Quantitative Finance

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Module - 05

Lecture – 28

So, welcome back. So, in the last slide of the when we just close the class of the last lecture we consider that we are trying to combined a forward and an option. Now why did we do that? That was the question which I have tried to explaining is that any negative moment also is we are trying to basically reduce a risk, on the positive moment also you are trying to reduce a risk. But if you look carefully at the diagram, the main trusted a is that you think in the long run, the prices ST would increase that is why you are afraid and you want to mitigate or lesson your overall impact.

So, your main concern is to go for a combination where your main concern is any increase of ST greater than K if it is done on a standard on basis; standard on means. If you are only gone for a forward of you are only gone for a option. That would have basically made a huge amount of loss; mainly for the option. So, now you are trying to combine them, such that you are able to listen your overall impact. A moment ST is greater than is equal to K. So, if come to the qualitative words it stays like this.

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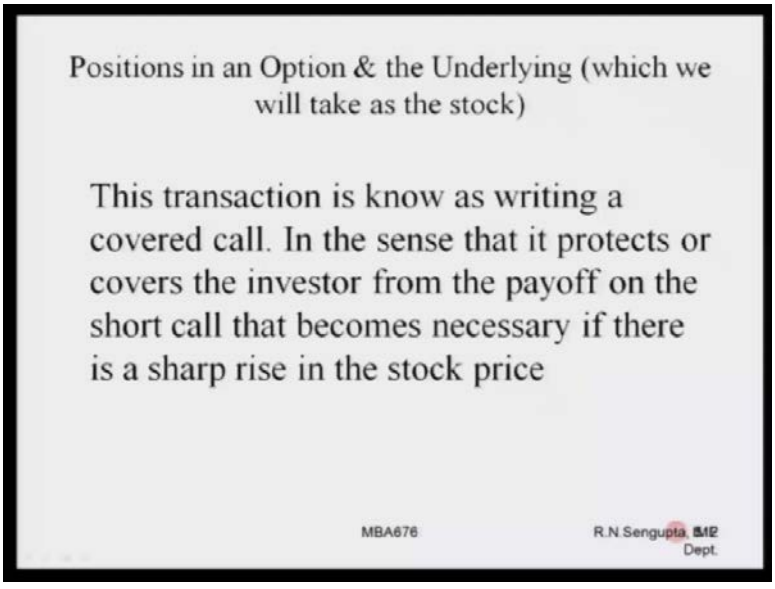

The transaction we have considered is known as writing a covered call; that means, you

are trying to cover the call. In the sense that it protects or covers the investment from the payoff on the short Call that becomes necessary if there is a sharp rise in the stock price. So, if there is a sharp rise in the stock price; obviously, the person has bought the option exercise, which means you would face a loss; showing in order to cover a loss you would basically go for a forward position also. Such that the overall impact is done in such a way that the overall profit or a profit or loss would be parallel to the x-axis. So, any extra amount of increase in ST would not have a detrimental effect on your overall risk.

So, similarly you may be thinking well. This was the case where ST is greater than K, you think is going to happen. What if s t? If you thing is going to be less than K. Can you, will do that? The answer is yes, we will see that in few moments.

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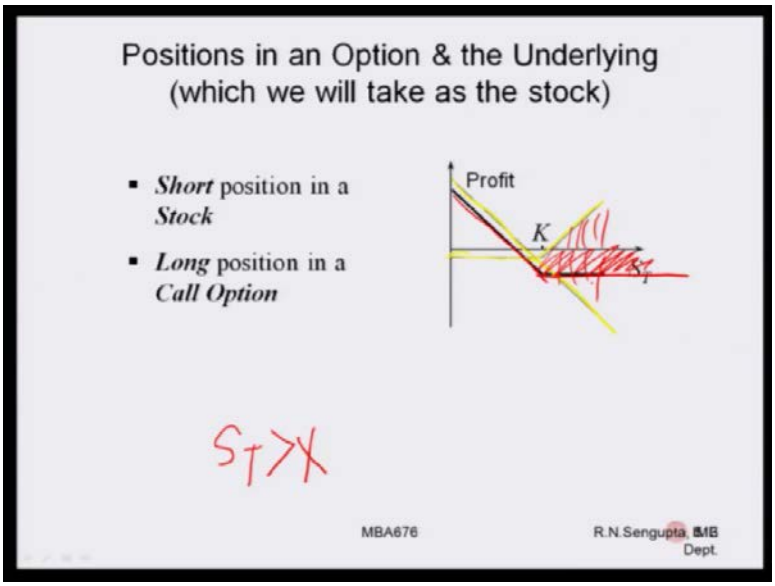

So, position is an option and then underlying one where you thing the prices would be on the downward trend later on; we will see that. So, consider is the short position in a stock; which is this one and the long Call which is this one. So, again this year ok. Before I come to the any negative moment. Here also again you will think, this will happen. ST in the long run would be greater than X or K. Which means if you consider this; this would have been the profit, this would have been the loss. So, we are trying to combine them such that is parallel. So, any loss is basically in between this. Such that you are able to overcome, you are overall huge amount of fluctuation in the price. If ST is greater than K.

So, now, this you have considered in the first example, it was a long and a stock and the

Call option was done accordingly. Here it is a short position on a stock and a long position on a Calls. So, now, you are basically trying to combine them; such that the short and the long go hand in hand. Thinking that in the long run if ST is greater than K, you will face a loss. Now as I was repeating, what happens if the ST is on the downward trend less then K? How do you do that?

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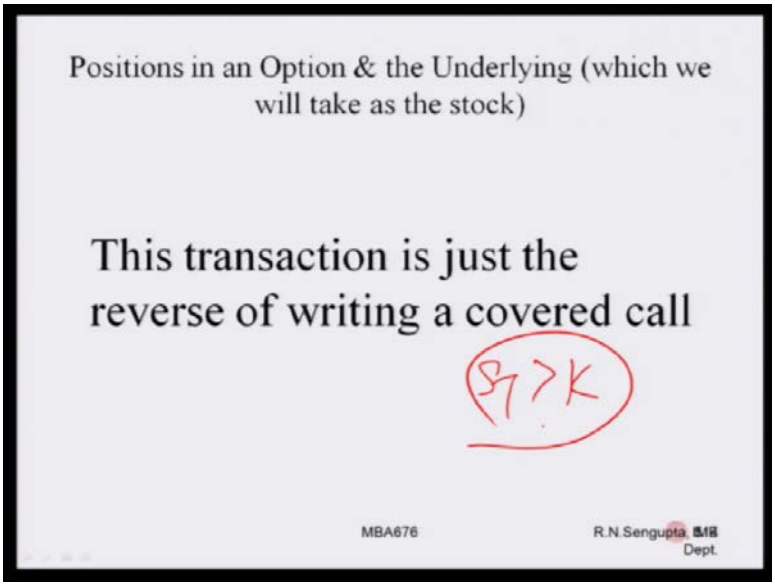

So, this transaction you jus reverse of writing a covered call. You have written then the first case, now you have bought second instants. So, in there are also you thought ST was greater than K would make a loss. So, you have basically reduced the overall loss.

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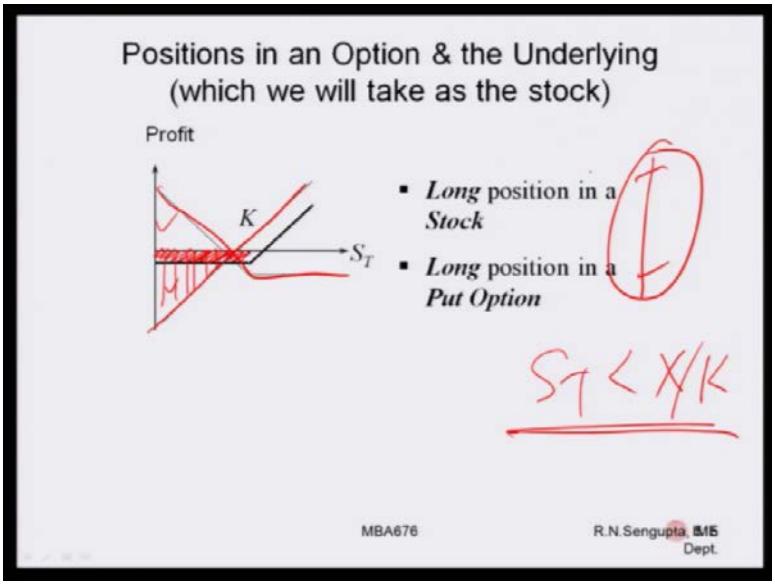

Now, think if the prices where happening in such a way, that you would have made a loss. So, consider you have only gone for the forward; this is the loss. So, you want to reduce. How would you reduce? You will also go for a long position in Put option. So, this is the one. So, any negative price moment this and this would be cancelled with each other, such that you are overall position would be this parallel line to the which is the bold one. So you are more thinking that any negative price moment of ST less than equal to X or K; is detrimental and is going to happens. Such that you will combine them with the long position in a stock and a long position on a Put. Again the next question comes, can we do that with the call? So, the answer is yes. What we have to going to do? We are going to see that if you can basically formulate a forward along with the option. Thinking that the prices are going to go on a downward trend, which is this. So, this was one position. Now we will see that how we are going to do? They would do that which a Call position.

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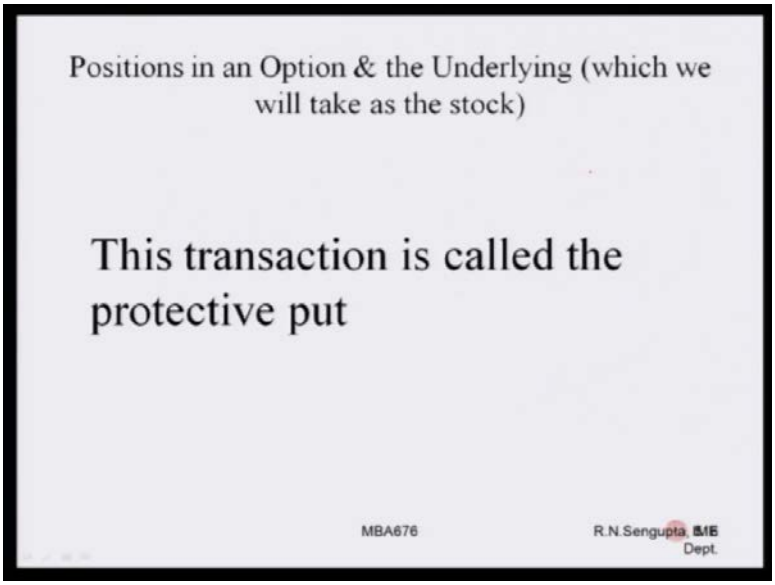

So, this transaction is called a productive Put; because we have been able to product the Put from any negative fluctuation.

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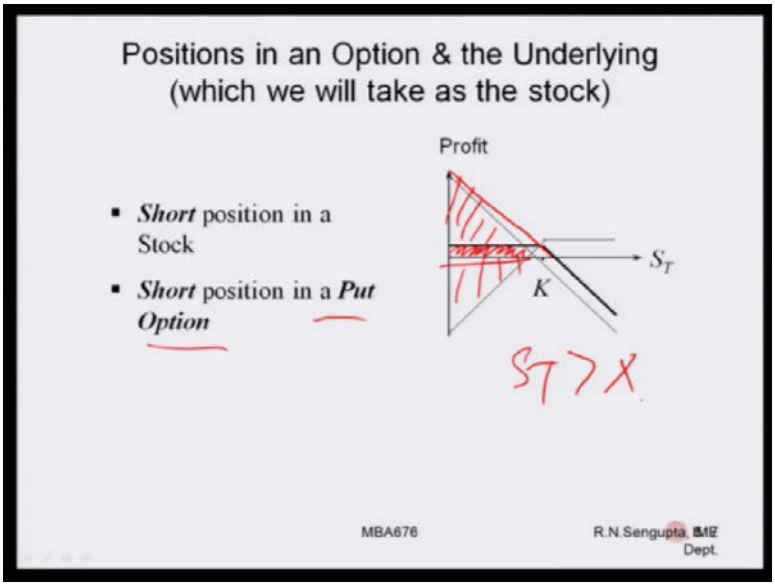

Again the same thing. If you are gone for an option, short position and Put option. This would have been a loss. Now, you also go for a short position as stock, such that combine them. This is the profit which you would have. This is the loss, the overall loss is reduce to the maximum possible extend. So, we have been able to combine that with the long, short or negative price moment and initial first two side it was basically combinations on option and forward. For any prices or ST was greater than K. So, we have basically been able to consider both positive and negative moment of ST.

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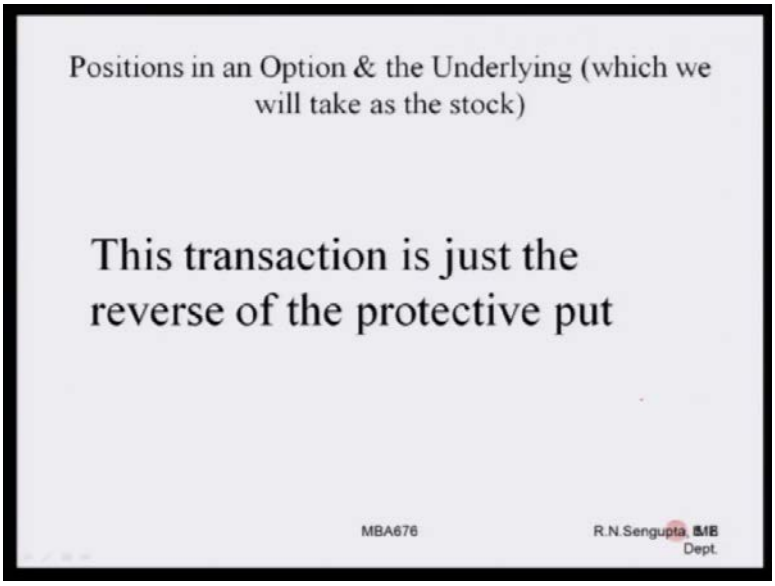

This transaction is just the reverse of the protective Put which we have consider. So now, we have been able to see any ST greater than K for there are two instances where we can

reduce the risk. ST less than K, again there are 2 instances you can did reduce the risk. So now we will see that how you can expand your combination in a ways or where. ST now basically starts varying in different domains or range.

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A spread strategy involves taking a position in two or more options at the same time, as the same expiry date. Some examples are Bull. Where you think, why the Bull is use? I will come to that. We will come to the concept of why Bear what is use? We are spread, we will also come to the concept of why Butterfly, what is used? So, these are the spreads. Spreads means the overall fluctuations.

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What does Bull spread mean? Bull spread means the investor is hoping that the stock price would increase. Similarly the Bear aspect would have been the investor is thinking or hoping the price would decrease. And in the Butterfly one will think or the investor is thinking that is basically fluctuating within a range. How that happens? Let us consider.

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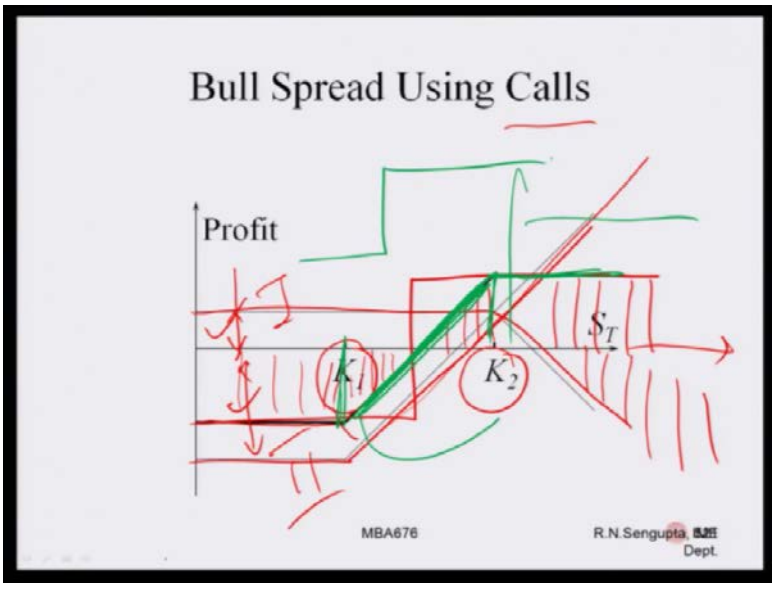

So, first for the case Bull spreads. Now you have basically have to using options only, these are Calls. So, this is one same time duration but the price is different, K2. Another option same time duration K1. Now if you consider both of them on a standalone basis. The first one, the moment it is greater than S2, you face a huge amount of loss. It increase as you go on to the right. For the case of 2, the price is greater than K1; so obviously, this is the price, it will increase. So, now, what you think is that, you want to basically minimize the overall loss such that you want to combine them in such a way.

So, any positive and negative moment thinking the positive would happen more, you are able to reduce your overall risk in both direction. How combine them? And consider these prices are, these are the prices which are paid. If you combine them, you see for any fluctuation which is less then K1; it is always constant any fluctuation greater than K2 is always constant. Any fluctuation in between would just basically wear straight line where there is much not much of a loss and much not of a gain. So, this is the loss, this is the gain.

So now, you ask what happens if K1 K2 become one? It will be a spite line, there is a step function. So, what we have been able to do is that, considering two different Call

options depending on the prices. Whatever the prices what paid or bought. You are able to reduce your risk in either direction, but here you are thinking that it would be more on a Bull spread because the price would be increasing; such that any increase in the price you have been able to mitigated this to a constant value, which is much less than the overall risk. Which you have would have face if they was only 1.

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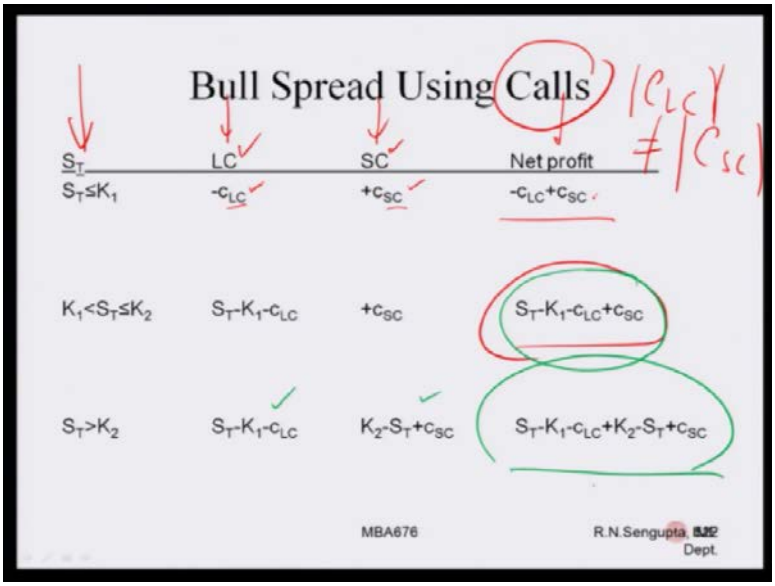

So now, consider if you remember I did mention that first draw the diagram or then the table or draw the table and then the diagram. So, exactly the same thing. So, we are considering on the first Call on ST the 2nd Call is the long Call. This is basically the short Call and this is a net profit. So, this is basically Calls on need. So, these are Calls, CC are the Calls, L and S are the long and short. Now also consider this L word LC SC are the prices of the long and short. So, we are trying to basically use the same symbol C, but with the suffix would denote what are the prices. So, also remember the value mod of LC is not equal to the mod of SC. That means, you considering the prices are different.

So, if they one not different; obviously, this would be 0. So for ST less than K1. So, you are value for the LC is the minus value which you have paid. The value for the short is that you have basically sold, you will get some money and the net profit would be the difference of the value which you have done. If you go back to the slides again, this is the negative value minus. It could be positive also depending on whether CSC and CLC are positive or negative, whichever is greater. Now, consider it is between K1 and K2. So, in the case of it is, if for the long Call it will be exercised. For the short Call it would not be. So, if you combined them the profit become this. So if you go back to the slide

again. So, this is the straight line. So, if you consider the straight line for values between K1 and K2. This is the equation you are trying to consider.

The moment ST is the greater than K2, which is in this region. So, what will happen? It 1 has already been exercise, this one. The second one will also be exercised. So, this is already been exercised, this will be exercise combine them and then your total profit functionally this. See this. This is the line which we had basically. So, this if you K again K1 K2 a same, this is spite function.

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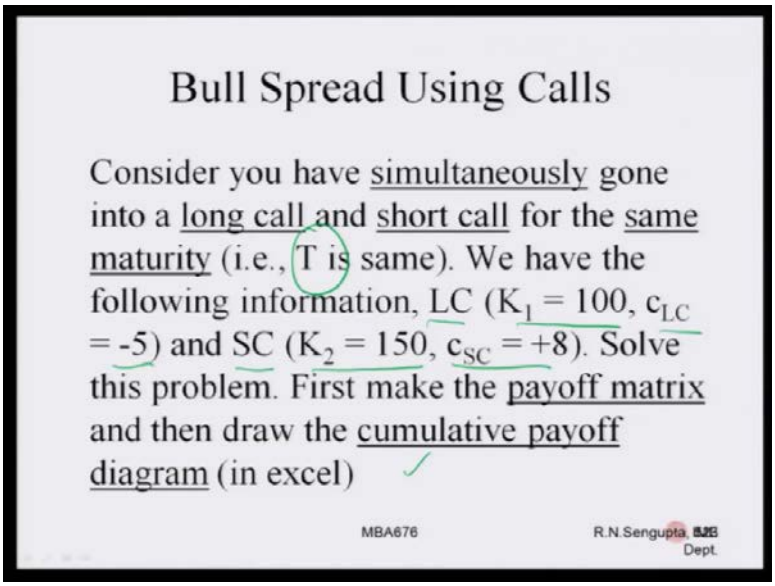

Consider you have a simultaneously gone in to a long Call and to a short Call for the same maturity remember time to maturity is fixed. You have long Call K1 is 100, CLC is minus 5; because of the amount of money being paid. And short Call is K2 is 150 and CSC plus because this is the money amount which you are getting. Solve the all above problem. So, if you basically Put these values. Exactly as it is you will get the matrix which is shown here; and when you get the matrix and get the graph combine them, you will get the Bull spread using the Calls where there are 2 Calls. What are these Calls? This is a long Call and a short call. And the values are given; LC straight price, price of the call, short Call price with the delivery price and the price of the call. And the time duration T is same for both of them remember that. That is important.

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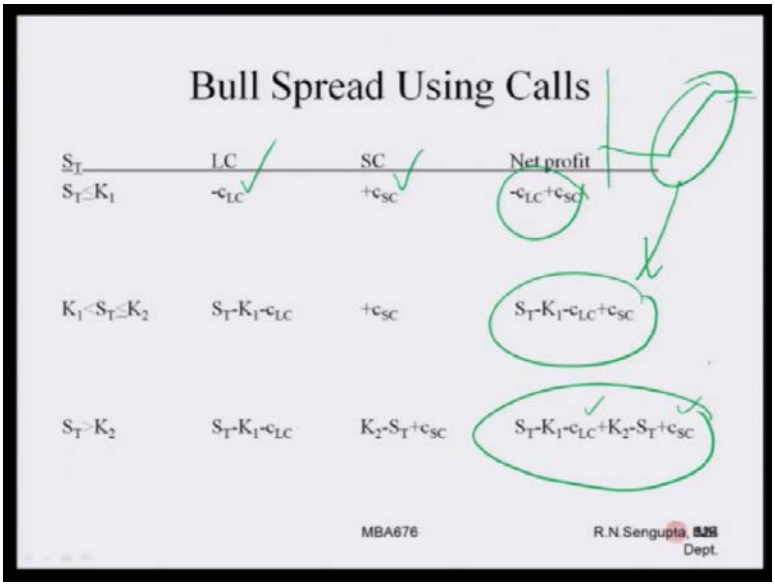

Now you consider the Bull spread using Calls, again the same thing. Now if ST is less than K1. Both would not be acted upon, because it is the profit and loss you are already made. This is the price which you have paid; this is the price you have got. So, the net profit is given depending on which is greater; positive is greater, so it will be on the higher side over the x-axis. If it is negative it will be on the lower side. The moment ST is in between K1, K2; you will have the final equation which is the straight line again; this portion. And in the value of say for example, ST is greater than K2, is basically straight line which is given by the equation again. CLC and CSC they would basically variant the values, but obviously with the positive and the negative sign and you can make a decision at any time.

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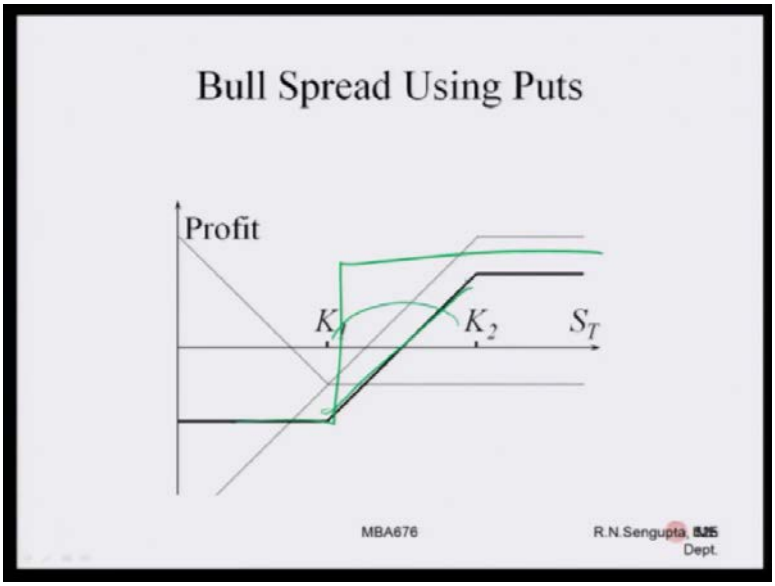

Now you are considering a Bull spread using a Put. So, again what you need to do is that understand very logically. First have the Puts, how many Puts are there? Whatever it is. Here we have only two Puts. So, it can be long Put, short Put, for different time durations, for different strike prices it does not matter. They can be 2 Puts, 3 Puts, 5 Puts whatever it is, it does not matter. So, what you need to do is that? Understand that they are for the time being initial condition they are of the same duration, time to maturity is fixed and then also you will consider the delivery prices K1 K2 K3 K4 are very clearly marked along the x-axis.

And then draw one at a time, what the different type of Puts? If it is a long or a short or different combinations of them draw them individually. And then once you have drawn them individually, then you make the cumulative graph that is method 1; and once you have the make cumulative graph then you can come back to the cumulative matrix. Another method would be 1st draw the table, what you need to draw? Basically in the 1st column you have the ST values in which domain and then you have basically different type of options; long Put, short Put, what are the amount of prices which you paying or a getting. And then the last column you basically take the cumulative profit as ST changes domain. Once you have done again you can basically go back and try to draw the diagram as it is given here and basically we will be able to understand that. Given the diagram you can draw the matrix and given the matrix you can get back to the diagram. So, let us see that given the diagram, we want to basically a double check how we will get the matrix.

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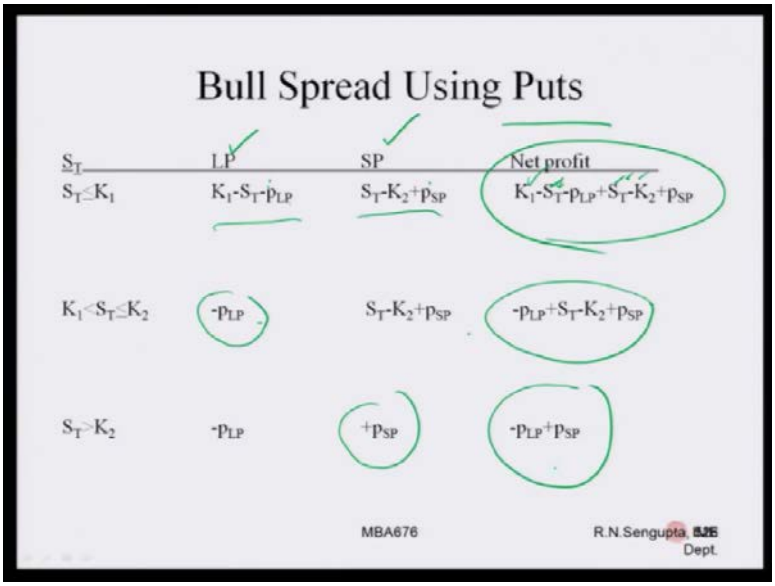

Again this is the Puts. This is known as long Put, short Put and the prices the Put are given by the symbols P. So obviously, it is minus and plus depending on all the whether the payments are being made or payments are being obtained. And the suffix LP and SP are the long Put and the short Put, SP and LP remembers that. Now if ST as less K1; obviously, in this case both are being exercise and the cumulative profit is given by this depending on the value of PLP and PSP. Relive a set then negative sign and the positive sign. The net value once you basic separate form 1 from each other, you will get the overall value of SP and LP. And this K1 and K2 are basically the prices of the delivery for the corresponding Puts which you have. So they are same, again remember it is a step function.

And the value of ST is basically the value of the, if you cancel, because these are going to cancel for both the cases. If you consider ST is basically the spot price for that particular stock as on time T cap T is capital T. As now ST changes its domain it is now greater than K1 and less than K2. And in the third instant which is the third row is basically greater than is equal to K2. You will find out they would be different combination of that; which means that if ST is greater than K1; obviously, it would not be a exercised. Again if it is greater than K2, obviously it is not exercised. Exercise by whoever the buyer is, it can be you or it can be the person; and based on you can find out in the last column the net profit. That means, if you draw the net profit, the graph which will be get is this. Again still I am saying the same thing, both K1 and K2 same it is basically a spite function. And as they change it basically becomes in the tangential at are

the sloping line. Sloping line means the one which you out of here.

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Now you consider the Bear spreads. The investors is hoping in the stock price will decrease. Here till now we have consider the stock price is increase, now we are thinking in the stock price will decrease. So now, consider again different type of options Put and Call in different combinations.

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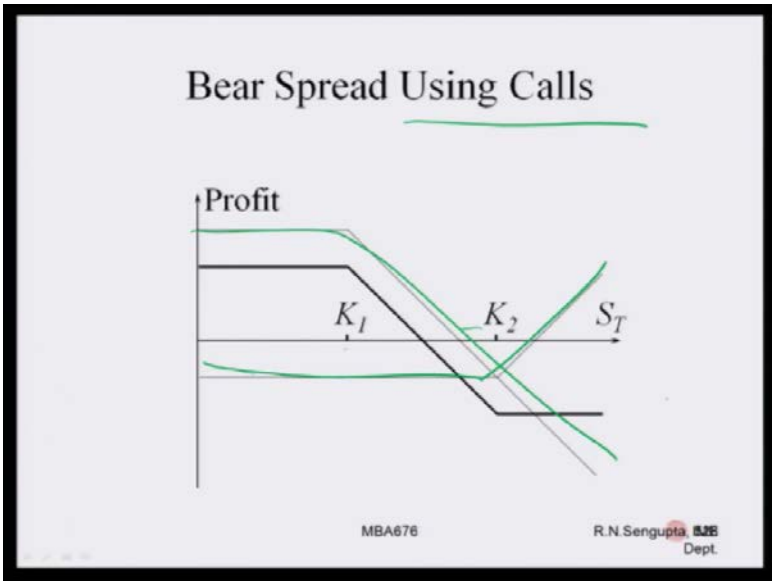

This is using the Calls only. So, now you are thinking it is on the reverse direction. ST would be decreasing it is on the Bear market. So, now, again you have to Calls, combine them again the difference of K1 and K2 is there. They are not the same once you

combine them. You will see the whatever the ranges, Bear overall profit and loss is basically kept within the bank; that means, we are able to mitigate there is to the maximum possibilities.

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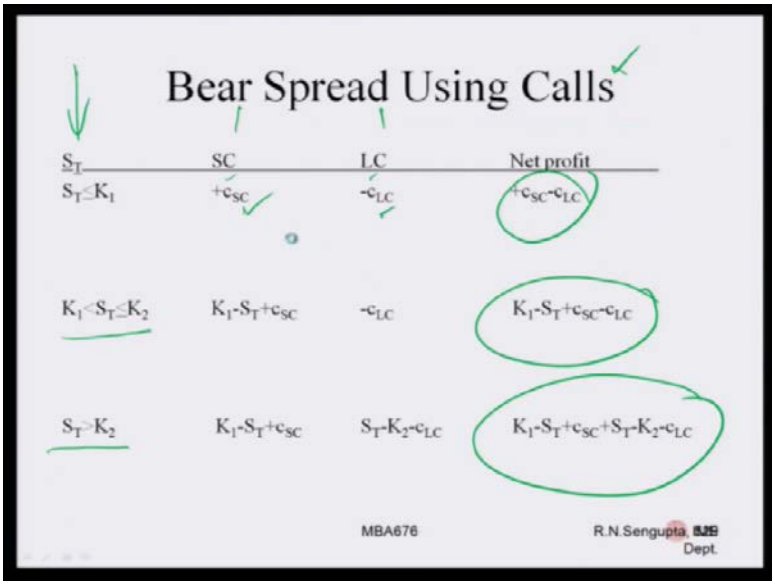

Again let us take the Calls, again draw the diagram. Whether first column is basically ST different domains or different ranges of ST. The 2nd, 3rd are basically the short column and the long column. Here again C is the prices minus and plus; depending on whether you are basically giving or buying or basically some bodies buying from you. And LC and SC are basically the simple concept of short Call and long call. Then as ST is the less than K1, ST is between K1 and K2 and ST is greater than K2. You will basically have the different combination of short Call and a long call. The first instant both of them are not exercise hence the profit is given by the difference with the negative or a positive sign whatever it is.

The moment ST is the greater than K1 and less than K2. The short Call will be exercise and the long Call would not be exercise. And the last instant when the ST is the greater than K2; obviously, short Call will be exercise, it have already been exercised. Now similarly long Call will be exercise. So, if you combine both these instances, when ST is between K1 K2, ST is greater than K2. The overall profit functions are given; that means in this case, obviously you will have if you combine them the overall profit function will be such that the matrix would basically give you the diagram as shown. So, this is now using the Calls. Now you question would be can be do it using Puts? Answer is yes. Let us see how.

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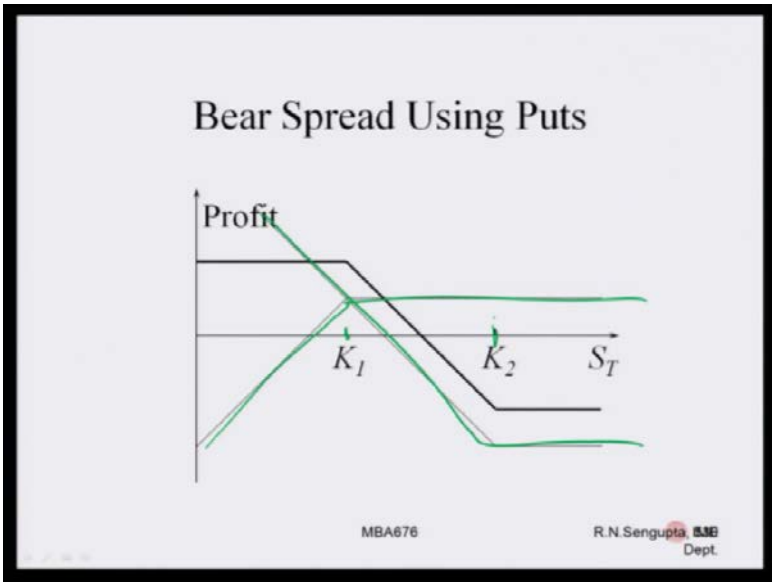

Now it is a Bear spread using Puts. So, this is basically 1 Put, this is one Put and I can note down the prices K1 and K2. Remember that time to duration to maturity same T. Now again if I can before showing the table, if you recollect; and the 1st column you have the ST, 2nd column you have the Puts long or short whatever it is. Depending on whatever that the delivery prices and the last column which will have is basically combination on the long Put and the short Put. So let us again we has the same example.

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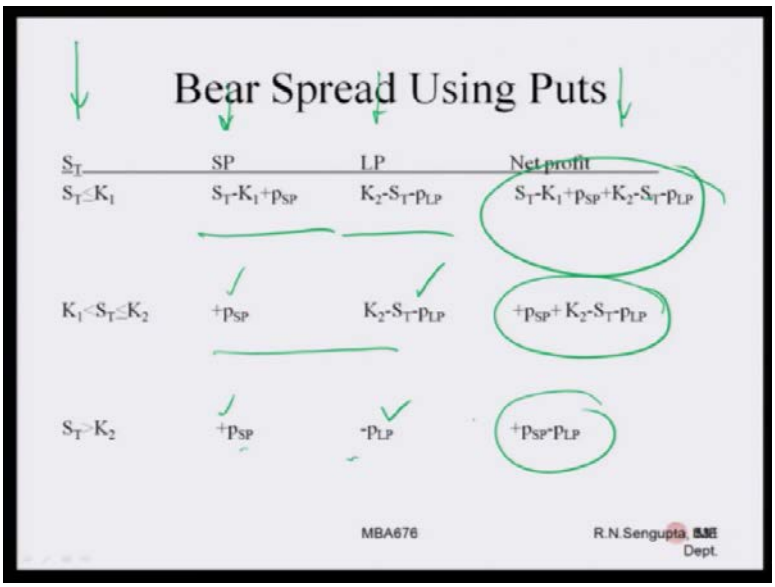

First column ST less than K1between K1 and K2, greater than K2. So, this is exactly what I have doing. If there are more case you will do basically break it down accordingly. The next column which is the short Put and the third one is the long Put and

the forth one is the combine profit. If you see the prices are given by P for the Put with the suffix SP and LP as they are the short Put and the long Put. And with the minus and the plus would basically means, money is flowing out of your pocket, money is coming to your pocket. So, in the case when it is less than K1; so both have been exercises, so the new cumulative profit would be this. Just remember ST and C ST would be canceling out. But I have basically it treating them in explicitly form for you to understand.

The moment ST is between K1 and K2, one of them would be stop; obviously, nobody were access and other would be on. On means somebody would exercises. So, the short Put would not be exercised, because the prices is already greater than K1and the long Put would be exercise still the level when ST is less than equal to K2. So, in this case it has been exercised in the last instance it has not been exercise. So if I consider both these values; this is the cumulative profit if I consider this, this is the cumulative profit. If I am able to draw that, the graph which you have already seen this one; that means, if you have basically try to combine long Put and short Put in order to basically find out Bear spread. Thinking in the prices are going to go on a downward trend.

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Now consider the Butterfly spread. In means investor is hoping the large stock price movements are unlikely. So now, in the if you go through the through the all the examples we have done. We are considering one instant prices would be on increasing trend, considering forward and option. Then considering uh prices of would be on a decreasing trend, again you consider forward and option. And now then later on we consider only options thinking the prices are increasing bearish, prices are decreasing

bullish. And this example we will consider, that investors things that the prices would not be fluctuating too much. So, we will slowly expand our examples and before we end this class I will again urge the students to please read John C Hall, understand the concept of Bear and Bulls spreads. Understand the combination of forward and options. And then slowly as we understand it, we will go into the Butterfly spreads on the on the different type of spread, which can be formulated startle and so enhance fourth, for different combination of options. And how we see that they can be utilize in order to mitigate the overall risk. Before I end the class again I want to re tell it. First draw the diagram then draw the matrix, if you think you are comfortably in that. Or else my suggestion would be first draw the matrix and then draw the diagram that will give you good picture how the problems can be solved.

So, I will end today, thank you very much and from next class I will start the detail discussion about different type of straddles, different type of butterflies depending on different type of concept with the; the investor has about the price moment of ST being greater than K1 or K2 or being between different banks.

Thank you.