What the Discount Rate Means, and How to Calculate It in a DCF

Welcome to our second financial modeling tutorial, designed to share with you the type of tangible skills that you need to win high-paying jobs in investment banking or private equity, and get promoted more rapidly and rewarded more generously once you're in.

In the first video in this series, we looked at unlevered free cash flow, what it means, and how to project and use it in a DCF based on a real company, Michael Hill. In this follow-up lesson, you will learn what the **discount rate** means and how to use it in a discounted cash flow analysis. This is just one of the 45 different topics we cover in our valuation and DCF lessons in our Premium course, but it's an important one.

We'll continue with the Michael Hill example from last time where we set up the cash flow projections for this retailer. **The discount rate goes back to that big idea about valuation and the most important finance formula: company value equals cash flow divided by (discount rate minus cash flow growth rate), where the cash flow growth rate must be less than the discount rate. I said before that the discount rate represents risk and potential returns. So, a higher rate means more risk, but also higher potential returns.**

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The discount rate also represents your opportunity cost as an investor. If you were to invest in a company like Michael Hill, what might you earn by investing in other similar companies in this market? These intuitive explanations are helpful, but in real life, you need actual numbers for the discount rate to be useful. Normally, you use something called WACC, or the Weighted Average Cost of Capital, to calculate the discount rate.

The name means exactly what it sounds like. You find the cost of each form of capital the company has, weight them by their percentages, and then add them up. Capital just means a source of funds. So, if a company borrows money in the form of debt to fund its operations, that debt is a form of capital. And if it goes public in an IPO, the shares it issues, also called "equity," are also a form of capital. The formula for WACC looks like this: **WACC = Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock.**

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Finding the percentages is basic arithmetic. The hard part is estimating the cost of each one, especially the cost of equity. These numbers represent the cost to the company, but to investors, the costs represent how much they could earn. **The company pays something to use the capital, and the investors providing the capital receive that payment in return.**

The cost of equity represents potential returns from the company's stock price and dividends, and how much it costs the company to issue shares. For example, if the company's dividends are 3% of its current share price, and its stock price has increased by 6% to 8% each year historically, then its cost of equity might be between 9% and 11%. The cost of debt represents returns on the company's debt, mostly from interest but also from the market value of the debt changing. Just like share prices can change, the value of debt can also change over time.

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For example, if the company is paying a 6% interest rate on its debt, and similar companies are as well, meaning the market value of debt is close to its value on the balance sheet, then the cost of debt might be around 6%. Then you also need to multiply that by (1 – Tax Rate) because interest paid on debt is tax-deductible. So, if the tax rate is 25%, the after-tax cost of debt would be 6% times (1 – 25%), or 4.5%.

The cost of preferred stock is similar because the preferred stock works similarly to debt, but preferred stocks dividends are **not** tax-deductible, and overall rates tend to be higher, making it more expensive. So, if the preferred stock coupon rate is 8%, and its market value is close to its book value because market rates are also around 8%, then the cost of preferred stock should be around 8%.

Let's put all these concepts together now, and show you how to calculate WACC. **WACC represents what you would earn each year over the long-term if you invested proportionally in the company's entire capital structure.**

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So, let's say this company uses 80% equity and 20% debt to fund its operations, and that it has a 25% effective tax rate. You decide to invest $1,000 in the company proportionately, so, you put $800 into its equity or shares, and $200 into its debt. We said before that the cost of equity was between 9% and 11%, so, let's just call it 10%. We know the after-tax cost of debt is 4.5% as well. So, WACC equals 10%, times 80%, plus 4.5%, times 20%, which comes out to 8.9% or $89 per year on an initial $1,000 investment. **That does not mean that we will earn $89 in cash per year from this investment. It just means that if we count everything—interest, dividends, and eventually selling the shares at a higher price in the future—the annualized average might be around $89.**

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WACC is more about being "roughly correct than precisely wrong." So, the rough range such as 10% to 12% versus 5% to 7% matters a lot more than the exact number. Now, let's jump into the Excel model and set up the key assumptions for the discount rate, calculate it using several different methods, and then use it in the free cash flow projections.

If you pull up the "Before" file in the Files and Resources section below, you'll see the partially completed model for this investment analysis. In the full course, we go into more detail on where to find all this information and how to think about the proper numbers to use. But here, we're going to focus on the Excel setup and formulas.

So, here we are in Excel, and as we normally do in the full courses on this site, I have some written notes over here on the right-hand side. These are for your reference and for additional clarification on some of these topics as we go through them. Let's start at the very top with the assumptions right here.

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And I have a bit of an explanation of what we need these all for. We have up here the cost of debt, the cost of preferred stock, and then we have two other assumptions, called the **Risk-Free Rate** and the **Equity Risk Premium**. So, let's go through these and discuss briefly why we need these and then enter the correct numbers.

The cost of debt and cost of preferred stock you should already know, because we just went over it. The case document also gives us the assumption to use for the cost of preferred stock. This will end up not even being relevant here because none of these companies, including Michael Hill, even used preferred stock, but we have it here for our reference. And if some companies in the market did use it, this would represent the approximate average coupon rate on that preferred stock.

Now, the cost of debt here is very much a rough estimate. The case document gives us the number to use: 6.7%. But if you're wondering where that comes from, if you go into Michael Hill's fillings and you refer to page six of the document and look at their "finance cost," in other words their interest expense, that's about ($2.7) million there.

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And then if you go down to their balance sheet, their statement of financial position as they call it, the average debt balance over the year has been around $40 million—$35.2 million in one period, and $45.0 million in the other period. And so, to calculate this, we just took the average of those two numbers and then we divided the interest expense by that, and we approximate the cost of debt like that.

Now, there are obviously some problems with that method. For example, what if the market value of debt changes? What if this represents what the company is currently paying on debt, but it doesn't represent cost to issue new debt? So, there are some issues with this, and in a more complex analysis we do this a bit differently, but we're just going to use this method for now in our quick analysis here.

In the full courses on the site, we deal with this issue. And when we look the cost of debt, we do factor in these problems and we use more complex methods and formulas to come up with it. We also have to factor in multiple tranches or types of debt, convertible bonds, which are a form of debt that's convertible into equity, and a whole lot of other issues.

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But for now, we're going to stick with this simple method. Now, the cost of equity, the last component to WACC, the Weighted Average Cost of Capital, is why we need the risk-free rate and the equity risk premium. Now, we know that the cost of equity represents the average annual expected stock price increase, plus the dividend yield. But how can we possibly estimate this average annual stock price increase?

The normal method used in corporate finance is to use something called the Capital Asset Pricing Model, which says that the cost of equity equals the risk-free rate, plus the equity risk premium, times levered beta. Now, there are bunch of new words there. So, let's go through this and define what these actually mean.

The risk-free rate is what you might earn on "safe" government bonds in the same of currency as the company's cash flows. So, if there is an Australian company that records its financials in U.S. dollars, and most of its customers are in the U.S., you would use the rate on 10-year U.S. treasuries, 10-year U.S. government bonds.

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Here, since this company is in Australia, but has operations in Canada and New Zealand and Australia, but ultimately records its financials in Australian dollars, we're going to use the rate on 10-year Australian government bonds. Now, this is something that you can easily look up on Google, "Australian 10-year government bond rates." And you can go down and you can find various sites that have this type of information depending on the time period that you're looking at. And so, we really just did a variant of this to find the rates on these Australian bonds.

And we did that and around this point in time according to our search and the case study document, the risk-free rate was around 2%. So, let's enter the 2.10% right there. **And then the second part of this, the equity risk premium. This measures the amount the stock market is expected to return each year on average, above the rate on "safe" government bonds.** So, you normally linked this to the stock market of the country the company operates in, and you can easily look this up online as well.

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One good source for finding this information is to search for "Damodaran," that's D-A-M-O-D-A-R-A-N, and "equity risk premium." And this professor at NYU updates this information each year. There are a variety of techniques you can use to estimate it, but the calculation isn't important right now. What is important is that the data is widely available and accessible online. And for Australia, the equity risk premium at this point in time was around 6%, 5.96% specifically.

So, if you think what these two numbers mean together, essentially, it's telling us that overall the stock market in Australia is expected to return just above 8% or so per year annually. And that if you invest in equities rather than safe government bonds, you can expect to earn about 6% more on average over the long-term. Although, you'll obviously be taking a lot more risk by doing that as well. So, that's why we need some of these assumptions.

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And then the last one here, levered beta, tells us how volatile the stock is relative to the market as a whole, factoring in both the business risks and the risks from leverage, in other words debt. Now, if levered beta is 1.0, then when the market goes up by 10%, the stock should also go up by 10%. When the market goes down by 10%, the stock should also go down by 10%. If beta is 2.0, then when the market goes down by 10%, the stock should go down by 20%. **So, putting all those together, the cost of equity is represented by the rate we can get on risk-free government bonds, plus the additional earnings we could get from the stock market, times this company's specific profile and how much more or less we can expect it to return than the stock market as a whole.**

Let's go to the next part of this lesson now, and actually get into the business of calculating the cost of equity. There are many different ways we could do this. One simple approach is we could just look up the company's historical levered beta, and we could even go to free sites like Google Finance and Yahoo Finance to find it like that.

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But normally, we like to look at peer companies to see what the overall risks and potential returns in this market across different companies are. So, in this case, we already have our comparable public companies, and we already have all the information for them filled out; they were given to us in the case study document in Excel file. In the full courses on the site, of course, we show you how to calculate these and how to go through the company's fillings and make all of the calculations for their valuation multiples and their financial figures and all of that and come to your own set of comparable public companies. But here, we're just going to go with what is already been provided.

The issue here is that we already have the Beta figures for all these companies. We can see that on average, they are riskier and have higher potential returns than the market as a whole. So, for some of these companies, if levered beta is 1.5, that means that if the market goes up by 10%, this company stock should go up by 15%. If the market grows down by 10%, this company's stock should go down by 15%. **The issue, though, is that these numbers reflect both inherent business risk and risk from leverage.**

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So, we need to "unlever" beta for each company to separate out the inherent business risk from that risk from leverage and get an idea of the inherent business risk for all these companies. And to do that, we are going to have to use some Excel functions here.

So, let's get started. And to set this up, we are going to use something called VLOOKUP, which is a way to look up specific values in Excel and match them based on certain parameters. Our lookup parameter here will be the ticker for the company, so, AX1 for Accent Group Limited right here. I'm going to anchor the C part of this, the column part, so this does not shift around. And then we're going to go over. I'll extend everything here so you can see where this coming from. And we want to select everything in this area which is where all our financial data is. We've already created a named region in Excel called Pub_Comps_Data. So, we have that set up. And then, we need to figure out which column we want to retrieve this data from.

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And I already have the column labels up here at the top. So, we just want to use the one in cell E11 right here. So, in other words, we want to go over six columns to get this and I'll say "False" to get an exact match. So, what's happening here is that we go into this area and we have the first column, the second column, the third column, the fourth column, and the fifth column, and then the sixth column, and that's where we want to take our debt here from. The equity is in the fourth column and the preferred stock is in the seventh column right here. And so, that explains why we have 7 and 4 for preferred stock and equity, and 6 for debt.

We cover all this in detail in our Excel course and go through our LOOKUP functions, VLOOKUP, HLOOKUP, Index and Match, and so on, so I'm not going to cover it in detail here. But you can get all the details in our Excel course. Let's just copy and paste this over for the preferred stock now. And copy and paste through our equity values, so we have that. And then, we can make these into percentages. So, we want to look at that percent debt, percent preferred stock, and percent equity for these companies.

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And to do that, we'll just take our debt right here and then we will take our total debt, our total preferred stock, and our total equity. Just add all those up and take the debt and divide by the total amount of capital the company has. And then we'll copy and paste these formulas over. And at this point, we can actually copy and paste these down and just see what we end up with right here.

The next step here is to get the tax rate for these companies. We're not going to bother trying to look this up or link this in. Instead, we're just going to go back to our DCF tab and take the effective tax rate for Michael Hill here. In Australia, the corporate rate is 30%, so this is probably a safe guess.

For unlevered beta, we need to get into some more explanation. We need to separate out that inherent business risk. And we do that by taking the beta figure that includes business risk and leverage risk, and then dividing by some number that is greater than one. So, we take one, plus the debt equity ratio, times (1 – Tax Rate), since interest paid on debt is tax-deductible.

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And then we also factor in the preferred to equity ratio. **And by doing this, we essentially get some number that is greater than one, which will reduce levered beta and remove the risks from debt and also preferred stock here, which, of course, is a form of debt.** So, let's go over here. I want to start with our unlevered beta, and then we'll divide it by one plus our debt to equity ratio, times (1 – Tax Rate). And then we'll take our preferred to equity ratio here, and we have that. And let's copy this down.

Now, the unlevered beta should always be less than or equal to the levered beta. We can see it for this company, the first company, Accent Group. We're removing the risk from leverage, so we only have one source of risk, which is less than two sources of risks, and so this should always be less than our levered beta – or equal to it if the company uses no debt, as in the case of the last company shown here.

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In any case, we have that set up now. So, at this point, let's go up and just take the medians for all of these so we can use them in our remaining calculations here. And so, we have that. So, we've unlevered beta for these companies. **The next step here is that unlevered beta tells us the inherent business risk for each company, but the subject company, the one that we're valuing, Michael Hill, has more than just at risk because it also carries debt. So, we need to re-lever this median unlevered beta for the similar companies based on Michael Hill's current or targeted capital structure to reflect the additional risk from leverage.**

To do this, it's just basic algebraic manipulation. We just take the unlevered beta formula, and we take that whole term that we're dividing by, and we multiply by it instead to move it to the other side of the equation, and then we can get to our levered beta like that. To start with, let's focus on Michael Hill's current capital structure: the current amount of debt, equity, and preferred stock it has.

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So, I'll link in our levered beta right here. And then for the debt, preferred stock, and these others, let's just copy and paste our formulas from up above down here. And now, we can see that we're getting their current capital structure. Let's link in the tax rate as well.

And then, for the levered beta, so, let just reverse that exact same formula that we used before. So, I'll take the unlevered beta and then we'll multiply by one plus our debt to equity ratio right here, times (1 – Tax Rate). And then, we'll take our preferred stock to equity ratio, and add that in as well, and then close out those parentheses, so we have that.

Now, something else you can do here is instead of just looking at the company's current capital structure, you can also look at the median capital structure according to the peer companies, under the logic that over time, most companies in the market tend to have similar capital structures or move toward capital structures that resemble one another.

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So, to do this, we are still going to start with the median unlevered data beta right here. But then, for the percentages, we're going to take the median percent debt, and preferred stock, and equity from these comparable companies. And then to figure out what the debt, preferred stock, and equity should be, we are just going to take our percentages right here.

And then we're going to take our total debt, plus our total preferred stock, plus our total equity, so, we're taking the total capital the company has, but just distributing it a little bit differently. And we'll anchor some of these so they don't shift around. We'll do it for the preferred stock, and we'll do it for the equity right here. The tax rate will be the same, and the formula for levered beta will also be the same. So, we have that. **And so, now, we have a couple different ways of calculating the cost of equity here.**

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We can look at it based on Michael Hill's current capital structure. We can base it on the optimal capital structure or the median structure for the comparable companies. Or we can just use historical data here and not worry about unlevering and re-levering beta at all. So, let's go up and take our risk-free rate, and then we'll take our equity risk premium here. And then the only difference in these calculations will be what we multiply by.

So, we'll take the levered beta for the current capital structure first, and then we'll copy this down and we will use the optimal capital structure, and then over here, we will use the historical levered beta for Michael Hill instead. So, we have that. **We can see that cost of equity here is in a very, very narrow range. It's clearly between 9% and 10%, and this is actually a good result because it means that regardless of the exact method we use, the cost of the equity for the company doesn't really vary that much, so, there's probably not that much of a question about what it should really be.**

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So, that takes us to the end of this step, calculating the cost of equity. Let's now go into the final step here and calculate and use WACC. Now, the formula is very simple, and I showed it to you in the slides before. We just take the Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock.

The real question is, what do we use for the cost of equity, and what do we use for the capital structure percentages? Because we have a couple of different approaches here. There is no clear answer, and even academics and practitioners and lots of other people disagree, so, we're going to look at several approaches and then just take the simple average of them to set this up. So, first off, for the WACC based on the current capital structure, let's go up and take our cost of equity based on comparables with Michael Hill's current capital structure. And then we'll multiply it by their current equity percentage right here.

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For the cost of debt component, we'll take the pre-tax cost of debt and multiply it by (1 – Tax Rate). And then we'll multiply it by our percent debt right here. And then we'll take our cost of preferred stock up here at the top, and multiply it by the preferred stock percentage right here.

Now, if we tweak this slightly and we base it on the median capital structure of the comparable public companies, we take our cost of equity based on those public companies. And then we take our percent equity based on those public companies. Then we go up and we take our cost of debt and multiply it by (1 – Tax Rate). And then we multiply it by the percent debt based on those comparable companies. And then for preferred stock, we do the same thing. We take our cost of preferred, and we multiply it by percent preferred that the comparable companies are using, on average.

And then finally, for the last one, for the WACC based on current capital structure and the company's own historical data, we just take our cost of equity based on the historical beta of the company right here.

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And then we take our percent equity that the company currently has. We'll go up and take our pre-tax cost of debt and multiply it by (1 – Tax Rate). And then we'll take our percent debt here. And then we'll take our cost of preferred stock and multiply it by the percent preferred stock right there. We can then just get a simple average of these numbers. And we can see the average WACC is around 9.15%. So, between 9% and 10%, we could say, for the range.

Once we have this, the next step is to actually go back to our DCF analysis. We now have the discount rate, so, let's link to this right here. And then now, we can go in and we can actually discount the unlevered free cash flow to their present values, in other words, what they're worth today. To do this, for the discount period, for the first projected year we'll enter 1, and then we'll add 1 to it in each these periods.

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And then to discount the cash flows, we will take the unlevered free cash flow in each period and then divide by ((1 + Discount Rate) ^ Year That We're In). And if you think about how this formula works, the denominator here will keep getting bigger in each period, which means that the present value of the unlevered free cash flow here will keep getting smaller relative to its actual future value. And so, we're discounting everything to its present value to figure out what this company's cash flows over the next 10 years are worth today. And that is part of how we use the discount rate in the DCF analysis like this.

We still have to finish this by fully using it to calculate something called the terminal value and finishing off the analysis. But that is how we use it to manipulate the company's current cash flows and get to their present values. So, that brings us to the conclusion of part two of our free tutorial series on valuation and DCF analysis.

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I hope you've gotten a lot out of this lesson, and that you'll get even more out of the full course. In fact, here is what one recent student had to say about it. As James here says, he was in consulting at MBB – McKinsey, Bain, or BCG, the top three management consultant firms. And he won a job offer in private equity as a result of using the courses here. He even improved on the job by pointing out some questionable assumptions to a management team. As he says, the course gives anyone a good shot of learning what they need to know to land and do their job.

Coming up in the next tutorial video, we'll take a look at how to calculate the terminal value in a DCF, what it means, and why so many students and professionals get it wrong and make simple mistakes that you can easily avoid. If you already know you want in to our full training, you can sign up right here: https://breakingintowallstreet.com/premium/. As soon as you sign up, you will be granted access to our entire suit of in-depth financial modeling courses to help you get hired, get promoted, and succeed on the job.