity Value
Discounted Per Share Value = Total Discountd Capitalization / Shares Outstanding

If all steps have been done correctly, Discounted per Share Value is a rough estimate of intrinsic value per share. However, this is easily skewed by poor estimates and false assumptions. That is why it is best to construct several valuations with differing assumptions: one for optimistic scenarios, one for pessimistic scenarios, and one for neutral occurrences. If your analysis is accurate and share market prices are above this value, shares are overvalued. If your analysis is accurate and shares market prices are below this number, shares are undervalued. In any case, if executed correctly, you will have a rough guideline for pricing shares.