Concept Covered

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

Then, we will look into resource company betas, then the capital asset pricing model, and at the end, we will see the weighted average cost of capital.

Hello everyone, and welcome again to this course on Mineral Economics and Business. This is our lecture number 29, and this is the first part of the lecture on determining the appropriate discount rate. So, in this lecture, we are going to cover or maybe give a brief introduction to the appropriate discount rate. Then, we will look into resource company betas, then the capital asset pricing model, and at the end, we will see the weighted average cost of capital. Ah.

So, from the previous lectures, what we have seen is that the correct decision on whether to develop a new project or not is determined by discounting future cash flows. Once the cash flow has been determined at the beginning of the project for both negative, which is the investment, and positive, which is the return. Then, they are discounted to one point in time, which we commonly take as the present time, to give the NPV, which is the net present value. So, if the NPV is positive, then at that discount rate, And then, it adds some additional value to the company.
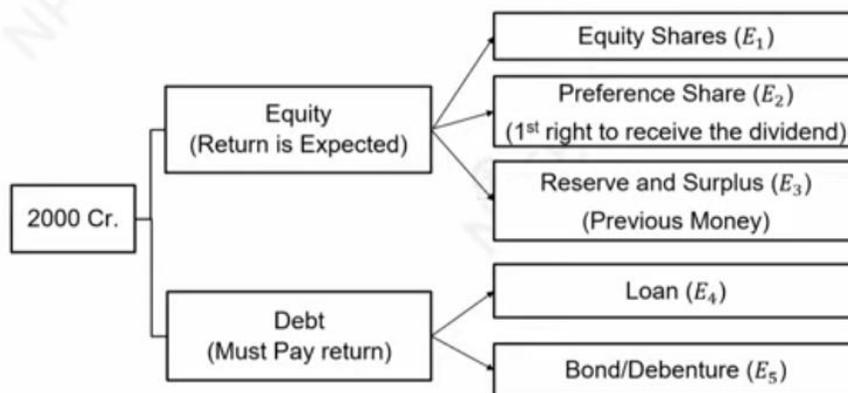
Introduction

- The 'correct' decision on whether to develop a new project or not is determined by discounting future cash flows.
- Once the cash flows have been determined, both negative (investment) and positive (return), then they are discounted to one point in time (commonly the present) to give the NPV.
- If a positive NPV is achieved at that discount rate, then additional value is being added to the company.
- The discount rate can be seen as a hurdle rate that needs to be achieved to meet the market's minimum expectation for listed equities.
- The capital markets theory, is the most common approach for determining the appropriate discount.

So, from the previous lectures, what we have seen is that the correct decision on whether to develop a new project or not is determined by discounting future cash flows.

The discount rate can be seen as a hurdle rate that needs to be achieved to meet the market's minimum expectation for listed equities. And the capital market theory, which will be discussed in the following slides, is the most common approach for determining the appropriate discount rate.

Appropriate Discount Rate

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                              ┌─ Equity Shares (E₁)
              Equity          ├─ Preference Share (E₂)
         (Return is Expected) │  (1st right to receive the dividend)
2000 Cr. ─┤                   └─ Reserve and Surplus (E₃)
          │                      (Previous Money)
          │      Debt         ┌─ Loan (E₄)
          └─ (Must Pay return)─┤
                              └─ Bond/Debenture (E₅)
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So, for this, let us take an example here.

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So, for this, let us take an example here. So, here, let us say to start a mining project, we initially need some 2000 crore, and from this 2000 crore, we can get this amount either from equity, where the return is expected, or maybe from debt, where we must pay the return.

So, in equity we have equity shares like in the preference shares where you know the they have the first try to receive the dividend, then we have reserve and surplus like you know the money we have from our previous project. In that we have loans and ah loans loans from the bank ah or maybe somewhere else or maybe ah you know the bond and the venture. So, we will get let us say E 1 ah E 2 E 3 all the way up to E 5 amount from different ah sources here. and the expectation or the you know expected return is let us say i1 percentage for ah the first one like where we have a equity share and then it is i2 for the next one i3 is ah the for the reserve and surplus the loan is let us say ah you know i4 and then i5 is for ah bond and debenture.

Resource Company Betas

A resource company's beta (β) is a numerical way of describing how that stock's share price, on average, will behave compared with the world's/nation's financial equity markets.

SENSEX	NIFTY
Sensitivity Index	National fifty
Bombay stock exchange	National Stock Exchange Mumbai
5000 + listed Company	1600 + listed company
How the top 30 companies are performing	Top 50 companies are performing

Index = $\Sigma\ Stocks \times Weight$

And ah if you see in India we have ah we have Sensex and Nifty ah to do that like ah and and Sensex is a short form of sensitivity index which is regulated through ah Bombay Stock Exchange and ah where we have 5000 plus listed company.

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So, once we know that in order to calculate this NPV or put some kind of you know overall ah you know ah cost of capital. So, we use something called weighted average cost of capital ah which we will discuss in the end of this ah lecture. So, ah but before going to this weighted average cost of a capital let us let us talk about ah the resource company betas. So, this resource company beta ah is a numerical way of describing how the stock shares price on average will behave compared with the world's or nation ah nations

financial equity market. And ah if you see in India we have ah we have Sensex and Nifty ah to do that like ah and and Sensex is a short form of sensitivity index which is regulated through ah Bombay Stock Exchange and ah where we have 5000 plus listed company.

And ah for nifty it is ah the short form of national 50 ah is regulated to the national stock exchange ah in Mumbai and it has ah more than 60 listed companies ah and and in here like what ah like the common term that we use is called index. for this either Sensex or Nifty. So, which is you know for let us say Sensex we have how the top 30 companies their
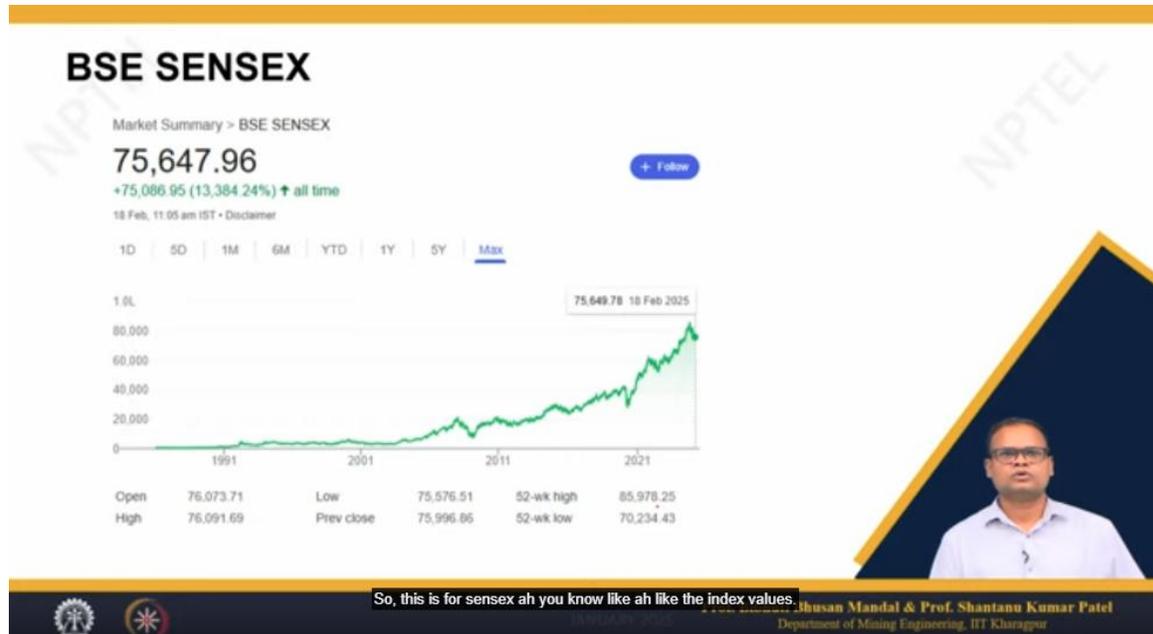
stock prices it is changing. And if you multiply with their respective weights, so it gives you the kind of an average value of this index. Similarly, for Nifty, the top 50 companies, how they are performing is used to calculate the index.

BSE SENSEX

2025 (Rs. 75,649.78)

1978 –79 (Rs 100)

$P = 100$

$F = 75,649.78$

$n = 2025 - 1979 = 46 \text{ years}$

$F = P(1+i)^n$

$\Rightarrow (1+i)^n = \dfrac{F}{P}$

$\Rightarrow i = \left(\dfrac{F}{P}\right)$

So, this is for sensex ah you know like ah like the index values. So, somewhere in ah 1978 ah 79 this has been started where it started with ah ah index value of 100 and ah as per 18th February ah 2025 we have ah this value goes to 75000 So, what does this mean is you know like at the beginning at 1978, 79 it was as I said it was 100 and it has gone to this value in 2025. So, what does this mean is like you know you can say that our initial amount p was 100 and you know like and the final amount has become 75649.78 and then for this you know it has taken some n equal to let us say 2025 minus 1979 which is 46 years

Thank you. So, if you put you know our previously discussed formula which is f equal to p into 1 plus i to the power n. So, where you know you can calculate 1 plus i to the power n equal to f by p and from here you can calculate i equal to f by p. to the power 1 by n minus 1. So, and if you put this put the respective value of p f and i this comes to be ah 15.5 percent. So, what does this mean is on average the index has increased ah by 15.5 percent per year ok.

So, similarly for nifty 50 like initially in this graph we can see like it was between 10,000 to 15,000 and it has you know grown all the way up to 22,814.3 on the as for 18 February 2025. So, if you see ah you know and and compare the the ah change in index for let us say Nifty 50 ah with another company in this case ah I have taken a example of the Tata Steel Limited So, if you see the index how it is changing ah it is starting from here there is a drop and then it is going to you know to some peak at ah before 2022 and again it is going dropping going up all the way you know close to you know between ah 2024 and 25 ah

later part of 2024. and again it is going down. So, similarly if you see for Tata Steel Limited if you see you know the price has gone down initially and then it is you know following the similar kind of ah trend as shown by Nifty 50 going down again and then going up ah which is close to 2000 you know between ah mid of 2024 and 2025.

Resource Company Betas

| SENSEX INDEX | | ABC mining Company | |
Monthly Accumulation Index	Change (%)	Share Price of the Company	Change (%)
8819.0	-	1575.0	-
8613.2	-2.3	1522.5	-3.3
8994.3	4.4	1606.5	5.5
9222.2	2.5	1659.0	3.3
9585.5	3.9	1753.5	5.7
9622.2	0.4	1764.0	0.6
9402.8	-2.3	1711.5	-3.0
9814.4	4.4	1816.5	6.1
9631.7	-1.9	1774.5	-2.3
9575.0	-0.6	1753.5	-1.2
9312.5	-2.7	1764.0	0.6
9723.0	4.4	1869.0	6.0
9863.7	1.4	1900.5	1.7
10182.9	3.2	2005.5	5.5
10360.4	1.7	1995.0	-0.5
10568.3	2.0	2058.0	3.2
10572.5	0.0	2058.0	0.0
10727.9	1.5	2100.0	2.0
10658.6	-0.6	2079.0	-1.0
10977.8	3.0	2163.0	4.0
11542.7	5.1	2299.5	6.3
12118.1	5.0	2478.0	7.8
12162.2	0.4	2488.5	0.4
11566.8	-4.9	2320.5	-6.8
11801.0	2.0	2383.5	2.7

And the index is changing from, let's say, 8,819 to 8,613 the next month.

So, and again, it is going down. So, it is What I am trying to say is it is almost following, not exactly the same trend, but it is following a similar trend to the national index by Nifty. So, this beta relates to how this company is doing compared to the overall market. We will see this. So, on the left side, you know, it is about, let us say, Sensex.

And the index is changing from, let's say, 8,819 to 8,613 the next month. So, this is the first month, let's say this is the second month, and it's changing, you know, month-wise. Similarly, if you see, there is an example company, let us say ABC Mining Company. For this, the share price is changing from 1575 to 1522 to, you know, like 16.5. So, in, in, like that, with a change in time. So, if you see, you know, let us say this is A here, like the index for Sensex is A, and this is B. So, what we can do here to get this percentage change is, you know, we can calculate the percentage

equal to B minus A divided by initial A, and you can multiply by 100 to get the percentage. So, if you do this between these two, we get, because there is a decrease, we will get, you know, the percentage change as minus Similarly, for the ABC Mining Company, you

know, if there is a change in the share price, you can say the next one minus the first one. So, 1522.5 minus 1575.0 divided by the initial, which is 75.0 into 100.

So, if you do this, you will get minus 3.3 percent. So, you can see the first, the national index is changing by minus 2.3, and for the company, it has changed to, ah, changed by minus 3.3 percent. So, the trend is similar, but you know the values are different. So, similarly, you can calculate for different months, ah, the percentage of change for the national index and also for the, you know, the example company. So, once you do this, ah, and plot it in a graph like here.

So, in the x-axis, we have change in index in percentage. And in the y-axis, we have change in share price of the ABC company in percentage again, and put all those values shown in the previous table. So, and you will find that, you know, there is a linear trend here between these two variables. And the representative equation is y equal to 1.2757 plus 0.2022 with r-square value of point, ah, close to 0.91. So, in here, like, ah, if you see, ah, if the market, as defined by the index, increases by 10 percent during 1 month, then on average, the share price should be moved by 12.7 percent from the previous figure with that equation.

So, which is, you know, 10 percent, ah, multiplied by 1.27, which is the slope of that line, is our, ah, 12.76 percent. So, this, ah, slope of the line from the previous figure, ah, that we saw is, ah, called our gear beta. So, which is, ah, is, is says wag gear is, ah, is unadjusted for, ah, that. And so, ah, we will see actually how to calculate the on gear data from this thing. So, for that, ah, you know, we have an example here where we have different, ah, mining companies, let us say BHP, Rio Tinto, Whale, and all.

Resource Company Betas

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

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So, in here ah in the second column it says the geared beta ah for these companies 1.6, 1.7, 1.5, 1.5, and 1.95 here and and the respective debt ah to equity ratio is 0.08.18 and is changing like this. So, in here ah what we need to do ah for ah new company if you want to calculate ah the beta ah then ah first what we have to do is to calculate the on geared beta for for the known companies. And, how it is done is ah you know the on geared beta is calculated using this equation ah beta on geared is beta geared ah divided by 1 plus ah d by e that too acuity ratio ah whole into 1 minus t. So, where beta beta here in in the top is ah ah is the geared beta and D is the debt and E is the equity and T is the corporate tax.

So, for the previous case for one of the company we had beta or the gear beta was 1.95 and debt to equity ratio in the table was 0.34 for the company and let us say the corporate tax is 30 percent. So, if you take this you know you can calculate the on-geared beta beta A is beta divided by ah 1 plus d by E into 1 minus ah the tax. So, and from here you can calculate ah if you put the values 1.95 divided by 1 plus 0.34 which is d by e 1 minus ah t t is 30 percent or 0.3. So, if you calculate this you will get that on the area of beta is ah 1.575 for this case this is on the area So, what is this on-gear means ah you know this debt to equity ratio is not considered.

ah like so ah if you see ah in here ah if you calculate ah. So, this was ah for one of this company where we took this example the ah on geared beta and then ah you know for other companies also if you know your geared beta and you can calculate ah you know the respective on geared beta for all these company. and then you can find out you know what is the ah ah on geared beta on average for all these mining company. ah Why we are doing this thing is you know for for the new company that ah we we we are thinking of can ah will have different value of debt to equity. So, we we have to calculate the geared beta for for the new company using ah this on geared beta ah the average value.

So, now coming to the geared beta for a new company, there are 3 steps. First is to calculate

Geared Beta 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 form previous equation.

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

So, now coming to the geared beta for a new company, there are 3 steps. First is to calculate the beta average for similar kind of companies which are ungeared, and then you have to calculate the D ratio between D and E or debt to equity for the new company.

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the beta average for similar kind of companies which are ungeared, and then you have to calculate the D ratio between D and E or debt to equity for the new company. And then the third step is to determine the geared beta for the new company from the previous equation which we have already discussed, which is that the ungeared beta equals beta divided by 1 plus D by E multiplied by 1 minus T. So, for example, let us say we want to start a new mining project where we have an ungeared beta that we found out from the previous table. The average beta ungeared, let us say, is 1.34 as we saw from the table. And then, let us say that the debt-to-equity ratio for our new company or new mining project that we are going to start is, let us say, 0.2. So, in this case, let us say that the corporate tax is 0.2.

And from here, if you put in that equation, the ungeared beta equals beta divided by— where it is geared beta divided by 1 plus D by E. E multiplied by 1 minus T here. So, here we know that our ungeared beta. So, the geared beta from here, which is this one, we can

put this value here, the D by E ratio here, and incorporate a tax of 0.3 here, and you can calculate beta equal to 1. So, this ends our lecture number 23. In our next lecture, what we are going to see is the capital asset pricing model and also what we are going to see is the weighted average cost of capital.