Commodity Derivatives and Risk Management
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Week-03
Lecture 14
Spot Price, Futures & Basis Risk (Contd.)

Welcome to the 14th lecture on Commodity Derivatives and Risk Management. And we will be continuing with the discussion related to the basis risk. In the previous session, we discussed basis risk to a certain extent, but I thought that let us revisit whatever we had discussed and continue with the remaining part of the discussion related to the basis risk. As you recall, basis is defined as the spot price on a given date minus the future price prevailing on that particular date. Now, with this let us understand a little more on the basis risk and why basis risk arises. Please note that the commodity producers, consumer and value chain partners' requirement for underlying commodity could be significantly different from the futures contract specification.

And basis risk arises from hedging with a futures contract that does not expire or mature on the same date as the underlying exposure. So, what do we mean by that? Let us say a particular contract is maturing on let us say 20th of a given month, but a hedger would like to buy or sell the underlying on let us say 10th or 12th of the month. Hence, this difference in the, you know, underlying contract expiry as well as the futures contract expiry leads to the basis risk, and this is also known as the calendar basis risk. Now, let us understand how exactly this calendar basis risk will be applicable to a short hedger and who is a short hedger? A short hedger is a party who has taken, who has a long cash position and has, you know, he owns the asset and is fearful that the price is going to go down and would like to take a short futures position.

Hence, the word short hedger. Now, let us go to the example of a soy oil producer. This soy oil producer crushes soybeans and produces refined soy oil. Now, let us say it intends to sell or deliver the first lot of soy oil which is around 14 metric ton on 12th June 2023 to a regular customer at the spot price which is going to prevail on 12th June 2023 and today we are the spot date which is your 19th May 2023. So, on standing on 19th May 2023, the soya oil producer is fearing that by 12th June 2023 price is going to go down and hence it takes a short futures position for 14 contract for June 2023 expiry and please note that the expiry of the June contract is going to happen on 20th June and what price this particular person is taking a short futures position that is for 870 rupees per kg.

So, that is the future price prevailing on 12th June 2023 that is the future price prevailing on 19th May 2023 for the 20th June 2023 contract. Now, on 12th June 2023, the

company sells oil to the market in the open market and also squares up its short position by taking a long position. Now, let us go and see how the basis risk is going to be affecting this particular trader who is a short hedger. So, this particular you know slide shows the discussion related to the basis risk. This as you can see this is the contract started on 19th May 2023, the soy oil producer takes a short futures position at a price of 870 rupees per 10 kg. This contract is going to expire on 20th June 2023. Let us move to 12th June 2023 when the soya oil producer is going to sell soya oil at the spot market at the prevailing spot price and simultaneously the soy oil producer squares up this short futures position by taking a long futures contract which is maturing in June 2023. And please note that in June 2023, the refiner will be selling soy oil in the spot market, hence the soy oil, he will receive a spot price prevailing on 12th June that is your S_t. And please note that it had entered into a short futures contract, so he would receive a F0, and it had taken a long futures contract to square up the position. So, basically you will be paying Ft. So, net receipt is going to be F 0 minus F T and we can rearrange this equation in this manner. And as you know that S T minus F T that is spot price minus the future price prevailing on a given date is the basis. So, total receipt for soy oil producer is going to be F0 plus basis on day T. Please note that this particular soy oil producer would receive definitely F0, but in addition to that he will receive basis. Now, basis depending upon whether basis is going to be positive or negative, his total receipt is going to be different than F0. Now, let us go to a numerical example to understand this aspect. So, this exactly the same detail which I discussed has given in a excel format. So, you have a futures price prevailing on 19th May at 870, contract maturity is 20th June 2023, contract closing or offset or square up, date which is applicable to the soy oil producer is 12th June 2023. And on 12th June 2023, different combination of spot and future price can happen. So, these five columns show the different combination of future price and spot price.

And as you can see depending upon how the spot and future price is going to be on the contract maturity date, the total receipt of soy oil producer will vary from you know combination to combination. So, as you can see in this case you have a basis is minus 12. Why are we telling basis is minus 12? You have a spot price of 785 and the future price is 797. So, spot price minus the future price gives us the basis. Hence, the basis is 12 rupees negative 12. And what is going to be the total receipt? Total receipt is going to be 870 plus the basis which is your minus 12. Hence, total receipt is going to be 858. So, in this manner we have calculated this different combination. And as you can see from the table given below the range of spot price varies from 785 rupees to 912 rupees. That is without the derivative contract there would have been a chance for the soy oil producer to sell soy oil either at a price of 785 or anywhere up to 912.

So, as you can see the price range is 127, but with the futures contract the soy oil producer will receive a price from 858 to it can go up to 889 a range of 31 rupees. So, without futures contract the price range is much higher than with the futures contract.

With this let us go to the next kind of an example which is hedging using a futures contract and basis risk, but here we are changing the situation where the party is a long hedger. That means, short cash and a long futures. That means, the party needs the underlying fears that the price is going to go up and is entering into a long futures position.

Hence, the word long hedger. And as you can see the logic is exactly the same, only thing changes here is total payment is going to be F0 plus basis t. In the previous example here, that was you know the total it was a total receipt, but here it is going to be total payment. Please note that the long hedger would be buying the underlying and also you know would be squaring of the futures contract at the contract maturity date and based on this two-combination total payment is going to be F 0 plus basis on day t and t is the day on which the person is going to square up the contract. Now, let us go to a you know example real life example.

Let us say a copper ware manufacturer requires around 600 metric tons of mixed copper scraps by 12th June 2023 and it is fearing that the copper price is going to go up and it would pay a higher price for buying copper scrap if it does not do anything. Hence, on the spot date which is 19th May 2020 it enters into long futures contract at a price of 309 rupees a kg that is your future price for the contract maturing on 20th June 2023. Now, let us go to the exactly the same way of finding out what is going to be the total payment by the copper ware manufacturer who intends to buy copper on 12th June 2023. Please see this exactly the same logic is applicable here. Future price prevailing on the 12th of June is 320 spot price is 328 because the spot price is more than the future price you have a positive basis of 8 rupees and because the basis is positive the party is going to end up paying 309 rupees plus 8 rupees as you can see total payment is going to be F0 plus basis on day t.

What is our F0? F0 is 309 rupees and the basis on day t is 8 rupees. So, all together total payment to buy the copper as well as payment in the futures market is going to be 317 rupees and the table below shows the various range of spot price payment which can happen and the corresponding payment with respect to if the trader would have gone for a spot as well as futures contract. So, as you can see the spot price has a range of 74 rupees from a lower price of 297 to 354 and similarly future price has a lower combination of 289 to 324, but that this is not so important what is the important is the range of price. As you can see without the futures contract the copper you know copper buyer copperware manufacturer would have paid a very low price or very high price is exposed to higher amount of price risk, but the moment he is entering into the futures contract he is exposed to price risk, but not to that extent it is the risk is minimized to the greater extent in fact it is nearly getting halved by entering into the futures contract. This slide shows the total summary of the basis risk and as you can see, we say that basis will strengthen when it is

going to be moving from more negative to less negative or from less positive to more positive.

As you can see, we say the basis is strengthening if it is becoming from less more negative to less negative or less positive to more positive. Similarly weakening of the basis happens other way around that is basis weakens when it you know reduces from more positive to less positive or you know increases from less negative to more negative. And short hedger total receipt is going to be F0 plus basis on day t long hedger total payment is going to be F0 plus basis t. So, depending upon if the basis strengthens if you can see if the basis is strengthening, a short hedger is going to be receiving a higher amount and will be gaining from the futures contract. And let us say if the basis is becoming negative a long hedger is going to benefit from it and if the basis is becoming more positive, a long hedger is going to be giving more payment hence will be unhappy about it.

So, this particular table shows the short hedger and long hedger gain or loss depending on whether basis is strengthening or whether basis is weakening. Now, we will come to the most important aspect with respect to the basis risk. Please note that hedgers in futures market replace price risk into another form of risk which is the basis risk. Please note that you know there will be you know they will be mitigating the price risk by entering into the futures contract, but they will be exposing themselves to the basis risk. Now, the question is basis risk lower than the price risk? The answer is yes, and the answer should be yes because if we are going to replace one risk with another risk obviously the second risk should be much lesser compared to the earlier risk.

So, as you can see the range of spot price payment or receipt in an earn hedge position is much higher than the range of hedge payment or payment or receipt. This aspect we have already discussed as you can see the soy oil producer who is long on soy oil can get a price range somewhere from let us say 785 to 912 without the futures contract, but with the futures contract the range of price realization will be much narrower. So, in this case 127 to 31. So, obviously the second situation is much better as compared to the first case of remaining unhedged. The same logic is applied to the copper wire manufacturer who is short on copper and intends to buy copper at a later point in time and the range of price if it remains unhedged will be 74.

It may buy at a low price, or it may buy at a high price, but if it enters into futures contract it will be the price range or price variation will be total price variation is going to be 35 rupees. So, basis risk exists in the case of a futures contract, but basis risk is much smaller compared to the price risk. Now, can basis risk be minimized? The answer to this question is yes. Hedgers can minimize the basis risk by normally choosing a contract future contract whose contract expiry date should be as close as possible to the physical

market operation. So, that is the only way futures position holders or hedgers will be able to mitigate the basis risk.

With this we will come to another type of basis risk which is known as your location basis risk and calendar basis risk. Please note that what we discussed is the calendar basis risk. There are other two types of basis risk which are known as your location basis risk as well as your quality basis risk. So, let us understand what we mean by location basis risk and quality basis risk. So, location basis risk is risk when a futures contract does not have the same delivery point as the underlying exposure of a hedger.

Let us take a MCX cotton contract as an example. Please note that the basis location for this MCX contract is the Rajkot Gujarat. Let us say a cotton yarn manufacturer at Coimbatore, Tamil Nadu who needs you know cotton, but it would like to buy cotton from Coimbatore, it does not want to take delivery from the Rajkot warehouse which is the exchange approved warehouse. Now, the cotton yarn manufacturer at Coimbatore will buy cotton bales at Coimbatore on the futures contract expiry date. Even if he is buying the cotton bales which are coinciding with the future contract expiry date, still it will be exposed to a basis risk. Why? On any given date, the basis at Coimbatore will be different than the basis at Rajkot. What do we mean by basis at Coimbatore? That means the spot price prevailing at Coimbatore minus the future price prevailing on that day is the basis at Coimbatore. Similarly, basis at Rajkot will be basis spot price prevailing at Rajkot minus the future price at MCX. So, these two prices are going to be different. The logic of this difference is that the supply demand conditions, the traders, the different market condition will influence the price prevailing at Coimbatore as compared to the Rajkot.

So, on contract expiry date, please note that the basis at Rajkot will be zero. There will be a spot price of Rajkot and the future price expiring on that day will be zero, while the basis of at Coimbatore may not be zero. So, that exposes the hedger who has delivery requirement at a different location than the contract specific location will be exposed to a locational basis risk. Now, coming to the second kind of a basis risk or third kind of a basis risk which is your quality basis risk. So, what do we mean by quality basis risk? The risk when a future contract underlying quality is different than the hedgers quality need.

Let us say there is one trader at Rajkot whose requirement for the cotton is different than the exchange approved quality. As you know we have discussed in earlier classes, earlier sessions the quality approved by the exchange quality mentioned in the exchange approved contracts are known as your fair average quality or FAQ. Let us say a cotton trader at Rajkot wants to take delivery of the cotton, but of not the same quality as of exchange approved quality. So, the trader will not be interested in taking delivery from

the exchange, it will go and buy the cotton from a different location from any open market. So, based on Rajkot for a quality which is other than the exchange approved quality will be different for the basis for exchange approved quality, because of the quality difference. So, that price difference because of the quality is known as the quality basis risk. Now, let us go to this example which shows a locational basis risk or quality basis risk in a far greater detail. Let us say a you know 22 carat price of gold or 24 carat price of a gold at two different places in India. Please note that the MCX contract has the 22 carats as the quality of the you know gold and the basis delivery center at Ahmedabad. And as you can see on a given day the spot price prevailing at Ahmedabad for 22 carat gold is 53,800 and the spot price prevailing at daily is 53,950 on a given date.

This is the actual price prevailing on a given date. Even the quality is same, but the prices are different. So, this is an example of a locational price risk. Now, let us come to the 22-carat price gold price vis-a-vis 24 carat gold price at Ahmedabad on a given date. Obviously, 22 carat gold prices will be cheaper than the 24 carat gold price and please note that not only this price will be different, the variation the fluctuation with which the 22 carat gold price will be you know will be at Ahmedabad over a period of time will be much different than the fluctuation of the price associated with the 24 karat gold.

So, this difference in variation of the gold price for 22-carat gold and 24 carat gold at Ahmedabad give rise to a quality risk. Now, it is also very important to understand that the location-basis risk and quality-basis risk is applicable to commodity derivatives only and not financial derivatives. So, with this we will summarize today's session with discussed what do we mean by basis and how the basis risk is inherent to any futures contract position holder because they are you know the day, they want the contract to expire, the day they want to close their physical activity is different than the contract expiry date. The kind of quality of the underlying they want is different from the kind of quality mentioned by the you know exchange approved contract. Also, the location at which they would like to do take delivery or give delivery from their physical market activity is completely different from the exchanged approved delivery location.

So, because of these differences' hedgers will be exposed to different kind of basis risk. However, it is very important to understand that the basis risk is much smaller proportion as compared to the price risk. With futures contract hedgers take on the basis risks, but they can control the price risk and price risk is much significant or much bigger risk as compared to the basis risk. With this we will end today's session and I look forward to interacting with you all in the next session related to pricing and valuation of futures Contract. Thank you all of you.