Commodity Derivatives and Risk Management
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Lecture 11
Commodity Basis Risk Part 2

Welcome to the next session on Commodity Derivatives and Risk Management. If you recall in the last session we started discussing about different aspect of basis risk. So just to recollect what is basis risk or what is basis, basis is defined as the difference between the spot price and the futures price and in case of a Contango Market basis is negative and in case of backwardation market basis is positive and the way basis changes during the contract initiation date and the contract square of date that impacts the in a gain or loss of a commodity futures product. One thing I would like to highlight here at this point of time is that there is a different between contract squaring up date and contract in expiry date. In case of a contract squaring date squaring up date, it is the date which is decided by the long futures position holder or the short futures position holder.

The hedgers delivers the underlying or buys the underlying depending upon its requirement in the cash market position and on the same day it would like to square up its open position, irrespective of whether that contract is coming to a maturity on that day or not. So maturity date is governed by the exchange; however contract squaring up date is decided by the trader depending upon its cash market position. Now with this let us take (an) let us take the example but we were discussing in the previous class where a soybean oil producer is fearing a price decline and it is it has entered into a short futures contract to mitigate its price risk.

So the soya oil producer is has entered into a short futures contract on a spot date that is on 22nd April 2016 and he enters into a futures contract which is which is going to expire on 28th June 2016 the spot date on who is the soy oil producer has initiated the contract that is 22nd April 2016 and this contract futures contract is going to expire on 28th June and the trader would like to square up its short futures position on 10th June 2016 and on the 10th June 2016 it is intending to sell the underlying soya oil in the local market, let us say an Indore market it intends to sell at the price prevailing at the Indore market on 10th June 2016. Now as we discussed so let me write down so what is a spot date, spot date is 22nd April 2016 and contract maturity date is 28th June 2016 and contract squaring up date is 10th June 2016.

So on spot date it has entered into a short futures contract at a price of F (0, T) of 870 rupees. So this spot date is 22nd April contract maturity date is 28th June contract squaring up date is 10th June short, it has taken a short futures contract at a price of 870 rupees per 10 kg. Now his net received from the net receipt from both the both selling the underlying in the underlying soya oil in the spot market and the margin payment and receipt will governed by your S t + F (0, T) - F (t, T). So F (0, T) is a futures price prevailing on 20th April and 22nd April F (t, T) is the futures price which is going to prevail on 10th June for a contract which is maturing on 28th June. So you have a small T here this is here and this is here.

So as we know it will be F (0, T), + ST - FTT so this part we know we call it basis on contract maturity sorry contract squaring up date, so F (0, T) + b t. Now let us take some combination of spot and futures price to understand how what is going to be the net receipt of the of this a long cash and short futures position holder.

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So as I mentioned sport date is 22nd April futures price prevailing on this date is 870, spot price prevailing on 865, basis is - 5 and you have a contract maturity date on 28th June and contract expiry date is sorry contract closing or upset date is 10th June. This is the date on which the trader would like to square up its position. Now let us take different combination of spot futures price which is going to prevail on the contract squaring up date that is 10th June 2016. Let us say futures price is 797 and the spot price is 785 so you have basis as - 12 and how much is going to be the receipt, so F 0 + b t so 870 + 12 so that is coming to your 858.

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Similarly if the basis is 16 the trader is going to receive 886 both from selling the underlying asset and from the futures market. If the if the basis is - 10 its receipt is going to be 860 basis

is going to be 10 it is receipt is going to be 870, if basis is 19 its receipt is going to be 889. One thing I would like to highlight here is that this is the hypothetical situation where you have basis as 0 before the contract maturity, this is not normally happens because before the contract maturity there will be some difference in the spot and futures price which will factor in the cost of carry. So just analysing the in a price variation 858 to 889 you can see that the total receipt of the long assets of futures holder can vary depending upon how the basis is changing.

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Now let us now let us go back to our slide so here I have given an exercise to all of you, in your spare time please try out that it is exactly a replication of the exercise for long cash and short futures that is what is the a black paper producer is fearing price decline and it would like to enter into the short futures position, and you have a different combination of spot futures position is given as spot and futures price is given for the date in which he would like to square up his contract that is on 11th April 2016. And based on this information try to find out what is going to be the net receipt of the hedger that is long asset and the short futures position holder.

Now similarly going back to the reverse side that is long hedger a party who is short on asset of party who is going to buy the asset at a later point of time and he fears, price is going to go up, to mitigate that risk it has entered into a long futures contract. In that case total payment is going to be $S_t + F_0 - F_t$ so same as your $F(0, T) + b_t$, but only difference which you have to remember is that in case of a long asset short futures position holder that is total receipt but in case of a short asset and long futures position holder it is total payment.

Now let us let us spend couple of minutes understanding how basis risk affects the long hedger, so you have let say a copper manufacturer, copperware manufacture based at Delhi New Delhi India. It requires around 6 metric tons of mixed copper scrap, it buys copper scraps from different parties and it in a it uses this copper scrap to manufacture copperware. So he what is his fear, his fear is that copper price is going to go up of course, at this point of time this is not a very valid fear considering all base metal prices are almost at a very very low label. So suppose had it been a situation where he is anticipating the copper price to go up and when copper price goes up, copper scrap prices also go goes up, so unless he does something he would be ending up buying this copper scrap at a at a higher price and because copper scrap futures contract is not available in the market, he is mitigating that risk with the copper futures contract which is listed at a multi commodity exchange.

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So what is the spot date, a spot date is 3rd April 2016 and would like to square up up its position before the contract maturity date that is he would like to square up its position on 13th May 2016. So exactly the same discussion what I we have done, so this is an example of a short cash and long futures, so the copper manufacturer copperware manufacturer is short on cash commodity, short on underlying and it would like to mitigate that price risk by entering into a long futures. So you have so what is a spot date, spot date is 3rd April and it would like to square up its open position on 13th May, contract maturity date is 25th May and what is the future price prevailing 309, what is a spot price prevailing 317.7, so it is a basis is positive so it indicating it is a backwardation market.

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Now depending upon the keys basis, if you see this copper copperware manufacture in of being something from 317 to 289 from a high price of 324 to a low price of 289, so this variability in the total payment or total receipt is what is defined as the basis risk. So with this discussion we come to an end on what is our understanding of basis risk.
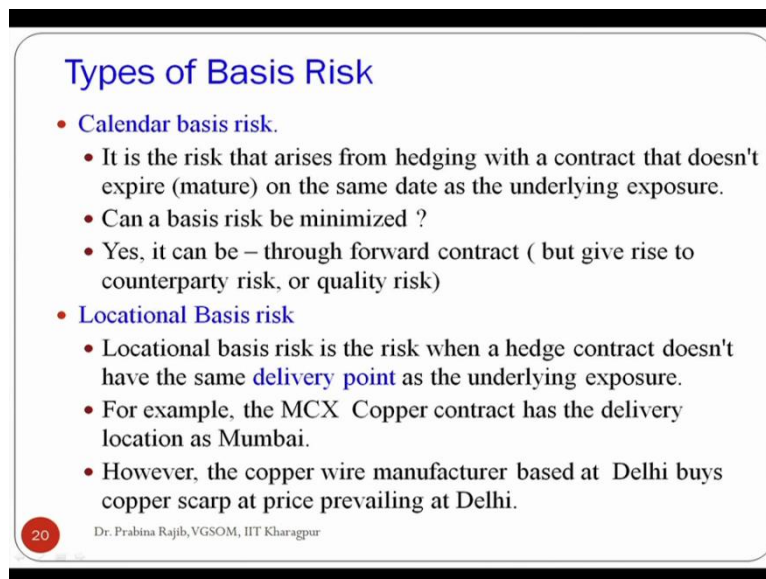
Let me repeat that in case of a forward contract the counter parties are exposed to credit risk or counter partner risk. In case of a futures contract the counter partner risk is not there however they are exposed to another kind of a risk which is known as your basis risk. In and how does a basis risk affects this futures position holder, they may end up paying a very high price or low price depending upon how the basis has changed from the contract initiation date to contract squaring up date.

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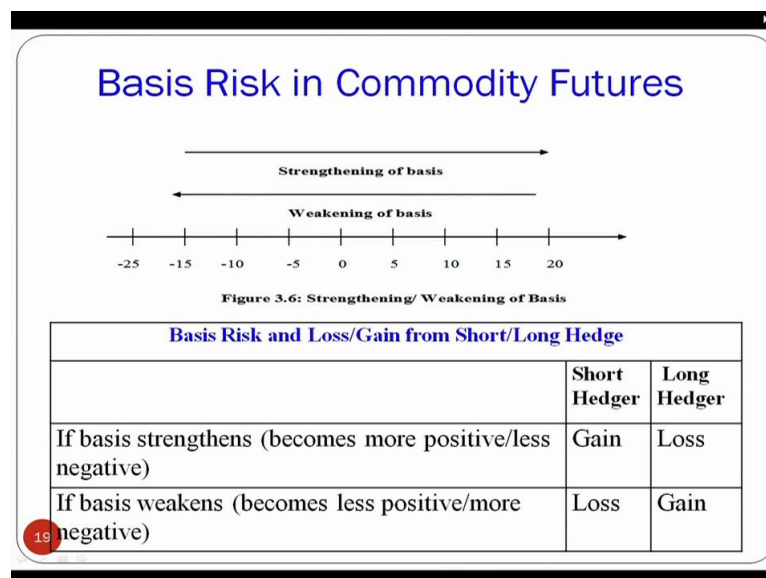
So to summarize what we have discussed if basis strengthens, that is from less positive to more positive or from more negative to less negative then a short futures position holder gains and a long futures position holder in losses, he incurs loss and a vice versa. If basis weakens that is more positive to less positive or from less negative to more negative than in that case the short futures position holder incurs loss and the long position holder benefits from the futures contract. It may take some time for each of you those who are getting exposed to this concept for the first time however if you spend couple of minutes or or spend little more understanding this concept this will be pretty clear to each of you.

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Types of Basis Risk
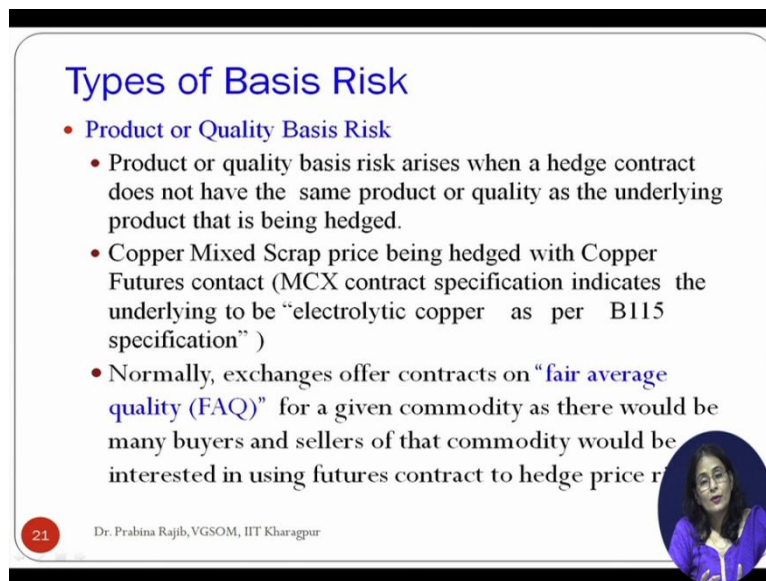
- Calendar basis risk.
  - It is the risk that arises from hedging with a contract that doesn't expire (mature) on the same date as the underlying exposure.
  - Can a basis risk be minimized ?
  - Yes, it can be – through forward contract (but give rise to counterparty risk, or quality risk)
- Locational Basis risk
  - Locational basis risk is the risk when a hedge contract doesn't have the same delivery point as the underlying exposure.
  - For example, the MCX Copper contract has the delivery location as Mumbai.
  - However, the copper wire manufacturer based at Delhi buys copper scarp at price prevailing at Delhi.

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Now why basis risk arises or what are the different types of basis risk? One is we have already explained that is called your Calendar basis risk, so the reason for basis risk emanating from the why the basis risk arises is the fact that the date traders would like to square up their position is different than the contract maturity date. If all traders would like to square up their position on the contract maturity date then a trader should not be exposed to the basis risk.

Similarly Locational basis risk, what is the Locational risk? The spot price, suppose I buy the or a trader buys the underlying commodity from one market and he is able to hedge that price risk for a with a contract which is delivered in another market, the delivery location is another market so the depending upon the tax, a difference in taxes and difference in local supply demand aspect, you can have the spot price and futures price can diverge from each other giving rise to Locational basis risk.

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And the third type of basis risk is your product or quality basis risk as we discussed in the previous example of a copperware manufacturer who is buying copper scrap because there is no futures contract available for copper scrap, he is entering into he is entering into futures contract for copper which has got as per the MCX contracts specifications, these are electrolyte copper as per B115 specification so this Delhi based copperware manufacturer is hedging his price risk with a different quality different quality underlying and it's the price movement of the spot commodity may be different from the price movement of the futures contract because of the quality difference.
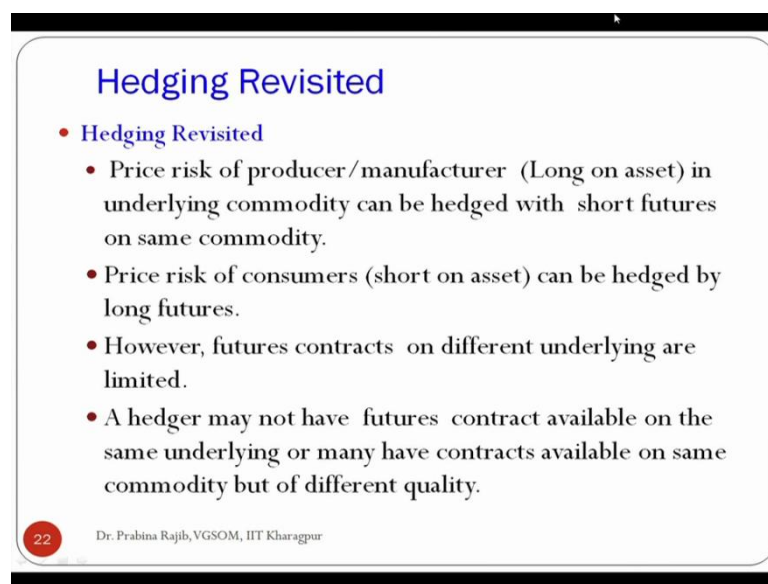
Also at this point of time, I would like to discuss one interesting aspect. A commodity can be available or a commodity can be produced with very varying quality so from a very poor quality to a very good quality. Now, when it comes to a quality specification which is given in black and white terms in a contract specification as per the as per a commodity exchange, how does a commodity exchange goes about deciding which quality specification it should mention in its contract because as we discussed quality specification could be quite different from a very low quality specification to a very pure form of a commodity with the very high rigid standards for quality.

The answer to this question is, normally exchanges of our contracts on fair average quality that is known FAQ so they exchanges go and meet with commodity producers, commodity consumers and they try to judge which kind of a quality specifications are predominantly consumed or produced by majority of a physical operators, that forms the basis of the fair average quality because if exchange goes ahead and makes a contract specification with very

very rigid quality standard then may not be many traders who would interested into buying this particular many traders would not be interested in entering into futures contract with that kind of a quality specification because their quality requirement will be different than what has been mentioned.

So to summarize, normally exchanges go and find out what is the quality which is predominantly consumed and produced by the market participants or commodity producers consumer and that forms the basis for the a quality specification in a contract which is given by the exchanges.

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Now at this point of time I would like to discuss little more on hedging aspect. Price risk of producer or manufacturers who are long on the asset can be faced with the short futures contract on the same commodity. Price risk of consumers can be faced by long futures however futures contract on different underlying are limited, so a hedger may not have futures contract available on the same underlying or may have contract available on the same commodity but for a different quality.

Let us take an example of situation where you let us say a farmer is producing a particular cereal or a commodity for which there is no futures contract listed in any of the exchanges. Now, how does that commodity producer or the farmer litigate its risk? So there is a way out so a trader or a farmer can litigate this price risk associated with the product agricultural product it is producing by entering into a futures contract for another commodity which is very closely related to the commodity the farmer is producing.

Let us say or when we are using the word closely related means the price movement of both commodities should be similar or they must be highly co-related commodity. The price series must be moving in tandem with each other so let us take an example in Indian case like you have barley contracts. Many farmers produce Bajra, but Bajra contracts are not available for trading or it was not available for trading in the commodity exchanges for still couple of years ago so right now these are available.

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Let us go with the assumption that let us if Bajra contract is not available and if Bajra producer would like to mitigate this risk, how it would be able to go ahead and find out which commodities can be used as a which commodity contracts can be used to risk hedge its own price risk. So this brings to our discussion on some cross hedge so what is a cross hedge? The hedger take futures position in a different commodity which is positively related to the commodity underlying of the hedger so in case of a cross hedge, you do not the exact commodity is not listed but you find out another commodity which is closely related with the commodity you are producing or consuming and use that other commodity which is already listed in a exchange to mitigate your own price risk.

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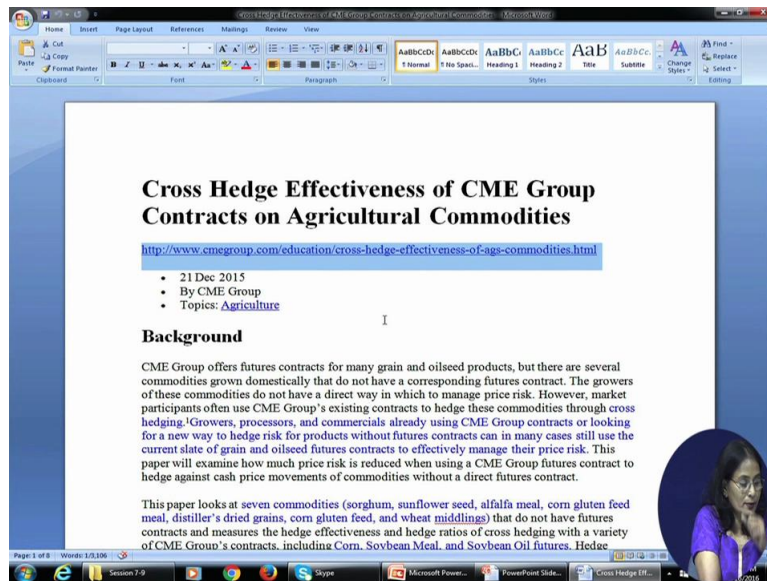
However, in case of a cross hedge, it gives rise to higher basis risk so how exactly how this higher basis risk emanates, we will discuss little later so at this point of time, I would like to share a interesting article on cross hedge and article which is prepared by a Chicago Mercantile Exchange so this particular document is I have downloaded from if you can see this is the Chicago Mercantile Exchange website so you have the title of that document is cross hedge effectiveness of CME group contracts on agricultural commodities so this document shows how sorghum producers can us corn futures contract for mitigating its price risk.

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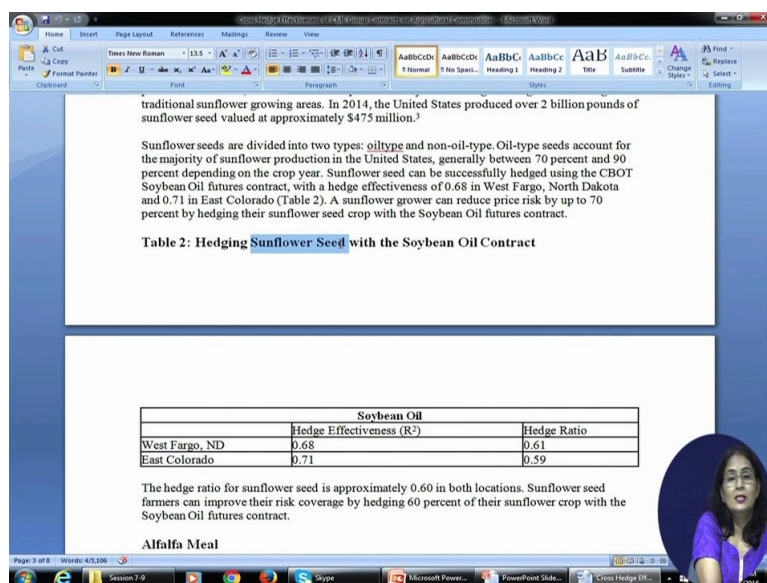
Similarly you have sunflower seed producers can mitigate this price risk of sunflower seed with soybean oil contract so this document is a very interesting document so if you are interested to learn more about cross hedging and how producer or consumer will be able to identify which commodities or which set of commodity contracts can be used mitigate the price risk, this is an interesting article. You can spend some time and read it.

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Now let us go to our discussion of how this cross hedge has a higher basis risk. Now, let us go to let us now let us go to our discussion on Bajra so you have let us say a farmer is producing Bajra and Bajra contracts are not listed for Bajra futures contracts are not listed in a commodity exchange so it is it I have done some basic co relation analysis of price of Bajra and the wheat prices and it found out that both prices are closely related or closely co-related so it can safely use a wheat futures contract listed in commodity exchanges to mitigate its own price risk.

So let us spend couple of minutes what is mentioned here. You have a spot price S 0 Wheat is the spot price prevailing on the contract initiation date, a spot price Bajra, S 0 Bajra is the spot price of Bajra on the contract initiation date. F 0 is the wheat futures price on contract initiation date. F t is the wheat spot price on contract squaring up date. S t Bajra is the spot price of Bajra on contract squaring up date, S t is the future of wheat on the contract offset date and accordingly you have to basis a based on the price difference between spot price of wheat and futures price of wheat on the contract initiation date and the contract expiry date, sorry contract offset date so you have b 0 and b t.

Now let us go to our understanding of how cross hedge gets added in a basis risk so this total receipt is going to be S t Bajra + F 0 wheat - F t wheat, with these let me add up S t Bajra, I am just shortening a F 0 wheat - F t wheat + S t wheat - S t wheat so adding up the same term and subtracting the same term should not be make any difference.

Now what we will be doing so I will be F 0 wheat I will bring it to left side and I make S t wheat, this term I will bring it here - F t wheat, this is the third term. Then I take this term, the first term S t b - S t w, so if you recall this is the futures price of wheat on contract initiation date. This is the B t wheat that is basis wheat basis prevailing on the contract squaring up date + the price difference between spot price difference between Bajra and wheat on day t.

So if you recall, so on day t if you recall this component was earlier there $F_t + b_t$, so you have $F_t F_0$ wheat $+ b_t$ wheat, we have now added component called price difference between Bajra and wheat on day t. So in case of crosses as we discussed that many times old commodity contracts are not available for futures contract on all commodities are not available and if a producer or consumer would like to mitigate its price risk, it can identify a commodity which is closely related to the commodity intense to hedge and using a cross hedge, it will be able to mitigate the price risk however, it is still exposed to the basis risk like any other commodity hedger, hedging futures contract.

However in case of a cross hedge besides the regular basis risk, it is also exposed to another kind of risk which is the price difference between the both the contracts, the commodity which he is owning or which he is producing or consuming and the commodity spot price for which he has gone ahead and bought or sold a futures contract. So the spot price difference between both commodity is going to be an added risk in case of a cross hedge. So this brings an end to our discussion on the different aspect of basis risk and I am looking forward to meeting you all in the session where we will be discussing about hedge ratio, minimum variance hedge ratio and the beta hedge ratio and thank you all of you.