Video 29 - WACC: Introduction and Calculating the Weights

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Hello, and welcome to another video. Up to this point, we have discounted our cash flows using a discount rate "r" that is given to us, but where does this discount rate or cost of capital come from? Today, we will be discussing the weighted average cost of capital, otherwise known as "WACC". By the end of this video, you will learn what WACC is, and what the components of WACC are, how WACC is used, and how we can calculate the weight on each of the components.

Video at 00:33

First of all, what is the cost of capital? Cost of capital is the rate of return that lenders require in exchange for lending their money to a firm. It can also be thought about as the opportunity cost: the return lenders can earn with their money by investing their money in the next best option. Recall that there is a trade-off between risk and return. Different firms may be riskier than others for various reasons: maybe they are in a risky industry like biotech or a small startup that has not yet established their market position. Because of this, you can imagine that the different riskiness in firms will affect the rate of return that their lenders require; thus, each firm will have its own cost of capital.

Video at 01:15

One measure of the cost of capital for a firm is the WACC, or weighted average cost of capital. It takes the weighted average cost of capital across all the components of the firm's capital. It is characterized by this formula:

$$WACC = R_D \times \left(\frac{D}{V}\right) + R_P \times \left(\frac{P}{V}\right) + R_E \times \left(\frac{E}{V}\right) = R_D \times w_D + R_P \times w_P + R_E \times w_E$$

Video at 01:29

You can see that the formula is broken down into components: "D" stands for debt. The first part of the formula gives us the cost of debt (R_D), expressed as a percentage rate, multiplied by the fraction of debt in the firm's capital structure ($w_D = \frac{D}{V}$). That is, the fraction of the firm that is financed by debt. The second part of the formula calculates the weighted cost of preferred shares, "P". If a company does not have preferred shares, then we simply ignore this part of the

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formula. The last component of the formula, "E", is for equity. This part calculates the percent return earned by common shareholders (R_E) multiplied by the percentage of common equity in the firm's capital structure ($w_E = \frac{E}{V}$).

Video at 02:13

The value of the firm, as denoted by “V”, is equal to the firm's assets (A). Recall that

$$Assets = Liabilities + Shareholder's\ Equity$$

Therefore,

$$value\ of\ a\ firm = V = D + (P + E)$$

Video at 02:27

You may wonder what WACC is used for. It has two common uses: one is determining the cost of capital of new projects that the company wants to undertake. To use WACC, we must assume the new project has similar risk and capital structure as the rest of the firm. For example, if the project is a renewal project, financed using the available assets of the firm, then we assume that the project will have similar risks and capital structure. If the project is an expansion project, going into a new field that the company has never operated in, then the risks associated with the expansion project may be different than the risk of the company. Therefore, the WACC may not be appropriate in this case, or may need to be adjusted for the different risk.

Video at 03:09

The second use of WACC is to be used as a discount rate when calculating the value of a company. Investors care about how much a company is worth, as this helps them to determine whether they are paying a fair price for a share in the firm. We can try to calculate this by estimating the company's future cash flows. Since the earnings are in the future, we can use WACC, which reflects the average riskiness of the whole firm, as our appropriate discount rate, to bring these earnings to present value.

Video at 03:35

Let's revisit the WACC formula again. Now, we will be learning about how to calculate the weights of each component of the capital structure. For now, capital structure will be given to

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you. If you take future corporate finance courses, the reason behind the capital structure and why companies maintain a specific capital structure will be discussed in much more detail.

Video at 03:56

A company may express its capital structure as follows: we have $40 million of debt and $50 million of common shares. Or, they may express it as this: our company has a debt-to-equity ratio of 0.8. Assume, for this example, that the company has no preferred shares.

Video at 04:12

Before we start calculating, always remember to use the market value of the debt and equity; never the book values! This is because, in finance, we care about the value of the projects or the value of a firm based on what the capital markets believe is fair (ie the market value), and not the accounting records or the book values. For example, the accounting records may tell us that the common shares have a book value of $30 million, but this is irrelevant to us, because if the shares were actually to be sold on the stock market, they would go for $50 million. This market value of equity comes from

$$\begin{aligned} \textit{market value of equity} &= \textit{market share price} \times \textit{number of shares outstanding} \\ &= \textit{market capitalization} \end{aligned}$$

Therefore, the value of the common shares is effectively $50 million dollars, not $30 million.

Video at 04:58

To do the calculation, let's take a trip down memory lane and recall: Assets = Debt + Equity. Debt and Equity represent the two ways firms can finance their operations, in order to generate assets, which represents the value of the firm, "V". The weight of debt in a firm means how much of the firm's total value is represented by debt, $\frac{D}{V}$. Similarly, the weight of equity is $\frac{E}{V}$. But, most of the time, "V" is not given to you, so in those cases, we would adapt the V = D + E formula (assuming no preferred shares) to calculate the weights. You can also think of it like this: the percentage or weight of debt is just the value of debt divided by the total value, which is simply debt + equity.

Video at 05:42

Let's try to solve a practice example. Pause this video, and try this question yourself. When you are ready, resume the video, and we will go over the answer together.

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There's a new company in town, Van-cool-ver, that is a one-stop shop for all the cool Vancouverites, selling everything from athleisure to kombucha to umbrellas. Imagine that Van-cool-ver has $40 million of debt and $50 million of common shares. What are the weights for debt, preferred shares, and common shares for this company?

Video at 05:52

The first step to solving a question involving weights is always to calculate the value of total assets ("A" or "V"). The total assets of this company must be equal to the sum of its financing

$$V = D + P + E = \$40 million + \$0 + \$50 million = \$90 million$$

Next, we divide each individual component by the total assets (total value) of the firm.

$$weight\ of\ debt = w_D = \frac{\$40\ million}{\$90\ million} = 44.44\%$$ and

$$weight\ of\ equity = w_E = \frac{\$50\ million}{\$90\ million} = 55.56\%$$

You can check your work by adding up the percentages. Because they are weights, they should add up to 100% (44.44% + 55.56%).

Video at 06:26

Let's try solving the same problem using only the debt-to-equity ratio. The debt-to-equity ratio of this company is 0.8. Pause this video, and try this question for yourself. When you are ready, resume the video, and we will go over the answer together.

Imagine that Van-cool-ver has a debt-to-equity ratio of 0.8. What are the weights for debt, preferred shares, and common shares for this company?

Video at 06:46

This question is slightly more complicated, because it does not give you the exact numbers for you to add up the assets. First, in this question, we assume that there are no preferred shares. A company not having preferred shares is actually quite common, so just ignore the preferred shares part of the WACC equation.

Video at 7:03

The debt-to-equity ratio is 0.8, which, if we arrange that, we can know that D = 0.8*E. If we assume that E is equal to 1, like $1 million, then D = 0.8*(1) = 0.8.

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Video at 07:15

Now we can add up D and E to get

$$V = D + P + E = 0.8 + 0 + 1 = 1.8$$

Therefore

$$weight\ of\ debt = w_D = \frac{0.8}{1.8} = 44.44\% \text{ and}$$

$$weight\ of\ equity = w_E = \frac{1}{1.8} = 55.56\%$$

Let's check our work again by adding up the weights; they should add up to 100% (44.44% + 55.56%). Notice that this approach of using the debt-to-equity ratio yields the same weights as when we use the market values of debt ($40 million) and equity ($50 million).

Video at 07:47

Congratulations! We now know what WACC is, and what it is used for. We also looked into how to determine the individual weights in the formula. In the next video, we will learn how to calculate the other components of WACC: the cost of debt (R_D), equity (R_E), and preferred shares (R_P).

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