Commodity Derivatives and Risk Management
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Lecture 40
Gold Quanto Futures, Delta Hedge Trap

Welcome to the 40th lecture on Commodity Derivatives and Risk Management. And today is going to be our last session on different aspects of Gold Price Risk Management. And today we are going to discuss two interesting aspects both are related to gold price risk management, but the concepts are related to gold quanto futures and delta hedge trap. We will understand the concept of delta hedge as well as what is the word trap associated with the delta hedge. As you recall in the previous session, we discussed that commodity exchanges all over the world offer gold and silver contracts for varying underlying sizes like Comex Gold offers gold ranging from 100 ounce to 10 ounce. Similarly, Comix Silver contracts have 5000 ounces and 1000 ounces and different other commodity exchanges such as Shanghai futures different other commodity exchanges such as Shanghai futures exchange offers gold contract on 1000 gram, multi commodity exchange offers gold contracts on 1000 gram to 1 gram and popularly known as 1 gram gold contracts are popularly known as gold petal contracts. Now, in this context let us understand a very innovative contract futures contract available in Indian exchange that is known as gold quanto futures. But before we go into the different aspects of quanto futures let us understand why a the quanto futures are required. And all of us know India's gold production is negligible India produces about 1.6 tons gold per annum, but India imports about 800 to 900 tons annually. So, you can imagine the extent of gold import in India as compared to the gold production. Let us say on 17th April 20 23 an Indian gold bar importer who imports gold and pays in US dollar is interested to import gold on 10th July 2023. I would want you to please pay attention to the dates. So, standing on 17th April 2023, a company which basically imports gold bar from the foreign country and pays in US dollars wants to import gold on 10th July 2023. And the importer is fearing that the gold price is going to increase in US dollar terms. And in addition to the fear that the gold price is going to increase it is also or the importer is also fearing that the rupee is going to depreciate, or INR Indian rupee is going to depreciate against US dollar. Now, the question is, can this particular Indian gold bar importer will be able to mitigate both risk that is gold price risk and USD INR exchange rate risk by entering into futures contract available in Indian commodity exchange? Now, let us say the gold importer can hedge in domestic commodity exchange where future price is denominated in rupee terms or let us say can hedge in any foreign commodity exchange where future price is denominated in US dollar terms. Let us assume on 17th April, the

gold importer enters into a long futures position for 4th August expiry in both cases. So, in both cases the gold importer is entering into futures contract in domestic exchange where future price is denominated in rupee terms also the company enters into a foreign enters into derivative position long futures position in a foreign commodity exchange where the future price is denominated in US dollar terms.

And if the payoff from both cases is the same, then one can safely assume that the gold bar importer can use any of the exchanges to mitigate the risk or the gold bar importer can mitigate the risk by entering contracts entering into futures contract in the domestic commodity exchange. Now, let us understand the payoff, here as we discuss the gold bar importer let us say enters into a long futures contract on 17th April and the long futures contract for the expiry of 4th August let us say on that day 10 gram gold price is about 60,225 and the corresponding future price when we are converting the same to your our ounce term which is coming to your 1,87,321 because 1 ounce is equivalent to 31.1034 grams. So, in domestic exchange futures contracts are priced in 10 grams and let us say the same gold bar importer enters into a futures contract where the price is denominated in US dollar terms and rest of the terms and conditions remain same for both contracts. So, on 17th April, the party takes a long futures position expiry is 4th August the price is 1940.13 US dollar per ounce. So, on 10th July this particular party would like to close its position by entering into a short futures position. Let us say the future price that is 17 July sorry 10th July the 4th of August future price is trading at 60558 per 10 gram which is equivalent to 188356 rupees per ounce. So, as you can see the fear of this particular gold bar importer is true, the price has gone up and in the domestic exchange it is benefiting by 1036 rupees. Now, let us compare the benefit of this gold bar importer with respect to how much of benefit or how much of profit it is incurring from the futures contract in the international exchange. So, suppose on 10th July, the short futures position takes the short futures position to close the long futures position. On that day gold price is 1970.21 dollar per ounce and as you can see benefit in US dollar is coming to 30.08 dollar. Now, on that day the US dollar spot rate is 82.45 and when we are multiplying the UST INR spot rate with the benefit which is in US dollar terms that is coming to about 2480 rupees in INR terms. Now, as you can see that these two numbers are different, that is profit in the domestic exchange is 1036 profit converted into INR terms in the international exchange is 2480. Hence this goes on to prove that a gold bar importer who is exposed to both the gold price increase risk as well as rupee depreciation risk cannot mitigate the risk by entering into futures contract which are listed and traded in India in INR terms or domestic futures contract available at the domestic exchanges. Hence to help gold importers which are paying US dollar price we now have a futures contract on gold and this particular contract is available at India International Exchange. It is a contract which has been very recently introduced and is doing pretty well, with a lot of trading volume it is garnering. So, this gold quanto futures contract which is denominated in US dollar is now available for mitigating gold price risk at India international exchange from that

particular exchange website from this weblink I have taken a snapshot of the gold futures contract. As you can see the trading hours are also very interestingly you can see the trading hours are very different and the interesting part is that the minimum price movement is US dollar and the contract value, please note that the contract value will also be expressed in US dollar and settlement mechanism is the contract will be settled in cash in US dollar. So, by entering into by buying or selling futures contracts which are gold quanto futures any gold or silver importer who is exposed to US dollar exchange rate risk will be able to mitigate that risk. In this context I would also like to highlight that any gold value chain partner who buys gold in INR terms and sells jewelry in INR terms should mitigate the risk by using the domestic exchange contracts. This contract is suitable for those who are importing gold and paying in US dollar, but there are many other value chain partners who buy gold bars from other importers gold importers in India and pay them in INR terms. So, if any value chain partner is buying in rupee terms and selling in rupee terms they should enter into a futures contract or they should prefer contracts in domestic exchanges. But any other value chain partner who is exposed to currency depreciation, that is USD INR risk that they should be going for this gold quanto future. So, let us understand a very interesting aspect related to gold price which is the delta hedge trap. So, before we go into the concept of trap let us understand what is the meaning of delta? What is the meaning of delta hedge? Now, delta is an option Greek please recall that in the initial part of our lecture we have discussed with respect to option Greeks. I would like you to recall the discussion related to Black Scholes option pricing calculator as well as Black 76 option pricing model. In these sessions we have discussed though very briefly with respect to option delta option Greeks and delta is one such Greek. And delta measures the sensitivity of option premium to the change in the underlying asset price. So, the delta of a call will be change in the call premium divided by one unit change in the underlying asset price or one rupee change in the underlying asset price. Similarly, delta put is change in the put premium divided by one rupee change in the underlying asset price. And as you can see, please note that the call premium derives its value from a function which is nothing but spot minus the strike price. And when the underlying asset price increases you can see that call premium will go up because spot is increasing strike remains as it is. So, when the spot price increases call premium increases. And similarly put premium is a function of strike minus the spot and when the spot price increases you can see the put premium goes down. Hence, delta of a call will be positive which may range from 0 to plus 1 while delta of a put is going to be negative which will range from 0 to -1. And we know that deep in the money call and deep in the money put option will have a delta +1 and -1 respectively and far out of call and far out of put option will have a delta of 0. In this context I have also taken the snapshot of the option calculator black 76 option calculator which I have taken from this NCX India website. As you can see the gold underlying price is 59374 and the strike price is 58000. Other information is given here. Based on these details as you can see the

call option price is 2230 and the put option price is 864. And more importantly I want you to pay attention to the delta value for the call delta it is 0.6549 and for the put delta it is negative of 0.3398. So, what is the interpretation with respect to call delta of 0.6549. So, this number can be interpreted as follows that is if the underlying asset price increases by 1 unit or 1 rupee call premium will increase by 0.6549 and vice versa. In other words, if the underlying asset price falls by 1 rupee call premium will fall by 0.6549. With this understanding let us go back to what is the meaning of what the delta hedge? Please note that you know for commodity derivatives we have hedgers and speculators. Let us say in this case a speculator who has taken a short call position. And in the context of gold, we have also discussed that the gold price is increasing almost linearly, that means, spot price is increasing. And when the spot price increases the call premium increases. And please note that derivative contracts are zero sum game when the spot price is increasing the short call position is incurring loss. Now, to mitigate the risk of the call premium risk this short call position holder will undertake a delta hedge or make the open call position as a delta neutral. Please note that a speculator who has a short call position he that particular speculator does not own gold, or it has nothing to do with gold as a business. So, this particular party has taken a short call position and gold price has gone up and because gold price has gone up call premium has gone up and increasing premium is a risk for this short call position holder. So, to mitigate the risk these short call position holders will be delta hedging or make the open call position as a delta neutral. And how they can make a delta hedge they will take position in the underlying asset by buying gold for 0.6549 units. Please note that you know in this case I have just taken a fractional number for the sake of explaining because in the previous slide we did discuss that delta of a gold of gold option was 0.6549. So, to make the open short call position delta neutral this particular party will be doing a delta hedging basically taking long position or buy gold to the tune of 0.6549 units. So, what is the hedge coming here? Please note that if the gold price increases further by 1 rupee it will be incurring loss in call premium and simultaneously it will be gaining in the underlying asset. Now, that this particular short call position holder is owning gold if gold price increases it will be incurring loss in the call premium as part of the short call and it will also be benefiting from the underlying asset gold asset which is bought for 0.6549 unit. So, this is the concept of gold delta hedge. Now, let us understand what do you mean by the trap? But please note that the moment short call position holder buys gold, gold price will increase and once the gold price increases call delta will increase. In this context I want all of you to pay attention to the second block. Please note that the first block is just a replica of the previous slide. In this slide in the previous slide, we did discuss this particular block in which the underlying price was 59,374 and the strike price was 58,000 and the delta was 0.6549. Everything else remaining constant we have only increased the underlying price to 59,450 and as you can see delta is now changed to 0.6624 earlier delta was 0.6549. So, when this short call position holder wants to buy gold or go and buy gold to delta hedge

their portfolio and when many short call position holders are buying the gold the price increases and when the price increases the delta also increases. So, the new call delta is 0.6624. So, to make their position delta neutral short call now has to buy 0.0075 units of the gold. So, when many short call position holders buy this additional gold, gold price starts increasing. So, such process that additional buying of gold will increase the delta further. So, this concept is known as a delta hedge trap and please note that many institutional investors have to undertake delta hedge for their naked option position. So, if any institutional investor like a bank or a hedge fund has entered into a short call position and is not holding any gold. So, company mandate their risk management policy says that at some point in time they have to either close the position they have taken a short call they can square up by taking a long call position or if they want to keep the position open, they have to delta hedge. And in cases of continuously increasing gold price, you can expect that the short call position holder gets into a trap because for every additional purchase of the gold, gold price increases and that kind of a pressurize them to again go ahead and buy additional gold. Now, the concept of delta hedge is very succinctly put by this particular website I would like to read this. Please note that I would like to read the concept related to the gold delta hedge. The gold shorts are faced with a potentially disastrous dilemma. Prudence indicates that they must increase their physical gold buying as the gold price rallies in order to maintain a balance delta hedge. On the other hand, if the initiate physical gold buys orders in a rising gold price environment the gold price rate increase will accelerate. As it accelerates, they will have to buy more gold to keep their delta hedges intact. Now, other banks will also see the price rise and they too will initiate buying to delta hedge their own naked return gold call options. So, the net effect will be a vicious circle where gold shorts covering begets more gold shorts covering with a classic short covering rally ensures that the gold price spirals higher and higher. So, this particular paragraph very nicely summarizes the concept of gold delta hedge trap and in this context please note that it is not the only the short call position holder faces the delta hedge trap. In the case of a prolonged period of declining price environment parties which have taken naked short put position holder they will also face similar dilemma they have to short sell the asset which in turn will depress the price. So, short call position holders will be getting into a delta hedge trap if the underlying asset price goes on increasing. Similarly, short put position holders will be entering will be getting into a delta hedge trap if the price continuously falls. So, with this we will come to the end of our discussion related to all things related to gold and in the next session we will be introducing different aspects related to crude oil price risk management. With this again I eagerly I am very eager to interact with all of you in the next session. Thanking all of you.