

MINERAL ECONOMICS AND BUSINESS

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Lecture 30 : Determining Appropriate Discount Rate - 2

Concept Covered

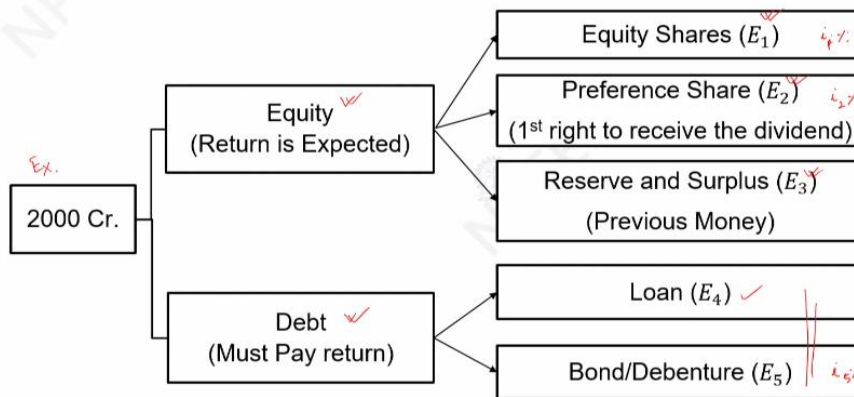
- Appropriate Discount Rate
- Resource Company Betas
- Capital Asset Pricing Model
- Weighted Average Cost of Capital



In this lecture, what we are going to cover is the capital asset pricing model and weighted average cost of capital.

Hello everyone, and welcome again to this course on Mineral Economics and Business. This is our lecture number 30, and this is the second part of the lecture on Determining Appropriate Discount Rate. So, what we discussed in our previous lecture is how we or a brief introduction about appropriate discount rate and then we discussed resource company beta. In this lecture, what we are going to cover is the capital asset pricing model and weighted average cost of capital.

Appropriate Discount Rate



So, these E values are the amounts we are going to get from different sources, and they have their own expected returns—like 11 percent, 12 percent, and all the way up to, let's say, 15 percent here.

So, what we discussed in our previous lecture is that, you know, if we have an example mining project to be started where we need some 2000 crore rupees, this amount can be obtained either from equity or debt and in equity, we have equity shares, preference shares, reserves, and surplus.

Resource Company Betas

β of mining Companies			
Company	Geared Beta	Debt/Equity	Ungeared Beta
BHP	1.6	0.08	1.52
Rio Tinto	1.7	0.18	1.51
Vale	1.5	0.22	1.3
Woodside	1.5	0.2	1.32
Newcrest	0.85	0.03	0.83
Fortescue	1.95	0.34	1.58
Average	1.52	0.18	1.34

So, what we saw was that, to know the expected return or maybe the overall cost of capital for a new mining project, what we have to do first is consider—

And then, we can get the amount from a loan from the bank or maybe from bonds and debentures. So, these E values are the amounts we are going to get from different sources, and they have their own expected returns like 11 percent, 12 percent, and all the way up to, let's say, 15 percent here.



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Geared β for New Companies

1. β average for similar company ungeared.
2. D/E rate for the new company.
3. What is the geared β for the new company from previous equation.

$$(\beta_a) = \frac{\beta}{1 + \frac{D}{E}(1-t)}$$

mining companies and their respective geared beta, and considering their debt-to-equity ratio, we have to calculate the ungeared beta. From the ungeared beta—the average value we

calculate—what we can do for a new company or project is calculate the respective geared beta, which is given by this equation here.

Capital Asset Pricing Model

- The capital asset pricing model (CAPM) provides a methodology to determine the level of return expected by shareholders from their investment in a particular listed company.
- You want to buy some shares of a company ABC, so what is the rate of return you can expect ?
- This is related to β



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So, what we saw was that, to know the expected return or maybe the overall cost of capital for a new mining project, what we have to do first is consider mining companies and their respective geared beta, and considering their debt-to-equity ratio, we have to calculate the ungeared beta. From the ungeared beta the average value we calculate what we can do for a new company or project is calculate the respective geared beta, which is given by this

equation here. Now, about the capital asset pricing model this model provides a methodology to determine the level of return expected by shareholders from their investment in a particular listed company.

So, you know, if you want to buy some shares of, let's say, an example company ABC

Capital Asset Pricing Model

The expected return by share holder is

$$R_e = R_f + \beta(R_m - R_f)$$

Where

β = Geared beta

R_f = Risk free return (Example Govt Bond)

R_m = Market return of similar Company

And the expected return by the shareholders is given by the equation here where R_e equals R_f plus beta into

What is the rate of return that you can expect? So, this is the question that is there. So, this expected return from the shares is related to the geared beta.

And the expected return by the shareholders is given by the equation here where

$$R_e = R_f + \beta(R_m - R_f)$$

where beta is the geared beta calculated from the previous lecture, and R_f is the risk-free return, like if you invest the money in a risk-free asset such as government bonds. So, what is that return value that we are going to get? And then we have R_m , which is the market return for a similar kind of company. Let us say we are starting a mining project. So, for previous mining companies or other mining companies, what is the return they are giving?

So, based on that, we can calculate the expected return by the shareholders, which is R_e . So, here, let us say the risk-free let us say this is 4 percent, and let us say the geared beta equals 1.34, which we calculated from our previous example in lecture number 29, and let us say the market return of a similar company equals, let us say, 14 percent. So, then the expected return and R_e expected equals R_f plus beta into R_m minus R_f .

So, if you substitute the values, this becomes R_f is 0.04 or 4 percent plus beta is 1.34 (the geared beta), and R_m is 0.14 or 14 percent minus 0.04, which is R_f . So, if you calculate this value, it comes to 17.4.

Capital Asset Pricing Model

Example :

$$\begin{aligned}
 \text{Risk free return} &= 4\% \\
 \text{Geared beta} &= 1.34 \\
 \text{Market return or similar comp.} &= 14\% \\
 \text{Expected return} \\
 R_e &= R_f + \beta (R_m - R_f) \\
 &= 0.04 + 1.34 (0.14 - 0.04) \\
 &= 17.4\%
 \end{aligned}$$

example, where the geared beta is 1.34, if somebody is investing in the shares of the new project, then they will expect around 17.4 percent returns.

So, for a new project, if you calculate using the previous example, where the geared beta is 1.34, if somebody is investing in the shares of the new project, then they will expect around 17.4 percent returns.

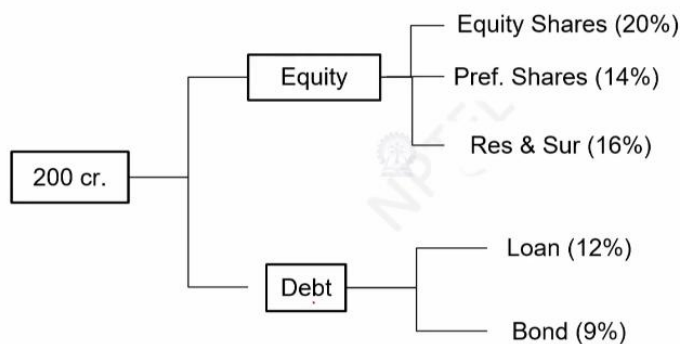
Weighted Average Cost of Capital

- If a mining company were able to source all its funding needs from the equity market, then its cost of capital would simply be its equity cost of capital estimated by the CAPM
- However, mining companies can also source capital by way of the debt markets, hence we use a weighted average cost of capital (WACC).

Now, coming to the weighted average cost of capital, if a mining company were able to source all its funding needs from the equity market, then its cost of capital would simply equal the cost of capital estimated by the CAPM. What does this mean? If you get everything from the share market

Now, coming to the weighted average cost of capital, if a mining company were able to source all its funding needs from the equity market, then its cost of capital would simply equal the cost of capital estimated by the CAPM. What does this mean? If you get everything from the share market. ah like the previous ah ah return expected return ah we calculated is is the ah cost of capital for the entire project. However, mining companies can also source capital by debt market, hence we use ah method called weighted average cost of capital ah or in short from WACC ah which we will see in our next ah ah slides.

Weighted Average Cost of Capital



So, ah let us say the previous company ah let us ah let it be you know we are we are ah targeting ah total amount of or any amount of let us say ah 200 crores ah and and we saw that ah the equity or let let it be you know 150 crores here.

Weighted Average Cost of Capital

- Assuming we need Rs 150cr start the mining company .

- Option - 01

100% loan at 12%

Cost of capital =12%

- Option - 02

100% Share holder fund

If 20% from CAPM

Cost of capital =20%

So, and if we calculate 20 percent from CAPM, then we can say that the cost of capital for for the new project will be simply 20 percent.

So, ah let us say the previous company ah let us ah let it be you know we are we are ah targeting ah total amount of or any amount of let us say ah 200 crores ah and and we saw that ah the equity or let let it be you know 150 crores here. and and either we get it from equity or debt and in in equity we calculated that the expected return is 20 percent. The preferred share return expectation is 14 percent this is little bit less because this is less risky and from reserve and surplus that we have accumulated from our previous let's say projects we invested some amount and the expected return is 16% and from the debt the loan the amount of interest we are going to pay is let's say 20% and bond it is let's say So, if you have ah these values ah we can ah you know if you assume that ah 150 crore ah will be needed at the start of the mining company. The first option is the 100 percent loan at 12 percent, then the cost of capital will be ah simply 12 percent. The second option ah can be 100 percent shareholder fund. So, and if we calculate 20 percent from CAPM, then we can say that the cost of capital for for the new project will be simply 20 percent. but ah like you know assuming ah that the third ah option can be like ah ah that 150 crore ah we need it from ah the different sources ah you know in in from both ah this ah That and equity and let us say this is taken from 55 crore from let us say shareholder equity and then we have let us say 40 crores. So this amount is in crore. and let us say we have 35 crore from the bank and from the bond we are going to get 20 crore. So, this total amount becomes let us say 150 crore.

And the first thing we need to do is calculate the weights. So, here we can say, you know, this weight from equity is 55 divided by the total amount, which is 150 crore. So, this is Similarly, W_P becomes, you know, 40 divided by 150; the bank loan and, or maybe the corresponding W_D is 35 divided by 150 here, and W_B from bond is 20 divided by 150. And the respective, you know, cost of capital for different sources of funds is, as we have discussed, this is 20 percent, this is, let us say, 14 percent, this is 12 percent, and let us say this is 9 percent.

Now, you need to know that the debt cost is tax deductible. So, from here, we can say that the WACC, or the weighted average cost of capital, can be calculated using the equation here. So, where we have the the weights and the expected return. So, if you multiply and sum it up, you can calculate the WACC value, considering, you know, the tax or the corporate tax T in the debt part.

So, T is our corporate tax. Here, you know, for example, if the corporate tax equals 30 percent, we can calculate our WACC equal to 55 by 150. into 0.2 is the R e. So, the first part is W e and 0.2 is the R e. Similarly, this is 40 divided by 150 into 0.14 plus 35 divided by 150 into 0.12 was the expected return or into 1 minus corporate tax, which is 0.3. Similarly, for WB is 20 divided by 150.

Weighted Average Cost of Capital

$$WACC = W_e r_e + W_p r_p + W_d r_d (1 - t) + W_b r_b (1 - t)$$

$t = \text{corporate tax} = 30\%$

$$= \left(\frac{55}{150} \right) \times 0.2 + \frac{40}{150} \times 0.14 + \frac{35}{150} \times 0.12 (1 - 0.3) + \frac{20}{150} \times 0.09 (1 - 0.3)$$

So, if you do this, this WACC comes out to be 13.867 percent.

The weight in RB is our 0.09%. Into 1 minus t, t is 0.3. So, if you do this, this WACC comes out to be 13.867 percent. So, from here, like you know, we know that if we need 150 crores for the company, using WACC, the cost of capital is 13.867 percent. Now, let us say the total amount, if we see, is we are going to invest it in project 1, and the return we are going to get is 12.2 percent. For project number 2, if we are investing that 150 crore, we are going to get 18.6 percent. We will definitely go for this project.

And, in this case, to calculate the share at t equal to, let us say we are going to go for n number of shares where S is the price of each share, and let us say it will yield after n years 10,00,000 rupees. At the end. So, from here, we can calculate our cost of each share as we can make it like, first, we have to calculate what is the present value of that 10 lakh rupees. Value becomes F divided by 1 plus i to the power n. Let us say this i equal to we calculated as 18.6 percent, and n let us say equal to 2 years. So, after 2 years, it is going to yield F

equal to 10 lakh rupees. 10 lakh rupees if the F value is 1 plus i is 0.186 to the power 2. So, this becomes 7 lakh 10986.

Weighted Average Cost of Capital

$$\begin{aligned}
 \text{Present value} &= \frac{F}{(1+i)^n} & i &= 18.6\% \quad n = 2. \\
 &= \frac{10,00,000}{(1+0.186)^2} \\
 &= 7,10,986 \text{ (P)} \\
 N &= 10,000 \\
 S &= \frac{P}{N} = \frac{7,10,986}{10,000} = 71.0986 \approx 71.1
 \end{aligned}$$

So, this is how we calculate the individual share price and also what we saw was how to calculate the weighted average cost of capital in this lecture.

Now, let us say this total amount is divided. This present value is divided into, let us say, 10,000 shares. So, our n becomes 10,000 here. The share price of each share will be that P divided by N, and that is 7,10,986 divided by 10,000. So, this is very close to 71 rupees. So, this is how we calculate the individual share price and also what we saw was how to calculate the weighted average cost of capital in this lecture.

So, this ends our lecture on the cost of capital.