Commodity Derivatives and Risk Management
Prof. Prabina Rajib
Vinod Gupta School of Management
Indian Institute of Technology, Kharagpur
Week-05
Lecture 21
Commodity Index

Welcome to the 21st lecture on Commodity Derivatives and Risk Management. And today we are going to discuss different aspects of commodity index creation and calculation of different types of commodity index and what are the relevance of these indexes. And a commodity index is an index that tracks the price of a basket of commodities. And please note that the commodity indices are calculated from the futures price. And some of the popular commodity indices are S&P Goldman Sachs Commodity Index which is popularly known as S&P GSCI, Bloomberg Commodity Index, you have Rogers International Commodity Index or popularly known as RICI Index, you have Refinitiv Core Commodity CRB Index and Homegrown Multicommodity Exchange also publishes a calculates and publishes a index called iCOMDEX and London Metal Exchange also publishes and calculates a index which is known as LMEX. Now, all of us know that any index calculation requires 3 parameters. And what are these 3 parameters? The first and foremost is that the index requires which entities are going to be part of the index. For example, let us say we are talking about a equity index, let us say we are talking about BSE Sensex, BSE Sensex comprises of 30 company shares. In India we have about 4000 to 4500 company shares are listed in equity exchanges. However, only 30 companies have been chosen to be part of the BSE Sensex. So, there is a mechanism through which the sense the Sensex monitoring committee selects these 30 companies. And once the constituent companies are selected, then weights associated of with each of these companies are identified. And finally, the price of each of these entities or companies will be incorporated into some kind of a formula to arrive at the index value or index point. Now, let us understand in a very simplistic manner how a equity index is calculated. And drawing upon from that understanding we will go further to the calculation of commodity index.

In a discuss little bit on how equity indices or indexes are calculated. Some of the popular equity indexes all over the world are BSE Sensex, Nifty Fifty which are from India, S&P 500, Nikkei 225, FTSE 100, Hang Seng index, CAC 40. These are different equity indices representing different equity markets. Now, let us go to understand how these indices are created. The first part or first aspect which we need to or one need to understand is the methodology to select companies. The primary methodology or primary parameter which is used all over the world by different equity exchanges is market capitalization. Companies are selected based on market capitalization or MCAP.

And in addition to the market capitalization companies are also selected from diverse business sector. What do we mean by diverse business sector? Let us say in India we have some 10 to 12 information technology company which are very large companies by market capitalization. But that do not mean that Sensex will comprise of all these 10 to 15 information technology companies. So, the index monetary committee of Sensex will be using parameters not only the market capitalization, but it would also choose companies which would be representing various economic sectors from India. So, normally companies are selected based on market capitalization as well as the sectoral or business sector representation. Now, once these companies are identified the weights have to be allocated. Please note that the weights are normally based on free float market capitalization. So, what do we mean by free float market capitalization? Free float is defined as the number of shares a come of a company that can be publicly or freely traded. So, what do we mean by free float? Let us go to the first block. Let us say we have four companies the index monitoring committee identified these four companies. Now, each of these four company ABCD have different number of shares issued by the company at any given point in time. So, the first column shows the total number of shares issued. Now, coming back to the free float number of shares. So, these free float numbers of share indicate the shares which are freely available for trading.

In fact, if the promoter group or the promoters are holding let us say some number of shares those shares will never come to the stock market for trading. So, when we are calculating the free float. So, those shares which are held by insiders which are held by promoter groups they will not be part of the free float number of shares. So, when we are talking about free float market capitalization we talk about the market price of that particular company multiplied by the free float number of shares. Now, let us with this understanding take this simplistic example to understand how indices are calculated daily. As you can see let us say a new index is going to be created on day one and these four companies A, B, C, D have been chosen to be part of this index. In reality never a index or equity index will have four companies they will be hundred fifty thirty forty different number of companies, but for a simplistic sake we are we are just taking this four companies. So, we have four companies A, B, C, D and each of these companies has the free float number of shares 80 to 205. Now, now let us say on day one the price of company A is 60. So, what will be the free float market capitalization for company A that will be 60 multiplied by 80. Similarly, on day one we will calculate the market capitalization for the other three companies and the total market capitalization will be 57,370. Now, because the index is coming to picture on that day that will be pegged to some base value, normally base is kept as thousand or hundred or ten thousand. So, let us say on this date we are giving a base value of the index as 1000. Now, the next day again there will be trading of these company shares. So, some shares price will go up some share price will go down and again we will calculate the market capitalization based on free float by multiplying the share price into the free float number of shares. Now, let us

say on the second day total market capitalization is 58,225. Now, if the total market capitalization is 58,225 what is going to be the index value this is pure simple math. If 57,370 is equal to 1000 how much is going to be equal to 58,225. So, based on this simple you know arithmetic we find out the index value is going to be 1014.9 on the next day and we will be listening from different media channels, or we will be talking that the index increase by 14.9 point day on day. So, compared to the previous day the index increases by 14.9 in number. Now, coming back to again the same process will go on and every day the exchange will calculate and report the index value. Please note that we do not need to remember what the base date is and what is the base value. What we need to only understand let us say for calculation of the index value on day 4, what we require to you know what we require to know is that yesterday's market capitalization and yesterday's index point. So, if these two data points is available to us we will be able to get what is the today's market capitalization and from there we will be able to calculate the what is going to be the index point. Now, with this let us come to the next block. So, from the in this you know total market capitalization we will be able to calculate the market capitalization weight for each of these companies. So, on day 1 you have A, B, C, D has weight of 88 percent to 13 percent ranging from 8 percent to 42 percent and total weight is going to be 100 percent. Similarly, as you can see every day the market capitalization weight will be caring for a given company not because of free float number of shares are changing, but because every day price is changing. So, just an example I have taken the percentage of weight of 3 companies Reliance, HDFC bank and ICICI bank on 2 random days as you can see on a given day Reliance had 10.32 percent weight while on another day it had 10.41 percent weight. Similarly, HDFC bank had 9.38 percent and 9.06 percent. So, this slide explains how equity index indices are calculated daily and more importantly how the weight for constitution of a particular company varies from day to day. So, every company weight will be varying on a day-to-day basis and why are we highlighting this aspect, in case of a commodity index this weight do not change. So, frequently weights do not change daily. In fact, weights normally change on an annual basis with this understanding of how equity index is calculated. Let us move on to the next aspect or today's agenda is the is how you know commodity indices are calculated. As we have mentioned commodity indices are not based on commodity spot prices, commodity indices are based on commodity future prices. Normally every commodity index will have a index advisory committee and this index advisory committee will be selecting different commodity future contract to be part of this indices. Now, let us first understand the constituent types for these 4-5 important commodity indexes, then we will go to the other aspect of how these commodity futures contracts have been selected and how the index points are calculated. S&P GSCI considers 24 commodity futures contracts traded at different exchanges belonging to the OECD countries. So, if an exchange is not part of the OECD country, then that commodity futures contract will not be part of S&P GSCI index. So, at present it consists

of 24 commodity futures contract traded at different commodity exchanges and all these contracts trading prices are denominated in US dollar. Similarly, the RICI index it uses 38 commodity futures contract traded at different exchanges and interestingly they are priced in different currencies that is USD, Euro, Great Britain Pound and GPY. Our in a Indian exchange that is multi commodity exchange prepares iCOMDEX this considers 8 commodity futures traded at MCX and all denominated in INR. Similarly, Bloomberg commodity index consists of 24 commodity futures traded at different exchanges and priced in US dollars. And LMEX, your London metal exchange index, is calculated based on 6 base metal commodity futures trading at LME and all these are priced in US dollars. So, these are some examples of how different kinds of commodity indices use different kinds of commodity futures and different currency denominations and different exchanges collect this information from different exchanges. Now, let us come to the next part, how these weights for these constituent companies are arrived at. And please note that for commodity futures contract calculation the weights are arrived at by considering world production of that commodity or trading liquidity of that commodity futures or combination of world production and trading liquidity. So, we will take some examples as we go forward to understand which index uses world production, which index uses only trading liquidity and which index uses combination of world production and trading liquidity. And what do you mean by world production weights? World production weight is a exchange calculates what is the total quantum of the underlying commodity is being produced all over the world and a rolling 5 year average production figure is normally used for weight calculation. And why the rolling average is done? Because each year if there is a significant amount of production then in that year weight may go very high and, in another year, if there is no production or very little production of that commodity then weight may go down. So, exchanges do not want the weights to vary significantly on a year on year basis depending upon that year production. So, that is the reason why exchanges normally use the rolling average production figure for 4 to 5 years to arrive at the weight. Now, coming to the second type of weight calculation is liquidity. So, liquidity means, it is measures by the futures trading volume again on a rolling basis. So, if a particular let us say gold futures is being traded at COMEX of USA. So, the trading volume futures trading volume average futures trading volume over 4 to 5 years will be used as a ah as a weight ah for some ah for some indices. Let us take an example like S&P GSCI uses only world production data to arrive at the weights Bloomberg gives one-third weight to the world production and two-third to the liquidity. And both S&P GSCI and Bloomberg commodity index also set weight cap for commodity or commodity groups. So, not only do they have weight for a single commodity they also set a weight cap for that commodity or commodity group. For example, this block shows the S&P GSCI weight cap. As per the S&P GSCI index creation document. So, it mentions that no single commodity such as natural gas or silver may constitute more than 15 percent of the index. Suppose each year the production of a

particular commodity has gone very high or over the last 4 to 5 years production of that commodity has become very high that does not mean that commodity will have a significantly high weightage in an index. So, the index monitoring committee sets a cap on the maximum amount of weight a particular commodity can have in an index. Similarly, other caps are mentioned. So, I would not like to spend time on reading out this just to summarize that the weights are based on the production or liquidity or combination of production and liquidity. However, for each of these commodities there is also a weight cap, a weight cannot be significantly high for a single commodity. Now, coming back to the little more detail about S&P Goldman Sachs commodity index. This index represents commodity futures, and this index also uses commodity contracts traded across major commodity exchanges such as LME, NYMEX, COMEX, ICE USA, ICE UK etcetera and it also has sectoral weights. So, as you can see it has a sector weight for energy sector has 68.79 percent weightage, industrial metal has 10.39 weightage, precious metal has 2.51 percent weightage and so on so forth. And also commodities within each sector also has a cap. So, as you can see crude oil will have a maximum cap of 34.26 percent in the under the energy sector. So, as you can see when we are you know we want to find out what is the total cap of crude oil in the overall index. So, the final crude oil weight will be maximum 23.57 percent that we have arrived at 34.26 percent*68.79 percent. So, that is giving us the maximum weight crude oil futures can have at Goldman Sachs ah GSCI index. Similarly, the cotton weight can be maximum 0.12 percent this is arrived by multiplying the commodity cap 0.92 percent into your agricultural sector as a cap. So, this detail is given in the this particular block. So, as you can see, cotton has 0.92 percent and agricultural commodity as a group has 13.08 percent. And this particular table shows what are the different kind of commodities ah futures considered by different indices. As you can see Bloomberg commodity index considers energy, precious metal, industrial metal, livestock, grains and softs. So, these are the list of futures contract Bloomberg commodity index considers and the weight sectoral weight also is mentioned. Similarly, London metal exchange consists of only 6 ah London metal exchange index consists of only 6 ah commodity futures. So, these are aluminum, copper, lead, nickel, tin and zinc and the weight is given aluminum has maximum 42.8 percent and 31.2 percent. Please note that when I am mentioning these weights these weights are applicable as currently and these are the some of the snapshots which I have taken from different websites, and I have given the wavelength here. So, that in case you are more interested to know about each of these index in greater detail you will be able to do so. And these weights will not be remaining constant year on year this weights will be changing. And coming back to Roger international commodity index, as you can see this Roger international commodity index by far considers the largest number of commodity futures denominated in different currencies like USD, GBP, yen and so and so forth and also consider commodity exchanges from wide array of

commodity exchanges all over the world. Now, coming to the commodity index snapshots related to the sources of production data.

Please note that almost all exchanges use production data to facilitate or to calculate the weight. Now, from which source they will be collecting the production data that also is very very clearly mentioned. So, that anybody who wants to know about the commodity index creation process know how exactly this index monitoring committee is collecting the data what is the data source to arrive at the production related weights. So, as you can see this natural gas detail will be collected from U.S. EIA annual statistical supplement data. And what will be that you know specific table from which the data will be collected that is gross natural gas production data. Similarly, not only about the production data exchanges also very categorically mentioned the liquidity data that is futures trading volume. So, as you know that futures trading volume has also rolled over the last 4 to 5 years. So, this Bloomberg commodity index also shows for every commodity in the last 4 to 5 years what is the total amount of futures trading which has been used to calculate the trading liquidity. And as you can see from this top block this Bloomberg commodity considers two-third of the commodity liquidity and one-third of the commodity production to arrive at the weight. And please see this is the commodity weights for futures contract which will be applicable for 2023. Again, this snapshot I have taken from the Bloomberg commodity index report and for 2023 this is the different weights for different commodities. And here I would like to highlight that this in individual constituent weights do not change in your weights are annually rebalanced. So, the exchange administration committee will identify based on different parameter what is going to be the weight associated with the futures contract. Please compare this one with the weights for an equity index. Weights for an equity index are calculated or arrived at daily and these weights change on a day-to-day basis. And if a particular company is doing exceedingly well then that particular company can have a significant amount of market capitalization in a equity index. In case of a commodity index that will not be there because the index administration committee normally sets a cap on a individual commodity or individual commodity group. With this we will be you know ending this particular session. In the next session we will be continuing with the remaining part of the commodity index creation and also what are the use of this commodity index, who uses this commodity index and what are the benefits of creation and calculation of this commodity index. With this we will be ending this session and I look forward to interacting with all of you in the next session.