

B A S E M E T A L S M A R K E T S A N D T R A D I N G

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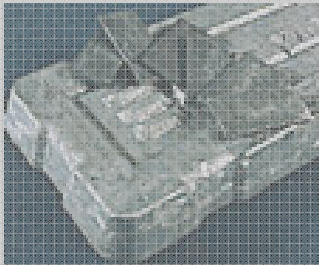
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Introduction to Base Metals and the London Metal Exchange



- Aluminium
- Copper
- Lead
- Nickel
- Zinc
- Tin
- Aluminium Alloy
- North American Special Aluminium Alloy

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Markets



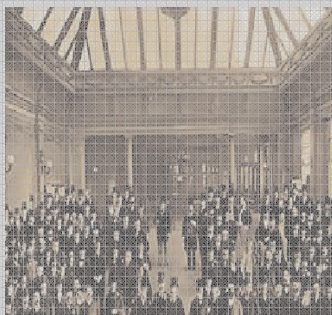
- The London Metal Exchange (LME) is the global center for the trading of base metals
- The LME trades for each business day out to 3m, then every Wednesday out to 6m and then for the third Wednesday of each month thereafter out to a maximum of 63 months for Copper and Aluminium. The OTC market trades with reasonable liquidity out to five years. The market trades 24 hours/day with maximum liquidity during London business hours when the LME is open
- Commercial players (mining companies, industrial users, physical merchants, end consumers), banks, brokers and investors are all active participants

Introduction to Base Metals and the London Metal Exchange



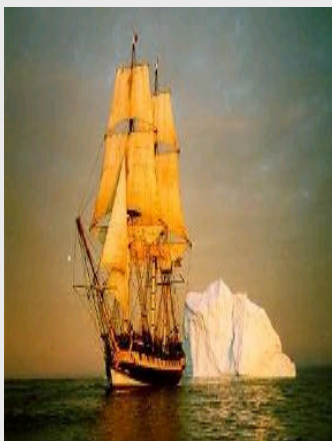
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Benchmark and settlement convention



- The 3-month price is the global benchmark. It is similar to spot prices for FX and precious metals, or front month futures in other commodities. Three months was historically (back in the mid 1800s) the amount of time for shipment from Americas and Asia to London
- Prices are quoted in USD/metric tonne. Some US users prefer cents/lb, which convert at 1 tonne = 2,204.623 lbs
- Most forward prices are quoted as a spread to the 3-month price (i.e. if the 3-month copper price is \$3,564/tonne, the average price for Calendar 2006 might be shown as -386 ("Cal06 over 3's") meaning the all-in price is \$3,178/tonne)
- Financially settled swaps typically settle against the average official cash settlement price for a specified monthly/quarterly period (also known as Asian settlement). European options expire on the first Wednesday of every month and settle against the third Wednesday

Trading base metals: The London Metal Exchange

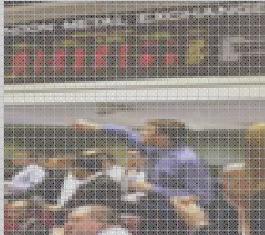
How the metals are traded



- The LME is a 24-hour market which operates by inter-office trading between members and customers and via an open-outcry trading floor between “ring dealing” members
- The LME trading floor is known as “The Ring”. The LME official settlement prices for each metal are established during open-outcry trading at the close of the second morning ring
- Additionally LME member firms are also able to transact trades between each other through online trading platforms

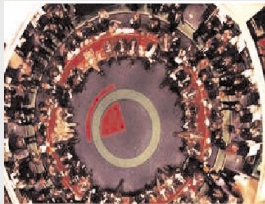
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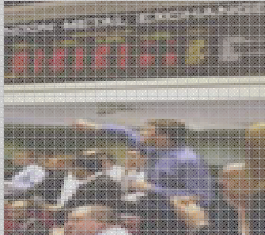
“The ring”



- The first open-outcry trading session (“Ring”) begins at 11:45 a.m. local London time. Each metal has a dedicated five minute trading period. At 12:20 p.m., all metals have traded once and there is a 10 minute break. Starting at 12:30, each metal contract trades again for five minutes
- The day’s official prices are published after the end of each metal’s second ring trading and confirmed ahead of the “kerb”
- At 1:15 p.m., the “kerb” begins and all 8 metal contracts trade at once until 3:10 p.m
- The second open-outcry trading session begins at 3:10 p.m. and follows the same schedule as the first, including a “kerb” session from 4:35 p.m. to 5:00 p.m.

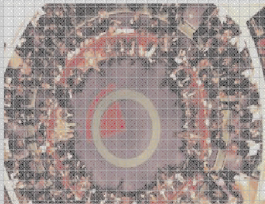
Trading base metals: The London Metal Exchange

How the metals are traded



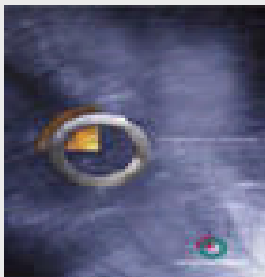
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The other facts to note



- The base metals markets are forward markets. The 3-month price is the benchmark and forward prices are quoted as a spread based on a combination of factors (USD interest rates, storage costs, and metal borrowing costs)
- All LME contracts are priced assuming physical delivery, although only a small amount of metal is actually delivered. Most contracts are unwound before settlement. The deliveries that do occur are placed into approved LME warehouses globally. These partly reflect the actual physical market’s demand/supply balance. LME warehouse stock movements are published daily

What are you actually trading in base metals

The LME (futures) contract

- The London Metal Exchange contracts assume that on falling due they will result in metal either being delivered or received.
 - Brands of metal that meet the required specification are stored in LME approved warehouses around the world
 - Traditionally placed close to consuming regions
 - In reality most contracts are settled out without that taking place

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 - Traditionally placed close to consuming regions
 - In reality most contracts are settled out without that taking place
- **There is a secondary warrant trading market, in which premium for particular brands and location are traded**
 - **Thereby, if available, you can purchase (swap for) your desired brand and location**

What are you actually trading in base metals, cont'd

Supply of metals

- If you are due to supply metal then you would need to have warrants in your possession to be given to the LME (who would then issue them to a counterpart due to receive metal).
 - The supplier of metal can choose which warrants they give to the LME (i.e. which global location, brand and form, as long as an LME registered brand).
 - You can either place metal on deposit in an approved warehouse and issue warrants for it, use warrants which have been issued to you from an earlier maturity, or try to borrow warrants from another market participant

What Drives Metals prices (what do we watch)

Supply

- The physical supply of metals and expectations
 - Potential disruptions; Strikes, accidents, economic closures (cost v price)
 - Expenditure on exploration (costs of new operations)
 - Inventory levels

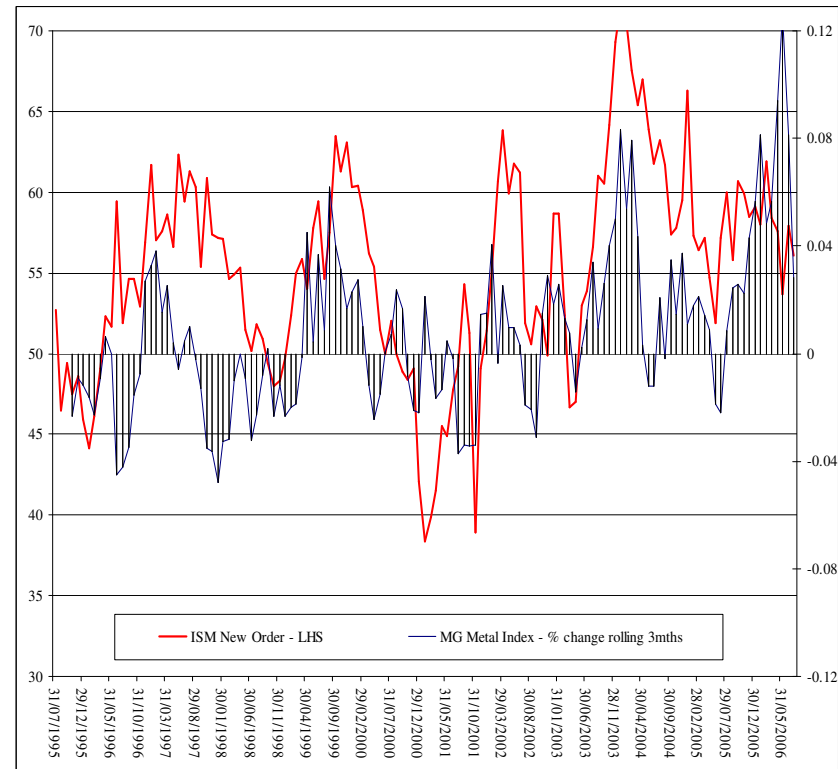
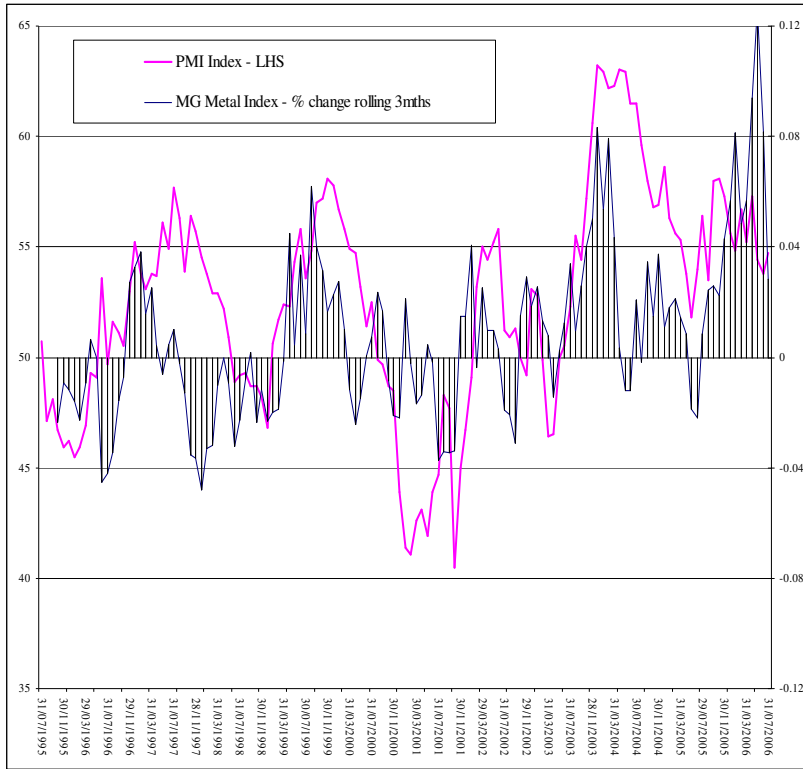
What Drives Metals prices (what do we watch)

Demand

- The physical supply of metals and expectations
 - Potential disruptions; Strikes, accidents, economic closures (cost v price)
 - Expenditure on exploration (costs of new operations)
 - Inventory levels
- Demand (growth)
 - Economics, substitution
 - Emerging world / developing world growth rates
 - Currency changes, interest rates

US Manufacturing PMI Data Shows expansion

US PMI v MG Metal Price Index



- Over the past 15 years, if the US PMI is above 50 then metal prices are rising and below 50 metal prices are falling
 - Though as the ISM trends towards 50 metal prices' rate of acceleration decreases

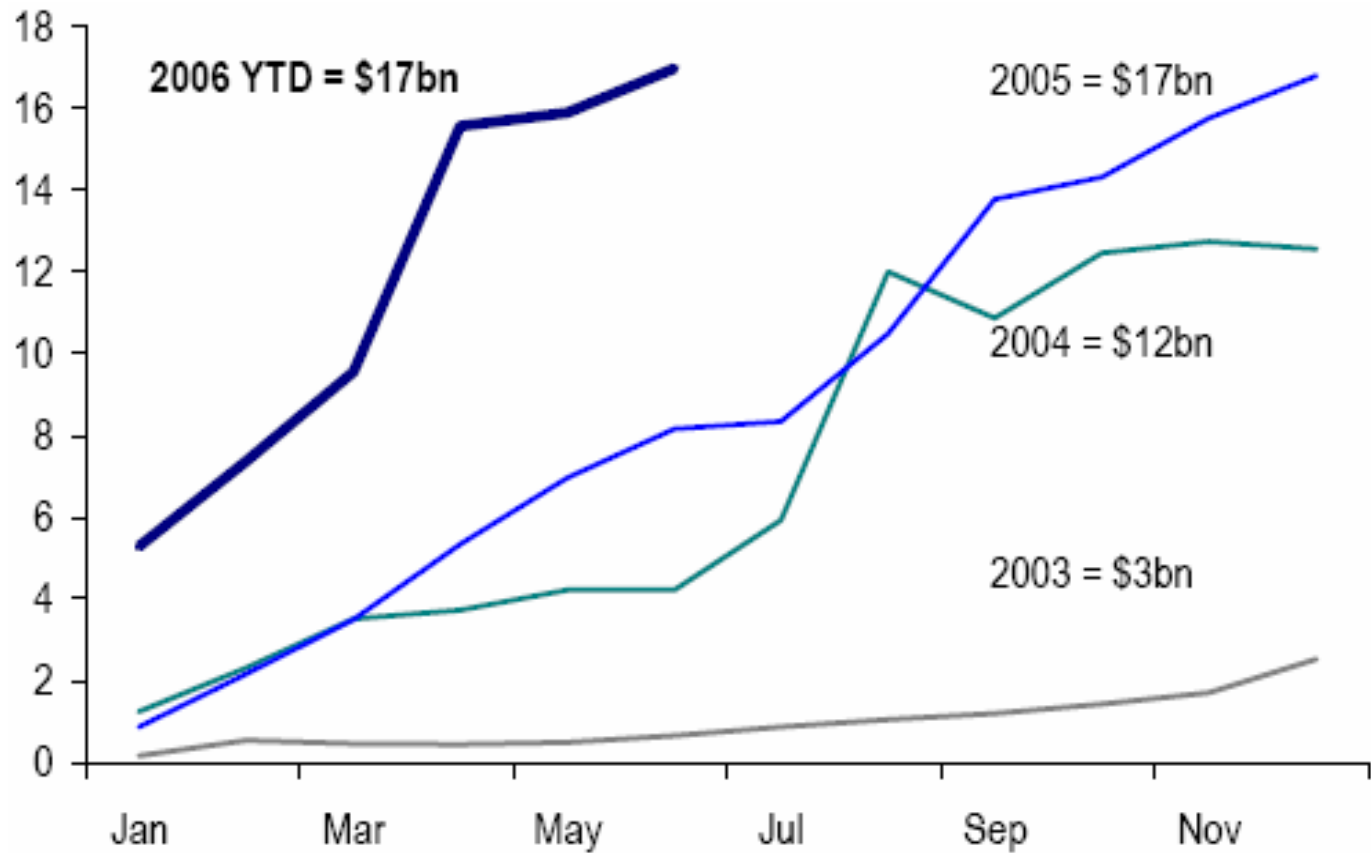
What Drives Metals prices (what do we watch)

Investor

- The physical supply of metals and expectations
 - Potential disruptions; Strikes, accidents, economic closures (cost v price)
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 - Inventory levels
- Demand (growth)
 - Economics, substitution
 - Emerging world / developing world growth rates
 - Currency changes, interest rates
- **Investor (Pension) sentiment towards commodities as an asset class**
 - GSCI, DJ-AIG.....
 - Watch flows in / out of commodity classes

Retail Investment in Commodities

Cumulative annual flows into retail commodity mutual funds



- Retail investment continues to be important driver for metal prices, while investment was high in first 6 months of 2006 demand has moderated more recently
- Investment is typically in the form of 'baskets' or into funds such as GSCI. JPMorgan predict metals have benefited disproportionately in 2006 being only sector offering positive roll yield (base) or only slightly negative (precious)

What Drives Metals prices (what do we watch)

Equities

- The physical supply of metals and expectations
 - Potential disruptions; Strikes, accidents, economic closures (cost v price)
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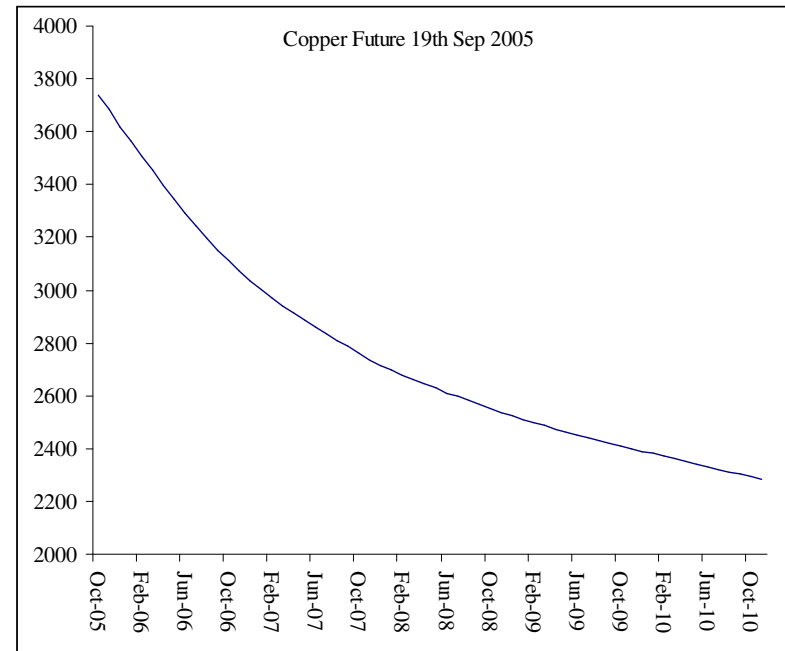
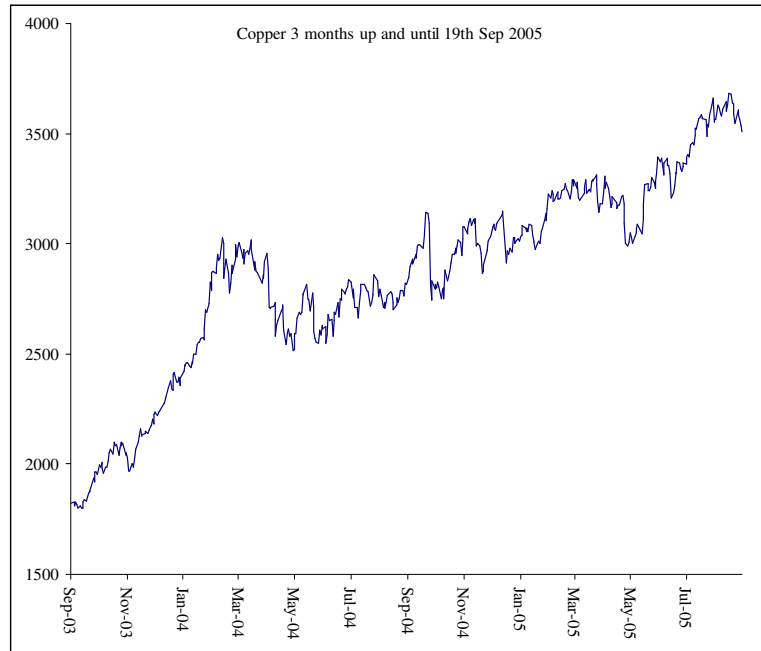
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- **Mining/resource equity price movements / announcements**
 - **Mergers and acquisitions, outlook statements**

Implication of the price curve: backwardations / contangos

Copper and forward curve: Does the shape of forward curve provide us with future price direction

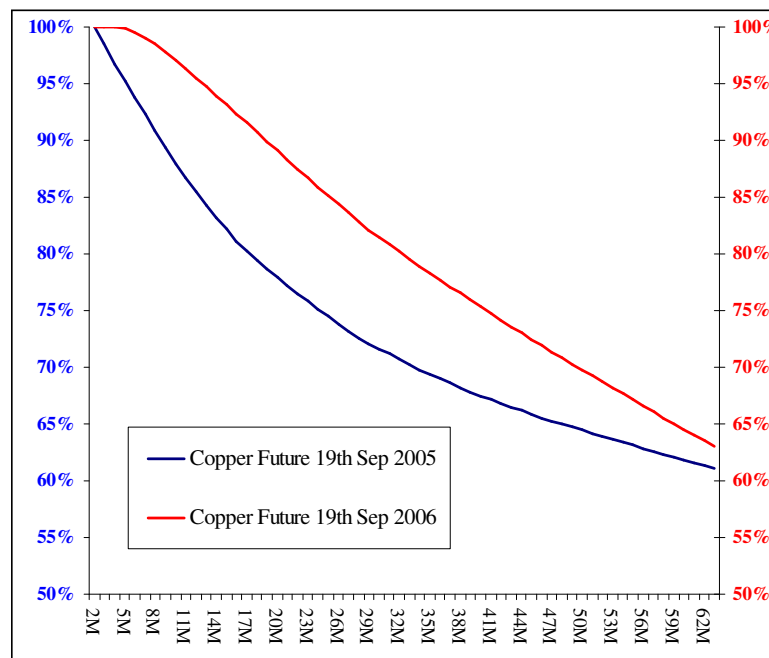
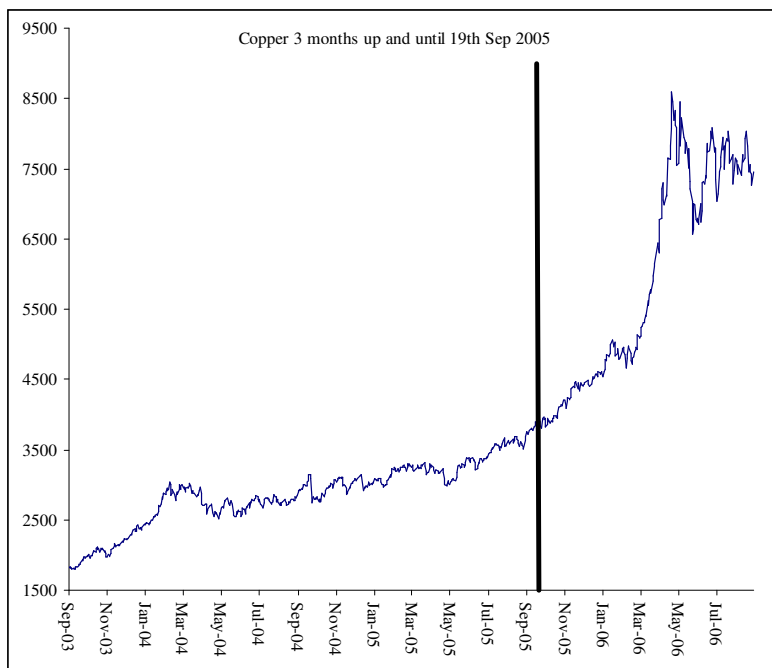


Source: Bloomberg

- Copper prices in September 2005 hit a record high, and the forward curve was in a heavy discount
- Forward selling dominated the forwards, as producers looked to lock in price - Hedge
- 63 months out the copper price settled at 2200, significantly above the industries average cost of production
- Consequently, with the sharply discounted forward curve, is this an indication of a impending price decline on the front of the curve?

Implication of the price curve: backwardations / contangos, contd

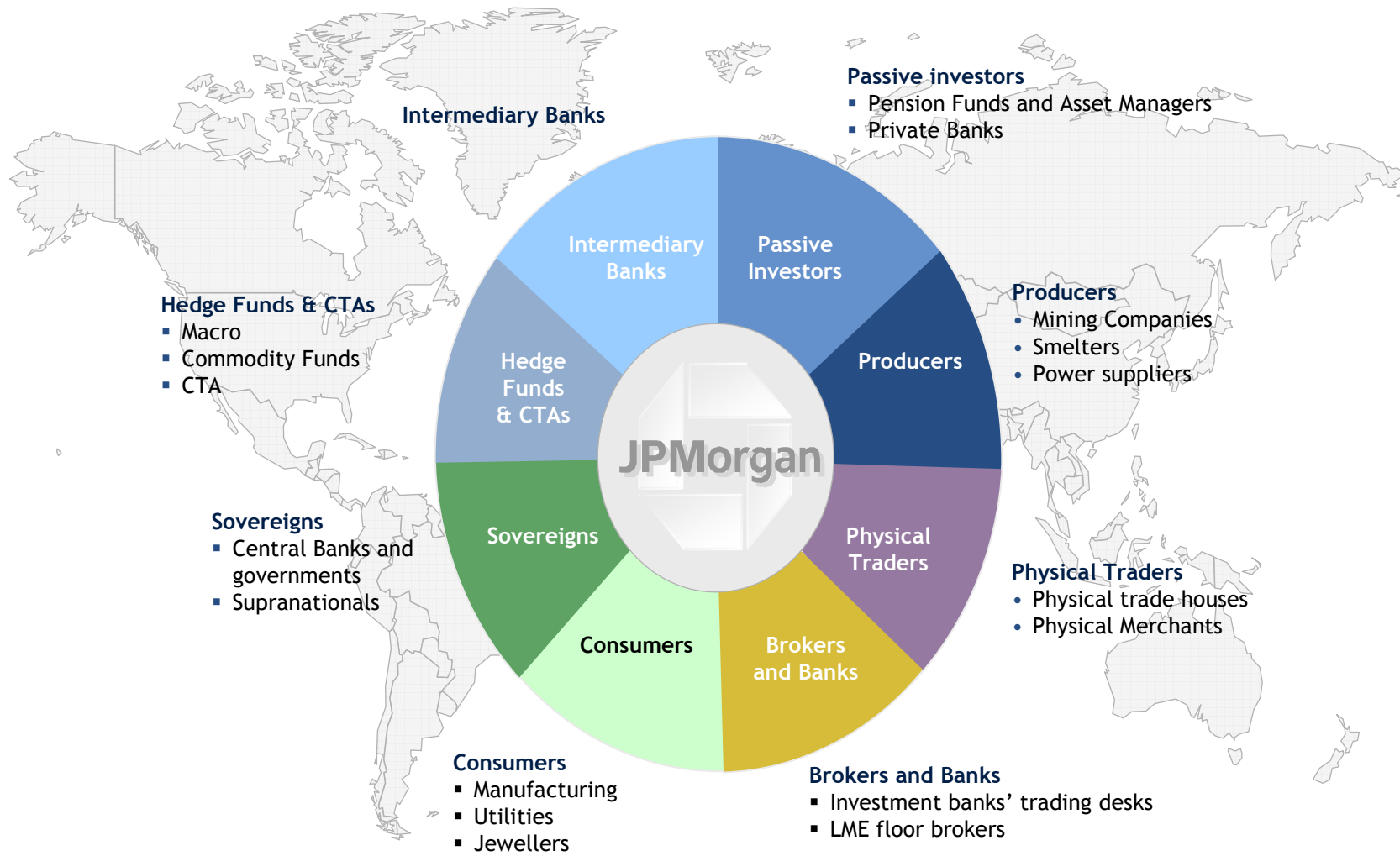
Answer: No, Copper prices continued to strengthen



Source: Bloomberg

- The backwardated forward curve rather than becoming steeper, actually leveled out, Why?
 - Reduced forward selling appetite, investor and consumer buying
 - Investor to take advantage of potential positive carry
 - Consumer to hedge future exposure
- Forward curve tend to be backwardated in upwardly trending prices, once they have moved above the industries average cost of production
 - Producers are natural longs and have a greater desire to hedge and are less fragmented compared with the manufacturing sector

Market Participants in the World of Commodities



▪ JPMorgan act as a market maker in three different time zones, located in London, New York and Singapore.
 ▪ Working together with all the different participants in the business allows us to have a unique insight into the market.

Characteristics of commodity price cycles

Average duration and amplitude of commodity price cycles, 1970 - 2005									
	# of completed cycles	Commodity price booms		Commodity price slumps		Current phase		Duration, months	Amplitude, %
		Avg duration, months	Avg amplitude, %	Avg duration, months	Avg amplitude, %	Avg duration, months	Avg amplitude, %		
All commodities	5	37	45	36	-42	boom (since Feb 02)	51	171	
Energy	3	36	58	27	-54	boom (since Feb 02)	51	244	
Base metals	4	28	48	47	-43	boom (since Nov 01)	54	196	
Precious metals	5	30	47	43	-42	boom (since Sep 99)	80	142	
Agriculture	6	35	48	34	-45	boom (since Nov 04)	18	32	
Livestock	5	41	35	34	-30	boom (since Sep 02)	44	35	

Source: JPMorgan

- Cycles surprisingly uniform at aggregate level
 - Average duration of 37 months, movements of 40%
 - Sub-sector cycles less symmetric

APPENDIX

Summary of everyday uses of base metals

Aluminium

Aluminium comes from the mining of bauxite, which is refined to alumina and then converted to aluminium metal through electrolysis. Refined metal, in turn, is used primarily in areas such as beverage cans, foil (and other packaging), automobiles, aircraft and other transport, building and construction, and electrical applications such as cables

Copper

Copper is used in the electrical industry both as a conductor (wiring) and for electrical equipment and in the construction industry primarily as copper pipe. It is used in the engineering sector, often in the form of an alloy material such as brass and bronze, and in the chemicals industry

Lead

A large proportion of the lead produced is used in the production of automobile and commercial vehicle batteries and industrial load-levelling uses. Over two-thirds of all lead consumed is by lead-acid batteries of one kind or another in Starter, Lighter and Ignition (SLI) applications, principally supplying the world's automobile and truck industry. Other uses include cable sheathing, pipe and sheet, chemicals (such as PVC and in glass for lighting and TV tubes) and alloys

Nickel

Nickel-containing alloys and steels are highly resistant to corrosion and oxidation and provide both strength and toughness at high temperatures. The major use for nickel is in the production of stainless steels, which account for 65% of total world nickel consumption. Other uses for nickel include alloy steels, nickel alloys, copper alloys, castings, plating and chemicals. Pure nickel metal or nickel alloyed with other metals (normally copper) is also used in coinage

Zinc

There are a number of major markets for zinc consumption. Zinc is used in the coating (galvanising) for protection of iron and steel corrosion, zinc alloys for casting and as an element of alloys such as brass. It is also required in sheet form for roofing and the cladding of buildings and in tyres in the form of zinc oxide. Zinc also has smaller uses in pharmaceuticals and products like sun-tan lotion

Aluminium alloys

The use of aluminium alloy, particularly for the production of automotive components including lightweight engine parts, has been steadily growing internationally over recent years

LME Ring trading times

First session

First rings

Aluminium Alloy & NASAAC	11.45 to 11.50
Tin	11.50 to 11.55
Primary Aluminium	11.55 to 12.00
Copper	12.00 to 12.05
Lead	12.05 to 12.10
Zinc	12.10 to 12.15
Nickel	12.15 to 12.20
Interval	12.20 to 12.30

Second rings

Copper	12.30 to 12.35
Aluminium Alloy & NASAAC	12.35 to 12.40
Tin	12.40 to 12.45
Lead	12.45 to 12.50
Zinc	12.50 to 12.55
Primary Aluminium	12.55 to 13.00
Nickel	13.00 to 13.05
Interval	13.05 to 13.15
Kerb Trading	13.15 to 15.10

Second session

Third rings

Aluminium Alloy & NASAAC	15.10 to 15.15
Interval	15.15 to 15.20
Lead	15.20 to 15.25
Zinc	15.25 to 15.30
Copper	15.30 to 15.35
Primary Aluminium	15.35 to 15.40
Tin	15.40 to 15.45
Nickel	15.45 to 15.50
Interval	15.50 to 16.00

Fourth rings

Lead	16.00 to 16.05
Zinc	16.05 to 16.10
Copper	16.10 to 16.15
Primary Aluminium	16.15 to 16.20
Tin	16.20 to 16.25
Nickel	16.25 to 16.30
Aluminium Alloy & NASAAC	16.30 to 16.30
Kerb Trading	16.35 to 17.00 ¹

¹ Note: at 16.45 Aluminium Alloy and NASAAC cease trading;
at 16.50 Lead and Tin cease trading;
at 16.55 Nickel and Zinc cease trading

Metals Traded Globally on Other Exchanges

World Metal Futures Exchanges

EXCHANGE NAME	LOCATION	MAJOR METALS TRADED	HOURS (All times are London time)
LME (London Metal Exchange)	London, UK	Al, Cu, Zn, Ni, Pb, Sn	0100-1900 Select (Electronic Platform) 11.45 - 17.00 Ring (Floor) 08.00 - 17.35 Major Liquidity 13.30-18.30 (Floor)
COMEX (part of NYMEX)	New York, USA	Au, Ag, Al, Cu, Pd, Pt	13.30-18.30 (Floor)
Shanghai Futures Exchange	Shanghai, China	Al, Cu	02.00 - 04.30 06.00 - 08.00
TOCOM (Tokyo Exchange)	Tokyo, Japan	Au, Ag, Pt, Pd	
Spot Gold, Silver and PGM's An OTC market	Worldwide	Au, Ag, Pt, Pd	Non-Stop bar major holidays.

What Grades are Acceptable for good Delivery

Metal Grade and specifications		
Metal	Other Information	Form
Aluminium	99.7% purity	Ingots (up to 26 kgs)
		T-bars (not more than 750 kgs)
		Sows (not more than 750 kgs)
Copper	conform to BSEN 1978:1998	Grade A Cathode
Nickel	99.8% purity Packed in steel drums not more than 500 kgs	Full Plate
		Cut Cathodes
		Pellets
Zinc	99.995% purity	Ingots (up to 55 kgs each)
Lead	99.970% purity	Ingots (up to 55 kgs each)
Tin		Ingots (up to 30 kgs each)
Base metals can be delivered to any exchange registered warehouse by agreement with relevant exchange and warehouse		
Gold	995 (99.50% purity)	LOCO LONDON, GERMISTON (SA), ZURICH,
Silver	999 (99.90% purity)	
Platinum	99.95%	Plate or Ingot from London/Zurich Good delivery list 1kg<Weight<6kg
Palladium	99.95%	Plate or Ingot 1kg<Weight<6kg Good delivery list at www.lppm.org.uk

Must meet Good Delivery Criteria. Good Delivery criteria set out on www.lbma.org.uk for London

Source: LME and LBMA

LME Trade Dates

LME, tradeable prompt (value) days

Daily from Spot date to rolling 3 month date

Every Wednesday of the month from rolling 3 month date to rolling 6 month date

Every 3rd Wednesday of the month is the standard prompt date.

Can trade every 3rd Wednesday of month out 63 months in Cu and Al, 27 months in Ni and Zn and out 15 months in Pb and Sn

All dates trade as a spread to the rolling 3 month contract. Trading as spread to cash also an option

LME options expire 1st Wednesday of every month. Upon expiry enter into Futures position prompt 3rd Wednesday of the same month.

Comex Futures Dates

Au, first 3 months trade. Any February, April, August, October within 23 month period. Any June and December falling within a 60-month period of current month.

Ag, first 3 months. Any Jan, March, May and September falling within a 23 month period. Any July and December within a 60 month period of current month.

Pt, first 3 months, then quarterly Jan, April, July and October, out max of 15 months total.

Pd, first 3 months, then quarterly March, June, September and December, out max 15 months total.

Al 25 consecutive monthly contracts, Cu 23 consecutive monthly contracts

Metal Exchange Contract Specifications

B A S E M E T A L S M A R K E T S A N D T R A D I N G

LME contracts and sizes (prices quoted are \$/metric tonne)	
Contracts (in order of decreasing liquidity)	Market Convention
Aluminium	1 lot = 25 metric tonnes
Copper	1 lot = 25 metric tonnes
Nickel	1 lot = 6 metric tonnes
Zinc	1 lot = 25 metric tonnes
Lead	1 lot = 25 metric tonnes
Tin	1 lot = 5 metric tonnes

COMEX Contracts and sizes . Base prices in \$/lb, Precious in \$/ troy oz		
Contracts	Market Convention	Limit*
Copper	1 Future = 25,000 lbs	\$0.20/lb from previous day settlement
Aluminium	1 Future = 25,000 lbs	\$0.20/lb from previous day settlement
Gold	1 Future = 100 troy ozs	\$75.00/oz from previous day settlement
Silver	1 Future = 5,000 troy ozs	\$1.50/oz from previous day settlement
Platinum	1 Future = 50 troy ozs	\$50.00/oz from previous settlement
Palladium	1 Future = 100 troy ozs	No limits

*Correct as of 24th May 2006

1 metric tonne = 32,150.747 troy ozs (3.d.p)

1 metric tonne = 2204.622 lbs (3.d.p)

1 lbs = 14.583 troy ozs (3.d.p)

1 troy ozs = 1.097 ozs (3.d.p)