

Commodity Derivatives and Risk Management
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Lecture 39
Commodity Options and Commodity Spreads

Uh, high all welcome to this session on Commodity derivatives and risk management and today we are going to discuss about different metal contracts traded at London Metal Exchange. So what are the metals and what are the metal derivatives contracts traded at London Metal Exchange?

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LME and Metal Derivatives

- Non Ferrous , Ferrous, Minor & Precious Metals at London Metal Exchange
 - Copper, Tin, Lead, Lead, Zinc, Aluminium, Nickel
 - Steel (Rebar, Billet, Scrap)
 - Cobalt, Molybdenum
 - Platinum and Palladium

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A wide a gamut derivative contracts on different base metal that is your non ferrous, ferrous, minor and precious metal trade at London Metal Exchange as you can see from the non ferrous category, you have copper, tin, lead zinc, aluminum, nickel etc trade and from the ferrous metal category, you have steel and within the steel you have rebar, steel blades and steel scrap also a trade. And from the minor metal category, you have cobalt and molybdenum and from the precious metal category, you have platinum and palladium contracts trade.

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Hedging requirement of metal & mining companies.

- Fluctuation in metal price affects companies differently depending on what phase of the production cycle a company is operating.
- If a company is manufacturing and selling Copper concentrate, it _____ **benefits/loses** if the Copper prices increase.
- A company uses Copper cathode to manufacture & sell Copper tubes _____ **benefits/loses** when Copper prices increase
- A company involved only in smelting and refining of copper (earns *treatment and refining (TC/RC) charges*) _____ **benefits/loses** when Copper price increases.
- Hence the hedging requirement of companies operating at different stages of the production cycle vary.

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Now, with respect to metal and mining operation, different companies operate at a different stages or different phases of the production and their hedging requirement are substantially different depending upon what stage of mining operation or production operation they are functioning. Let us do a small quiz to understand what are the hedging requirements of a company which are what are the hedging requirements of companies which are operating at a at different stages of copper mining and copper extraction and copper production process. Let us focus on this a second point. Let me ask a question to you, let us say a copper if a company is manufacturing and selling copper concentrate and if copper price increases, will it benefit or will it lose?

Actually this particular company is going to benefit by increase in the copper price because copper concentrate are nothing but one stage ahead from the copper ore and they are priced with respect to copper and these copper concentrate normally contains 20 to 30% of the copper. When copper ore is extracted from the copper mine, copper ores are treated and refined and the refined product is known as the copper concentrate.

So when copper price increases, a company which is mining copper ore and manufacturing copper concentrate will benefit from this price increase. Now, let us go to the second company, let us say a company which uses copper cathode to manufacture and sell copper tubes. What would be its profit or loss if the copper increases? Will it gain or will it lose? The answer is, this particular company is going to lose if the copper increases because it will be buying copper at a higher rate and if it is not able to commensurately pass on this profit commensurately pass on this price increase to customer, its profit is going to take a hit.

So when copper price increases, a copper cathode buyer and a copper manufacturing company will incur loss. Now, Let us go to a third company. Let us say a company which is involved only in smelting and refining of copper. What would be its profit or loss if copper price increases? In fact the answer will be neither because, this kind of a company only gets treatment charges and refining charges which is known as TCRC charges in the copper industry. They earn per tonnage of copper, they treat and refine, so irrespective of whatever may be the copper price, their profit does not increase or does not go down with the movement of the copper prices.

So what we are leading at what we are discussing is that depending upon what kind of a value chain or what kind of production process or which phase of production process a company is operating, the price increase or decrease is going to affect that those companies in a different manner. So hedging requirement of this company operating at different stages of the production cycle will vary with the change in the copper prices.

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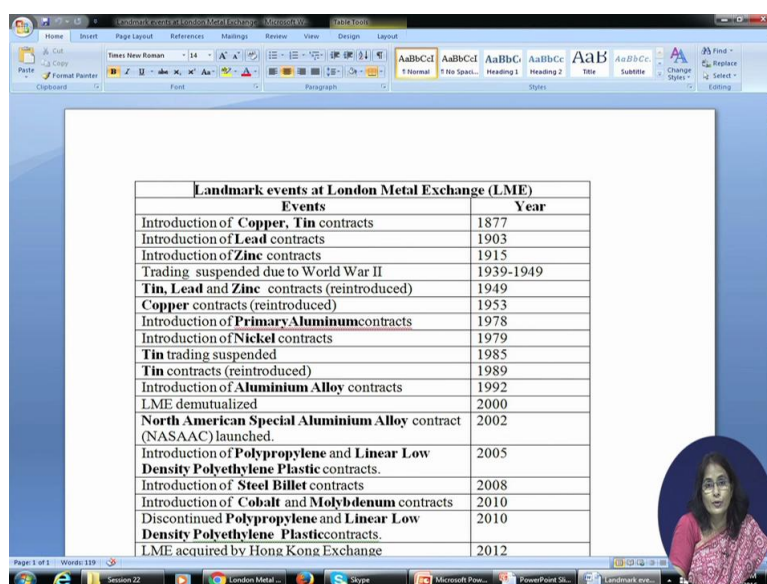
London Metal Exchange (LME)

- Started formally in 1877
- Different contracts were introduced at different points in time.
- Faced major crisis in 1985 during International Tin Council (ITC)'s failure
- Considered very important exchange for metal
 - LME prices are used as *reference price* for spot transaction by all most all companies in the world
 - LME is known as *market of last resort* as traders can take/give physical delivery of metal.
 - Around 600 warehouses are registered with LME.

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Now, let us go to little bit our discussion on London Metal Exchange. It is one of the oldest exchange, it started formally in 1877 and this is one of the oldest exchange, still it continues its operation and it is one of the largest exchange with respect to all metals we discussed a couple of minutes back. Now, just I will just take you through how this particular exchange had emerged since I hope you are able to see this.

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Events	Year
Introduction of Copper, Tin contracts	1877
Introduction of Lead contracts	1903
Introduction of Zinc contracts	1915
Trading suspended due to World War II	1939-1949
Tin, Lead and Zinc contracts (reintroduced)	1949
Copper contracts (reintroduced)	1953
Introduction of Primary Aluminum contracts	1978
Introduction of Nickel contracts	1979
Tin trading suspended	1985
Tin contracts (reintroduced)	1989
Introduction of Aluminium Alloy contracts	1992
LME demutualized	2000
North American Special Aluminium Alloy contract (NASAAC) launched.	2002
Introduction of Polypropylene and Linear Low Density Polyethylene Plastic contracts.	2005
Introduction of Steel Billet contracts	2008
Introduction of Cobalt and Molybdenum contracts	2010
Discontinued Polypropylene and Linear Low Density Polyethylene Plastic contracts.	2010
LME acquired by Hong Kong Exchange	2012


See this introduction of copper and tin contract futures and option contract on tin started in the year 1877 and different other contracts have been introduced in different year. I am not going into this detail and another interesting aspect that London was that is London Metal Exchange was acquired by Hong Kong Exchange in 2012. So this is little bit about history of London Metal Exchange and this London Metal Exchange almost came to closure with International Tin Council failure. Basically, this failure was so severe that the whole future of London Metal Exchange came to a standstill.

And at that point of time, in fact till 1985, this London Metal Exchange did not have a clearing house. If you recall, in some of the earlier session, we discussed the role of clearing house in a commodity exchange or commodity derivative exchange. Clearing house provide a very important function which is known as your novation. In novation, the clearing house takes the counter party to each and every trade and guarantees each and every trade which gets executed in the exchange platform. So if a counter party defaults, the settlement guarantee fund of the exchange is supposed to take care of these counter party default so that the one side of the even if one side of counter party, a one counter party defaults, the other side is not negatively affected.

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However, till 1985, London Metal Exchange did not have this clearing house associated with it. Post 1985, this International Tin Council, the London Metal Exchange created a clearing house. Now, the importance of London Metal Exchange can be just from the fact that LME prices are used as reference price for spot transactions by almost all metal producing companies in the world so if a company is buying and selling copper or aluminum or steel or tin or zinc, any metal they are buying and selling, they price their their output or when they are buying, they price their input with respect to LME price.

And a London Market Exchange sorry London Metal Exchange is also known as a market of last resort as traders can take and give physical delivery of the metal. Also, another interesting aspect of this London Metal Exchange, which is not applicable to other commodity derivative exchange Commodity derivative exchange normally do not provide spot trading facility so however, in case of a London Metal Exchange, London Metal Exchange also has a facility for spot trading so producers of metal, consumers, buyers, sellers of metal can go to the LME platform and take delivery of the underlying metal or give delivery of the underlying metal.

So this market that is why London Metal Exchange is also known as a market of last resort for all kinds of metal producers and metal consumers and traders. In fact, to facilitate the spot trading, there are around 600 warehouses which are registered with LME, so there are all over world, at different places, there are LME registered warehouses which from these warehouses buyers can buy LME approved metal contracts as well as they can deliver the metal which if a seller intends to sell.

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Country	Location	Warehouse Company	Aluminium Alloy	Copper	Lead	NASAAC	Nickel
Belgium	Antwerp	4STOX NV	56	55	55	/	59
		C. Steinweg Belgium NV	53	48	48	/	57
		CWT Commodities (Rotterdam) BV	54	48	47	/	57
		Erus Metals Ltd	52	47	47	/	57
		Henry Bath BV	51	47	47	/	55
		Katoen Natie Commodities Antwerp	51	47	47	/	55
		Keystore Ltd	42	36	32	/	43
		Metal Terminals International NV	50	45	45	/	53
		P. Global Services NV	53	48	48	/	58
		Pacorini Metals Vlissingen BV	53	47	47	/	55
		Vollers Group GmbH	49	44	44	/	53
		Worldwide Warehouse Solutions UK Ltd	56	55	55	/	59
		Zuidnatie NV	51	46	46	/	54
Germany	Bremen	BLG Cargo Logistics GmbH & Co. KG	37	/	32	/	39
	Hamburg	C. Steinweg (Sud-West Terminal) GmbH & Co.	53	48	48	/	57
		Vollers Group GmbH	49	44	44	/	/
Italy	Genoa	C. Steinweg - GMT S.r.l.	53	/	48	/	57
		Pacorini Metals Italia S.r.l.	52	/	46	/	54
	Leghorn	C. Steinweg - GMT S.r.l.	53	48	48	/	57
		F.lli Bartoli S.r.l.	/	45	45	/	53
		Pacorini Metals Italia S.r.l.	52	47	46	/	54

Uh I hope you are able to see this particular excel file. Let me just increase the font size so if you see this one, this particular shows the different warehouse locations which are approved by London Metal Exchange you have in the country. These are your different commodity warehouses and in Germany, you have Italy, you have Japan, you have South Korea, you have Malaysia, you have Netherland, you have Singapore, Spain, Sweden, Taiwan and so and so forth, so I am not going into this detail.

And also another interesting aspect is that this LME also informs us, if you see this one, this is the, this column shows the rates per ton per US this is your rate per ton per US per day in US cents, so if a particular buyer or if a particular trader wants to store aluminum for aluminum alloy for one day and for one ton, if this company has to pay 56 cents as warehouse charges. And besides making availability of this warehouse information in with respect to the rental charge by the warehouse, LME also on a daily basis Informs all traders or participants what is the total availability of a particular commodity at each of these warehouse.

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<u>LME Warehouse</u>					
<ul style="list-style-type: none">On a daily basis LME publishes the availability of metal inventory at each of these warehouses					
Daily Warehouse Details for Copper					
Date: 01/01/20X1	in Tons				
Warehouse Location	Opening stock	Stock In	Stock Out	Stock Change	Ending Balance
Warehouse A (Spain)	4725	0	0	0	4725
Warehouse B (South Korea)	10125	500	700	-200	9

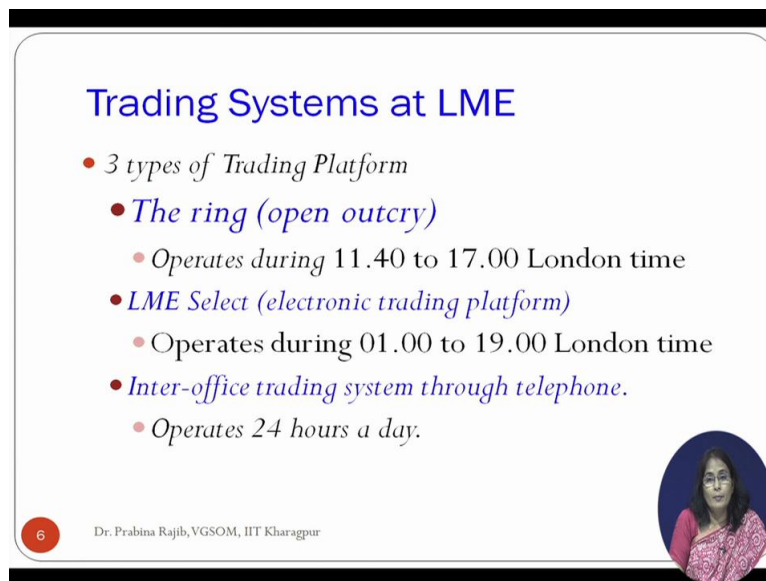
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So this very information with respect to inventory level and based on this inventory level, buyers and sellers will be able to know what is the supply demand pattern for a particular commodity at a given point of time. Let us say like this is just a typical example for daily warehouse detail for copper so X LME will inform warehouse A in Spain. What is the opening stock on given day, how many what is the stock in, what is the stock out.

What is the change in the stock change and what is the ending balance. Let us say in the warehouse B, so you have 10125 tons of copper was there, stock in is 500, stock out was 700, net change is -200 and this is the ending balance. So with this kind of a information when this when this kind of information is made available to all participants, they come to know what is a supply demand for a particular commodity, metal commodity at a given point of time and it helps then in taking pricing decision.

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Trading Systems at LME

- 3 types of Trading Platform
 - *The ring (open outcry)*
 - Operates during 11.40 to 17.00 London time
 - *LME Select (electronic trading platform)*
 - Operates during 01.00 to 19.00 London time
 - *Inter-office trading system through telephone.*
 - Operates 24 hours a day.

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Now, Let us go to understand a little bit on trading system at LME, so this is one of the oldest commodity exchanges as I mentioned and it operates 3 types of trading platform. One is the the Ring, it is open outcry method of trading happens. I am sure some of the old videos you must have seen, where people used to congregate and make some hand gestures etc to buy and sell so the Ring open outcry system of LME still undertakes those kind of buying selling the traders or trading members go to the exchange Ring and physically interact with each other to undertake trading.

We will go and next couple of minutes, we will discuss little bit more about this Ring trading system because this is very unique to LME and no other commodity has is offering this kind of a trading system as of today. All exchanges have graduated to electronic order matching that is buyers and sellers sitting at different corners of the world are able to place their order and order and order matching is done through electronically.

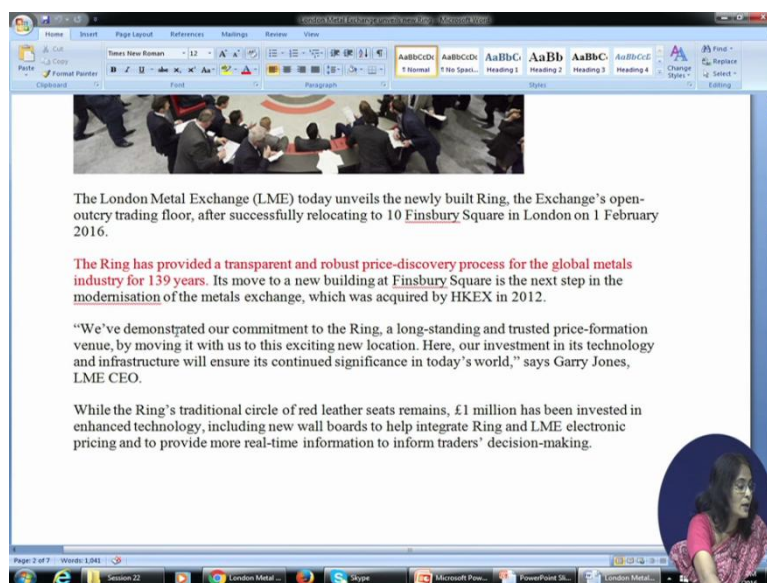
Besides the Ring, LME also offers electronic trading platform which is known as LME Select and it also offers trading system through telephone system which is known as inter office trading system through telephone and this operates 24 hours a day. Now, let us go to little bit of more on the Ring.

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Now, this is if you can see, this is the London Metal Exchange unveils new Ring if it I am you are able to see this. This particular report has been downloaded from the LME website. This is as late as 18th February 2016; this picture shows this is the Ring if you can see. This is the circular these red leather chairs are the Ring and if you can see, there are some people who are sitting with papers in their hand and these are the trading members. Basically, in stock exchange parlance, these are your brokers so these trading members of brokers collate the buy and sell orders and take it to the exchange and they physically interact and arrive at different, arrive at the prices at which orders are matched.

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So more about the Ring trading and how order execution happens, this is available at the LME website. You can find this particular document which is freely downloadable; you can download and read it. And as you can see, this is the rate fund. The Ring has provided a transparent and robust price discovery process for the global metal industry for 139 years, so this is latest report which was published by London Metal Exchange.

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Ring Trading Systems at LME

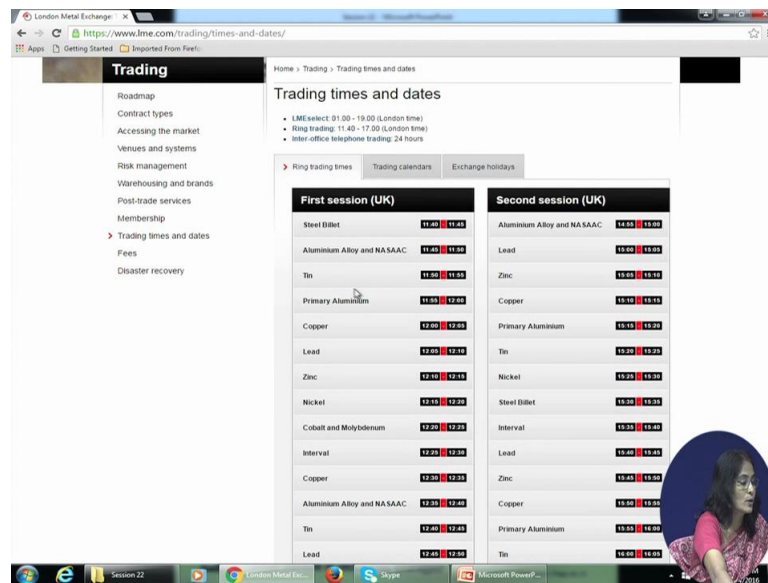
- Ring Trading
- <https://www.lme.com/trading/times-and-dates/>
- “The Ring, our open-outcry trading floor, is central to the process of price discovery.”
- Every day there are 4 ring sessions
- Each metal is earmarked 5 minutes of trading in each Ring Trading
- Kerb Trading : All metals trade simultaneously

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And also another quote-unquote from the LME website this is the Ring, our open outcry trading floor is central to the process of price discovery. Now, how exactly the ring trading happens? Throughout the day, there is like in India, you have BSE NSE starting from 9 o'clock onwards and trading is going till 3:45. Similarly the Ring also has some opening time and closing time and this total trading time is divided into 4 ring sessions and in each Ring session, each metal year marked for 5 minutes.

And buyer sellers or the trading members interact with each other to buy and sell for a sell that commodity during that 5 minutes and there is also a specific time year marked which is called a curve trading and in this curve trading, all metals are traded simultaneously, so any buyer or any seller or any trader has to buy or sell something, during that curve trading time, they can buy and sell each and every commodity.

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Trading times and dates

- LMEselect: 01:00 - 19:00 (London time)
- Ring trading: 11:40 - 17:00 (London time)
- Inter-office telephone trading: 24 hours

Ring trading times | Trading calendars | Exchange holidays

First session (UK)		Second session (UK)	
Steel Billet	11:40 - 11:45	Aluminium Alloy and NASSAC	14:55 - 15:00
Aluminium Alloy and NASSAC	11:45 - 11:50	Lead	15:00 - 15:05
Tin	11:50 - 11:55	Zinc	15:05 - 15:10
Primary Aluminium	11:55 - 12:00	Copper	15:10 - 15:15
Copper	12:00 - 12:05	Primary Aluminium	15:15 - 15:20
Lead	12:05 - 12:10	Tin	15:20 - 15:25
Zinc	12:10 - 12:15	Nickel	15:25 - 15:30
Nickel	12:15 - 12:20	Steel Billet	15:30 - 15:35
Cobalt and Molybdenum	12:20 - 12:25	Interval	15:35 - 15:40
Interval	12:25 - 12:30	Lead	15:40 - 15:45
Copper	12:30 - 12:35	Zinc	15:45 - 15:50
Aluminium Alloy and NASSAC	12:35 - 12:40	Copper	15:50 - 15:55
Tin	12:40 - 12:45	Primary Aluminium	15:55 - 16:00
Lead	12:45 - 12:50	Tin	16:00 - 16:05

Now, let us go to I hope this is visible to you. If you can see, this is your Ring trading starts 11:40 AM to 5:00 PM in London time and if you can see if you can focus on this particular screen now, if you see this one, this is the first session, first station. The steel billets trade from 11:40 to 11:45, aluminum alloy traded from 11:45 to 11:50 so and so forth, and if you have like you have buy if you see the first Ring, first Ring trade ends by 12:25 and there is a interval 12:25 to 12:30 and the second Ring starts from again copper start starts getting traded from 12:30 to 12:35.

I want all of you to focus this particular time, copper in the second Ring trades from 12:00 to 12:35. In the first Ring, copper traded at 12:00 to 12:05 noon and in the second Ring, copper traded from 12:30 to 12:35 and at the end of the Ring session 2, you have a curve trading. Please note that one. Curve trading is for 20 minutes that is your 13:25 to 14:45 minutes. Similarly you have afternoon session is again divided into 2 Ring sessions, so you have Aluminum alloy and other commodities like lead, zinc etc as trading and again you have a interval of between 15:35 that is 3:35 to 3:40 and again there is a curve trading at that end of the 4th Ring, that is from 4:15 to 5:00 PM, so 4:15 to so almost 45 minutes, you have year marked for curve trading and this is so this is all about the ring trading session at LME.

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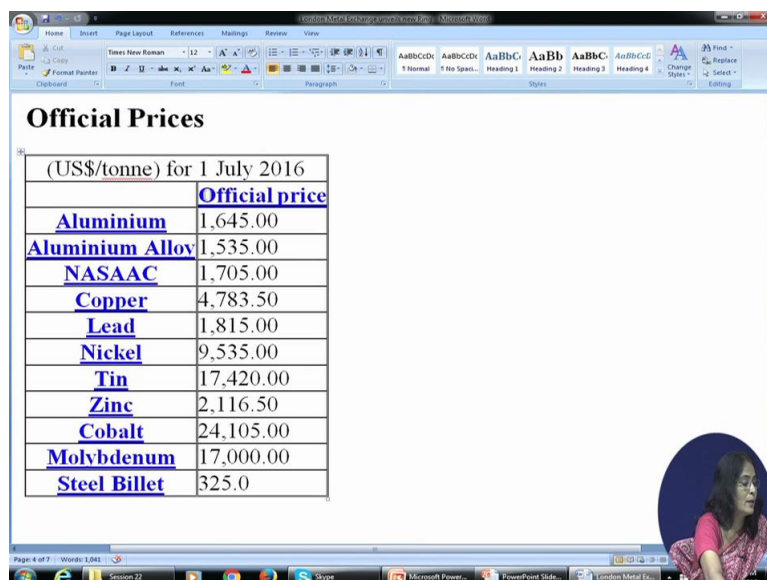
Price Discovery at LME

- LME publishes three sets of prices on daily prices.
 - *official, unofficial and closing prices.*
- Official price is arrived during **second ring session**.
 - It is the **last offer price** for the cash/spot position
- Unofficial price is arrived during the **fourth ring session**.
 - Last **offer price** prevailing during the fourth ring session to determine the unofficial prices
- Closing price is arrived at during **second kerb trading session**.

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And at the end of each of these Rings trading session, the LME informs what the price is and these prices are known as LME informs 3 sets of price on a daily basis that is official price, unofficial price and closing price. So let me take me through how does this official price look like.

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(US\$/tonne) for 1 July 2016	
	<u>Official price</u>
<u>Aluminium</u>	1,645.00
<u>Aluminium Alloy</u>	1,535.00
<u>NASAAC</u>	1,705.00
<u>Copper</u>	4,783.50
<u>Lead</u>	1,815.00
<u>Nickel</u>	9,535.00
<u>Tin</u>	17,420.00
<u>Zinc</u>	2,116.50
<u>Cobalt</u>	24,105.00
<u>Molybdenum</u>	17,000.00
<u>Steel Billet</u>	325.0

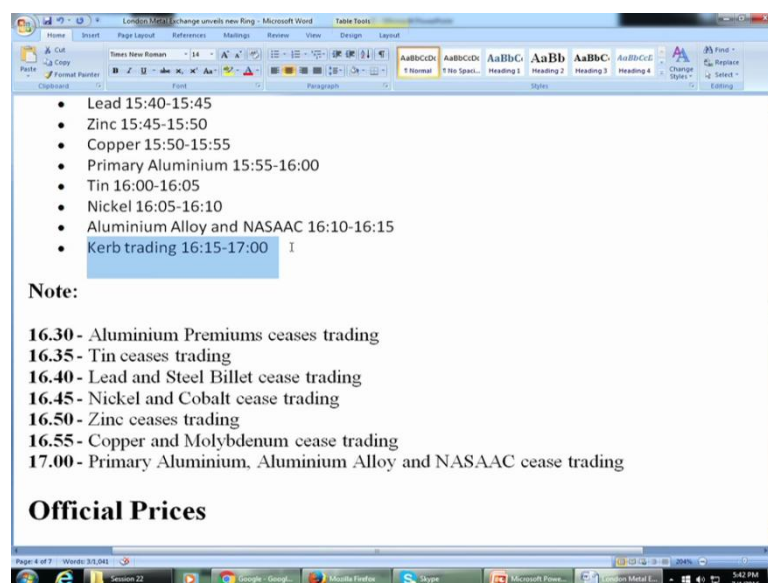
Please see this one, if you can see this particular table. This is official for official price as announced by LME as on 1st July 2016, so you have aluminum official price is this. Aluminum, aluminum alloy, copper etc are these are the official prices. Besides this official price, LME also provide something called unofficial price and closing price, so what are these unofficial price and closing? So official price arrived is arrived at the end of the second

Ring session so if you recall, copper was trading around 1230 to 1235 so the price arrived during this session for copper will be known as the official price.

In fact, it is the last offer price for the cash and spot position so during these 5 minutes, buyers and sellers not only trade futures and options, they also trade spot positions so the last offer price, all of that whenever buyers are bidding, they give a buy price and whenever sellers are giving their interest, the price interest that is known as your offer price or ask price.

So the last offer price for the spot trading for the copper at the second ring session is known as the official price. Similarly, what is the official price, unofficial price is the offer price for the spot trading which for a commodity during the 4th Ring session so in the afternoon, in the second session, that is the 4th Ring session, what is the offer price last offer price came from a seller during that 5 minute slot so that will be known as your unofficial price.

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And what is the closing price? Closing price is arrived during the second curve trading session so let me take you to the okay if you if you remember this is the the curve trading starts from that is 4:15 to it ends about 5:00 o'clock and during the curve trading, aluminum and aluminum ceases trading at 4:30, tin ceases trading at 4:35, so the last offer price for the spot which was which came during this period of time, that is before 16:35, that becomes the spot price for that becomes the spot price for tin contract, that is the closing price for the tin contract that day.

Let me summarize what I just mentioned so let me summarize what I just mentioned, LME publishes official price, unofficial price and closing price and why so many prices are informed by the or made available by the LME, not the last price only. Okay the answer to this particular question is that LME price is used to price the spot trading spot transactions by many companies all over the world, so depending upon depending upon what is their working hour and what is the working time for those companies so LME makes available 3 different prices so depending upon whichever price is suitable, a company uses that price as a reference price for its spot transactions, buying and selling commodity in physical market.

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Official Price Discovery Mechanism at LME				
Official price discovery mechanism at LME.				
Time	Ring opens	Ring closes	Official price (Provisional)	Official price (Final)
12:30	Copper			
12:35	Aluminium Alloy	Copper		
12:40	Tin	Aluminium Alloy	Copper	
12:45	Lead	Tin	Aluminium Alloy	Copper
12:50		Lead	Tin	Aluminium Alloy
12:55			Lead	Tin
13:00				Lead

As I mentioned, you have, if you see official price discovery mechanism at LME, copper trades at copper trades at 12:30, copper closes at Ring closes for copper, Ring close at 12:35. Official price which is a provisional official price, gets announced by the quotation committee, LME has a quotation committee which announces provisional offer price and that offer price is made available to all trading members and in case there is discrepancy, they get in touch with the quotation committee and once the discrepancy is resolved, official price gets if you can see this official price gets announced to the market whole world by 12:45.

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LME Asian Benchmark Price

- The LME Asian Reference Price (previously known as LME Asian Benchmark) is calculated using a volume weighted average price (VWAP) from transactions on LMEselect between 06.55 -07.00 GMT.
- The prices are discovered and published to coincide with the end of the Asian trading day.



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So whole by 12:45 PM, all the exchange officially informs what the copper price is for the second ring session. Also besides this official unofficial price, LME also informs or publishes LME Asian benchmark price. So what is this LME benchmark price, Asian benchmark price is that it is the weighted average, volume weighted average price of transactions in the LME Select that is your electronic market.

As you recall LME offers 3 different kinds of trading system, Ring trading as well as LME trading which is your electronic platform, so volume weighted average price is calculated and that is informed the in the general market and the old trades which have been executed by during 6:55 to 7:00 PM GMT. During that period of time, whatever trades has been executed, that volume weighted average price is informed to the market as a Asian reference price and these prices which are discovered and published coincide with the end of the Asian trading day. So subsequently if any company wants to price they its product for buying and selling, they can use this LME Asian benchmark price to price their products.

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Commodity Contracts Traded at LME

- Cash trading at LME
 - T+2 settlement
- Dematerialized warrants/warehouse receipts are transferred to the buyer's account and recorded in the LMESword from seller's account.
- Derivatives trading at LME
 - Futures
 - Options
 - Traded average price options (Tapos)

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Now, commodity contracts at LME, as in any exchange has definitely futures options contract, you also have at LME, you also have companies can buy and sell physical commodities so this cash trading at LME is can be done and it is done through T + 2 settlement that is trading day and buyers and sellers will be giving money and sellers will be giving warehouse receipts to the LME within T + 2 day and for the spot transaction.

And in LME parlance, the warehouse receipts are known as warrants. All along we have been using the word warehouse receipts but at LME, these warehouse receipts are known as warrants and these warrants are gets recorded or gets transacted from the sellers account to the buyers account in a Demat account and that Demat account is known as LME Sword, so how these words have come I am not very clear, but this Demat account is known as LME Sword and the warehouse receipts are known as your warrants and derivative contracts which derivative contracts trade at LME, there are quite a few derivative contracts trade at LME in futures options and traded average price swap options and swaps, etc.

So we will be continuing with discussion on these contracts in our next session so thank you all of you and again looking forward to the next session which is going to be the last session for this particular subject.