Commodity Derivatives and Risk Management
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Week-03
Lecture 13
Spot Price, Futures & Basis Risk

Welcome to Commodity Derivatives and Risk Management and today is lecture 13. And today we are going to discuss spot price, future price and the basis risk. Now, before we go into the discussion of basis risk in greater detail, let us understand two Another interesting concept called contango and backwardation with respect to how does the spot price and future price are positioned with each other at a given day. So, what do we mean by a market which is contango market? Contango market is a market where the future price is higher than the spot price and the distant future price is higher than the nearby futures price. Let us take this simple example of course, this is hypothetical data, this is not real data. So, let us say on the spot date which is the 19th May 2023, let us say for a commodity A, the spot price is 10 rupees, while the contract futures contract maturing in June, July, August, September, October is in like 22, 30, 35, 37 and 40.And as you can see if we plot the spot and forward curve, it will be an upward sloping curve. So, this

market is known as a contango market and as you can see a near month future contract that is June 23 contract is higher, contract price is higher than the spot price and July 23 contract is higher than the June 23 contract future price. So, this market is known as a contango market. Similarly, you have another commodity, commodity C where the spot price is highest, 50 is the spot price and near month future price is 45, distant month future prices are progressively going down. As you can see the spot price is the highest

one and other month prices are going down. This market is known as a backwardation market and obviously, you can have a combination of markets depending upon how the spot and future price for different months does are placed with each other. So, commodity B and commodity D are a exhibiting both contango and the backwardation part of it. So, if you can see this part is a backwardation for commodity D and this is a contango market and similarly this is a backwardation and this is a contango market. So, what is a backwardation market? Let me repeat backwardation market is a market where future price is less than spot price and the distant future price is less than the nearby future price.

Now, does this really happen? Now, let us take some in a real-life situation to understand whether really this contango and backwardation happens or not. And this is the data which I have downloaded from the Bloomberg data and please note that the spot date is

19 May 2023 and as you can see let us say we are taking this data which is your this you know this light orange color forward data. So, this particular data is a 5-year-old data that means, on 18 May 2028 the forward curve was upward sloping, or it is a contango market that means, distant month future price was higher than the near month future prices and so on so forth as you can see. So, the market is completely in contango. Similarly, we can see like you know any other date let me take let us say gold price prevailing on let us say 19th April 2023.

So, that is this red dot point. So, 1 month ago the gold price was also in contango and as you can see distant month future prices are less are higher than the near month prices and as you can see almost all forward curve at different point in time the forward curve indicates that the market is in contango. So, all these examples 5 to 6 examples where you have a gold is in contango market where it is an upward sloping forward curve. Now, let us go to the again the same you know data related to copper future prices. As you can see the copper future prices here again this is the last the orange data is the last one which was prevailing on 18th May 2018 that is 5 years ago as you can see this copper was in a initially it was in a contango market and later point in time the future price was almost constant.

Also, very interesting aspect which you all must notice that in case of the copper futures price at CME the contracts trade for far longer into maturity like for example, on 20 May 2028 somebody will be able to take futures contract up to you know 2021 and so on so forth. And in India we have futures contract on many commodities are available, but hardly there is trading available for 5 to 6 months, and this is because India's market is a very nascent market it is very recently only commodity derivative initiatives have been started unlike Chicago Mercantile Exchange which has a history running from last almost you know 150 years of history. So, the market has matured, and a lot of trading happens both hedgers, speculators enter into the contract for far longer maturity contract. And as you can see this particular contract this contract relates to copper price at 1 year ago that is the copper future price 1 year ago it was prevailing on 19 May 2022. So, initially it was you know back warded and initial part it was in a backwarded and later part of the contract on 19th May 2022 it was in contango.

So, this was in a combination of backwardation and contango market. So, the concept of contango and backwardation happens pretty regularly from commodities to commodities. Also, one thing I would like to highlight here is that a market for a underlying commodity may be contango today it may shift to backwardation at a later point in time or the you know the situation of the forward curve can change from time to time. It is not a static that copper will always be in contango, or you know let us say cotton will always be contango or or in backwardation it depends on various factor. In subsequent sessions we will understand why markets go into contango or backwardation.

The logic behind the contango and backwardation market we will understand in greater detail, but today I am only indicating or only showing what do we mean by a contango market and a backwardation market. Similarly, this is again the backwardation market for soyabean in futures price at CME. Again the data is from Bloomberg and the spot date is 19 May 2023. And as you can see this is the 5 years ago this data. So, it had a little bit of contango then backwardation again contango and all that.

So, this is the 5-year data. The forward curve as it was looking on as it was there on the 18th of May 2028, but as you can see this data this is the pink color data represents your forward curve 1 year ago. As you can see, in the near month future price was the highest and the distant month future prices progressively went down. So, this is a clear-cut case of a backwardation market. So, what basically I am driving here is that from commodity-to-commodity backwardation and contango can happen.

Now, with this understanding let us focus on what do we mean by commodity basis. Basis is defined as the spot price minus the future price at a given day. So, basis on day t let us say today we are calculating basis for a particular commodity. Let us say swab in swab in spot price for let us say one quintile is let us say 3000 rupees and the near month future price is quoting at 3500 rupees. Then that means, the basis value is going to be negative 500, the spot is 3000 and the near month future price is 3500.

So, the basis is going to be negative value and it is calculated as spot price minus the future price. And, as you know contango is a market where future price is more than the spot price. Hence, basis will always be negative in a contango market and basis will always be positive in a backwardation market. And, please note that the basis normally goes down as the delivery approaches and spot and future price converge on the maturity date. So, this particular diagram as you can see the bolder line is a data corresponding to the future price movement and the thinner line relates to the spot price movement.

Before the contract maturity the steep point is the maturity point. Before the contract maturity spot and future price will be different than each other. Sometimes spot price will be more than the future price in that case it will be a backwarded market or vice versa sometimes future price will be more than the spot price leading to a contango market. And, irrespective of whether the market is contango or backwardation before the contract maturity, the spot and future price will converge. In fact, the spot and future price are going to be nearly the same on the contract expiry date.

So, this particular diagram shows that spot price is going down, future price is going down, but spot and future price is converging on the contract expiry. Similarly, the spot price is also in these diagrams spot price is going up, future price is going up, but finally, spot and future price is going to be converging. So, this is not actual data, but this is just a diagram to indicate the price relationship between spot and future price from a contract

start date to the contract expiry date. And the basis can move from positive to negative depending upon whether the market is a contango or backwardation. So, if you can see at this point in time the market will be a market will be in backwardation because spot is higher than your spot is higher than your future price and basis is going to be positive.

In this case you can see the future price is higher than the spot price and it will be a contango market and the basis is going to be negative. So, basis positive here, basis negative here. So, the basis can keep changing depending upon how the spot and future price move with each other, but please note that on the contract maturity date the spot and future price are same basis is going to be 0 on the contract maturity date. So, with this let us understand why we are talking about basis or what is the relevance of basis with respect to commodity hedgers. Now, please note that the hedging using futures contract gives rise to basis risk.

So, what do you mean by basis risk? Basis risk arises from hedging with a futures contract that does not mature or expire on the same day as the underlying exposure. Let us understand this sentence with respect to a real-life example. Let us say a soy oil producer which buys soybeans, crosses soybeans and produces refined soy oil. It intends to deliver the first lot of soy oil of about 14 metric tons on 12th June 2023 to a regular customer and what price it is going to get on 12th June whatever the price of soy oil prevailing in the local mandi or local wholesale market this particular soy oil crusher is going to get that money. So, it fears by the time 12th June 2023 the soy oil price will go down.

Let us say today's spot date the day the soy oil producer is fearing that you know if I do not do anything by 12th June 2023, I am going to incur loss that date is 19th May 2023. So, that is the spot date. So, on the spot date this particular company will take into short futures contract of 14 contracts maturing on 20th June 2023. So, we are talking about 3 dates. Spot date is 19th May 2023. This particular company will be delivering the refined soy oil to the counterparty on 12th June 2023 and this soy oil producer is fearing that by 12th June 2023 soy oil price will go down. To mitigate the risk, it enters into a futures contract which is maturing on 20th June, and it takes short futures contract let us say at a price of 870 rupees per kg. See it goes to the exchange platform enters into a future price. So, if it is taking short futures position somebody will be agreeing to that price label and the counterparty is taking a long futures position and both this soy oil producer and whoever is the counterparty their order matching happened at a price of 870 rupees per 10 kg. Please note that why am I giving a price of 10 kg because the soy oil futures contract quotation value is for 10 kg.

Even if somebody is entering into a futures contract having a underlying for one metric ton, the quotation base value is for 10 kg. Hence, he is entering into a short futures position at 870 rupees a kg. Now, on 12th June because this particular company is a

hedger and not a speculator the company will sell the soy oil in the spot market to the you know whoever is the counterparty and simultaneously it will square up its short position by taking the long futures position. So, these particular two pictures represent this discussion about what we did. The spot date is 19th May 2023, the soybean producer takes short futures position at a price of 870 rupees per 10 kg. Please note the denomination $F_{0,T}$ that is future price on day 0 for contract maturing on T that is your 20th June futures contract. So, this happened on 19th May 2023. Now, let us move to the date on which the particular party will be delivering the soy oil to the counterparty. So, let us the spot date becomes the 12th of June 2023. In this case the spot date was 19 May 2023, we are moving ahead, and the spot date is 12th June 2023.

So, what this particular refiner will do? It will be selling soy oil at the spot price and squaring of its you know short futures position by entering into long futures contract which will be maturing in the June 2023 contract which is maturing on 20th June 2023. Now, on 12th June 2023 the refiner sells soy oil in the spot market and squares of its short futures position by taking long futures position. And how much he will be receiving? Please note that it will receive S_T because it will be selling soy oil at the spot market. So, the price prevailing on 12th June it will receive. Earlier he had taken a short futures position. So, he would be receiving $F_{0,}$ and he would be now squaring off his position by taking a long futures position. He will be paying F_T. So, you can see that the total receipt for this particular soybean crusher or refiner is going to be S_T the price prevailing on 12th June plus the difference between F_0 minus F_T. And if we can rearrange this equation, we can write this equation as F_0 plus S_T minus F_T. And as you know S_T minus F_T is nothing, but the basis on day T.

So, total receipt on day T that is your 12th June 2023 is going to be F_0 plus basis on day T. Now, let us take the numerical example to understand this. So, again this particular you know table shows the same detail in a in a tabular format. The spot date on the day in which he took the short futures contract is 19th May 2023, took short futures contract for 14 metric ton for 870 rupees per 10 kg. Let us say the future price prevailing the price at which it entered the futures contract is 870 rupees per kg.

Let us say on that day that is on 19th May 2023 the spot price prevailing was 865. On that day, the basis was minus 5, because basis is spot price minus the future price. Now, let us move to the contract square of date that is 12th June 2023. So, these are some price combinations which can happen on let us say 12th June 2023. So, let us say future price for the contract maturing on 20th June as on 12th June 2023, let us say the price is 797.

And future price is 797 and spot price is going to be 785. And as you can see total receipt from the futures market based on the daily mark to market margin will be governed by 870 and 797. So, that is coming to your 73. So, he will be receiving 73 from the futures combination, futures market and he will also be receiving 785 rupees from the

spot market transaction leading to a total receipt of 858. Similarly, various combinations are given. So, if these two combinations happen, he is going to get 886 rupees and this combination he will get 860 rupees. Let us say you know a very unique combination on 12th June 2023, let us say spot and future price is going to be the same in that case basis is going to be 0, if basis is going to be 0, he will be getting 870 rupees. So, as you can see the basis has gone from negative 12 to positive 19 and when the basis is higher this particular person receipt is going to be more because he is getting F_0 plus basis T. So, how does the basis he has changed on the contract expiry date which that is going to govern the receipt for this particular you know hedger and please note that this is a pure hedger because the day he is delivering the underlying to the counterpart is same day he is squaring of the contract. So, he will realize the price which will be combination of the future price plus the basis prevailing on the contract square update that is your 12th June 2023.

With this we will come to the end of this discussion that is the what do you mean by contango market, what do you mean by backwardation market, what do you mean by combination of contango and backwardation market and what do what is the meaning of basis and how does the basis actually influences the amount of money a hedger is going to get on the contract square update. We will be taking you know another kind of example where the underlying where the trader would be long on asset and take short futures. In this example we have taken long assets and short futures in that other example we will take whether the trader has a short asset and long futures, and we will see how the basis affects itself, how does the basis affect the trader. So, we will continue with this unfinished part of the basis risk in the remaining lecture session, and I eagerly look forward to being part of lecture 14 very soon. Thank you.