Financial Mathematics
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Lecture – 40
Financial Leverage and Total Leverage

Welcome to the lecture on financial leverage and total leverage. So, in the last lecture we discussed about the operating leverage and we know that the leverage is categorized into three parts one is operating leverage then we have financial leverage and then total leverage. So, let us discuss about the financial leverage and the total leverage.

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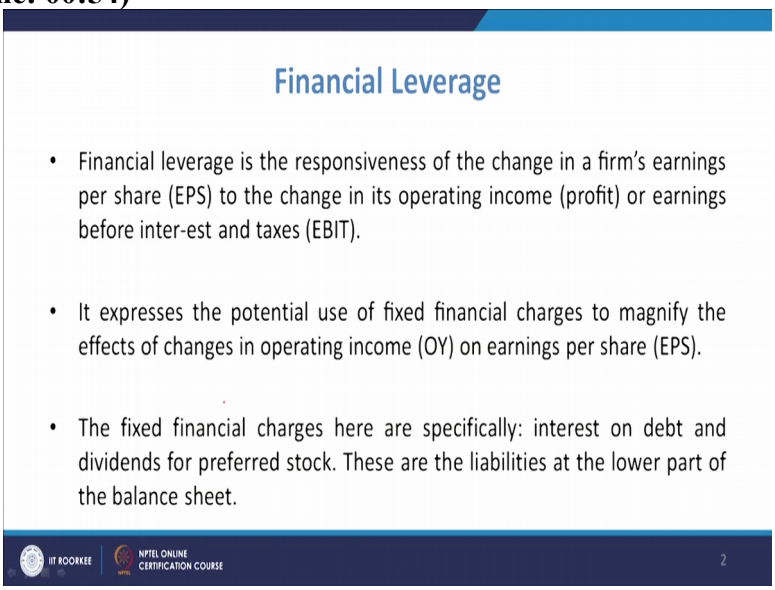

Now financial leverage is the responsiveness of the change in a firm's earnings per share that is EPS to the change in operating income or profit or earnings before interest and taxes. So, basically this is something like when you talk about the financial leverage then you have to have the operating income changes and then also the earning per share and how they reflect you know change in one how that is reflected in to the change of other like once you have the operating income or profit or earnings for interest in taxes.

So, how that change, reflects to the earnings per share so that is basically represented by the financial leverage. So, it expresses the potential use of fixed financial charges to magnify the effect of changes in operating income on earnings per share that is what we discussed that it will be talking about the you know magnified the effect of changes in operating income on the earnings per share. Now the fixed financial charges here are like interest on debt and dividends for preferred stock these are the fixed financial charges.

And basically the effect many times when you have to find the net income or we have to find you know so you if there are many debts or dividends which has to be paid and there are also taxes which are to be you know deducted so all that is to be you know taken into account and these are the liabilities which are the low at the lower per part of the balance sheet and they are taken into you know care while finding this financial leverage.

So, ultimately you know for this change in the operating income what is ultimately its effect on the you know earning per share this is how this financial leverage we will be talking about.

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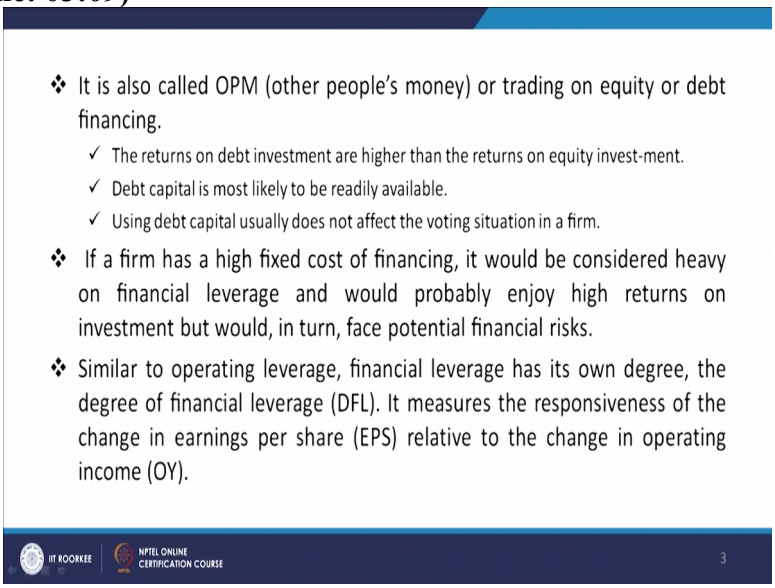

So, it is also called the other people's money or trading on equity or debt financing. So, this is also another name now in these cases what happens that many a times it has been found it is a truth that the returns on debt investment are higher than the returns on equity investment you know so this is you know is found to be true. Then debt capital is most likely to be readily available so that is also there because once you have taken them that is more readily available for the use by the company.

And because many a times you know you have to if you are using the; you know the other person's money or so if you are using the money of another form maybe sometimes then you may have other obligations to be performed. Then using a debt capital usually does not affect the voting situation in a firm. So, when you have you know use whether you use this debt capital then it indicates that the voting situation in the firm is not affected.

Many a times in some situations you may have to give the voting rights or you have to ask how to use a certain you know some so that is basically not affected. If a firm has hiked of fixed cost of financing it would be considered heavy on financial leverage and would

probably enjoy high returns on investment but would in turn face when a financial you know risks potential financial risk.

So, that is also the truth that if you have the high cost of financing in that case there may be you know higher value of financial leverage. So, but then there are certainly how much you are taking you know so how much is the debt or so. So, in those cases there are certainly some risks. Now similar to the operating leverage as we have discussed you know there is also a term known as the degree of financial leverage DFL.

So, in that case you had the operating leverage and in this case so we discussed about the OL degree of operating leverage and in this case we get the degree of financial leverage and the degree of financial leverage is basically the responsiveness of the change in earnings per share to relative to the change in operating income.

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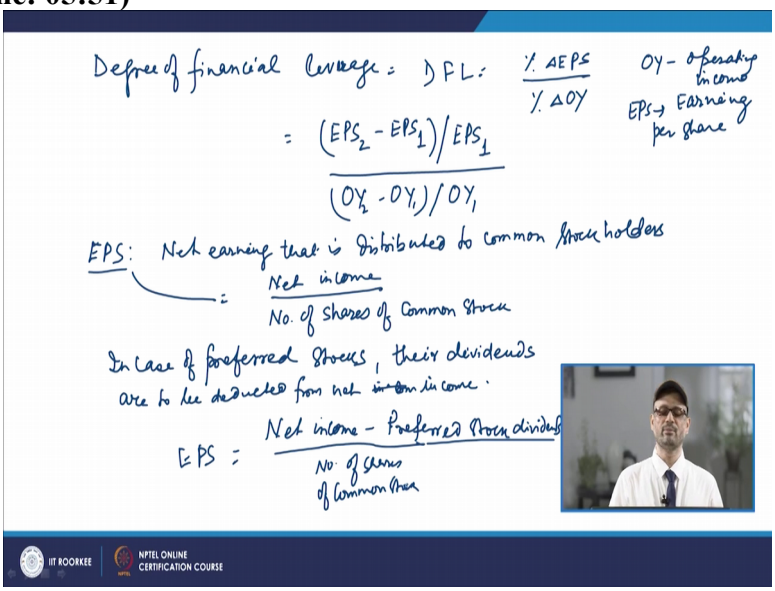

So, basically when we talk about the degree of the financial leverage DFL so as the definition indicates it will be a percentage change in the; so it will be denoted by DFL and it will be percentage change in the in EPS so that is your earning per share and this is relative to the percentage change in your operating income. So, the OY is the operating income and your EPS is your earning per share.

Now what happens that you will have 2 values suppose you EPS1 and EPS2 so basically when a EPS1 will change to the EPS2 in that case in the second year if you have the value of EPS as EPS2 and then you have the EPS 1 value in the first year so change and divided by EPS1 because change is from EPS1 and this will be divided by you know OY2 - OY1 / OY1. So, this is your operating income for the first and second year so based on that you can calculate these DFL values.

Now when we talk about the earning per share values so, EPS so when we talk about this earnings per share it will be referring to the net earnings basically and that that net earning which is basically distributed to common stockholders. So, this is a, net earnings that is distributed to common stockholders. So, now the what we calculate this EPS will be so EPS will be equal to net income and earnings per share so you have to you know divide it with the number of shares in common stock so that is of common stock.

Because we will discuss later that there are stocks also of 2 types common stock and preferred stock. So, this common stock we are talking about here. So, this will be your net income divided by number of shares of common stock. Now in this case you know once you have the preferred stock if you have suppose a preferred stock they are to be paid first their dividends is to be paid first we know that so that we will live in you know study once we study about the stocks.

So, in case of preferred stocks you know what we do is that their dividends are to be deducted first their dividends are to be deducted from net income. So, in that case what you will do is you will find EPS as net income minus the dividend which you are paying on the preferred stock so this will be preferred stock dividends and that will be divided by same thing like number of shares of common stock.

So that way we calculate these EPS and once you calculate EPS then operating income is anyway you know calculated based on the data and you can calculate the degree of financial leverage. And the value of financial leverage once you get that will tell so suppose you get financial degree of financial leverage as 1.5 it means if the change in operating income is 1% in that case the change in the earning per share will be 1.5%.

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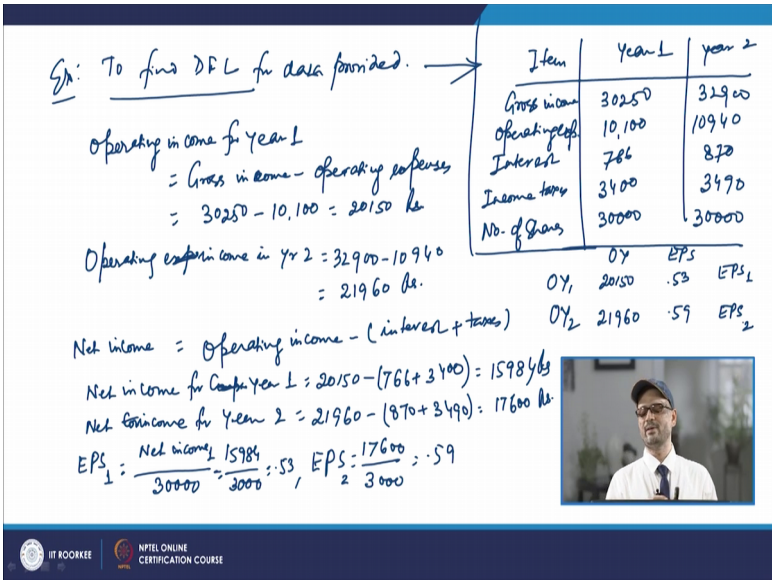

So, this is how we calculate these degree of financial leverage and we can also see by looking at a an example suppose there are certain data which is given and suppose you have some item is given and here under that you have year 1 and year 2 values are given and suppose you have gross income in the first year so in the terms of rupees is thirty 30250 and this is 32900 suppose and then operating expenses say let us say this becomes 10100 and here it is 10940 and interest what is deducted is basically 766 and this is 870.

And income taxes suppose which is paid is 3400 and 3490 and then number of shares suppose is 30000 here and 30000 here also. So, suppose for this data you have to find the degree of financial leverage for the company. So, how you will proceed for finding the degree of financial leverage, so to find degree of financial leverage for data provided. Now this is the data provided and for that for the company you know you have to find the degree of financial leverage.

So, you have to find the change in the operating income and you have to find the change in the earnings per share and then you have to get the ratio of earning per share by you know operating income changes. So, now you can calculate these operating income, operating income for year 1 so that will be the operating income will be for year 1 so it will be basically gross income minus operating expenses.

So, you have gross income as 30250 and operating expenses is 10100 so it is coming as 20150 rupees. Similarly if you operating expense for year 2 operating income in year 2 so here also you will be having the subtraction of operating expenses in the second year minus the net income you know gross income in the second year. So, gross income in the secondary thirty two thousand nine hundred and in this case it is 10940 so you know it will be 21960.

So, this is your operating you know income in year 1 and year 2 now you know we have to calculate the earnings per share. Now earning per share for that what we do is we need to calculate the net income. So, net income if you see so earning per share we know that it will be net income minus and divided by the number of shares. So, net income will be your you know operating income whatever you have got and then you have the interest earned income taxes which are paid so that is to be subtracted.

So, you will have the you know net income you will be operating income and minus interest for Texas interest and you know taxes which you have you know paid so operating income we have calculated so net income for company 1 for year 1 will be this is 2150 minus tax is 3400 and interest is 766. So, 766 + 3400 so if you subtract that it will be 15984. Similarly if you have to calculate the net income in for year 2 so year 2 net income is operating income is 21960 and minus you will subtract these interest is 870 and taxes are 3480.

So, it will be 870 + 3490 so if you subtract that it will be 17600 rupees so you got the net income as 15984 and 17600 so EPS you will get so EPS you know for year 1 will be net income divided by number of shares. So, net income 1 by number of shares 30000 that is 15984 / 30000 so it will be 0.53 roughly. And if you calculate EPS 2 so it will be you know 17600 / 30000 so you know so that came equal to if you do it will be something close to 59 or it will be 583 or 3or so 586 something like.

So, 59 we can take now once we have a EPS1 and EPS2 and we have operating you know income in year 1 and year 2 then we can find certainly the DFL and we have a basically matrix we have a matrix formed now we have a operating income 1 operating income 2 and so we know that this is your EPS if you look at so do you have you got 21 so you had the you know operating income has 2150 and here to was 21960 and EPS is you know .53 and you have 0.59.

So, this is your EPS 1 and this is your EPS 2 so now if you have to calculate the degree of financial leverage it will be this one as this divided by you know EPS 1 - EPS 2 and 2- 1 divided by now you know EPS 1 then a whole divided by OY2 - OY1 / OY1.

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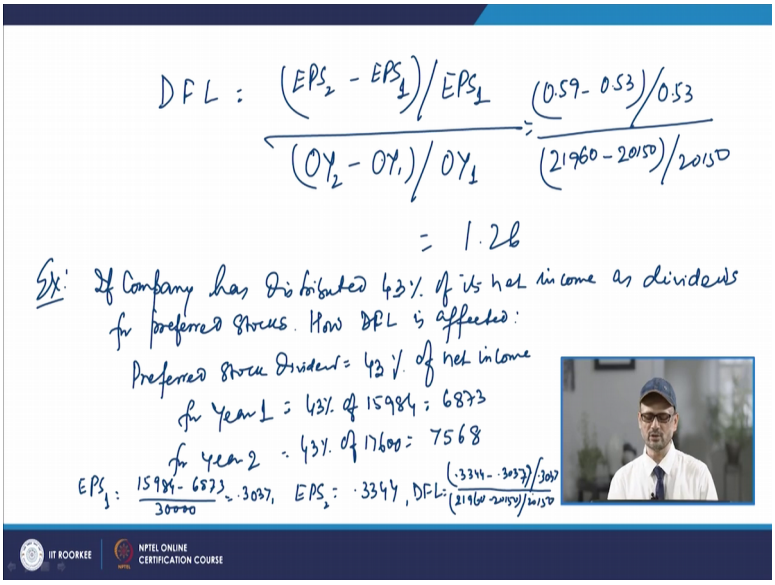

So, now you can finally you can find DFL as EPS 2 - EPS 1 / EPS 1 whole / OY2 - OY1 / OY1 so this is how you will get EPS 2 we know that it is 0.59 EPS 1 is 0.53 / 0.53 and then further OY2 is 21960 and then this is 20 you know 150 / 2150 so if you look at this ratio it is coming as 1.26 it means that if there is a change of you know the operating income by 1% in that case the change in the earning per share will be 1.26% so this is what the meaning of the you know degree of financial leverage will be.

Now this is the calculation of DFL when you do not have the you know data of the dividends which are to be paid to the preferred stock. Now let us say you know if the condition is that the company has preferred stock also company you know company has distributed so if the company has distributed you know 43% of its net income you know so 43% of its net income so that data distributed as dividends for preferred stocks.

Now what will happen in that case so how so how DFL is affected? So, in that case what you have to do is you have to find further the EPS 1 and EPS 2 so you know the dividend which is paid will be 43% of the net income. So, preferred stock dividend will be in 43% of net income so net income we have already calculated and so that is why you know for year 1 so it will be for you know 43% of 15984 so that will be 6873.

And similarly for year 2 you know it will be 43% of 17600 so it will be 7568 now you know once you calculate the EPS in that basically what we find is in the EPS in the net income you are paying the amount you know the dividend of the preferred stock from the net income. So, you know if you calculate the EPS for year 1 and 2 it will be different so EPS 1 now in this case will be basically whatever in a net income you have you have to subtract this.

So, suppose 15984 - 6873 and that is divided by 30000 so this will be coming as 0.3037 similarly if you find the EPS in the second year now again here also the 17600 - the 43% is 17568 / 30,000 and that will be coming as 0.3344. So, once you get that then you have to calculate the; you know DFL. And if you calculate the DFL so DFL in that case you have to you have these different values and if you calculate the DFL in that case so DFL if you calculate so it will be EPS 2 so it will be 0.3344 - .3037 and divided by you know 0.3037 and then this is divided by your same thing that is your 21960 - 2150 and divided by 2150.

So, this way if you calculate the DFL it will be coming out as 1.125 so what you see that the DFL was earlier 1.26 and since you have paid the dividend to the you know preferred stockholders so your DFL has gone down to 1.125 in this case it means your if they are operating income is changed by 1% your you know EPS will be changed by 1.125% so that is what the meaning is and we calculate the DFL in such fashion.

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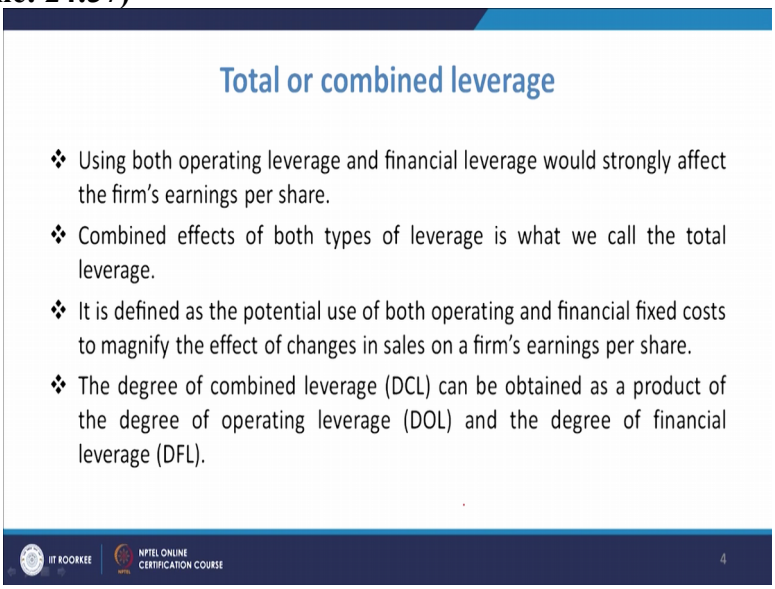

Now we will talk about the combined leverage or total leverage. Now when you have the both operating leverage and combined leverage they have the; so both have the strong effect on the firm's earning per share. And this is what the combined effect of both the types of leverage is known as the total leverage and in this case it is the net earnings it is defined as the potential use of both operating and financial fixed costs to magnify the effect of changes in sales on firms earning per share.

So, you know in that case what we do that you have to have the combination of these two and this is why your change in sales income and how it effects on earning per share that will be known as your the total leverage. So, degree of combined leverage can be combined as

product of degree of operating leverage DOL multiplied by degree of financial leverage so there will be a link between the two and how that will be changing.

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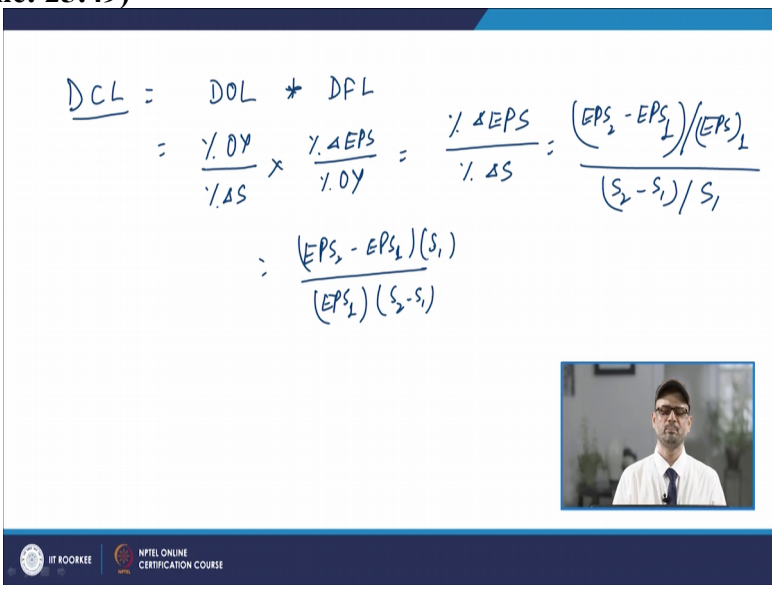

So basically what is the formula is that you know degree of combined leverage DCL degree of combined deliveries and it will be degree of operating leverage multiplied applied by degree of financial leverage. So, this is how the degree of combined leverage will be changing you see that DOL when we define DOL it is nothing but you know percentage of operating income and with respect to the you know percentage change in sales and then this is you know percentage of the earning per share with respect to percentage of operating income.

So what you do is see that this both will be cancelling and it will be giving you the change in earning per share with respect to change in the sales. So, you know what we see that it will be percentage of you know change in earning per share to percentage of change in sales. So, this is how we calculate and we can write EPS 2 - EPS 1 and then divided by EPS 1 and then further you have S2 - S1 and divided by S1 so this way we calculate you know the degree of combined leverage and you can further simplify EPS 2 - EPS 1 divided by EPS 1 into S2 - S1 and here it will be S1.

So, this way you know you can calculate the degree of combined leverage and you may have the data you can have the data where the values are given and you can directly use those formula to find these you know degree of combined leverages.

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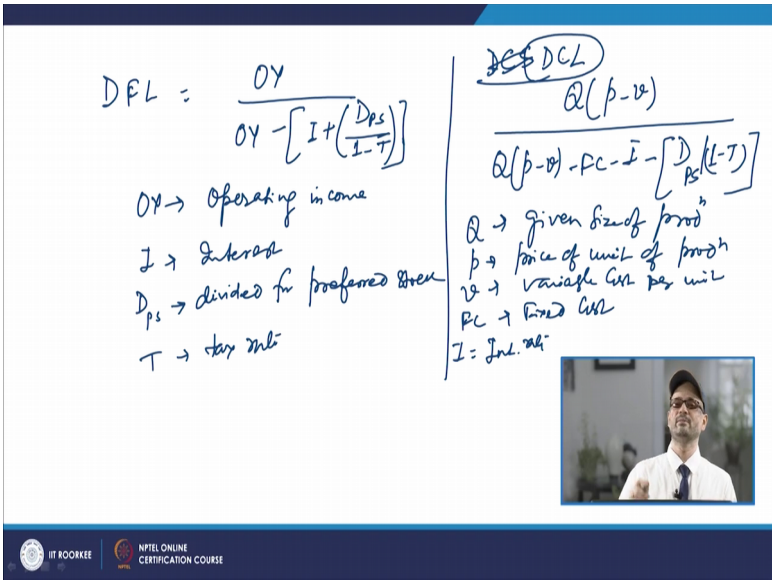

You must be also knowing a certain other formulas for finding that you know your degree of financial leverage and degree of financial leverage alternatively you can use certain you know formulas you know so when you have at the base of the operating income so you have you can have this OY / OY -1 + DPS / you know in 1 - t so this is I and this is how you calculate the you know directly the degree of financial leverage. So, here OY we know that it is the operating income and you know I is the interest.

And DPS so when you have the preferred stocks so if you know if you have the problems where it deals with the preferred stock you know dividends so that can be directly used so DPS will be you know dividends for the preferred stock. And T is the tax rate so many a times tax rate is also you know supplied so the in that case income taxes in normal situations you calculate the income tax but tax rate may be there.

So, certain percentage of; may be given so that percentage is there. So, in that case one minus that percentage will be there so that can be used and directly you can get the DFL. Similarly you can also find the degree of combined leverages also by using some formula directly and that formula becomes like Q * P - V and divided by you have Q * P - V then you have -FC - I minus then you have DPS and by 1 – T.

So, this way you know you do you can calculate the degree of combined leverage where Q is the different size of production and you have P and V you know that you know P is the price of unit of production and V is variable cost per unit you know FC is very clear it is fixed cost so FC will be fixed cost you know and then I is the interest rate and DPS is the same thing like you know dividend you know for the preferred stock.

So, that way these formulas can be directly used for the calculation of the DFL or you know DCL for this yes this is DCL degree of combined leverage or total leverage. So, this is basically about the chapter on leverage and you can keep these formulas in to your mind and that can be used for solving these problems, thank you very much.