ICFAI Foundation for Higher Education
(Deemed-to-be University under Section 3 of the UGC Act, 1956)
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IBS® ICFAI BUSINESS SCHOOL HYDERABAD

Hedging of Price Risks in Base Metals





Submitted by

ICFAI Business School, Hyderabad
ICFAI Foundation for Higher Education

Research Team:
Dr. A. Amarendar Reddy - Senior Consultant
Dr. Tamma Koti Reddy - Consultant
Dr. M.V.S. Kameshwar Rao - Principal Investigator
Dr. D. Satish - Co-Investigator
Dr. T. Sita Ramaiah - Co-Investigator
Dr. Rajneesh Ranjan Jha - Co-Investigator

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Executive Summary

During the last 10 years, the prices of base metals have become more volatile, owing to uncertainties created by COVID-19, wars, downturn in developed economies, and geo-socio-political dynamics, in the world. Business entities which are not prepared to mitigate the risks emanating out of such uncertainties may face dire consequences including closure. Commodity Price Risk arises due to the multiplying effect of Price Volatility (due to Macro Economic, Demand & Supply, and Market Microstructure factors) and Quantum of Exposure (due to Level of Inventories, Time Gap between buying and selling the commodity, and Ability to Pass Through the price changes).

There is growing importance of manufacturing in India, especially in the infrastructure, space, defence, automobile, green energy sectors. Base Metals are crucial inputs to the various products that are manufactured by these sectors. Various initiatives have been undertaken by both Securities Exchange Board of India (SEBI) and Multi Commodity Exchange of India (MCX) to develop a vibrant and credible commodity derivative market in India. However, there is little documented work on hedging practices of Indian base metal players in both the academic and practice literature. This project fills this gap.

This project comprises of four objectives. First, understanding hedging practices of Indian base metal value chain players, including their preference for Over the Counter (OTC) and Exchange Traded Derivatives. Second, comparison of practices prevalent in other parts of the world. Third, identifying the level of awareness and preferences of Indian players for Indian or foreign commodity exchanges. Last, making suitable recommendations to encourage Indian value chain players to hedge on Indian commodity exchanges. A pan-India survey of base metal players across the value chain of the industry was undertaken including, associations of various players, commodity risk management consultants, brokers, and experts. Personal interviews, both offline and online, were conducted over a period of 8 months, across 17 different states in India with a semi-structured questionnaire to capture the views of a large sample of respondents.

Prices of base metals are globally determined in the London Metal Exchange (LME) and in US Dollars. Therefore, the base metals industry in India, imports all the vagaries of these global prices, coupled with the volatility of INR currency. India is currently a significant player only in the production of Aluminium, however, the quantum of production and consumption, like every other base metal, is not enough to exert a dominating influence. Correlation of Indian base metal prices with LME are decreasing ever since SEBI's guidelines on mandatory physical delivery were issued in 2019. The Indian commodity derivative

markets, especially in the base metal sector, are going through a period of re-alignment to the policy change in 2019, COVID19, war induced uncertainties, challenges of the existing ecosystem, and the practices of players in the base metal industry. India can consider a ***domestic reference price for aluminium, zinc, and lead,*** *where the Indian production and consumption are matching.*

Indian base metal industry is predominantly a sellers' market at the primal end of the value chain with a few major smelters and some medium recyclers. They are either offering ***OTC type forward contracts*** *(like* ***Price Now Deliver Later, Deliver Now or Price Later****) or are* ***charging premium*** *to the customer* ***to provide 1 month or 2-month price constancy*** *or sell on* ***"cash and carry basis" passing on the risk to their customer.*** *The large primary producers hedge their* ***existing and anticipated exposures on LME****, rather than MCX* ***due to long dated contracts and liquidity.***

At the distal end it is a buyers' market with relatively few large manufacturers of B2C goods. These players consume the value-added base metal products produced by many MSMEs in the middle of the value chain and use ***markup on cost, product mix, cross subsidisation*** *as their price risk mitigation techniques. Otherwise predominantly the price risk is* ***"passed on to their customers"****. Distributors and Retailers are the quintessential conduits that connect the primal and distal ends to the Micro, Small and Medium Enterprises MSMEs in between, respectively. They try as much as possible "****not to keep inventory",*** *or undertake "****back-to-back booking****", which essentially means that they place a buy order after they receive a sell order and achieve a target* ***"bid-ask" spread*** *on annual volumes.* ***If they expect built-up of inventories, they hedge using futures contract****. Therefore, hedging of* ***commodity risk using derivative*** *products is* ***happening at the distal ends due to their scale, ability and skill to hedge****. The* ***long-standing relationships*** *of the* ***medium enterprises*** *with their suppliers - motivated by* ***volume discounts, and credit terms*** *- have helped mitigate some portion of the price risk. The cash rich firms buy* ***OTC type forward contracts by paying a premium****. Others, just accept the price risk as part of cost of materials. While selling,* ***passing through the price changes to the customer****,* ***negotiating price variation clauses, and mark up on cost*** *are the popular ways in which the medium size firms are mitigating the commodity price risk. The* ***small firms are getting squeezed*** *by both the suppliers and customers, especially with* ***historical average pricing on metals with upward price trends*** *hence they are the most vulnerable to commodity risk. Their response is to keep themselves nimble, like shipment to shipment, without much inventory and no long sales pipelines. So essentially, they are* ***reducing their exposure.***

Across the world large firms look at ***commodity risk as both operational and strategic****, where their* ***operational strategies are like what the Indian firms***

are engaging in *- supplier networks,* ***OTC forward contracts within the supply chain*** *- and the* ***strategic exposure is hedged through derivatives*** *on commodity exchanges.* ***LME is the reference price*** *for majority of the companies in the world. There are a* ***few companies*** *which* ***feel that hedging takes away their chances of profit*** *making and hence is* ***not in the best interests of creating long term value to the shareholders.***

Indian base metal industry shows ***variations in the choice of reference pricing according to the type of metal****.* ***LME's*** *cash settlement price is the reference price* ***for Copper*** *and* ***Nickel. NALCO's listed price*** *is* ***for Aluminium****.* ***Vedanta's*** *listed price is for* ***Zinc****, and* ***Bombay Metal Exchange*** *is the reference price for* ***Lead****.* ***Price Reporting Agencies*** *are providing the* ***spot price visibility*** *service by polling the prices from various players especially for the recycled market. Sometimes, they* ***offer forecasting and inventory visibility too.*** *However, they are* ***not yet pan India services*** *and their prices come* ***with a lag, than real time.***

Scale of operations, Inability to finance the margins, and lack of expertise *are firm specific factors for not hedging.* ***Cost of hedging, lack of relevant products, lack of longer maturity contracts, lack of liquidity, very less stock for physical delivery, physical delivery at undesired location, and lack of faith in the price of commodity exchanges*** *are some of the commodities exchange related factors that explain the significantly lower proportion of hedgers.* ***Hedger Education, mobile based hedger user interface, engaging with the nudgers (consultants not brokers), new contracts for value added products, reduction of cost of hedging, creating the inventory visibility, improving credibility of polled spot price, rolling settlement, MSME outreach, communicating quality of underlying, reach out to associations,*** *is what MCX can consider and explore further.* ***Fiscal policy changes, stability of regulatory environment, cost of trading in derivatives, commodity focussed exchanges for better liquidity consolidation, broadening the trading community, concerted action, bank finance, policy on domestic pricing and developing a co-created commodity ecosystem*** *is what the Government, policy makers, industry players and MCX should together attempt for a vibrant commodity derivative markets, only then MCX can perform the prime facilitating functions like, "Price Discovery" and "Risk Mitigation".* ***This is the opportune time for MCX to engage, nudge, collaborate with stakeholders and consolidate its position.***

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Chapter 1: Introduction

During the last 10 years, the prices of base metals have become more volatile, owing to economic uncertainties due to COVID-19, wars, downturn in developed economies, and geo-socio-politico dynamics, in the world. Such unexpected volatility in base metal inputs has a snowballing effect on the downstream products. Business entities which are not prepared to mitigate the risks emanating out of such uncertainties may face dire consequences including closure. Commodity derivative markets across the world have emerged as crucial institutions, which nurture an ecosystem of value chain players involving a commodity. They promote active spot markets, thereby creating visibility of inventory, leading to market determined price discovery for both spot and forward time periods, and offer derivative instruments which help mitigate the price risk of the value chain players.

There is growing importance of manufacturing in India, especially in the infrastructure, space, defence, automobile, green energy, sectors. Base Metals are crucial inputs for the various products that are manufactured by these sectors. Against this background, MCX, embarked on a journey of understanding the behaviour and perceptions of physical metal players towards exchange traded derivative instruments. This primary survey-based research project is in response to the award of the research project by Multi Commodity Exchange of India Limited (MCX), Mumbai, India to ICFAI Business School, ICFAI Foundation for Higher Education, Hyderabad. As part of this project the following deliverables have been conceived by MCX, India.

- To understand the hedging patterns of Indian Companies
- To compare the extent of hedging between Global and Indian Companies
- To identify the awareness, preference, ease of access, and difficulties in hedging commodity risks by Indian companies
    - Domestic Exchanges
    - International Exchanges
    - Using OTC derivatives in international markets
    - Using OTC derivatives in domestic markets
- To suggest measures for encouraging companies to hedge on domestic exchanges, based on the feedback of survey, as well as global exchanges.

IBS, Hyderabad undertook the project, and has conducted the primary survey of the value chain players in the base metal industry during the last eight months, covering extensively the significant manufacturing hubs, and marketplaces across India. Predominantly the survey was conducted in the form of personal interviews of senior officials of mining, smelting, refining, recycling, manufacturing, and physical metal trading companies and firms, industry associations, commodity risk consultants, derivative traders, and advisors. The understanding and findings of this exercise are presented in this report covered under the following sections.

1. India in the Global Base Metal Market – Chapter 2
2. Relevant Review of Literature on Commodity Risk and its Management – Chapter 3
3. Hedging Patterns of International Companies – Chapter 4
4. Retail Participation in Commodity Markets – Chapter 5
5. Empirical Analysis of Spot and Futures Prices of MCX – Chapter 6
6. Insights from Survey of Value Chain Players – Chapter 7
7. Insights from Experts on Commodity Markets – Chapter - 8
8. Conclusions – Chapter 9
9. Recommendations Chapter 10

The style of presentation in Chapters 2 to 6 would be brief intro about the chapter and what is expected to be covered, followed by a box containing the highlights (gist of understanding of the chapter). Then the detailed discussions, data analysis, and presentations under various sections would follow. Chapter 9 would conclude, by broadly conveying the understandings of the previous chapters, leading to the recommendations in Chapter 10.

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"Value is always Co-Created". But for the above stakeholders this report would not have been possible and meaningful.

Chapter 2: India in the Global Base Metal Market

Highlights of the Chapter

- ✓ *China produces about 60% of the global primary aluminium while India and Russia are a distant second and third largest producer of the metal.*
- ✓ *Global mined copper production dropped considerably in the year 2023*
- ✓ *Though South and Central America mine Copper the most, Asia supplied 60% of refined copper to the world*
- ✓ *Demand for copper was the highest from Asia, constituting 75 % of the total demand for copper*
- ✓ *From the year 2021, the global demand and the global supply of refined copper from India was almost the same. Mined copper from India, which is falling over the years, is basically consumed in the country itself. The increase in recycled copper might have also played an important role in meeting the demand from India*
- ✓ *Asia supplied more than 40% of the mined Zinc and 70% of the Zinc slab in 2023. Australia is the largest exporter of Zinc with a traded value of 1921 mn USD followed by Peru at 1684 mn USD and US at 1517 mn USD respectively. On the other side China was the largest importer of Zinc at 3981 mn USD followed by European Union at 2548 mn USD and Korean Republic at 2044 mn USD*
- ✓ *The demand for Zinc slab in India was less than the Zinc slab production leading to exports. India stood at 52nd position with respect to Zinc exports worth 0.586 mn USD*
- ✓ *Asia contributed to 0.70 mn tonnes of Lead which was nearly 55% of the total global mined lead supply.*
- ✓ *The year 2022 saw a sharp fall in Lead mined as well as demand for Lead and Supply of Lead. Lead recycling could have played an important role in this reduction*
- ✓ *India's lead mining was far less than refined lead production which shows that India is either an importer or recycler of lead.*
- ✓ *India does not feature in mined Nickel or Refined Nickel production but India features in refined Nickel demand.*

2.1 Introduction

This chapter presents the global demand and supply trends of base metals Aluminium, Copper, Zinc, Nickel and Lead, by comparing them with that of India. This chapter lays down the fundamentals for understanding the dynamics that underlie the choice of reference prices, dominance of certain countries and markets in setting the price agenda, and sensitivities to geo-political risks.

2.2 Demand and Supply for Base Metals

The prices of commodities are determined primarily by the demand and supply of the commodities. The base metals are mined in few countries, but their refinement might happen in other countries. Also, the major demand for metal might come from countries which do not mine these metals. A sudden growth in demand for a specific base metal might not be matched by its supply as the miners take time to mine and supply. Further, existing capacities might not be adequate, requiring additional capital investments, leading to further lag in augmenting the supply. The mismatch between demand and supply arises due to economic cycles, substitution by other metals, sudden upsurge in demand, geopolitical risks, wars, labour strikes, natural disasters, and regulatory issues. As commodities are traded in international markets, currency fluctuations also play a role in demand and supply of the metal. This section throws light on the demand and supply side of the base metals and the flow of international trade in these commodities.

2.3 Aluminium

The global production of Aluminium grew steadily from 63.35 mn tonnes in 2019 to 70.58 mn tonnes in 2023. China produces about 60% of the global primary aluminium. **India and Russia are a distant second and third largest producer** respectively with production of 4.04 mn tonnes and 4.01mn tonnes respectively. Refer to the Table 1 for top regions & India on primary Aluminium production data.

Table 1: Primary Aluminium Production: Top Regions & India (Million Metric Tonnes)

Description	2023	2022	2021	2020	2019
Global Primary Aluminium Production	**70.58**	**69.03**	**67.09**	**65.32**	**63.35**
China	41	40.43	38.83	37.33	35.79
North America	3.89	3.74	3.88	3.97	3.80
West and Central Europe	2.71	2.91	3.22	3.33	3.44
East Europe and Russia	4.01	4.08	4.14	4.15	4.15
India	4.04	4.00	3.97	3.60	3.64

Source: International Aluminium.org

2.4 Copper

Mined Copper production which stood at 20.69 mn tonnes in the year 2018, which grew marginally to 22 mn tonnes in the year 2022 before sharply falling to 18.52 mn tonnes in 2023. South and Central America mined the maximum with 6.96 mn tonnes followed by Asia with 3.8 mn tonnes and Africa by 2.93 mn tonnes. Refer to Table2 for a detailed region wise copper production data.

On the other hand, global copper refined supply which was nearly 24 mn tonnes in 2018 grew steadily to 25.69 mn tonnes in 2022 before falling to 22.84 mn tonnes in 2023. Asia supplied 13.83 mn tonnes of refined copper which constituted 60% of the total refined copper supply followed distantly by Europe at 3.08 mn tonnes and South and Central America at 2.10 mn tonnes. **Though South and Central America mined Copper the most, Asia supplied the largest refined copper to the world.** Demand for refined copper grew marginally from 24.13 mn tonnes in 2018 to 25.35 mn tonnes in 2022 before falling sharply to 21.79 mn tonnes in 2023. Demand from Asia was the highest constituting 75 % of the total demand. Demand from Europe was a distant second with 2.64 mn tonnes and demand from North America was 1.89 mn tonnes. Refer to the Table 2 for a detailed region wise data on supply and demand for refined copper.

India has seen a **steady fall in mined copper production** which fell from 0.037 mn tonnes in 2018 to 0.024 mn tonnes for the year 2023. The refined supply for copper from India which was 0.55 mn tonnes in 2018 was steady till 2022 when the refined supply was 0.543

mn tonnes. But for the year 2023, the refined supply fell to 0.42 mn tonnes. Global refined demand for Copper from India was 0.50 mn tonnes for the year 2018 went up to 0.55 mn tonnes for the year 2022 and sharply fell to 0.42 mn tonnes for the year 2023. For the year 2018, the supply of refined of Copper from India was 0.55 mn tonnes catering to its demand from India to the tune of 0.50 mn tonnes. India producted 0.037 mn tonnes of mined Copper. **From the year 2021, global demand and global supply of refined copper from India was almost the same. The quantity of mined copper - which is falling over the years - was basically consumed in the country. The increase in recycled copper might have played an important role in this regard. Refer Table 3 for detailed data.**

Table 2: Mined Copper Production: Region Wise (Million Metric Tonnes)

	2023	2022	2021	2020	2019	2018
Global Mined Copper Production	18.521	22.070	21.107	20.676	20.544	20.692
North America	2.059	2.567	2.499	2.537	2.607	2.518
South & Central America	6.962	8.286	8.256	8.222	8.611	8.650
Europe	1.356	1.593	1.518	1.538	1.484	1.474
Asia	3.819	4.680	4.335	4.005	3.727	4.070
India	**0.024**	**0.028**	**0.031**	**0.027**	**0.037**	**0.037**
Oceania	0.767	0.945	0.909	0.957	1.044	1.047
Africa	2.934	3.219	2.816	2.475	2.224	2.261
Other Regions	0.626	0.778	0.776	0.944	0.846	0.671

Source: Bloomberg, and authors' summarisation

Table 3: Refined Copper Supply and Demand: Region Wise (Million Metric Tonnes)

Global Copper Refined Supply	2023	2022	2021	2020	2019	2018
Global Refined Supply	22.845	25.692	24.643	24.019	23.862	23.915
North America	1.335	1.697	1.687	1.611	1.771	1.833
South & Central America	2.104	2.607	2.647	2.708	2.761	2.945
Europe	3.084	3.717	3.709	3.715	3.637	3.712

Contd…

Contd…						
Asia	13.833	15.273	14.458	14.039	13.547	13.241
India	**0.422**	**0.543**	**0.492**	**0.336**	**0.429**	**0.553**
Oceania	0.381	0.406	0.393	0.384	0.433	0.409
Africa	1.972	1.869	1.559	1.151	1.278	1.350
Other Regions	0.135	0.124	0.189	0.412	0.435	0.424
Global Refined Demand	21.793	25.355	24.822	24.981	24.128	24.133
North America	1.891	2.317	2.413	2.286	2.444	2.380
South & Central America	0.284	0.342	0.360	0.353	0.403	0.402
Europe	2.648	3.496	3.476	3.154	3.263	3.514
Asia	16.302	18.924	18.204	18.628	17.384	17.199
India	**0.429**	**0.553**	**0.496**	**0.421**	**0.533**	**0.505**
Oceania	0.004	0.011	0.018	0.028	0.031	0.029
Africa	0.118	0.135	0.137	0.131	0.121	0.122
Other Regions	0.545	0.130	0.213	0.400	0.482	0.487

Source: Bloomberg, and authors' summarisation

2.5 Zinc

The supply of mined Zinc varied between 13.50 mn tonnes in 2019 to 10.72 mn tonnes in 2023. Asia supplied more than 40% of the mined zinc with 4.84 mn tonnes, followed by South and Central America at 1.75 mn tonnes and 1.37 mn tonnes, respectively supplied by North America. Supply of Zinc slab production stood steady between 13.39 to 13.50 mn tonnes between 2018 to 2022 but fell in 2023 to 11.65 mn tonnes. Asia produced nearly 70% of Zinc slab with a supply of 8 mn tonnes. The demand for Zinc slab kept in pace with the supply of Zinc slab. Demand from Asia was the highest at 7.5 mn tonnes followed distantly by Europe at 1.78 mn tonnes and North America at 1.1 mn tonnes. Refer to Table 4 for detailed information on Mined Zinc Supply and Zinc Slab supply and demand. Australia is the largest exporter of Zinc with a traded value of 1921 mn USD followed by Peru at 1684 mn USD and US at 1517 mn USD respectively.

On the other side China was the largest importer of Zinc at 3981 mn USD followed by European Union at 2548 mn USD and Korean Republic at 2044 mn USD. Refer to the Tables 5 and 6 for detailed data on the top 10 exporters and importers of Zinc.

Table 4: Zinc Supply and Demand: Region Wise (Million Metric Tonnes)

Description	2023	2022	2021	2020	2019	2018
Zinc Supply/Demand						
Global Mined Zinc Supply	**10.727**	**12.949**	**13.058**	**12.802**	**13.509**	**13.105**
North America	1.374	1.738	1.665	1.779	1.787	1.782
South & Central America	1.755	1.972	2.174	2.072	2.121	2.212
Europe	0.518	0.656	0.637	0.685	0.678	0.681
Asia	4.838	5.830	5.840	5.805	5.835	5.613
India	**0.704**	**0.812**	**0.789**	**0.800**	**0.720**	**0.765**
Oceania	0.999	1.267	1.330	1.419	1.274	1.112
Africa	0.031	0.039	0.044	0.038	0.050	0.049
Other Regions	1.211	1.446	1.368	1.987	1.765	1.656
Global Zinc Slab Production	**11.658**	**13.507**	**13.865**	**13.849**	**13.687**	**13.398**
North America	0.926	1.098	1.228	1.331	1.164	1.148
South & Central America	0.481	0.585	0.579	0.613	0.583	0.586
Europe	1.725	2.113	2.272	2.483	2.272	2.371
Asia	8.013	9.131	9.127	9.816	8.984	8.552
India	**0.705**	**0.821**	**0.721**	**0.780**	**0.725**	**0.761**
Oceania	0.348	0.468	0.461	0.494	0.444	0.499
Africa				0.021	0.065	0.067
Other Regions	0.165	0.111	0.198	0.195	0.175	0.174
Global Zinc Slab Demand	**11.380**	**13.787**	**13.989**	**13.281**	**13.884**	**13.605**
North America	1.105	1.337	1.277	1.306	1.305	1.220
South & Central America	0.260	0.352	0.347	0.317	0.284	0.305
Europe	1.787	2.364	2.397	2.412	2.374	2.403

Contd…

Contd…						
Asia	7.507	9.010	9.250	9.496	9.178	8.888
India	**0.627**	**0.664**	**0.592**	**0.610**	**0.674**	**0.699**
Oceania	0.099	0.158	0.167	0.143	0.148	0.156
Africa	0.053	0.060	0.060	0.052	0.048	0.044
Middle East	0.055	0.056	0.043	0.052	0.047	0.053
Other Regions	0.240	0.140	0.137	0.140	0.155	0.161

Source: Bloomberg, and authors' summarisation

India's mined Zinc supply was more or less stagnant between 2018 to 2023 between 0.70 mn tonnes to 0.80 mn tonnes. Zinc slab production in India also ranged between 0.82 mn tonnes and 0.70 mn tonnes for the period. The Zinc slab demand from India ranged between 0.59 mn tonnes to 0.69 mn tonnes**. The demand for Zinc slab for India was less than the Zinc slab production showing exports**. India stood at 52nd position with respect to Zinc exports worth 0.586 mn USD while on the other hand it imported Zinc worth 0.31 mn USD and stood at 35th position in Zinc imports.

Table 5: Zinc Ore and Concentrates Exports: Top 10 Countries (2021)

Country	Trade Value (Mn USD)
Australia	1921.282
Peru	1648.696
United States	1517.455
Bolivia	1381.611
Sweden	493.877
Turkey	469.339
South Africa	444.166
European Union	387.139
Portugal	343.986
Russian Federation	323.798
India (52nd Position)	***0.586***

Source: Bloomberg, and authors' summarisation

Table 6: Zinc Ore and Concentrates Imports: Top 10 Countries (2021)

Country	Trade Value (Mn USD)
China	3981.093
European Union	2548.817
Korea, Rep.	2044.885
Spain	1107.667
Japan	1043.659
Canada	1035.349
Finland	700.839
Netherlands	479.214
Norway	377.397
Germany	359.573
India (35th Position)	0.315

Source: Bloomberg, and authors' summarisation

2.6 Lead

The mined Lead supply was 4.70 mn tonnes in 2018 which increased marginally to 5.23 mn tonnes in 2021 before slumping by a fifth to 1.24 mn tonnes in 2023. Asia contributed to 0.70 mn tonnes which was nearly 55% of the total global mined lead supply. North America supplied 0.14 mn tonnes. Most of the global demand for lead was made good by the refined Lead Production.

The refined Lead production which was at 11.75 mn tonnes in 2018 grew to 13.33 mn tonnes in 2021 before falling by 75% to 3.3 mn tonnes. The demand for global refined Lead which was 11.93 mn tonnes in 2018 grew to 13.37 mn tonnes in 2022 before falling sharply to 3.43 mn tonnes in 2023.

Lead has a high recycling rate and perhaps lead is being recycled to cater to the demands. Refer to the Table 7 for detailed region wise information on supply of mined lead and region wise supply and demand for refined Lead.

Table 7: Lead Supply and Demand: Region Wise (Million Metric Tonnes)

Description	2022	2021	2020	2019	2018
Lead Supply/Demand					
Global Mined Lead Supply	1.246	5.235	4.821	4.838	4.707
North America	0.143	0.591	0.604	0.565	0.522
South & Central America	0.094	0.387	0.368	0.441	0.448
Europe	0.120	0.583	0.606	0.558	0.543
Asia	0.706	3.009	2.550	2.648	2.610
India	***0.054***	***0.227***	***0.222***	***0.201***	***0.187***
Oceania	0.125	0.505	0.532	0.480	0.450
Africa	0.027	0.105	0.103	0.107	0.102
Other Regions	0.031	0.055	0.058	0.039	0.033
Global Refined Lead Production	3.302	13.332	12.733	12.086	11.751
North America	0.395	1.618	1.875	1.825	1.794
South & Central America	0.088	0.348	0.365	0.326	0.330
Europe	0.514	2.053	2.095	1.977	1.948
Asia	2.191	8.866	7.949	7.647	7.287
India	***0.226***	***0.897***	***0.880***	***0.653***	***0.609***
Oceania	0.040	0.164	0.167	0.101	0.196
Africa	0.025	0.097	0.094	0.089	0.086
Other Regions	0.049	0.187	0.188	0.121	0.110
Global Refined Lead Demand	3.430	13.374	12.703	12.268	11.936
North America	0.499	1.940	1.995	1.928	1.923
South & Central America	0.097	0.392	0.367	0.295	0.300
Europe	0.438	1.616	1.705	1.666	1.666
Asia	2.140	8.455	7.641	7.411	7.065
India	***0.201***	***0.847***	***0.869***	***0.620***	***0.583***
Oceania	0.003	0.008	0.011	0.013	0.016
Africa	0.014	0.055	0.055	0.052	0.056
Middle East	0.002	0.006	0.003	0.024	0.024
Other Regions	0.237	0.902	0.927	0.880	0.886
Refined Lead Net Surplus/-Deficit	-0.128	-0.043	0.030	-0.182	-0.185

Source: Bloomberg, and authors' summarisation

Peru is the largest exporter of Lead at 947 mn USD of traded value followed by Mexico at 746 mn USD and 743 mn USD exported by US. Korean Republic Imported 1874 mn USD of Lead followed by China at 1449 mn USD and Europe which imported 637 mn USD worth of Lead. Refer to the Tables 8 and 9 titled for complete information on top 10 lead exporters and importers.

India's mined Lead increased from 0.187 mn metric tonnes in 2018 to 0.227 mn metric tonnes for the year 2022 before falling sharply to 0.054 mn for the year 2023. On the other hand, India's refined lead production was 0.60 mn tonnes in 2018 and increased to 0.89 mn tonnes for the year 2022 before falling sharply to 0.22 mn tonnes for the year 2023. This shows that **India depends on lead imports for refining**. On the other hand, India's demand for refined lead was 0.58 mn tonnes in 2018 increased substantially to 0.847 mn tonnes in 2022 before falling sharply to 0.20 mn for the year 2023. India stood at 46th position for Lead Ore and Concentrates exports while it stood at 18th position for lead Ore and Concentrates Imports.

Table 8: Lead Ore and Concentrates Exports: Top 10 Countries (2022)

Reporter	Trade Value (Mn USD)
Peru	947.749
Mexico	746.165
United States	743.711
Australia	541.680
Turkey	216.643
Bolivia	193.189
European Union	178.881
Spain	161.544
Tajikistan	117.443
Sweden	113.958
India (46th Position)	*0.104*

Source: Bloomberg, and authors' summarisation

Table 9: Lead Ore and Concentrates Imports: Top 10 countries (2022)

Reporter	Trade Value (Mn USD)
Korea, Rep.	1874.318
China	1449.585
European Union	637.045
Kazakhstan	369.877
Belgium	339.905
Japan	330.437
Italy	223.259
Australia	216.376
Canada	213.246
Netherlands	148.330
India (18th Position)	3.621

Source: Bloomberg, and authors' summarisation

2.7 Nickel

Global mined Nickel Supply was 2.35 mn tonnes in 2018 which grew to 3,21 mn tonnes in 2022 before falling marginally to 3.09 mn tonnes in 2023. Asia was the largest supplier of mined Nickel at 2.09 mn tonnes followed by Oceania at 0.37 mn tonnes and Europe at 0.21 mn tonnes. Global refined Nickel Production which was 2.21 mn tonnes in 2018 grew to 3.02 mn tonnes in 2022 and then fell to 2.85 mn tonnes in 2023. Asia made the bulk of the production at 2.06 mn tonnes followed distantly by Europe at 0.26 mn tonnes and Oceania at 0.136 mn tonnes respectively.

On the other side, the Global refined Nickel demand which was 2.33 mn tonnes in 2018 grew to 2.94 mn tonnes in 2022 before falling marginally to 2.60 mn tonnes in 2023. Bulk of the demand for refined Nickel came from Asia at 2.21 mn tonnes. Refer to Table 10: for a detailed region wise supply of mined Nickel and supply and demand for refined Nickel.

Table 10: Nickel Supply and Demand: Region Wise (Million Metric Tonnes)

Description	2023	2022	2021	2020	2019	2018
Nickel Supply/Demand (mt)						
Global Mined Nickel Supply	3.098	3.219	2.761	2.585	2.549	2.350
North America	0.113	0.126	0.144	0.190	0.204	0.201
South & Central America	0.168	0.213	0.209	0.202	0.177	0.185
Europe	0.214	0.273	0.246	0.310	0.281	0.284
Asia	2.090	2.038	1.579	1.290	1.324	1.104
Oceania	0.370	0.408	0.377	0.431	0.401	0.417
Africa	0.078	0.088	0.082	0.071	0.099	0.097
Other Regions	0.065	0.073	0.123	0.090	0.063	0.063
Global Refined Nickel Production	**2.853**	**3.023**	**2.704**	**2.510**	**2.400**	**2.217**
North America	0.091	0.113	0.109	0.131	0.124	0.135
South & Central America	0.115	0.165	0.161	0.167	0.158	0.157
Europe	0.269	0.283	0.332	0.402	0.384	0.376
Asia	2.063	2.202	1.862	1.727	1.456	1.249
Oceania	0.136	0.172	0.157	0.205	0.195	0.222
Africa	0.032	0.040	0.039	0.032	0.039	0.039
Other Regions	0.145	0.047	0.044	0.027	0.046	0.039
Global Refined Nickel Demand	**2.605**	**2.943**	**2.816**	**2.416**	**2.416**	**2.335**
North America	0.102	0.125	0.119	0.124	0.129	0.149
South & Central America	0.011	0.014	0.015	0.013	0.016	0.020
Europe	0.235	0.288	0.292	0.299	0.314	0.341
Asia	2.214	2.435	2.348	2.082	1.881	1.737
India	***0.061***	***0.071***	***0.068***	***0.064***	***0.061***	***0.069***
Oceania	0.002	0.002	0.002	0.002	0.002	0.002
Africa	0.006	0.011	0.012	0.018	0.025	0.035
Other Regions	0.035	0.068	0.030	0.045	0.050	0.051
Refined Nickel Surplus / Deficit	**0.255**	**0.080**	**-0.112**	**0.106**	**-0.016**	**-0.118**

Source: Bloomberg, and authors' summarisation

Philippines is the largest exporter of Nickel at 1258 mn USD of trade value followed by 1101 mn USD exported by Zimbabwe. On the other hand, the bulk of the imports of Nickel was made by China which imported 4536 mn USD of Nickel followed by 503 mn USD imported by Canada and 382 mn USD imported by Korean Republic. Refer to tables 11-12 for data on top 10 Nickel Exporting and Importing Countries.

India does not feature in mined Nickel or refined Nickel production but India features in Refined Nickel Demand. The demand varied between 0.061 and 0.71 mn tonnes per year from 2018 to 2023. India stood at 36th position in Nickel ore and concentrate imports.

Table 11: Nickel Ore and Concentrates Exports: Top 10 Countries (2022)

Reporter	Trade Value (Mn USD)
Philippines	1258.877
Zimbabwe	1101.947
European Union	365.280
Finland	357.656
United States	328.713
Brazil	321.094
Australia	235.300
Canada	196.761
Zambia	118.954
Cote d'Ivoire	88.560

Source: Bloomberg, and authors' summarisation

Table 12: Nickel Ore and Concentrates Imports: Top 10 Countries (2022)

Reporter	Trade Value 1000USD
China	4536.097
Canada	503.353
Korea, Rep.	382.427
	Contd…
Contd…	

European Union	369.043
Table 12	
Finland	327.152
Japan	283.676
North Macedonia	58.408
Ukraine	15.428
Cyprus	11.045
Australia	6.802
India (36th Position)	0.005

Source: Bloomberg, and authors' summarisation

Though on an **annual basis the gap between demand and supply for base metals may average out, but in the short-term periods the demand and supply dynamics play an important role in the price fluctuation resulting in risk.**

Chapter 3: Review of Relevant Literature

Highlights of the Chapter

- ✓ Commodity prices fluctuate due to factors influencing the cost of production, cost of energy consumed in refining and smelting, transportation, government levies, and demand and supply factors.
- ✓ Most of the primary commodities' prices are globally determined, hence their currency of price determination happens to be USD and hence the respective countries exchange rates also influence the local or regional commodity prices.
- ✓ Reducing risk, cashflow volatility, and tax payments are some of the voluntary motives of commodity risk management. Increasing pressure of regulatory and governance compliance, investor activism are some of the external forces that prompt firms to hedge commodity risk.
- ✓ Commodity price risk is mitigated through operational techniques and use of commodity derivatives. These techniques are adopted when the firm cannot pass on the commodity price risk to downstream supply chain players.
- ✓ Large firms dealing with the physical metal, with branded products, significant market share, and power of pricing; predominantly pass through the price risk. The residual risk they hedge using derivative contracts. Medium and small firms, which are price takers, depend on long term supplier networks for price constancy.
- ✓ Commodity price risk hedging using commodity derivatives is successful when there is effective price discovery, high hedging efficiency, and low basis risk in the commodity derivative markets.
- ✓ Hedgers are attracted towards commodity exchanges, when there are adequate risk absorbers in the form of speculators, market balancers in the form of arbitragers, and there is high degree of alignment between the spot and forward/futures market.
- ✓ There is consensus on the price discovery efficiency of commodity exchanges of India, but the evidence is divided on their hedging efficiency. Long term co-integration of futures and spot prices is observed with short term divergence.
- ✓ Absence of long dated futures, high transaction costs, transaction taxes, lack of awareness and skill among physical metal value chain players, lack of inventory visibility, inaccessible commodity exchange warehouses, absence of an organised and dependable spot market, and a spot price polling mechanism affect the Indian Commodity Derivative markets.
- ✓ There is a nudging regulatory environment, and a supportive Income Tax regime for commodity price risk hedging in India. Commodity Transaction Tax needs a review.

This chapter reviews the existing literature on Commodity Price Risk, and its Management. It draws from extant peer reviewed literature, published articles in various association journals and white papers of globally reputed consulting companies.

The literature review chapter is presented in 8 sections, covering Dynamics of Commodity Price Volatility, Motives for Hedging Commodity Price Risk, Corporate Hedging Practices, Operational techniques to hedge Commodity Price Risk, Hedging and its Effectiveness in Indian Commodity Derivative Markets, Issues and Challenges for Hedging in Indian Commodity Derivative Markets, and finally the regulatory and taxation regime in India towards Commodity Risk Hedging.

3.1 Dynamics of Commodity Prices and their Volatility

Understanding the pricing of the commodities is important to analyse the price risk of commodities. Based on extensive literature review we have found that the **pricing of commodities primarily depends on demand and supply for the commodity among other factors.** Demand for commodities in general, comes from the overall economic conditions and it is derived from the demand of its end products where it is consumed. A well-functioning economy will have a growing demand for commodities. The **levels of commodity inventory** maintained by various players in an economy is another significant determinant of its price.

Supply disruptions due to war, natural calamities, environmental activism, human force strikes and geo-political tensions influence the global commodity prices. Apart from the demand and supply for commodities, there are other factors which affect the price of the commodities.

Freight constitutes a major part of landing price of the commodity as mining and consumption happen often in different continents. **Freight charge increases as fuel price increases**, the longer the distance the commodity is transported the higher its cost of production. **Prices of electricity** increase the cost of smelting and refining, hence exert considerable influence on the commodity prices.

Price of the commodities are also affected by **government intervention**. **Minimum support price, Import Duties, Anti-Dumping Duties** would increase the price of the imported commodities. Prices also increase if the **major mining companies form a cartel** to sell at a predetermined price. With the growing financialization of the commodities market with the **increased investments by alternate funds and hedge funds,** the prices of the commodities are also affected by the amount of flows into the commodity markets. **Speculation** on the future price movements also affect the price of the commodities. Commodities are also seen as alternative investments to stock markets and when the stock markets fall, the price of commodities especially safer haven metals like gold increases. Finally, as most commodities are traded in dollars in the international market, the price of the commodity depends on the **value of the dollar** and also the **exchange rate of dollar** versus local currency like Indian Rupee.

3.2 Motives for Hedging

Given the dynamics that affect the prices of commodities and the resultant price risk, commodity market players have an option to hedge the price risk. Our extensive literature review has thrown up some important reasons to hedge. Keynes (1939) and Hicks (1939) hypothesis state that **risk reduction is the prime motive of hedging and hedgers pay a premium to speculators** who assume these risks. **Hedging is like an insurance against price risk**. Smith (1922), Marshal (1919), Keynes (1930), Hicks (1939) and Kaldor (1939) defined and discussed hedging as a risk mitigation tool.

Hedging can also have dual motives - reduction in risk while maximizing profits. (Stein (1961) and Johnson (1960)). Hedging also depends on the availability of suitable hedging instruments especially derivatives(Lodha, 2008). According to the L.C. Gupta Committee (1998), financial derivatives are an efficient facility to hedge against market risk in the most cost-efficient way.

Futures, forward and options are three derivative products which are used to provide a shield against the unexpected price movements. Hedging is necessary when the prices are volatile to limit the downside risk. Entities that keep large inventory would have to hedge

the price risk as there is a difference in the time of purchase of metals and sale and this can give rise to unfavourable price while selling.

Whether the prices are market determined or are dictated artificially by few large players in the value chain is crucial. **Small firms who do not have any control over the price of the commodities and cannot pass on the price risk** across the value chain **have no choice but to hedge the price risk** as they are price takers. An empirical study (De Angelis and Ravid, 2010) study found that 64 per cent of the firms with low market power hedge commodity risks as opposed to 18 per cent of the firms with high market power.

Hedging reduces uncertainties and reduces the cash flow fluctuations. This reduction in uncertain cash flows **reduces expensive external financing** (Froot et al, 1993) and lower financial distress costs (Myers, 1977; Smith and Stulz, 1985) ultimately resulting in creation of shareholder value. An empirical study (Geczy et al, 1997) found that firms with greater growth opportunities and tighter financial constraints are more likely to use derivatives as this would help them to raise capital in the future.

Growing regulatory compliance, accounting disclosure and audit of risk and its management has also is compelling companies towards hedging. Commodity price tail risk especially during bouts of unprecedented commodity price rise can play havoc with the entities. (Manual Ammann et. al., (2022)). **Risk management resulting in stable tax flows also help in lowering tax as in a progressive tax regime.** Stulz (1996), empirically proved this argument. There is also **growing shareholder activism to create value through risk management**. Growing investors who are looking at stable and steady growth of companies whose cash flows do not fluctuate widely based on the price of the commodities.

Hedging results in competitive advantage in a highly competitive market space where margins are low. Following the theory of Resource Based View (RBV) of the firm (Rumelt, 1984; Hamel & Prahlad, 1994), this control over price stabilisation is an inimitable resource that creates differentiation and provides competitive advantage. But, **hedging is taken up only if** the player has a strong belief that the price the players are receiving for **hedging is fair and generated through a transparent market determined process**. Also, the

effectiveness of the hedging – The extent to which the hedge is nullifying the risk. Also matters. **The success of any futures market depends on the hedging efficiency of futures contracts** (Pennings & Meulenberg, 1997; Silber, 1985).

3.3 Corporate Hedging Practices

Bartram, Söhnke (2017) paper investigated the effect of derivatives usage on the risk and exposure of nonfinancial firms around the world and found evidence of the usage of derivatives for hedging purposes. The study found **no evidence of corporate speculation with derivatives** except for marginally higher net commodity price exposure for firms using commodity price derivatives. Wayne Guaya, S.P Kothari (2003) studied 234 large non-financial corporations using derivatives, and reported the magnitude of their risk exposure hedged by financial derivatives. If interest rates, currency exchange rates, and commodity prices change simultaneously by three standard deviations, the median firm's derivatives portfolio, at most, generates $15 million in cash and $31 million in value.

Commodity Risk Mitigation Survey done by **Capgemini** in 2014 on 23 companies having significant exposure to commodity risk found out that, **uncertainty, availability, unpredictability of commodity price is the source of commodity risk.** The **market based price volatility is mitigated through hedging with 50% hedging using financial derivatives** – Futures and Forwards. **90% use multiple supplier strategy and 70% use supplier partnership strategy. Larger companies can pass the price risk to the customers. 55% had this ability.** 95% of the companies make forecast of the prices of the commodities but only 40% use quantitative forecast.

3.4 Operational Techniques of Commodity Risk Management

Many companies manage risk internally on their own. Some of the ways they manage the price risk internally include the following.

a. Creating and selling value added products. This would help them price the product at a mark-up over the commodity price.

b. Creation of a brand known for quality, durability and on time delivery for which the players charge a premium

c. Wherever possible companies use substitute products which can deliver the same durability as well as change the input mix when the specific metal price has gone up

d. Companies Shift production to low cost geographies so that even though the input cost of the commodities is high the lower cost of production would help them stay competitive.

e. Companies also strive to achieve scales to not only minimize the overheads but also to purchase commodities in bulk and avail the discount

f. Companies also strive for lowest cost of production by reducing wastage and use automation and technology that would enable them to be competitive even if they purchase the commodity at a higher price

g. Stock pile inventory by buying in bulk, that would reduce the freight charge per unit of commodity as well as avail discount but this could face challenges when price of the metals reduces. Also it depends on carrying costs, Container/truck lots handling cots and price discounts

h. Creating and managing state of the art logistics and supply chain management. That reduces the freight charges, handling charges and delivers commodities at lowest handling and carrying costs.

i. Relocating the plant closer to customer or mining/production reduces the cost of freight which in some cases is a large proportion of the commodity costs

j. Backward integration and purchasing the mines

3.5 Hedging & its Effectives in Indian Derivatives Market

Carter, C. A. (1989) research found **that hedging does not eliminate the risk completely but replaces the price risk with basis risk**. Normally, the basis does have the same variability. According to Carter (1989), hedging will reduce price risk if the basis variability

is less than the cash price variability. Lodha (2008) concluded that in order to combat risk, there is a **greater need for hedging instruments.** The **success of any futures market depends on the hedging efficiency of futures contracts** (Pennings & Meulenberg, 1997; Silber, 1985). If the loss in the spot market is exactly made good by the gain in the futures market, then the hedge ratio of 1 would result in a perfect hedge. **But, in reality this does not happen resulting in basis risk.**

After Johnson (1960) and Stein (1961), introduced portfolio theory to hedging. Johnson (1960) proposed a portfolio theory to hedging and 'minimum variance hedge ratio (MVHR)', which factored in less than perfect relationship between spot and futures prices and aimed to minimize the variance of returns on a hedged position. Ederington (EHE; 1979) proposed the hedging effectiveness measure which demonstrated the existence of an optimal hedge ratio, which minimizes the variance in the portfolio value.

Research conducted by Sashi Gupta etal (2017) revealed that **the Indian futures market provides higher hedging effectiveness in case of precious metal** (65–75 per cent) **compared to industrial metal and energy commodities** (less than 50 per cent). Brajesh Kumar, Ajay Pandey, (2013) found **near month futures prices of most of the commodities are cointegrated with the spot prices,** thinly traded contracts fail to forecast future spot prices and are inefficient. Bhabani Sankar Raut, etal (2021) studying the price discovery process, short run disturbances and hedging mechanism in Indian agricultural and metal commodities futures market **found that spot market is acting as a leader in the longer period and laggard in short run.** Pravakar Sahoo (2009) paper examined the efficiency and futures trading-price nexus for five top selected commodities namely **gold, copper, petroleum crude, soya oil, and chana** (chickpea) in commodity futures markets in India and found the **commodity futures market was efficient for all five commodities.**

Nidhi Aggarwal, et.al,. (2014) paper examines price discovery and hedging effectiveness of commodity futures and concludes that, **futures prices do discover information relatively efficiently, but help to manage risk less efficiently.** The authors opined that high **settlement costs, widely dispersed delivery centres, unreliability of warehouse receipts, a mismatch in quality specifications, and disruptions caused by various policy**

interventions are the reasons. Hussain, Yaganti,. & B., Kamaiah. (2012 found that the **futures market leads the price discovery in nearby month contracts**. In case of base metal slight variation is seen in hedging performance among different maturity periods. MCX Report (2013) found that across a broad range of commodities traded on MCX **hedging efficiency of MCX is not only high but also compares favourably** with international exchanges, both for weekly and monthly prices.

3.6 Challenges for Using Exchange Traded Derivative Contracts in India

Some of the challenges documented in the literature include **absence of liquidity in the far month's contracts** which reflects in price anomalies in the Indian derivatives market. Estimating the cash flow requirement based on the **fluctuating margin calls also is another challenge**. Taxes in the form of **CTT and GST, stock exchange transaction charges, SEBI Turnover charges, stamp duty and brokerage charges on the derivatives contract add to the cost of trading**. Imposition of CTT on non-agricultural commodities including base metals, resulted in decline of liquidity. Sinha & Mathur (2015) found a 40% decline in trading volumes for Aluminium, Copper, Zinc, Lead, Crude Oil and Natural Gas compared to a year before the imposition of CTT. Sehgal & Agarwal (2019) reported that CTT destroyed the parity of the Indian commodity futures market and the international markets - COMEX, LME, NYMEX which do not have CTT. Ghosh & DSouza (2021) analysed data from 2006 to 2019 for five non-agricultural commodities i.e., Aluminium, Copper, Crude oil, Gold, and Silver and found the efficiency of **price discovery was reduced** in the case of Copper, Gold and Silver **in the post- CTT era** and **hedging efficiency declined**. The **compulsory physical delivery settlement introduced in the commodity exchanges has also impacted the liquidity** in the markets with the speculators and market makers not being able to hold on to the contracts till maturity.

Commodity Price Risk Hedging Practices in Finnish Manufacturing industries was examined by Antti Ahola (2023) from different manufacturing industries, to know the state of financial hedging in these companies and the way these companies have organized financial hedging decision making. It was found that the decision making on financial

hedging is often dispersed between business functions and done in cross-functional teams. The study shows that both the food and the agricultural companies seem to use commodity derivatives for financial hedging whereas the forest industry as a heavily vertically integrated system seems not to have the same need for financial derivatives. Finally, regarding the available commodity derivatives it seems that even though the applicable products were available in the market, the **geographical differences between their physical flow of goods and the location of the commodity exchanges posed challenges.**

The **scams and failures of some of the markets** like National Spot Exchange Limited (NSEL) has eroded the confidence of the hedgers to use a derivative market to hedge. In July 2013, 13000 persons who traded on the NSEL platform, claimed that other trading members had defaulted on the payment of Rs 5,600 crore. In April 2022, Supreme Court had upheld the validity of attaching the assets of 63 Moons by the Maharashtra Government, who held more than 99% share in NSEL. [1]

Prof. Joshy Jacob's (2021) report found out the reasons of **poor liquidity in the long-maturity** contracts is due **to lack of participation by physical commodity traders.** While the **large firms are hedging on LME, the medium and small firms are depending on their trade partners for price assurance.** Inspite, of institutional interest in long-term contracts, **rolling over is costly on MCX driving them away from participation.** They further found that after the stipulation of mandatory physical delivery, **future and spot prices have diverged significantly,** and there is **lack of inventory visibility for financial traders** to take views about commodity prices. The report opined that **Commodity Transaction Taxes, GST have also increased the cost of taking physical delivery.**

Prabina Rajib et.al., (2021), found that **futures prices absorbs news information fast and hence lead the spot markets. Speed of information absorption in MCX contracts is better than LME contracts,** and has further improved after the contract modification. **Futures prices are found to be unbiased estimators of spot prices in MCX,** leading to lower welfare

[1] NSEL scam: Supreme Court upholds assets attachment, April 23, 2022, http://timesofindia.indiatimes.com/articleshow/91017423.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

losses. Degree of unbiasedness is higher than that in LME, and has further improved post modification. **Hedge ratio is much lower than desirable, and suggest that futures prices do not move in tandem with spot prices. Higher percentage of days of backwardation in post-modification period. There is no spot exchange for primary/ secondary/recycled products leading to information asymmetries regarding inventory positions, demand and supply.** Because of these constraints, India remains a price taker of base metals, with prices of London Metal Exchange (LME) driving the trends.

3.7 Tax Implications on Commodity Hedging and Trading:

Trading in commodities attract Commodity Transaction Tax (CTT) which came into force from July 1, 2013. CTT is levied on trading of commodity derivative instruments like futures and options. Trading in non –agricultural commodities attracts CTT. **Trading in all Base metals attract CTT apart from other charges like exchange transaction charges, SEBI charges, Goods and Services Tax (GST), and stamp duty from respective state governments where the investor is residing.** This is a deterrent for players to hedge in the commodity stock exchanges as the total transaction cost comes out to be high.

While **CTT is based on the trades**, there are also **taxes on Profits from Commodity trading**. In stock markets trading, there exists short term capital gains tax and long-term capital gains tax. Long term gains above Rs 1 lakh attract a tax of 10% and short-term equity gains are charged a tax of 15%. On the other hand, **Commodities trading profits/losses are treated under other/ business income** and taxed as per the entities Income Tax slab.

3.8 Promotion of Hedging Practices in India

SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015, popularly known as **LODR mandates every listed company to** strengthen their corporate governance through adequate disclosure of the risks and risk mitigation measures adopted by companies. This regulation calls for **inclusion in the annual reports among other things,**

disclosure with regards to commodity price risk and hedging activities, hedging positions, in a transparent and detailed manner for the consumption of the shareholders.

The Finance Act, 2013 provided for coverage of commodity derivatives transactions undertaken in recognized commodity exchanges under the ambit of **Section 43(5) of the Income Tax Act, 1961.** This allows **business profits/losses to be offset by losses / profits undertaken in the commodity derivatives transactions**. This enhances the attractiveness of risk management on recognised commodity derivative exchanges and incentivizes hedging.

Removal of Limit on open position as against hedging. Genuine hedgers having underlying exposure that exceed the prescribed Open Interest limits given in the contract specifications can be allowed higher limits based on approvals. This enables hedgers to take positions to the extent of their exposure on the physical market and are allowed to take position over and above prescribed position limits on approval by the exchange.

SEBI allowed an intermediary to deal in both commodities and equities. This would increase the transactions in commodities market as it offers the scope for **cross selling commodity products and increase awareness on commodities derivatives.** Creation of universal exchanges where different asset classes like currencies, commodities, equities and bonds are traded has been **taken up by major exchanges like NSE and BSE which trade in multiple asset classes.** SEBI allowed **broad based commodity index futures to be traded.** This would allow financialization of the commodities market and induce non hedgers to play in the market increasing liquidity in the market and improving the price discovery process.

Chapter 4: Hedging Patterns of International Companies

Highlights of the Chapter

- ✓ All the major players aim to manage the price risk operationally and strategically.
- ✓ To tide over long term price fall of commodities, the companies aim to maintain low leverage, improve efficiency, focus on production of base metals that are in demand, constantly look for creating demand from new sources, diversify geographically as well as across industries. In essence it is a portfolio risk management approach
- ✓ Most of the companies believe hedging is not to make speculative gains, but to curtail losses. Significant few avoid hedging because it limits their profitability. Probably the long term increasing trend in base metals might be the reason for it.
- ✓ Passing on the risk to the downstream players seems to be very much prevalent across the globe.
- ✓ One common practice among the smelters and refiners across the globe seems to be buying and selling on a provisional price basis, and finally settling the account after 3 to 6 months, based on a quoted market price. This is something like Deliver Now and Price Later. The significant price risk in this process is hedged using derivatives.
- ✓ Companies do enter into long-term fixed price contracts with their customers and hedge the risk using derivatives
- ✓ Hedging the residual risk (purchases minus sales) is adopted to reduce the cost of hedging. More so in companies dealing with more than 1 base metal, a portfolio risk management approach is adopted.
- ✓ Because electricity prices / energy costs form a major component in the refining and smelting process, some companies use electricity futures to hedge energy costs rather than commodity prices.
- ✓ All Chinese companies use Shanghai Futures Exchange to hedge the price risk along with LME. Other major players in the world use LME to hedge and consider LME's price as the reference price.
- ✓ Along with LME, MCX price is emerging as a benchmark reference price for Indian Companies.

Learning from best practices abroad is the aim of positioning this chapter in this project report. It was challenging to compile the information required due to lack of comprehensive documented works on the same. Annual reports of various global companies which feature in the top 10 for each metal are the source for this compilation.

4.1 Commodity Price Risk Hedging by Major Players

This segment is the output of analysing the annual reports of top base metal players for reporting on commodity exposure and hedging. Table 13 gives the snapshot of commodity price hedging of top 25 major base metal players who have reported on commodity exposure and commodity risk hedging in their annual reports.

Table 13: Commodity Price Hedging by top 25 major Base Metal Players

S.No	Company	Country	Base Metal	Hedging Practice
1	Nornickel	Russia	Nickel, Palladium	Forecasts demand and Supply. Manages risk operationally and Strategically. Secures feedstock supplies for key consumers through long-term contracts to supply metals in fixed volumes
2	Anglo American Pic	UK	Platinum, Diamond, Copper, Nickel, Iron ore Coal	Generally do not hedge but hedging done for strategic reasons majorly using forwards
3	Antofagasta Pic	Chile, HQ: UK	Copper	Uses Futures and Min Max Options. Conducts sensitivity analysis to measure the impact of price volatility. The company regularly conducts sensitivity analysis to understand the impact of movement in copper prices on the financial instruments held at the reporting date.
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4	BHP	Australia	Copper, Nickel, Iron Ore	Commodity price risk is managed as part of the portfolio risk management strategy. Forwards and other derivatives are used from time to time to achieve a specific objective.
5	Boliden AB	Sweden	Zinc, Copper, Lead, Nickel	Company has a policy of not to hedge and allow price changes to affect the profits. The imbalance between sale and purchase of metal is hedged.
6	Aluminum Corporation of China Limited	China	Aluminium	Uses Futures and Options on LME and SFE only for hedging
7	Freeport-McMoRan	US	Molybdenum, Copper, gold	Do not hedge. The company receives market prices based on prices in the specified future period, which results in price fluctuations recorded through revenues until the date of settlement. Revenues are recorded and customers are invoiced at the time of shipment based on then-current LME prices, which results in an embedded derivative on the provisionally priced concentrate and cathode sales that is adjusted to fair value through earnings each period, using the period-end forward prices, until final pricing on the date of settlement.

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8	Glencore	Switzerland	Copper, Cobalt, Zinc, Nicked, Ferro Alloys	Manages risk by maintaining a diverse portfolio of commodities, geographies, assets and contracts. The company prepare itself for anticipated shifts in commodity demand by putting a special focus on business that will potentially grow and reduce the production of any commodity within its portfolio in response to changing market conditions. The company maintains a financial leverage of under 1x to support its ability to obtain financing in a downside scenario and focuses on cost discipline and achieving greater operational efficiency to increase its resilience to lower prices. Has a policy to substantially hedge price risk. Manages strategically and Operationally. Uses Futures and Options traded on OTC and commodity exchanges worldwide. Residual basis risk exposures are a key focus point for Glencore's commodity department teams who actively engage in the management such risks.

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9	Hindalco	India	Aluminium, Copper	The Company categorizes its price risk in broadly 2 categories - Offset Hedge Exposure and Strategic View Based Exposure. Under the Offset Hedge Program, the Company uses derivative products to eliminate the price risk arising due to timing mismatch. For Strategic View Based exposure, derivative instruments are used to manage the price risk for future tenor. Hedging is done for commodities in active derivative markets.
10	Hindustan Zinc Limited	India	Zinc	The company sees exposure to commodity price fluctuations as an integral part of Company's business and its usual policy is to sell its products at prevailing market prices, and not to enter into long-term price hedging arrangements. However, to minimize price risk for finished goods and to achieve monthly average, hedging is done. Forward contracts for the respective quotation period to hedge its commodity price risk is done based on average LME prices.

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11	Jiangxi Copper Corp	China	Copper	Enters into commodity derivative contracts, T+D forward contracts and provisional price arrangements to manage its exposure in relation to forecasted sales of copper products. Uses commodity copper options and copper cathode futures contract on Shanghai Futures Exchange and LME.
12	Lundin Mining Corporation	Canada	Copper, Zinc, Nickel	Does not hedge metal prices, preferring to remain fully exposed to metal price movements. The company feels that current or future hedging may limit future profitability and per share returns.
13	Rusal	Russia	Aluminium	Uses long term electricity contracts and other commodity derivative contracts in order to manage its exposure of commodity price risks.
14	Rio Tinto	UK	Iron Ore, Aluminium, Copper, Diamonds, Lithium	Follows a policy to sell the products at prevailing market prices. For certain physical commodity transactions for which the price was fixed at the contract date, Rio Tinto enters into derivatives to achieve the prevailing market prices at the point of revenue recognition. The company does not consider that using derivatives to fix commodity prices would provide a long-term benefit to their shareholders.

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				Mitigates the exposure to changes in the relationship between Aluminum prices and power prices by purchasing electricity contracts that are directly linked to the daily official LME cash ask price for high-grade Aluminum (LME price) and to the US Midwest Transaction Premium (Midwest premium)
15	Teck Resource Limited	Canada	Copper, Zinc	Uses Zinc and Lead derivative contracts
16	National Aluminum Company Limited (NALCO)	India	Aluminium	The Company does not have exposure on commodity hedging
17	Bharat Aluminum Company Limited (BALCO)	India	Aluminium	The company has a policy which aims to sell the products at prevailing market prices. The commodity price risk in importing Alumina is hedged on back-to back basis ensuring no price risk for the business. Hedging is used primarily as a risk management tool and secure future cash flows in cases of high volatility by entering into forward contracts or similar instruments.
18	Vedanta	India	Copper, Nickel, Aluminium	Company has a policy to sell its products at prevailing market prices, and not to enter into long-term price hedging arrangements.

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				However, to minimize price risk for finished goods where price of raw material is also determined by same underlying base metal prices (e.g. purchase of alumina, copper concentrate for manufacturing and selling copper and aluminium products, respectively) back-to-back hedging is employed
19	Century Aluminum	US	Aluminium	Engages in hedging transactions that have a material adverse effect on its business, financial position and liquidity. The company manages the exposure by entering into different types of hedging arrangements
20	Hydro Aluminum	Norway	Aluminium	Short- and medium-term price risks are managed based on the margin between sales prices and cost of raw materials and energy cost. Price risks for raw materials and energy are managed mainly through price variation clauses in the relevant contracts, supplemented with derivatives where considered beneficial. LME is used as a reference price. Aluminium futures contract on LME is used to hedge 1 to 3 months' price risk.
21	Chalco	China	Aluminium	Chalco use futures and option contracts traded on the SHFE and LME to hedge against fluctuations in the price of primary aluminium.

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22	First Quantum Minerals	Canada	Copper, Nickel, Zinc	Derivative contracts are used to offset the exposure to final pricing adjustments on the provisionally priced sales contracts.
23	Jinchuan Group International Resources Co. Ltd	China	Copper, Nickel	The company has appointed a special team to monitor the price risk and will consider hedging the risk exposure when the need arises.
24	Gravita India Limited	India	Battery Hydro Separation Systems, Cutting Machines, Rotary Furnace, Lead Refining Furnace	The company considers exposure to commodity price fluctuations to be an integral part of its business and its usual policy is to sell its products at monthly average prices linked with London Metal Exchange (LME) and Multi Commodity Exchange of India Limited (MCX). To minimise price risk involved in procurement of major raw materials for the manufacture of finished goods hedging is done.
25	Trafigura Group	Singapore	Petroleum Products, Non Ferrous Metals, Iron Ore and Coal	Commodity derivative contracts are used to hedge commodity price risk exposures in relation to physical purchase and sales contracts, including inventory. Commodity swaps, options and futures are used to manage price and timing risks

Chapter 5: Retail Participation in Commodity Markets

Highlights of the Chapter

- ✓ There is need for any commodity exchange to attract investors, with varying risk appetite, investment horizon, views on the commodity prices, and motivations to engage with derivatives.
- ✓ Over the years, cash settlement, sophisticated research in the field of investment management emergence of various managed investment services has made commodities an attractive alternative asset class
- ✓ "Financialisation" of commodity markets lead to the participation of financial institutions and retail investors.
- ✓ Retail participation is expected to increase market volatility, however technology and regulation can control the same.
- ✓ Low awareness about commodity markets, more interest in equity markets, low analyst following in the commodity markets, and higher cost of transacting leads to low interest of retail participants
- ✓ Measures like partnering with brokers, increasing awareness, creating new products(mini contracts) with less costs and more ease of transacting(mobile based applications), promoting alternate investment funds, are being adopted in the popular global commodity exchanges to improve retail participation with success.

This chapter provides an overview of the various approaches the popular commodity markets of the world are taking to improve retail participation in the commodity markets. This chapter provides the necessary approaches which MCX India could adopt to become a vibrant commodity exchange for efficient price discovery and an avenue for effective hedging.

Commodity derivative markets are extremely crucial institutions that provide the necessary infrastructure for multiple stakeholders operating across the various stages of the supply chains of commodities related to agriculture, metals, and energy. Their role in assisting price discovery and price risk hedging for the producers and consumers of commodities has been well established in literature. The quality of price discovery and a ready market making for the hedgers depends very heavily on the presence of high

liquidity and depth in the derivative market. Essentially it means that there is need for any commodity exchange to attract investors, with varying risk appetite, investment horizon, views on the commodity prices, and motivations to engage with derivatives.

Commodity exchanges have been the natural destinations for stakeholders dealing with the physical commodity. However, over the years, the cash settlement feature on the commodity derivative exchanges, sophisticated research in the financial investments and related advisory services sector, and the emergence of various shades of managed investment services has highlighted the attractiveness of commodities as an alternative asset class. The belief that commodities are good hedges for inflation and their relatively less correlated movement with equity and bond markets has offered a unique selling proposition for the engineering of alternative investment funds (AIFs) and commodity focused mutual funds and exchange traded funds (ETFs). This has led to "Financialisation" of commodity markets, and hence increased the participation of financial institutions and retail investors.

The role of retail investors has been debated time and again, due to their propensity to increase volatility due to lack of knowledge of understanding the dynamics of commodity markets, and excessive speculative greed. Such exuberant behaviour of investors not only hurts them but also creates collateral damage to the real sector players dealing with the physical commodity. Sometimes such price fluctuations create devastating impacts on economies as commodities constitute significant inputs to economic activities. However, such negative effects have been mitigated by regulation, use of information technology by commodity exchanges, investor education on responsible investing, long term nurturing behaviour of the broking community, to enjoy the positive effects of widespread participation, and retail participation in specific.

5.1 Reasons for Low Retail Participation in Commodities Markets

- Absence of spot market participation for retail investors.
- Underlying equity exposure resulting in using equity derivatives to hedge.
- Low awareness about Commodity Markets.

- Relatively more coverage of financial assets market, by Analysts and Researchers.
- Higher cost of adding commodity markets demat account compared to that of equity markets.
- Lack of appreciation and direct physical relationship with many commodities other than gold.
- Lack of awareness of how to exit from commodity investments when in need of funds
- Lack of understanding on the liquidity of commodity markets
- Inability of commodity markets to project the image of investment alternative for long term with capital appreciation, due to the seasonality and cyclicality in prices.

Inspite of the existence of the above reasons, commodity markets world over have always attempted to woo retail participation, considering them as a crucial segment of the market.

5.2 Encouraging Retail Participation

Many stock exchanges set up teams to attract retail investors. Broadly the common strategies and initiatives that commodity exchanges have employed to promote retail investor participation:

1. **Reducing Trading Costs:** On some contracts, the LME offers lower margin requirements for retail investors. The margin requirement for ordinary investors trading micro WTI crude oil futures contracts, is less than the full size WTI contracts. On CME E-mini S&P 500 futures contracts, for example, is $500 per contract, compared to $6,500 for the full-size contract. Deutsche Borse and SHFE has reduced trading costs for retail investors by lowering brokerage fees and transaction taxes.

2. **Providing Educational Resources:** The LME provides a number of educational materials to assist retail investors in learning about commodities trading. Online classes, webinars, and e-books are among the tools available. The LME also maintains a learning platform specifically for retail investors. ICE also provides a virtual trading platform where individual customers can practice trading without putting real money at risk. **Eurex and DEGIRO** (European Retail Broker) have partnered to provide retail investors with market research information and education on products available on Eurex Exchange. Eurex and Trading Technologies partner to enhance trading experience by offering direct access to RFQ information available on Eurex Platform, reducing time to price discovery in market.

3. **Offering Risk Management Tools:** The LME provides a number of risk management tools to assist individual investors in managing their risk exposure. At ICE Retail investors can use stop-loss orders to close off a deal at a specified price if the market goes against them. Retail investors can use limit orders to enter or quit a transaction at a defined price. CME's TT is a software tool that connects ordinary traders to CME trading exchanges. TT provides a number of tools that can assist retail traders in risk management and improving trading success. Retail investors can use stop-loss orders to close off a deal at a specified price if the market goes against them. Retail investors can use limit orders to enter or quit a transaction at a defined price. The CBOT Risk Management Education Program. The TOCOM Retail Investor Support System are other risk management tools.

4. **Developing New Products and Services:** At LME for example, one micro WTI crude oil futures contract equals 100 barrels of oil, whereas the full-size contract represents 1,000 barrels of oil. Micro contracts are tiny copies of full-size contracts that are less expensive for ordinary investors. One micro E-mini S&P 500 futures contract, for example, represents one-fifth of the full-size contract. Small and medium-sized businesses (SMEs) have their own market

called Euronext Growth. Retail investors can benefit from decreased listing fees and trading costs, among other things, by using Euronext Growth. Binary Options are being considered by LME.

5. **Supporting retail Investor Associations:** LME assists retail investor organizations with financial help and other tools. This assists the organizations in educating ordinary investors about commodities trading and advocating on their behalf. Retail Trader Support (RTS) program of CME. Euronext Investor Academy. Deutsche Borse and SHFE have simplified trading procedures by making it easier for retail investors to open accounts, deposit and withdraw funds, and place and manage trades.

6. **Engaging with Retail Investors:** LME communicates with retail investors daily via social media and other platforms. This assists the LME in understanding the requirements and concerns of retail investors and developing regulations and products to address those needs. Euronext Fund Connect is a platform that facilitates individual investors' access to a wide range of funds, notably exchange-traded funds (ETFs). Real-time market data and online trading are only two of the services that Euronext FundConnect provides to ease the investment process for individual clients. CBOT teaches ordinary investors about commodity trading through outreach initiatives. Online events, seminars, and workshops are all part of these programs, CBOT Retail Investor Education Program, CBOT Retail Investor Forum, and TOCOM Retail Investor Advisory Committee

7. **Partnerships with Brokers:** ICE has alliances with many brokers who specialize in serving retail investors. Retail investors benefit from lower commissions and other perks provided by these brokers. Eurex provides instructional content and data to help retail investors comprehend the products and services available. This might include seminars, tutorials, articles, and guidelines. Exchanges collaborate with retail brokerage firms to facilitate access to their markets for retail clients and create more user-friendly interfaces for trading. To make it easier for regular

investors to create accounts and begin trading, the LME has collaborated with a number of brokers. The LME also supplies brokers with training tools and marketing materials to help them reach out to individual investors.

Beyond the approaches that are being undertaken by various commodity exchanges across the world, the following could also be attempted to promote retail participation. Global commodity derivative markets trade at 30 times the physical commodity market. Currently Indian market trades at only 3 times the physical spot market:

- Introducing simple Yes/No Binary event-based contracts where investors can place trades by swiping a phone screen.[2]
- Increasing the number of analysts covering commodities
- Telling a good story on some commodity which has given substantial returns like gold in the long term.
- Introducing long dated commodity derivatives for gold and if possible other bullion commodities
- Make the investor aware of the importance of portfolio diversification and the role of commodities in diversifying the portfolio
- Awareness and encouragement at the financial advisor level and at the dealer level and the client point of contact as retail investors interact and develop a relationship with them
- As commodity price is dependent on demand and supply rather than fundamental analysis, the establishment of credible publishing agencies which will publish the supply and demand position regularly has to be established.
- More agencies/analysts who can predict the supply and demand for commodities should be set up. More of such agencies will try to arrive at an unbiased future price.

[2] CME looks to lure retail traders with daily options frowned on in Europe: https://www.ft.com/content/9d793bf3-2c82-42a0-a5fb-453968533b05

- Encourage launching of more commodity specific funds/ETFs/Alternate funds
- Reducing the contract and tick sizes
- Introducing E-mini contracts with less margins and smaller contract sizes[3]
- Targeting short term investors and day traders
- Coming with assured return products if the regulation allows[4].

The Commodity Futures Trading Commission estimates that retail trading volume in futures contracts on US exchange now averages about 50% higher than during the pre-pandemic period. Better Technology lower commissions and generational shift in investor psychology and behaviour. Millenials, Gen Z and Gen Alpha want more than buy and hold returns and are seeking brokers for the same. The mutual fund industry and the alternate investment funds, trading advisors are convinced of the hedging efficiency of the commodity derivatives market. Hence it is time the institutional investors in association with the commodity exchanges catch the next gen retail investors "young".

[3] Exchange innovation of the year: CME Group. https://www.risk.net/awards/7162231/exchange-innovation-of-the-year-cme-group

[4] Famya Exchange launched Rin Jin Bao: A financial product that guaranteed retail investors a return of 13.7% per annum with a right to withdraw funds at any time. Liquidity issues and inability to sell the metals saw its accounts frozen. It had owed $6.4 bn owed to 2220,000 investors.

Chapter 6: Empirical Analysis

Highlights of the Chapter

- ✓ Monthly, quarterly, and yearly frequency returns, on MCX near month and spot Aluminium, Copper, and Nickel prices have increased, since March 2019. The same decreased in the case of Zinc and Lead. Volatility of returns has decreased after March 2019, across all five base metals and across all frequencies, barring for Nickel in the annual frequency.
- ✓ Correlation of MCX spot price returns with that of LME spot price returns have decreased since March, 2019 (After the mandatory physical delivery guidelines by SEBI). Each metal has its own unique correlation pattern.
- ✓ MCX futures prices are underestimates of actual spot prices based on near month futures prices. Therefore, basis is also negative as a percentage of actual spot prices, across all metals and period breaks during 2006-2019.
- ✓ MCX prices have been predominantly on backwardation since April, 2019, across all metals
- ✓ Volumes and Open Interests on MCX have dropped since April, 2019, across all metals. Aluminium is regaining its pre-2019 levels.

This chapter focusses on descriptive analysis on the following aspects.

- Monthly, Quarterly and Yearly returns of MCX spot and near month futures for the period upto March, 2019 and the period post March, 2019.
- Correlation of LME and USD/INR daily spot price returns with various period breaks from 2006 to 2023, for each base metal.
- 25-day Rolling Correlations of LME and MCX daily spot prices returns from 2006 to 2023, for each base metal.
- Comparative analysis of volatility of MCX and LME spot prices based on coefficient or variation of monthly mean returns and standard deviations for each year from 2006-2023.
- How unbiased are MCX futures prices in predicting Actual Spot Prices with various period breaks from 2006, for each base metal.
- Basis Risk in MCX futures prices for various period breaks from 2006, for each base metal.
- Contango and Backwardation Analysis of MCX near Month Future Prices from 2006.
- Volume and Open Interest Visualisations from 2006.

6.1 Monthly Returns on MCX Near Month Futures & Spot Prices: Before and After 2019

Table 14: Descriptive Statistics of Metal-wise MCX 1 Month Futures Price Returns-Apr'06-Mar'19 (Monthly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-31.79%	-16.67%	-31.17%	-26.39%	-29.57%
Max	32.51%	18.46%	25.32%	27.03%	28.66%
Median	0.00%	0.00%	0.45%	0.82%	-0.11%
Mean	0.68%	0.37%	0.63%	1.04%	0.65%
Std.Dev	7.54%	6.15%	8.26%	9.29%	9.73%
Coef.Var	11.0939	16.5057	13.0088	8.9658	15.0154

1 month futures prices are extracted from Bloomberg database

Table 15: Descriptive Statistics of Metal-wise MCX 1 Month Futures Price Returns-Apr'19-Dec'23 (Monthly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-11.82%	-13.58%	-13.74%	-11.41%	-18.03%
Max	20.24%	13.58%	14.52%	30.65%	28.84%
Median	0.23%	0.00%	1.34%	0.00%	-0.38%
Mean	1.01%	0.71%	0.39%	0.63%	1.20%
Std.Dev	5.95%	5.18%	6.33%	6.04%	8.85%
Coef.Var	5.8894	7.3278	16.0894	9.5982	7.3570

1 month futures prices are extracted from Bloomberg database

Table 16: Descriptive Statistics of Metal-wise MCX Spot Price Returns – Apr'06-Mar'19 (Monthly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-31.00%	-16.67%	-31.17%	-26.39%	-29.57%
Max	32.38%	18.46%	25.32%	27.03%	28.30%
Median	0.53%	0.00%	0.28%	0.72%	0.05%
Mean	0.68%	0.38%	0.70%	1.04%	0.62%
Std.Dev	7.82%	6.20%	8.39%	9.35%	9.49%
Coef.Var	11.5092	16.5044	11.9525	9.0009	15.1965

Spot prices are extracted from Bloomberg database

Table 17: Descriptive Statistics of Metal-wise MCX Spot Price Returns-Apr'19-Dec'23 (Monthly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-11.20%	-12.15%	-12.85%	-8.15%	-14.55%
Max	20.62%	12.35%	13.68%	24.19%	30.12%
Median	0.67%	0.00%	0.00%	0.00%	-0.24%
Mean	1.07%	0.72%	0.41%	0.63%	1.17%
Std.Dev	5.85%	4.69%	6.31%	4.45%	8.91%
Coef.Var	5.4493	6.5494	15.3015	7.0480	7.6142

Spot prices are extracted from Bloomberg database

The above Tables 14-17 provide the descriptive statistics of monthly returns on both spot and near month futures prices of all the five base metals, on MCX during 2006-2023, by splitting the period into before 2019 and after 2019 (to absorb the effect of regulation on physical delivery).

Both spot and futures prices of Copper, Aluminium and Nickel have increased post 2019, but that of Zinc and Lead have decreased. But the volatility has decreased across all the metals after 2019.

6.2 Quarterly Returns on MCX near Month Futures & Spot Prices: Before And After 2019

Table 18: Descriptive Statistics of Metal-wise MCX 1 Month Futures Price Returns-Apr'06-Mar'19 (Quarterly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-49.67%	-37.50%	-29.87%	-46.43%	-29.55%
Max	44.44%	27.17%	31.87%	48.84%	59.08%
Median	1.19%	-0.43%	1.87%	2.97%	-1.96%
Mean	2.32%	1.13%	1.79%	3.41%	2.10%
Std.Dev	14.72%	10.42%	13.49%	17.73%	18.64%
Coef.Var	6.3381	9.2310	7.5344	5.2029	8.8792

1 month futures prices are extracted from Bloomberg database

Table 19: Descriptive Statistics of Metal-wise MCX 1 Month Futures Price Returns-Apr'19-Dec'23 (Quarterly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-15.26%	-25.53%	-18.99%	-6.79%	-20.69%
Max	23.66%	26.46%	21.75%	16.55%	55.57%
Median	4.66%	0.00%	1.78%	0.00%	-0.11%
Mean	3.07%	2.36%	1.23%	1.56%	4.39%
Std.Dev	10.62%	11.44%	11.67%	5.95%	21.33%
Coef.Var	3.4544	4.8487	9.4681	3.8154	4.8545

1 month futures prices are extracted from Bloomberg database

Table 20: Descriptive Statistics of Metal-wise MCX Spot Price Returns-Apr'06-Mar'19 (Quarterly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-53.00%	-37.50%	-29.87%	-46.43%	-29.23%
Max	40.98%	27.17%	30.77%	47.73%	59.92%
Median	1.89%	0.00%	1.60%	2.97%	-1.51%
Mean	2.34%	1.13%	1.99%	3.39%	2.09%
Std.Dev	15.11%	10.41%	13.69%	17.59%	18.64%
Coef.Var	6.4459	9.2320	6.8878	5.1954	8.9307

Spot prices are extracted from Bloomberg database

Table 21: Descriptive Statistics of Metal-wise MCX Spot Price Returns- Apr'19-Dec'23 (Quarterly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-14.88%	-26.19%	-16.99%	-9.03%	-22.09%
Max	20.62%	28.38%	19.93%	10.79%	56.96%
Median	6.06%	1.44%	0.86%	2.13%	1.33%
Mean	3.21%	2.44%	1.20%	1.73%	4.28%
Std.Dev	9.79%	11.22%	10.75%	4.55%	21.18%
Coef.Var	3.0487	4.5987	8.9908	2.6339	4.9520

Spot prices are extracted from Bloomberg database

The return pattern as depicted in Tables 18 to 21 of the five metals has been the same as found in the monthly frequency. Post mandatory physical delivery the returns on Aluminium, Copper, and Nickel increased.

But that of Zinc and Lead decreased. Average returns of any of the five base metals have not been above 5% quarter on quarter. Volatility of Aluminium and Nickel has increased, but that of Copper, Zinc, and Lead decreased.

6.3 Yearly Returns on MCX near Month Futures & Spot Prices: Before and After 2019

Table 22: Descriptive Statistics of Metal-wise MCX 1 Month Futures Price Returns-Dec'06-Dec'18 (Yearly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-44.73%	-26.98%	-52.88%	-54.55%	-48.67%
Max	126.32%	47.14%	122.22%	146.67%	65.33%
Median	1.07%	1.85%	-1.90%	5.35%	-4.75%
Mean	8.98%	2.03%	7.55%	12.42%	-1.10%
Std.Dev	42.32%	20.60%	47.37%	47.47%	31.58%
Coef.Var	4.7121	10.1516	6.2775	3.8219	-28.6295

1 month futures prices are extracted from Bloomberg database

Table 23: Descriptive Statistics of Metal-wise MCX 1 Month Futures Price Returns- Dec'19-Dec'23 (Yearly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-2.43%	-5.83%	-14.23%	-3.72%	-43.62%
Max	36.67%	31.18%	32.56%	21.57%	63.06%
Median	7.86%	6.20%	3.47%	2.68%	28.03%
Mean	13.23%	10.94%	7.12%	5.61%	21.33%
Std.Dev	16.51%	16.03%	19.14%	9.64%	40.95%
Coef.Var	1.2474	1.4654	2.6892	1.7190	1.9200

1 month futures prices are extracted from Bloomberg database

Table 24: Descriptive Statistics of Metal-wise MCX Spot Price Returns- Dec'06-Dec'18 (Yearly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-47.19%	-26.98%	-52.88%	-54.55%	-48.57%
Max	143.97%	47.14%	120.37%	146.67%	64.82%
Median	0.40%	2.31%	-1.10%	4.93%	-4.76%
Mean	10.16%	2.14%	7.55%	12.43%	-1.10%
Std.Dev	47.07%	20.82%	46.97%	47.49%	31.58%
Coef.Var	4.6317	9.7435	6.2180	3.8210	-28.8127

Spot prices are extracted from Bloomberg database

Table 25: Descriptive Statistics of Metal-wise MCX Spot Price Returns- Dec'19-Dec'23 (Yearly)

Metric	Copper	Aluminium	Zinc	Lead	Nickel
Min	-3.99%	-4.80%	-13.97%	0.00%	-44.92%
Max	32.23%	37.95%	32.88%	19.75%	62.47%
Median	9.69%	7.69%	4.57%	1.29%	28.04%
Mean	13.00%	11.33%	7.32%	6.46%	21.06%
Std.Dev	15.48%	17.56%	19.09%	8.63%	40.63%
Coef.Var	1.1909	1.5493	2.6070	1.3373	1.9290

Spot prices are extracted from Bloomberg database

Yearly returns (depicted in Tables 22-25) also show the same behaviour as that of monthly and quarterly returns with clear increases in the post physical delivery period. However, the average annual returns have not changed significantly for Zinc in the post mandatory delivery period. Annual volatility of only Nickel has increased in the post physical delivery period. This could be due to the International War situation and the exorbitant price increases in the metal.

6.4 MCX Vs LME Spot Price Behaviour

The Indian primary producers of virgin metal, and those who produce primary forms of Aluminium, Copper, Nickel, and Zinc from imported scrap, suggest that they follow import parity pricing for their output. LME prices are global standards due to their age-old status, global network of warehouses, focus on metals sector and robust spot price polling mechanism. It has become the defacto standard for price referencing in these metal markets in India too. LME cash settlement price happens to be the base, on which various others layers like Japanese Port Premium, Import Duty, Inland Transport, Fabrication charges are added for any buyer. Finally, the price which rules the physical traded of these metals, is adjusted for the local demand and supply conditions. The popular perception is that MCX's futures prices in India also mirror LME prices. The above analysis is taken up to investigate this behaviour.

The Tables in 26 and 27 below show positive correlation between the returns of LME spot and MCE spot returns. The futures prices of LME and MCX are not comparable one to one, because the near month and the most liquid contracts of LME have 3 months duration, while in MCX they are of 1 month duration. Therefore, comparison of spot prices is taken up. The spot prices are polled prices in both the exchanges, and they act as the cash settlement prices. However, there is a difference in these spot prices too. In LME the prices are based on prompt dates, wherein the traders can physically deliver the commodities by transferring the warrants (warehouse receipts in India) and close their positions before the date of maturity of their futures contracts. In India however, daily spot prices reflect polled prices. The official cash settlement prices are based on 3 day historical averages of these polled prices. This gives us a direction to observe whether the Indian prices are truly Import parity prices. Since inception, of the futures trading Aluminium price returns show the

highest correlation (0.77) with that of LME followed by Nickel (0.55), and Lead (0.52). Copper and Lead returns have not shown strong correlation with that of LME. The sub-period wise analysis presents a different picture.

After 2021, while the correlations of Nickel and Zinc spot price returns maintained their long-term relationship, Aluminium and Lead spot price returns have become less correlated with LME. Copper has shown a significant increased correlation with that of LME, post 2019. Aluminium and Lead have a fair degree of domestic supply for consumption, which may be the cause for the same. Copper's demand, lack of adequate supply, and increasing imports might be the reason for its increased correlation to LME.

Table 26: Correlation of Daily Returns on LME & MCX Spot Prices

Period	Aluminium	Copper	Nickel	Zinc	Lead
2005-2009	0.9389	0.4234	0.4411	-0.2157	0.5730
2010-2014	0.9030	0.3976	0.7878	-0.2737	0.5050
2015-2019	0.8607	0.3454	0.9330	-0.1489	0.4465
2020+	0.3762	0.6778	0.5773	-0.1519	0.1185
Pre-COVID (2005-2019)	0.9084	0.4031	0.5413	-0.2140	0.5318
COVID (Jan'20-Jun'21)	0.1139	0.5727	0.7014	-0.1817	0.0989
Post-COVID (After Jun'2021)	0.4499	0.7487	0.5649	-0.1498	0.1295
No Slicing	0.7690	0.4430	0.5469	-0.2045	0.4795

Table 27: Correlation of Daily Returns on LME Spot Prices & USD/INR

Period	Aluminium	Copper	Nickel	Zinc	Lead
2005-2009	-0.2449	-0.3212	-0.2585	-0.2157	-0.2541
2010-2014	-0.3645	-0.4016	-0.3481	-0.2737	-0.2674
2015-2019	-0.1457	-0.1951	-0.1901	-0.1489	-0.1014
2020+	-0.1564	-0.3125	-0.0835	-0.1519	-0.1369
Pre-COVID (2005-2019)	-0.2637	-0.3089	-0.2572	-0.2140	-0.2199
COVID (Jan'20-Jun'21)	-0.2506	-0.3802	-0.2738	-0.1817	-0.1691
Post-COVID (After Jun'2021)	-0.1247	-0.2669	-0.0179	-0.1498	-0.1139
No Slicing	-0.2403	-0.3079	-0.2199	-0.2045	-0.2106

Figure 1: 25 day Rolling Correlation of Aluminium Daily Spot Returns between LME & MCX

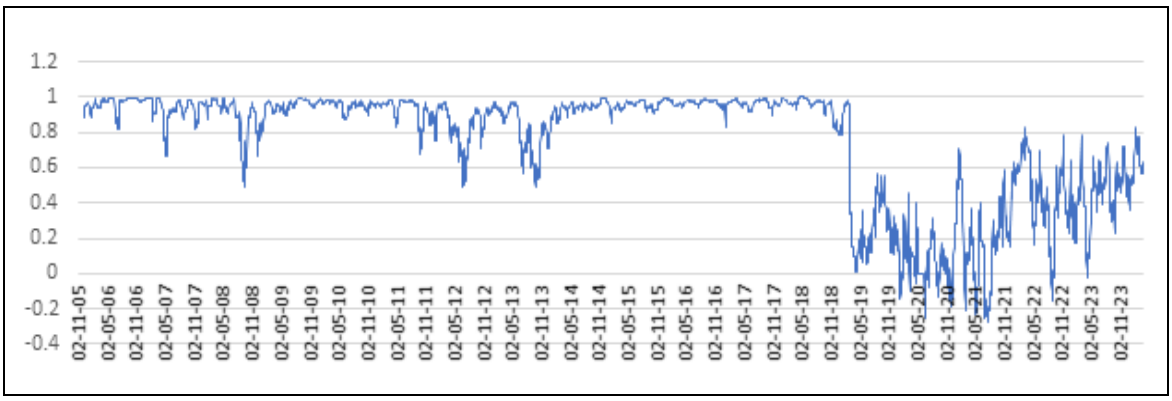


Figure 2: 25 day Rolling Correlation of Copper Daily Spot Returns between LME & MCX

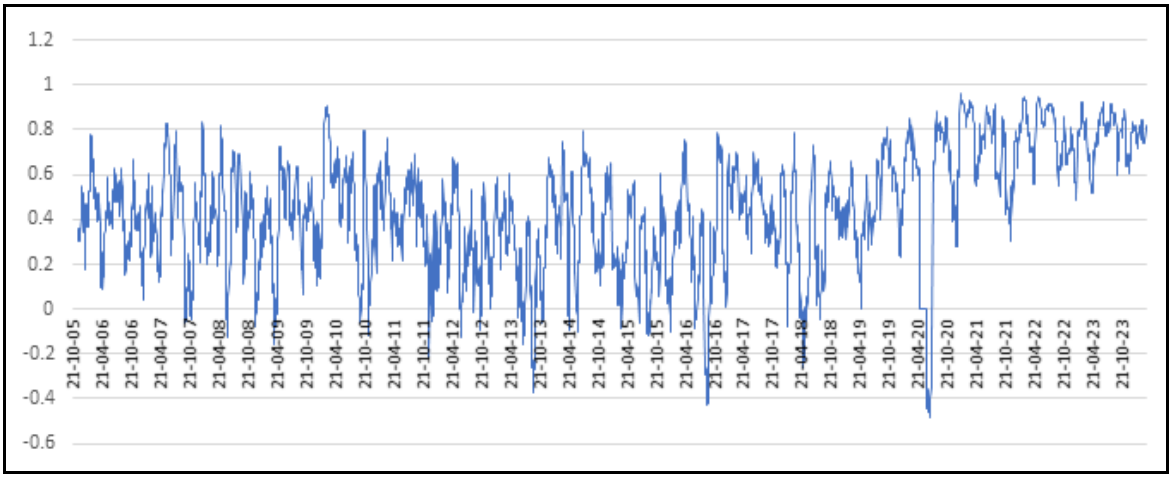


Figure 3: 25 day Rolling Correlation of Nickel Daily Spot Returns between LME & MCX

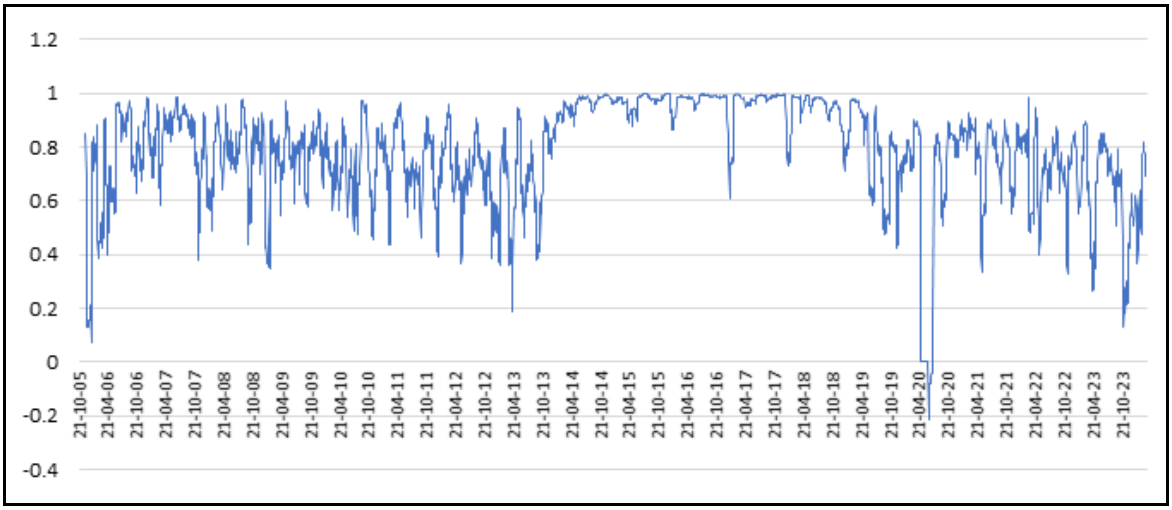


Figure 4: 25 day Rolling Correlation of Lead Daily Spot Returns between LME & MCX

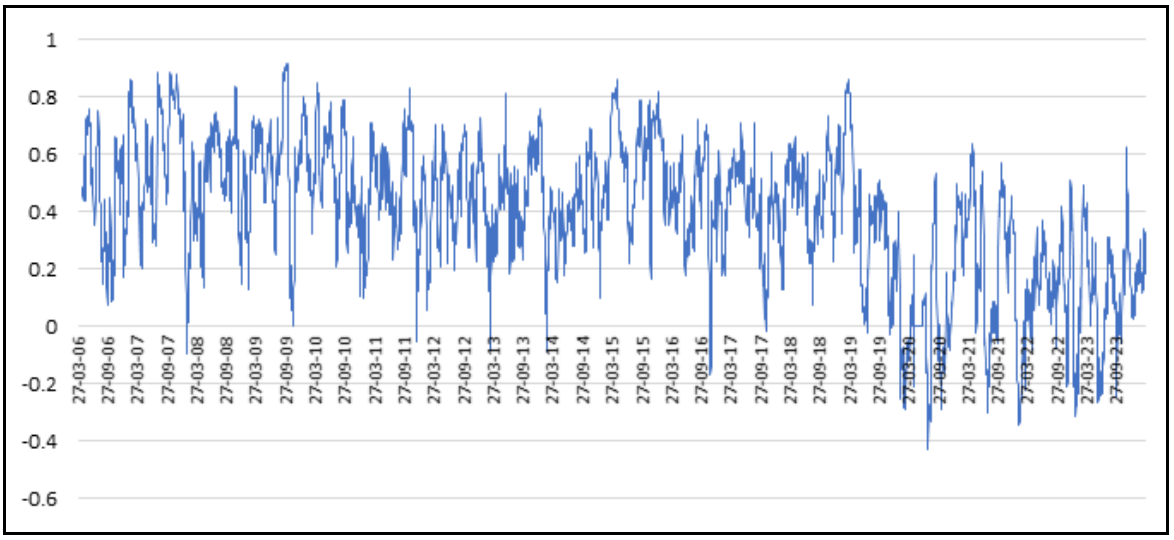
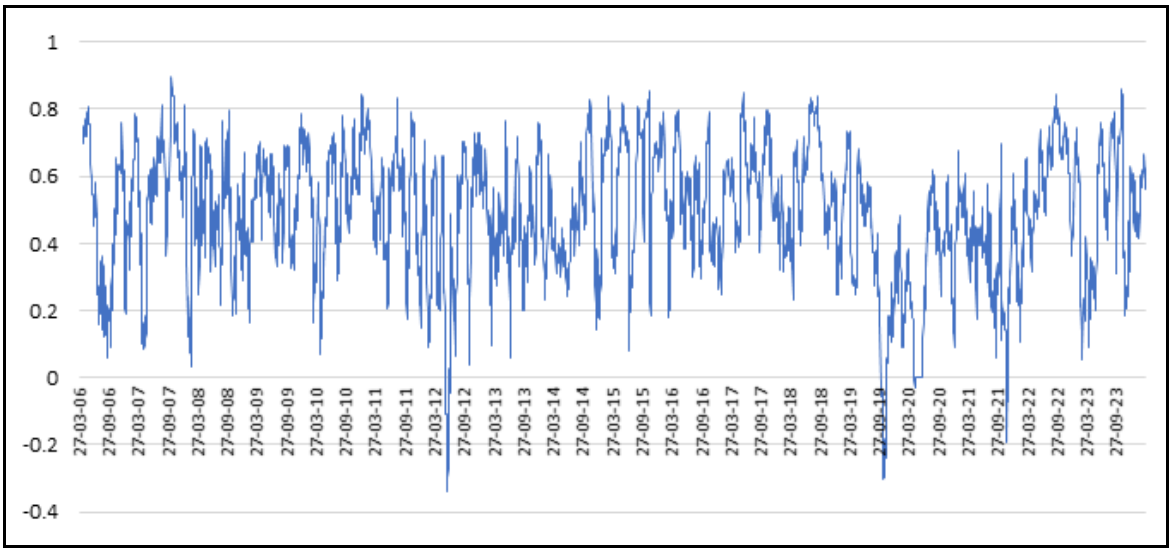


Fig-5: 25 day Rolling Correlation of Zinc Daily Spot Returns between LME & MCX



To unearth the time varying relationship between LME and MCX daily prices a rolling window correlation is displayed in the graphs (Fig-1 to Fig-5) above. It is evident that LME's and MCX's correlation has discernible patterns in these five base metals.

While Aluminium and Lead are showing delinking from LME, Copper and Zinc have shown a persistent "less than perfect" correlation but are increasingly converging to LME. Nickel has shown strong linkages to LME during 2013-2018, and later came back to its less than perfect correlated relationship, right from the beginning.

6.4.1 Implications for the Indian Base Metal Players

The less than perfect correlation of Indian MCX spot prices and the LME spot prices indicates a segmented market and hence a possibility for different reference pricing for domestic and international transactions for Indian players. It would not be an issue for firms which are both importers and exporters, because they use LME on both legs of their transactions. But for firms which Import and sell in India, and those that source in India and export, it would require additional effort to identify specific domestic reference prices that are in tune with LME to protect their commodity price risk. MCX prices are not appearing to be good proxies for international transactions, considering this empirical evidence on spot prices. This might be an outcome of the Indian way of organising the base metal market and its price referencing based on Price Reporting Agencies (PRAs) and the list prices provided by the three significant players of NALCO, VENDATA, and HINDALCO. The PRAs provide the reference prices for the scrap recyclers producing the primary form of base metals. The three dominant primary producers provide their own pricing (which is supposed to be in tune with LME) that is widely used amongst their network of customers and the downstream supply chains.

Another important factor that might be influencing this not so perfect correlation is the negative correlation of USD/INR exchange rate returns with LME spot price returns. The persistent negative correlation, thought weak, even during sub-period analysis based on daily frequency means that when the prices of base metals are going up in LME, Indians are paying lesser INR to buy a US dollar. The above evidence and the discussion point to a segmented Indian market pricing for the base metals, especially for the purely domestic market participants. The fragmented derivative markets in multiple Indian exchanges, the distributed liquidity (whatever little it is), the prevalence of multiple price reporting agencies, are signals for the need for a concerted effort and action by Indian authorities to consider a single Indian reference price, which, while, reflecting the global demand supply factors, will also strongly reflect the Indian market realities.

6.5 Volatility of MCX and LME Spot Prices

Fig-6-10 depict the coefficient of variation metric that standardises the volatility of each metal with their mean. The yearly trend shows that volatility at MCX persistently higher than that of LME. The gap is higher during some period, and it narrows down to almost negligible during some other period. This section discussed about the relationship of MCX spot price and its relationship with LME. The coming section 5.6 discusses the relevance of MCX futures prices for price discovery and for hedging for base metals players.

Figure 6: Coefficient of Variation of LME and MCX Monthly Copper Spot Price Returns

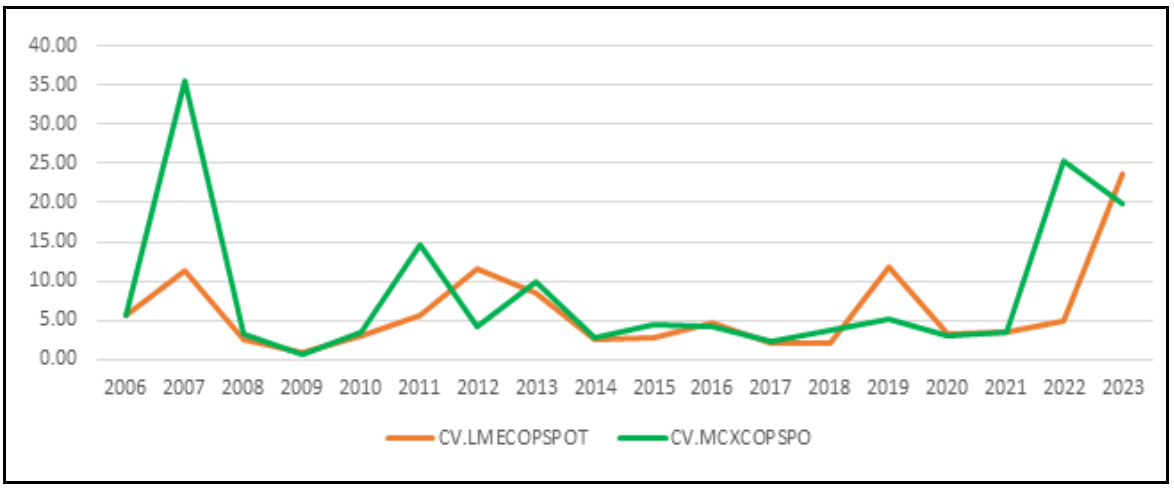


Figure 7: Coefficient of Variation of LME and MCX Monthly Aluminium Spot Price Returns

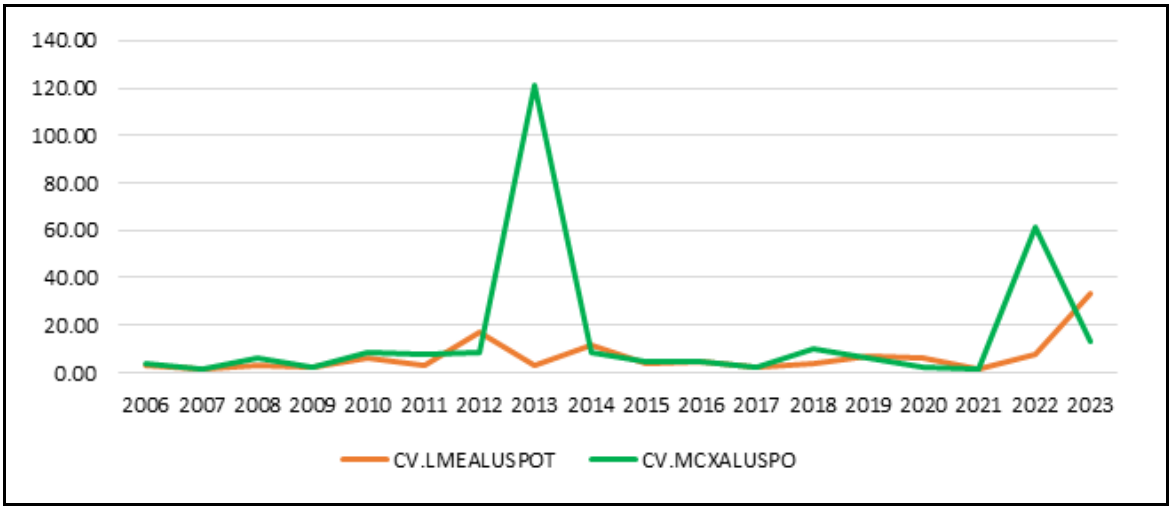


Figure 8: Coefficient of Variation of LME and MCX Monthly Nickel Spot Price Returns

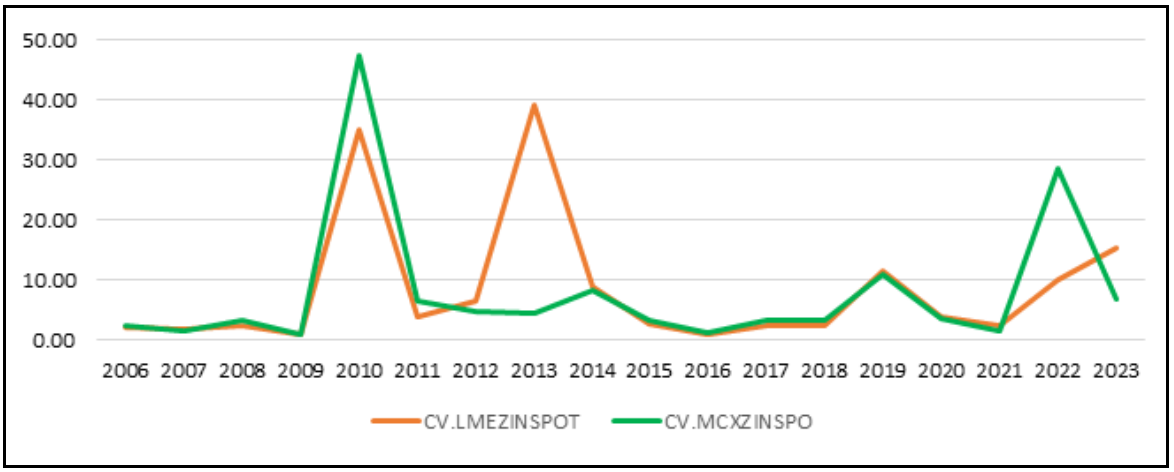


Figure 9: Coefficient of Variation of LME and MCX Monthly Lead Spot Price Returns

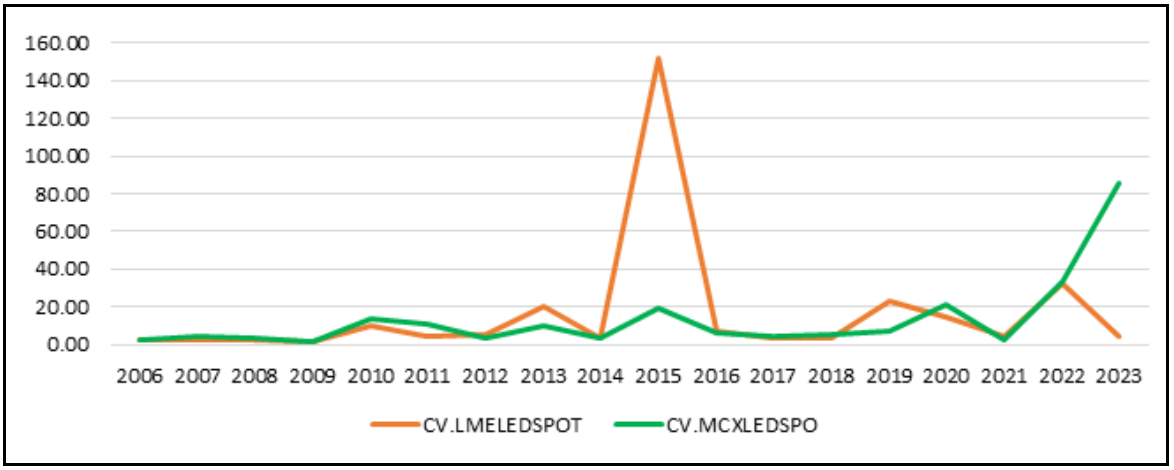
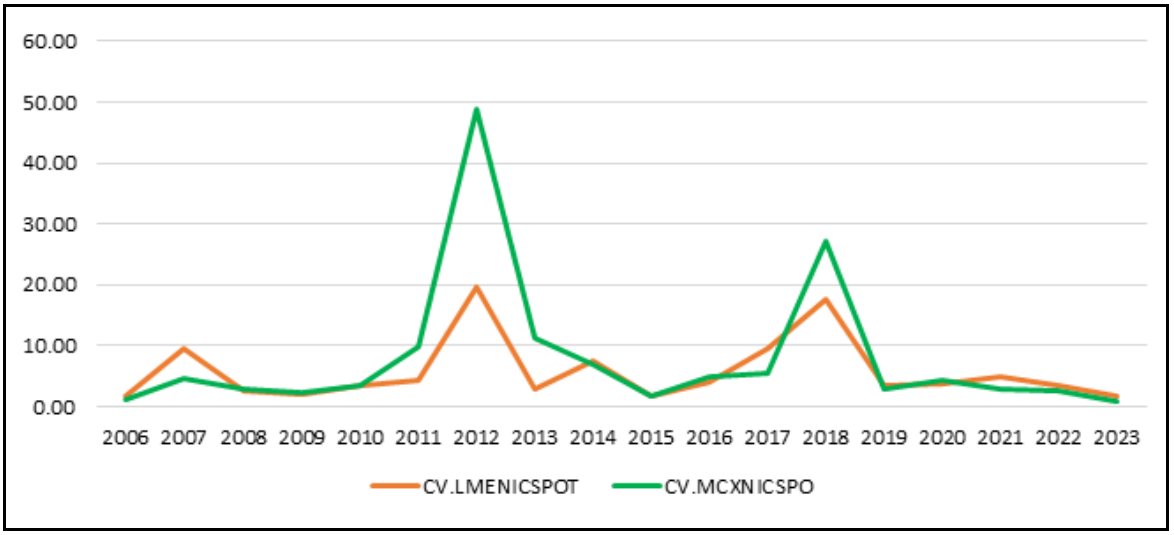


Figure 10: Coefficient of Variation of LME and MCX Monthly Zinc Spot Price Returns



6.6 Predictive Power of MCX Futures Prices, since 2005

Value chain players dealing with the physical metal, either from the sell side or buy side are expected to be benefited by the presence of an organised commodity futures exchange. The futures contracts, for various maturities into the future, provide price discovery. The regulatory framework and governance of Commodity Exchanges, reduce the counterparty risk while engaging in any futures contract. Therefore, it is believed that Futures prices are theoretically unbiased predictors of expected actual spot prices for a given maturity. Similarly, theoretically, the futures prices in the futures markets also converge to the spot markets on the date of maturity, thereby providing an opportunity to hedge commodity price risk, with a fair degree of precision. The lack of convergence leads to, what is popularly known as, “basis risk”.

Higher the efficacy of futures prices in predicting the actual spot prices, higher would be their acceptance as reference prices for all forthcoming physical contracts in the value chain of the metal industry. This unbiased predictor characteristic also builds the confidence of the value chain players to consider futures contracts for hedging their commodity price risk, either by physical delivery or cash settlement. On the same lines, **if the futures price on the date of maturity converges to the actual spot prices, then there is less of basis risk.** There is a rare occasion of no basis risk or perfect prediction of actual spot prices. Therefore, traders and hedgers would be interested to find out whether, atleast, on an average, over a quarter or an year the mean basis risk is negligible if not zero, and futures prices predict the spot prices with a lesser margin of error.

To test the unbiased predicting capability of futures prices, a simple OLS regression is undertaken with the actual spot prices, on the date of maturity of a 1-month contract, as the dependent variable, and the first day’s futures price of the same 1-month contract as the independent variable. To control for any unobservable effect of time (trend), time is also introduced as a control variable. Ideally the slope coefficient of the futures price should be 1, and the intercept 0, and the coefficient on the time variable should also be ideally 0. Then it means that the actual spot prices are completely predicted by the futures prices, on average. In our further analysis, the spot prices are forecasted, using the coefficients of the

regression equation (Table 28). The difference between forecasted spot price and actual spot price is captured without sign (mean absolute deviation). The average of these differences are presented for various frequencies like, quarterly, half-yearly and yearly, and base metal wise. Further, these differences are also presented sub-period wise till March 2019 and post March, 2019. Finally, the difference between the first day's futures price and the actual spot price on the date of maturity, with signs, are presented in the tables from 29 to 33, sub-period wise. The analysis is done based on daily prices per kilo.

Table 28: OLS Regression Coefficients

Metric	Aluminium	Copper	Nickel	Lead	Zinc
Intercept	-3.36#	1.54	24.05	6.64*	-1.57
Day-1 Futures Price	0.99***	0.97***	0.95***	0.89***	0.96***
Time	0.04***	0.09#	0.18	0.07***	0.08***
Adjusted R Square	0.97	0.97	0.94	0.95	0.97

Dependent Variable is Actual Spot Price on Date of Maturity of 1 month Futures Contract, and Independent Variable is first day's Futures Prices of a 1-month contract and time.

**** .1%; ** 1%; * 5%; # 10% Significance Levels*

The regression results in Table 28 show that none of the coefficients of the first day's futures price are equal to 1. Leaving aluminium every other coefficient is between 0.89 to 0.97. The statistically significant and positive coefficients of time, show that the actual spot prices are greater than those predicted by first day's futures prices. Therefore, the futures prices are underestimates of actual spot prices on the day of maturity.

Table 29: Mean Absolute Deviation MCX Spot Price and that which is Predicted by Futures

Period	Aluminium	Copper	Nickel	Lead	Zinc
Pre March 2019	5.06	17.98	64.71	7.16	6.91
March 2019 onwards	7.15	22.34	90.78	4.08	10.67

The same phenomenon is shown in the sub-period wise analysis of the difference between the first day's futures minus actual spot price in the following tables. The mean absolute deviation analysis in the graphs 11-15 and the above Table 29 show that the error of

predicting the actual spot price using futures price and the trend factor. It can be seen that the predicting error smoothens out over the months. The quarterly and the half-yearly lines show lot of variation.

Table 29 also splits the data into pre 2019 and post 2019. The predictive accuracy of futures prices has gone down after 2019. This need not be ascribed to only the mandatory delivery norm instituted by SEBI. The entire global macroeconomic politico stability has been very volatile after 2019, which could have lead to differing expectations about futures prices. The spot prices were behaving based on the immediate demand and supply, and supply shortages. Due to higher demand for immediate delivery the spot prices have been greater than the futures prices.

Figure 11: Mean Absolute Deviation - Alumiunium - by Period during 2006-2024

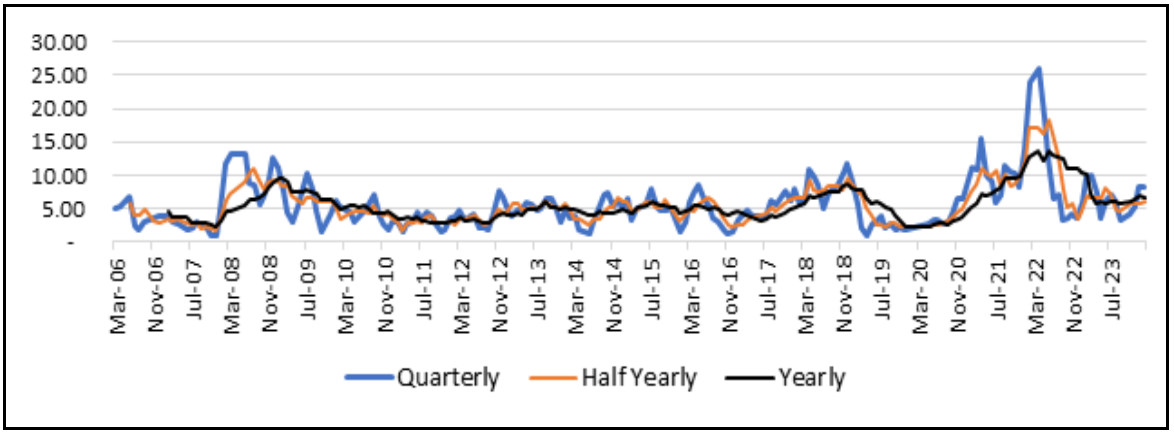


Figure 12: Mean Absolute Deviation - Copper - by Period during 2006-2024

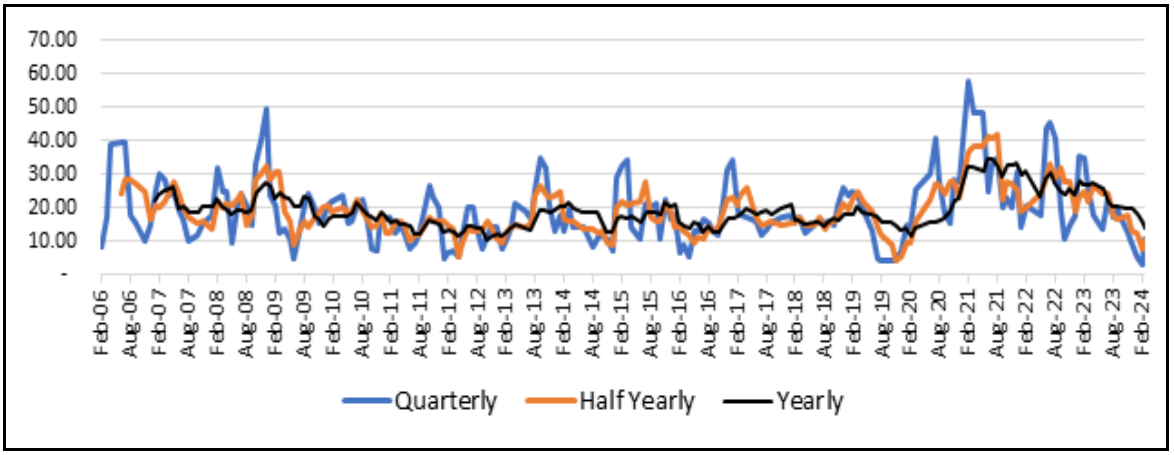


Figure 13: Mean Absolute Deviation - Nickel - by Period during 2006-2024

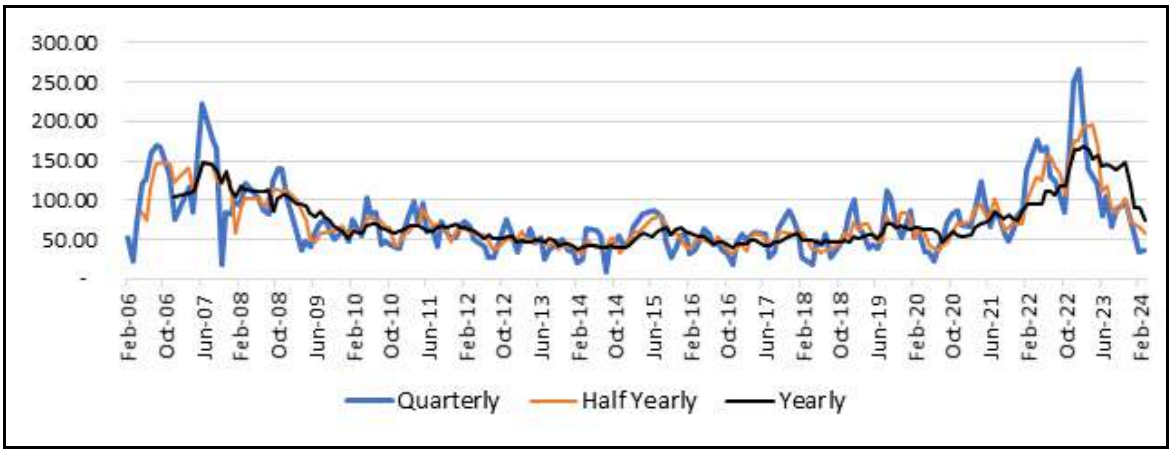


Figure 14: Mean Absolute Deviation - Lead - by Period during 2006-2024

Figure 15: Mean Absolute Deviation - Zinc - by Period during 2006-2024

The Tables 30 to 34 below show that only during 2011-2015 MCX futures prices have been overestimates of actual spot prices, but for the period of 2016-2019 and 2019-2024 that MCX futures prices are underestimates of the actual spot prices.

Table 30: Descriptive Statistics of Difference between MCX Aluminium Futures and Actual Spot Price

Full Period		2005-2010		2011-2015		2016-2019		2019-2024	
Mean	-0.48	Mean	1.89	Mean	1.19	Mean	-0.38	Mean	-4.81
Median	0.85	Median	2.30	Median	1.45	Median	0.03	Median	-3.65
SD	7.91	SD	7.14	SD	5.14	SD	6.98	SD	9.97
Range	55.35	Range	35.45	Range	20.05	Range	28.80	Range	55.15
Min	-39.25	Min	-19.35	Min	-10.05	Min	-18.85	Min	-39.25
Max	16.10	Max	16.10	Max	10.00	Max	9.95	Max	15.90

Table 31: Descriptive Statistics of Difference between MCX Copper Futures and Actual Spot Price

Full Period		2005-2010		2011-2015		2016-2019		2019-2024	
Mean	-0.67	Mean	-0.60	Mean	5.58	Mean	1.48	Mean	-9.12
Median	-0.25	Median	-4.65	Median	2.95	Median	6.60	Median	-7.17
SD	25.87	SD	26.66	SD	20.88	SD	20.54	SD	31.19
Range	200.95	Range	160.40	Range	122.20	Range	91.30	Range	199.95
Min	-118.95	Min	-78.40	Min	-55.65	Min	-63.40	Min	-118.95
Max	82.00	Max	82.00	Max	66.55	Max	27.90	Max	81.00

Table 32: Descriptive Statistics of Difference between MCX Nickel Futures and Actual Spot Price

Full Period		2005-2010		2011-2015		2016-2019		2019-2024	
Mean	4.67	Mean	5.51	Mean	18.01	Mean	0.42	Mean	-6.73
Median	4.30	Median	-0.90	Median	18.20	Median	-0.45	Median	1.60
SD	100.33	SD	123.74	SD	63.83	SD	60.04	SD	125.00
Range	862.90	Range	764.90	Range	284.30	Range	238.00	Range	607.30
Min	-346.70	Min	-248.70	Min	-133.90	Min	-138.30	Min	-346.70
Max	516.20	Max	516.20	Max	150.40	Max	99.70	Max	260.60

Table 33: Descriptive Statistics of Difference between MCX Lead Futures and Actual Spot Price

Full Period		2006-2010		2011-2015		2016-2019		2019-2024	
Mean	-1.17	Mean	-0.38	Mean	0.25	Mean	-0.02	Mean	-4.19
Median	-2.33	Median	-2.38	Median	-0.35	Median	0.45	Median	-4.90
SD	8.47	SD	10.87	SD	7.57	SD	9.54	SD	4.83
Range	51.95	Range	51.95	Range	35.55	Range	47.70	Range	20.35
Min	-24.45	Min	-24.45	Min	-19.35	Min	-22.70	Min	-14.70
Max	27.50	Max	27.50	Max	16.20	Max	25.00	Max	5.65

Table 34: Descriptive Statistics of Difference between MCX Zinc Futures and Actual Spot Price

Full Period		2006-2010		2011-2015		2016-2019		2019-2024	
Mean	-0.47	Mean	3.05	Mean	1.09	Mean	-2.10	Mean	-4.87
Median	0.40	Median	2.90	Median	0.90	Median	-0.75	Median	-5.10
SD	11.03	SD	11.13	SD	6.03	SD	10.43	SD	13.58
Range	70.45	Range	66.20	Range	25.65	Range	38.90	Range	60.80
Min	-31.25	Min	-27.00	Min	-13.15	Min	-22.95	Min	-31.25
Max	39.20	Max	39.20	Max	12.50	Max	15.95	Max	29.55

6.6.1 Implications for Value Chain Players

When a persistent trend of over or under prediction of actual spot prices happens, then the credibility of futures prices and their modelling would be at stake. When futures prices are under-estimates, then sellers of physical metal would realise less than the spot price on the date of maturity. This would drive them away from placing their stocks on delivery-based futures contracts. Though the buyers would show interest, the socks would not be available. For the seller it would be beneficial to sell spot, the buyer would not find counterparty in the futures contract, and hence would be forced to buy in the spot market at high price. Over abd above the demand for base metals, the survey analysis in section 7

shows that the prevalence of strong distribution networks with the downstream value chain players, quantity based memorandum of understanding signed by buyers with the primary producers, and OTC type forwards contracts offered by the primary producers, creates immediate sale of primary products (like ingots, and cathodes) leaving only the residual for the MCX warehouses.

6.7 Basis Risk Analysis

(Basis Risk is the difference between Closing Futures Price and Actual Spot Price on MCX on the date of Maturity expressed as percentage of Actual Spot Price)

Table 35: Descriptive Statistics of Basis between MCX Aluminium Futures and Actual Spot Prices

Full Period		2005-2010		2011-2015		2016-2019		2019-2024	
Mean	-0.62%	Mean	-0.20%	Mean	0.08%	Mean	-0.13%	Mean	-2.17%
Median	-0.08%	Median	-0.04%	Median	-0.04%	Median	-0.07%	Median	-2.14%
SD	1.50%	SD	1.06%	SD	0.71%	SD	0.40%	SD	1.87%
Range	12.05%	Range	8.37%	Range	5.54%	Range	2.05%	Range	8.86%
Min	-7.41%	Min	-7.41%	Min	-0.90%	Min	-1.03%	Min	-5.81%
Max	4.64%	Max	0.96%	Max	4.64%	Max	1.01%	Max	3.04%

Table 36: Descriptive Statistics of Basis between MCX Copper Futures and Actual Spot Prices

Full Period		2005-2010		2011-2015		2016-2019		2019-2024	
Mean	0.39%	Mean	0.92%	Mean	0.66%	Mean	0.17%	Mean	-0.45%
Median	0.18%	Median	0.65%	Median	0.37%	Median	0.28%	Median	-0.57%
SD	1.74%	SD	1.98%	SD	1.72%	SD	1.48%	SD	1.29%
Range	12.79%	Range	12.09%	Range	9.22%	Range	7.83%	Range	7.11%
Min	-4.61%	Min	-3.91%	Min	-3.21%	Min	-4.61%	Min	-4.03%
Max	8.18%	Max	8.18%	Max	6.02%	Max	3.22%	Max	3.08%

Table 37: Descriptive Statistics of Basis between MCX Nickel Futures and Actual Spot Prices

Full Period		2005-2010		2011-2015		2016-2019		2019-2024	
Mean	-0.04%	Mean	0.32%	Mean	0.10%	Mean	-0.06%	Mean	-0.38%
Median	-0.01%	Median	-0.01%	Median	0.09%	Median	-0.03%	Median	-0.49%
SD	1.35%	SD	1.63%	SD	0.59%	SD	0.40%	SD	1.85%
Range	16.50%	Range	8.84%	Range	4.38%	Range	2.38%	Range	12.67%
Min	-8.57%	Min	-0.92%	Min	-1.55%	Min	-1.87%	Min	-8.57%
Max	7.92%	Max	7.92%	Max	2.83%	Max	0.52%	Max	4.09%

Table 38: Descriptive Statistics of Basis between MCX Lead Futures and Actual Spot Prices

Full Period		2006-2010		2011-2015		2016-2019		2019-2024	
Mean	-0.49%	Mean	0.21%	Mean	0.07%	Mean	-0.07%	Mean	-1.68%
Median	-0.04%	Median	0.00%	Median	0.00%	Median	-0.08%	Median	-2.09%
SD	2.04%	SD	2.06%	SD	0.76%	SD	0.24%	SD	2.80%
Range	15.93%	Range	12.58%	Range	6.26%	Range	1.25%	Range	12.45%
Min	-6.60%	Min	-3.25%	Min	-1.56%	Min	-0.67%	Min	-6.60%
Max	9.32%	Max	9.32%	Max	4.70%	Max	0.58%	Max	5.85%

Table 39: Descriptive Statistics of Basis between MCX Zinc Futures and Actual Spot Prices

Full Period		2006-2010		2011-2015		2016-2019		2019-2024	
Mean	-0.21%	Mean	0.44%	Mean	0.21%	Mean	-0.18%	Mean	-1.36%
Median	-0.07%	Median	0.00%	Median	-0.05%	Median	-0.16%	Median	-1.49%
SD	1.27%	SD	1.29%	SD	0.70%	SD	0.41%	SD	1.33%
Range	11.87%	Range	7.03%	Range	3.59%	Range	2.07%	Range	9.22%
Min	-5.96%	Min	-1.13%	Min	-0.80%	Min	-1.16%	Min	-5.96%
Max	5.91%	Max	5.91%	Max	2.79%	Max	0.91%	Max	3.25%

The Basis Risk analysis in the above Tables 35-39 for 5-year sub-periods shows that basis risk has been the lowest during the 2011-2015 period and it has significantly increased during 2019-2024, which in effect has significantly pulled down the full period mean too. In our analysis the basis risk is calculated as futures price on the date of maturity less the spot price on the same date of maturity, expressed as a percentage of spot price of the same date. Therefore, a negative sign means that the futures price on the date of maturity has been lesser than the spot price, this is in tune with the previous unbiased predictor analysis. When such a significant basis risk exists, hedgers would face either abnormal gains or losses. In effect there is no perfect hedge. Prevalence of basis risk requires hedgers to buy either greater or lesser quantity of contracts than their underlying exposure. This may lead to higher cost of hedging, which essentially would lead to inadequate motivation to approach the derivative exchange for hedging.

6.8 Contango / Backwardation Analysis:

Backwardation and Contango are two prominent price behaviours in the futures market. All types of traders monitor these two trends regularly to frame an opinion of the market, and appropriately devise their speculative or hedging strategies. Contango - where the futures price is higher than the spot price - is the normal expected behaviour in a commodity futures market, due to the presence of carrying cost and storage costs. Backwardation – where the futures price is lower than the spot price – is usually not expected, but happens, when traders place more importance to convenience yield and there is more immediate demand than in future. Table 40 below shows the number of times the MCX near month futures was either in a Contango or Backwardation by splitting the full period of analysis from 2006 to 2019 and to that after 2019.

Table 40 depicts the number of times the futures market in base metals in MCX was on Contango or Backwardation. Upto 2019 most of the metals have shown Contango behaviour, and after 2019, all of them have been on backwardation for most number of days. Charts (Fig-16 to Fig-20) also depicts the same. This essentially means that futures prices are lower than the spot prices persistently after 2019. For buying hedgers, it is an

attractive situation as they are assured of buying the physical commodity by locking in a lower price. However, buyers can achieve this only when the sellers place adequate stock in the warehouses. The sellers would not be interested in selling in the futures market, because they see a persistent trend of backwardation. They would be selling more in the spot market than the futures market.

Table 40: Instances when MCX Near Month Futures was on Backwardation or Contango

Aluminium	**Backwardation**	**Contango**	**Converged**
Upto Mar'2019	26	119	1
After Mar'2019	49	3	0
Copper	**Backwardation**	**Contango**	**Converged**
Upto Mar'2019	39	106	1
After Mar'2019	32	18	0
Nickel	**Backwardation**	**Contango**	**Converged**
Upto Mar'2019	24	117	2
After Mar'2019	40	16	1
Lead	**Backwardation**	**Contango**	**Converged**
Upto Mar'2019	24	115	2
After Mar'2019	37	15	1
Zinc	**Backwardation**	**Contango**	**Converged**
Upto Mar'2019	29	108	2
After Mar'2019	47	3	0

Note: The data is based on the first day's future's price for the near month contract and the spot price on that day. The frequency of analysis is monthly. The number of months for each of the metal would not be same due to the range of data on the contracts. It is due to different dates of commencement or no price days from the Bloomberg Database. The above analysis might not be interpretatively different, even if the missing data is provided. Daily frequency also could have been taken, but extant literature has already shown the results with daily frequency that the base metals market is in backwardation since 2019 on MCX.

Figure 16: MCX Aluminium Near Month Contango / Backwardation

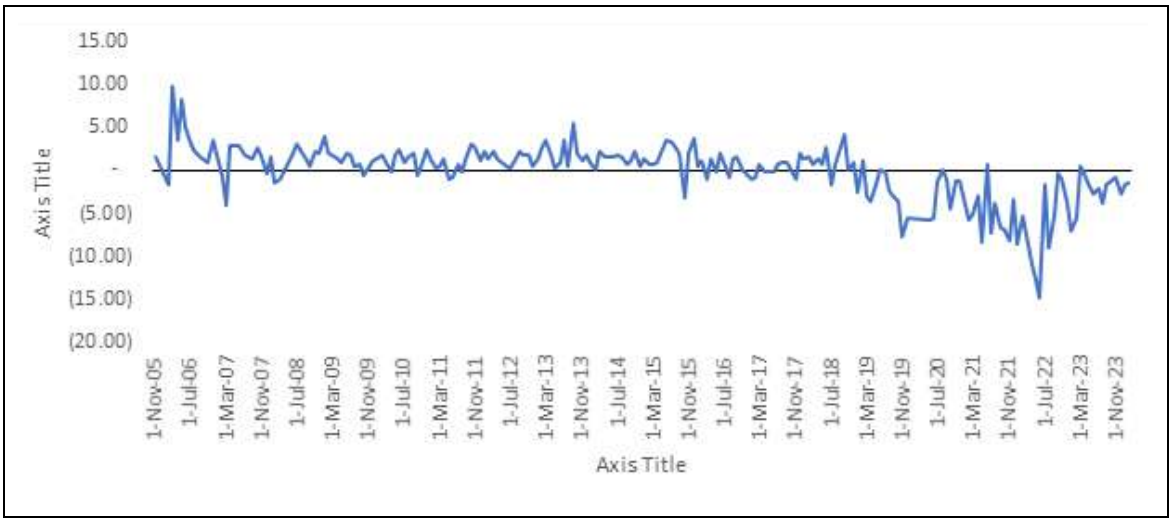
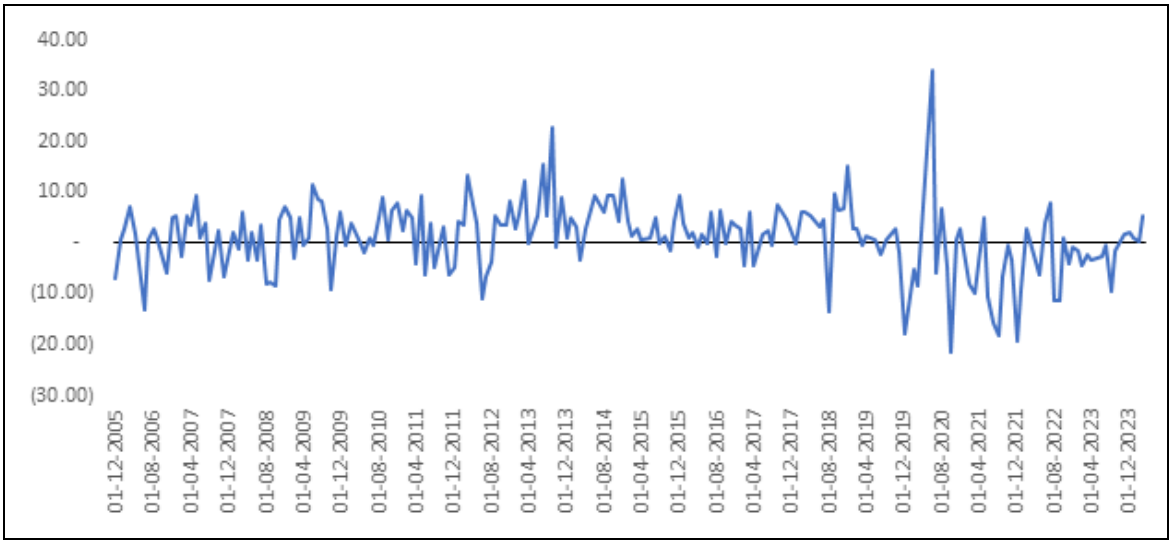


Figure 17: MCX Copper near Month Contango / Backwardation



"Many times, there is backwardation and price squeeze happening on the MCX markets, hence the price is distorted"

– CEO, Copper Recycling and Value Added Product Manufacturer

Figure 18: MCX Nickel near Month Contango / Backwardation

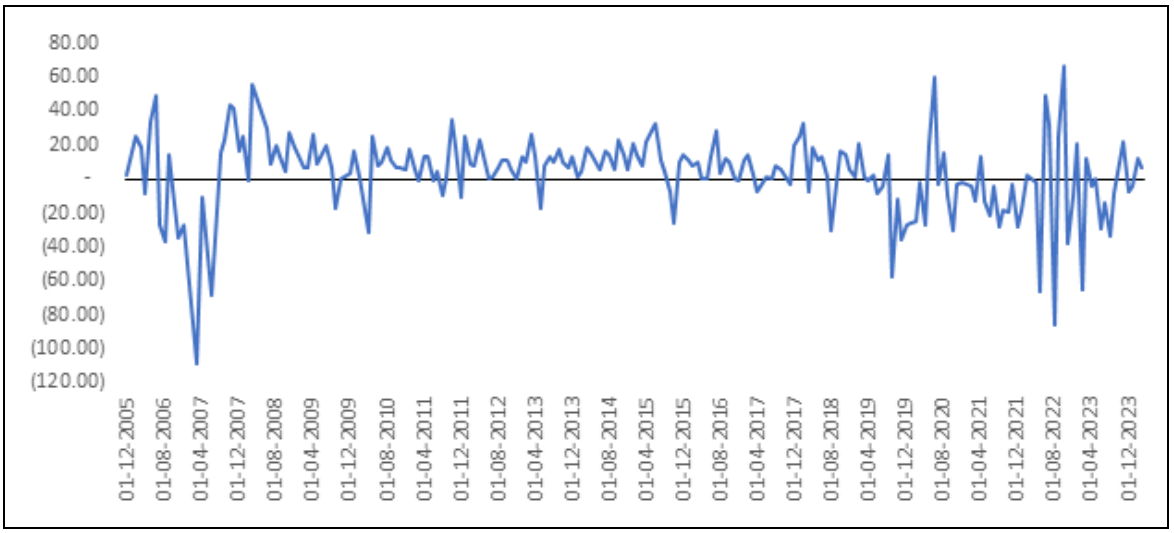


Figure 19: MCX Lead Near Month Contango / Backwardation

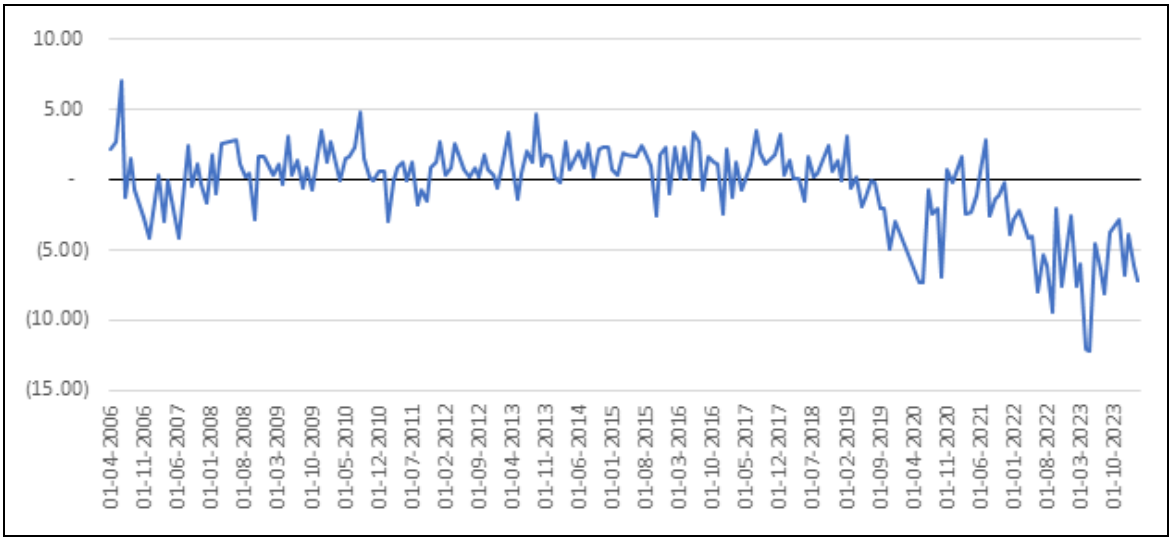
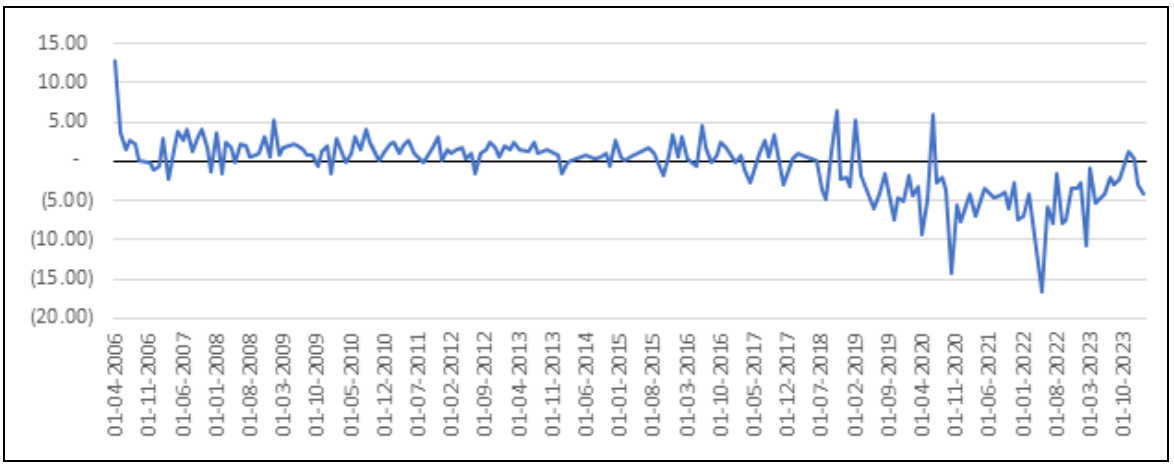


Figure 20: MCX Zinc Near Month Contango / Backwardation



6.9 Volume and Open Interest Analysis

Traded volume and Open Interest are indicators of liquidity in a future market. Higher the liquidity higher will be the interest of buyers and sellers in the market and better would be the price discovery.

In India SEBI in March, 2019 issued a guidelines for mandatory physical delivery in the commodity futures market. This notification aims at reducing price speculation and nudging towards better price convergence between the spot and futures market.

Figure 21: Copper near Month Futures Traded Volume (in '000s)

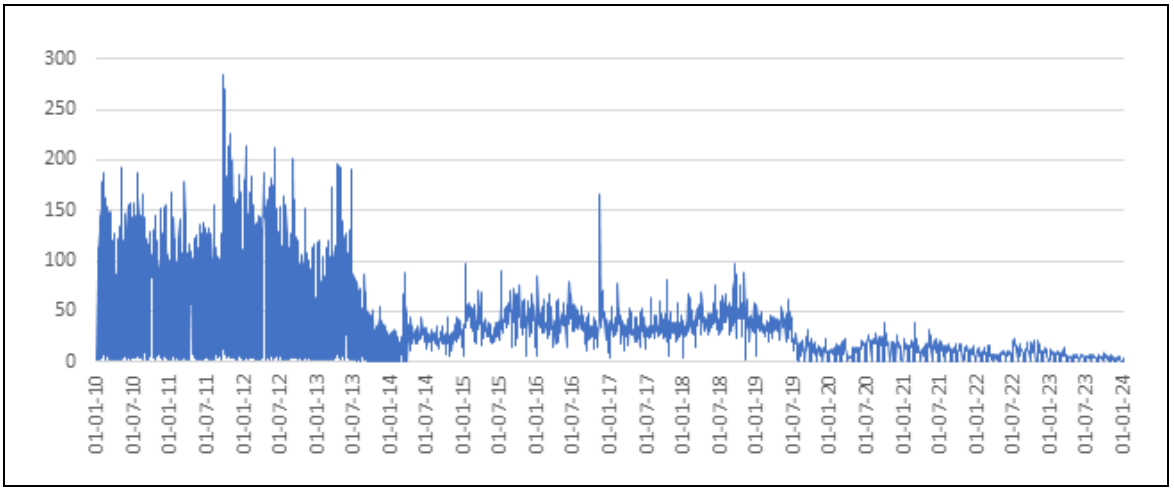


Figure 22: Copper near Month Futures Open Interest (in '000s

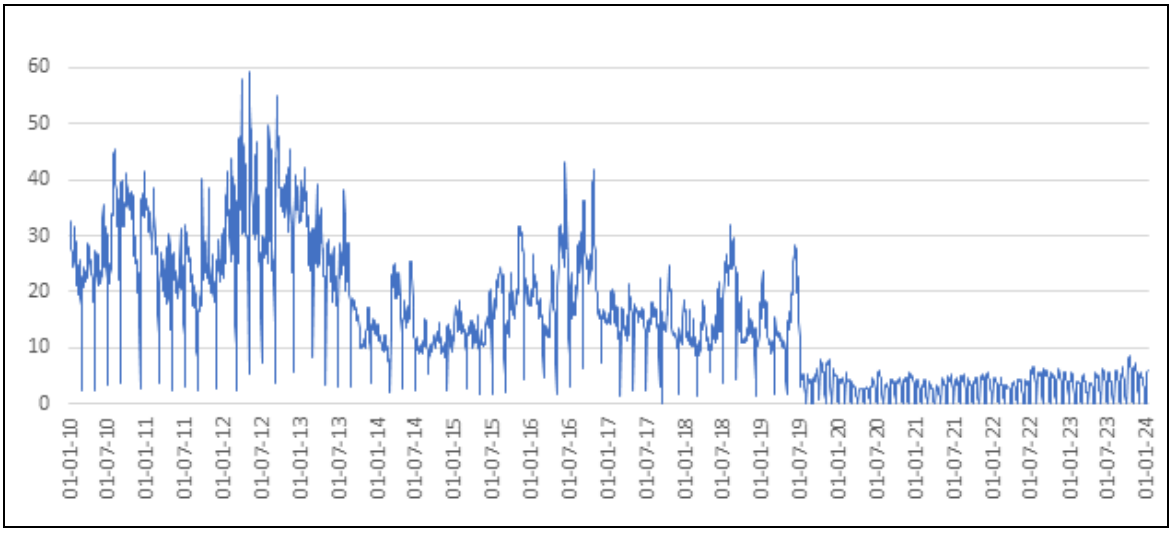


Figure 23: Aluminium near Month Futures Traded Volume (in '000s)

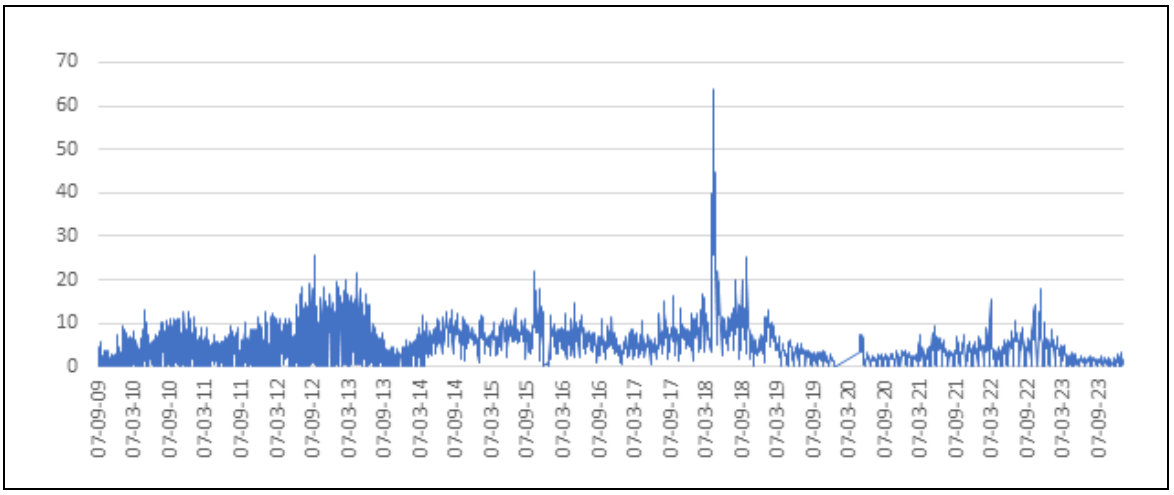


Figure 24: Aluminium near Month Futures Open Interest (in '000s)

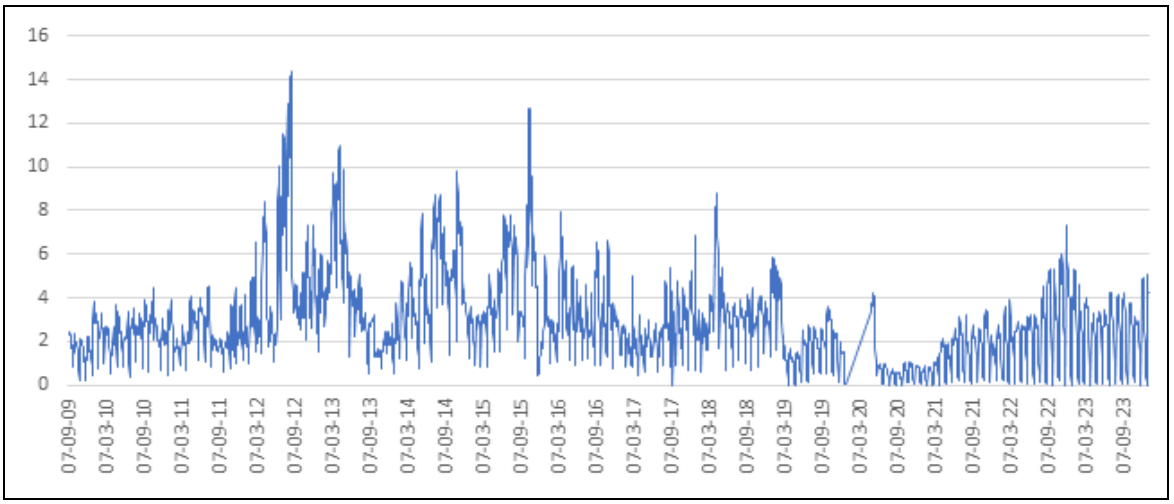


Figure 25: Zinc near Month Futures Trade Volume (in '000s)

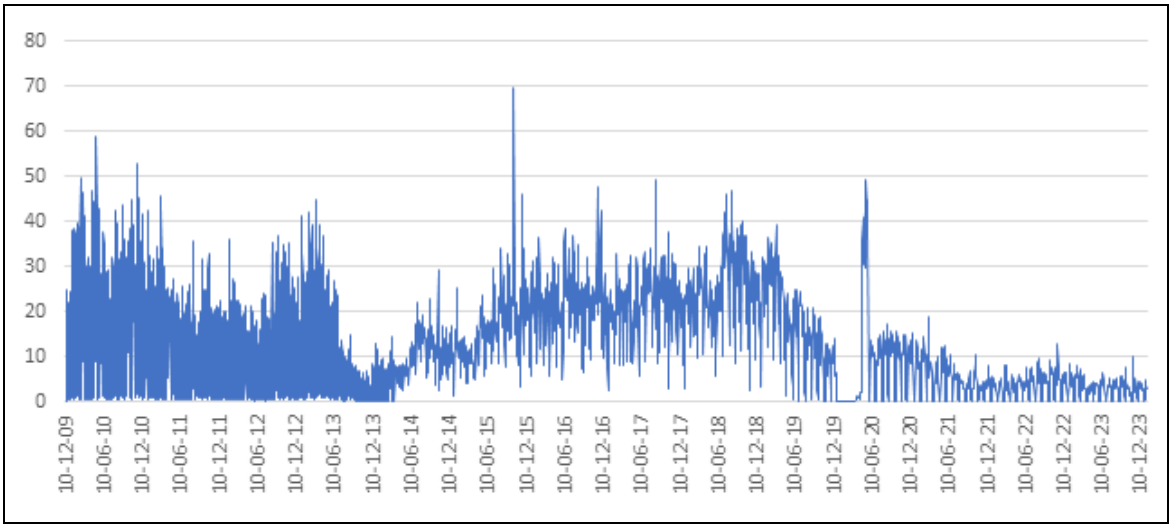


Figure 26: Zinc near Month Futures Open Interest (in '000s)

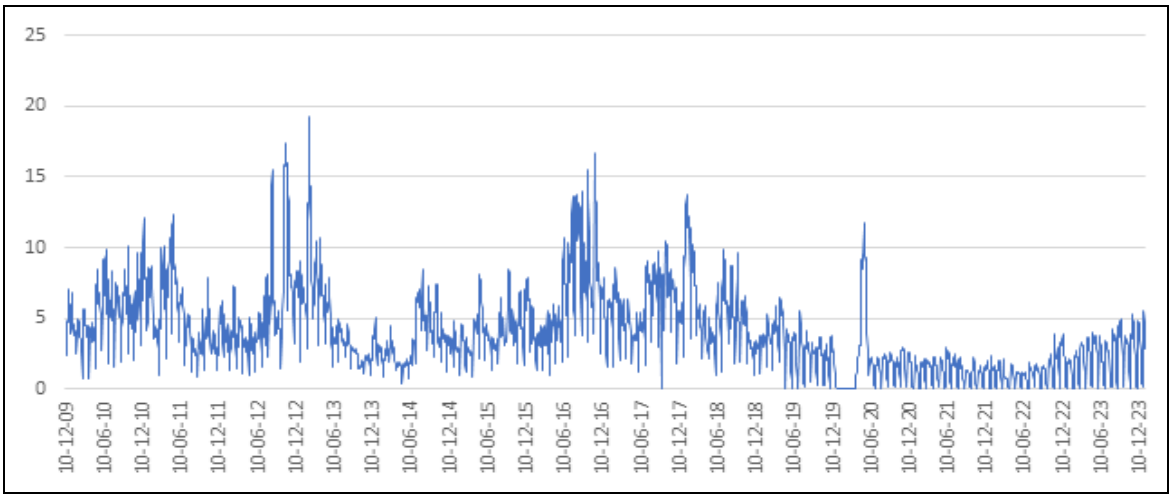


Figure 27: Lead near Month Futures Trade Volume (in '000s)

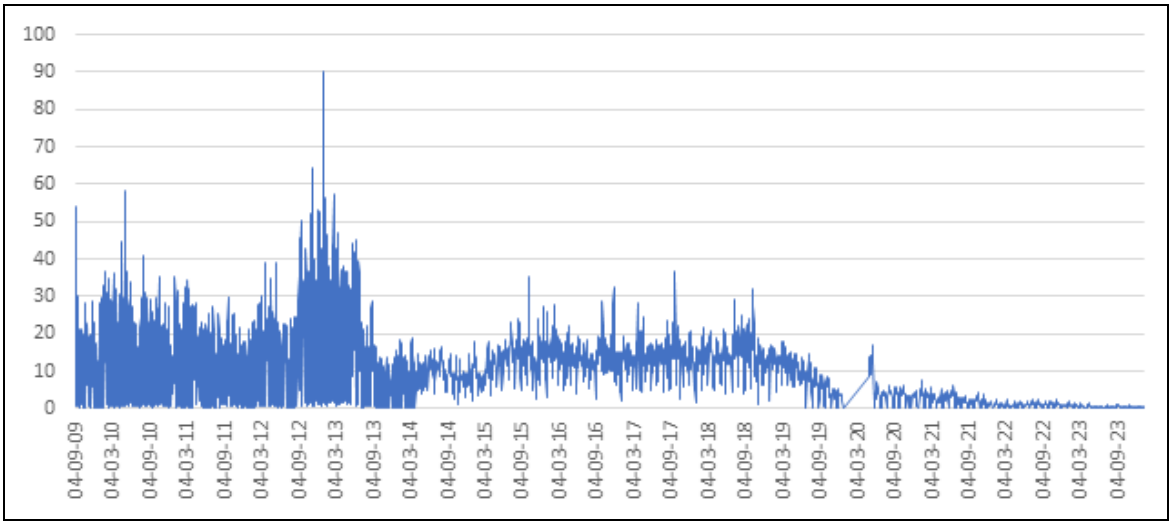


Figure 28: Lead near Month Futures Open Interest (in '000s)

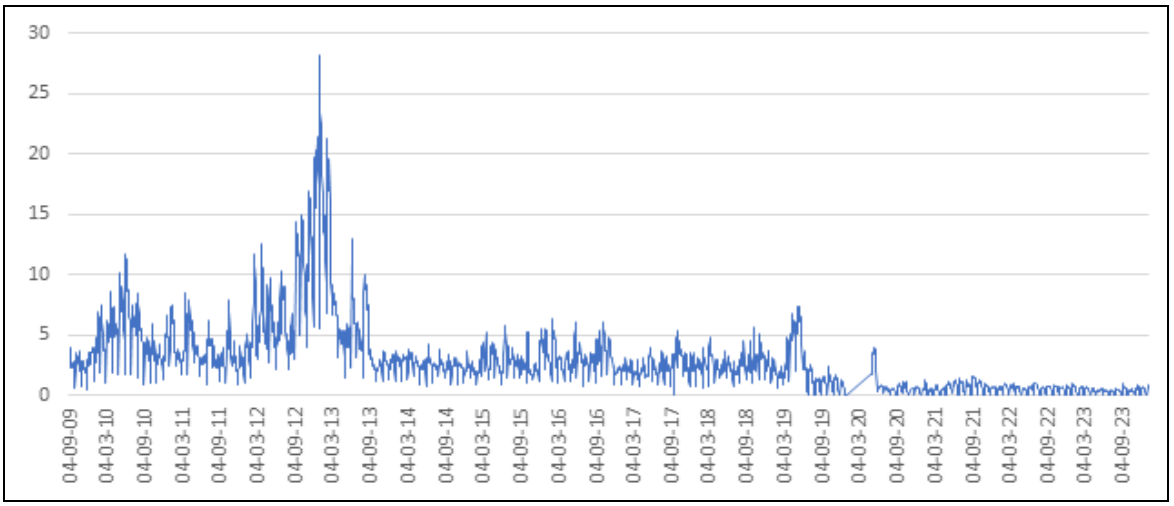


Figure 29: Nickel near Month Futures Trade Volume (in '000s)

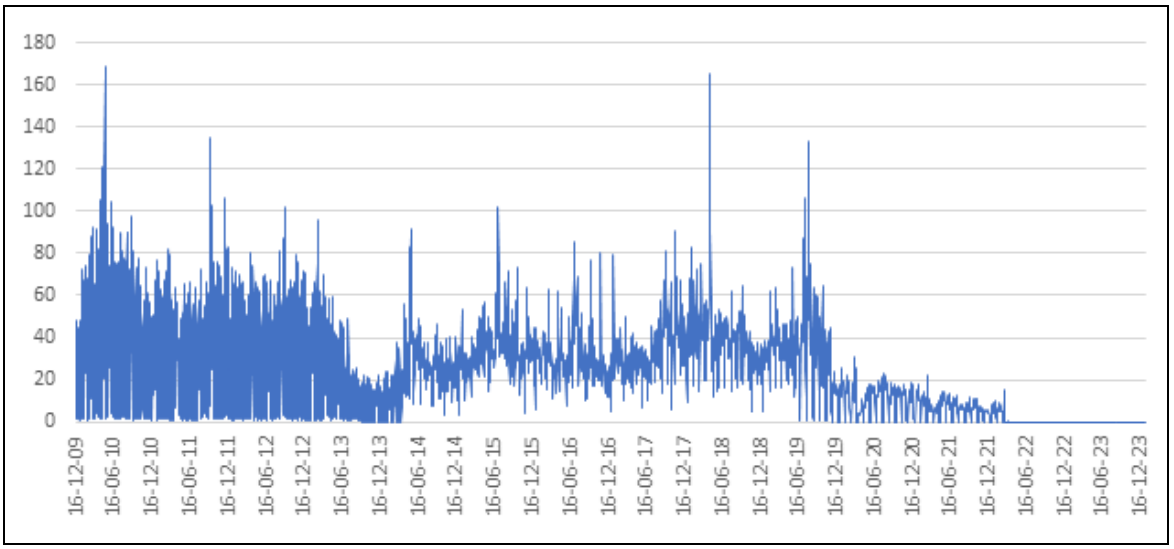
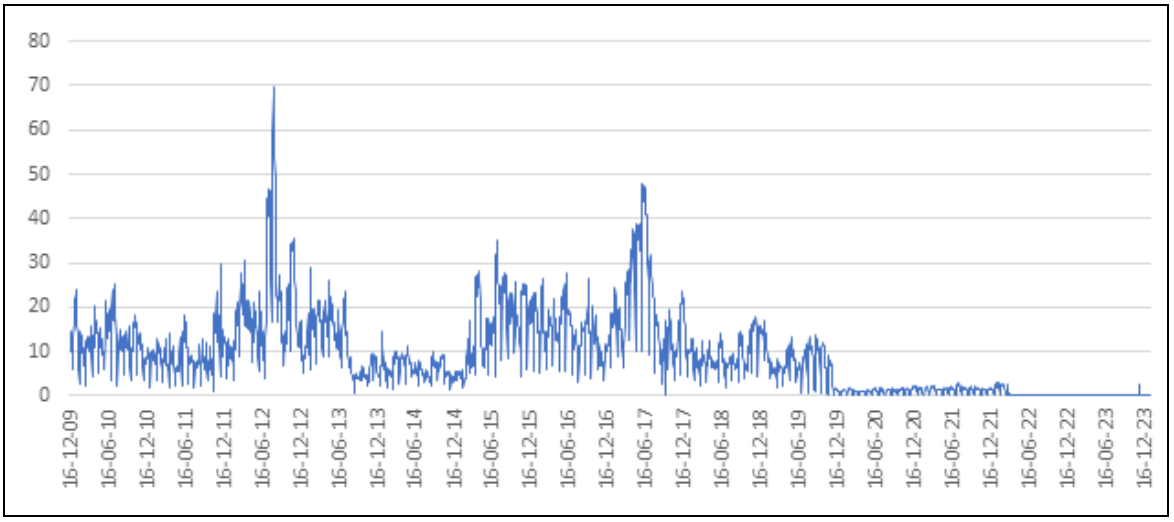


Figure 30: Nickel near Month Futures Open Interest (in '000s)



The above graphs Fig 21-30 on both traded volume and open interest show that leaving Aluminium, in the case of all other base metals, the traded volume and open interest have declined after the SEBI notification. This may be an indication of declining interest of the speculators and arbitragers in the market, due to mandatory physical delivery.

Zinc is tracing back to the pre-2019 levels. Declining volume in the futures market can indicate, either lack of

> *"Where is price discovery in base metals in India, when there is a stranglehold of few primary producers"*
>
> **– A large physical metal trader in Aluminium, Copper**

participation by financial traders, or that of physical metal hedgers. Of which the former appears to be more plausible, due to the typically lower physical metal hedging community on MCX. This could also be a wait and watch situation by the financial traders to understand the changing price dynamics, the spot polling methodology of MCX, its efficiency, the convergence with LME, and the visibility of inventory across the value chain. There is significant prevalence of algo trading, and even their computing algorithms must be fed with the new spot price data set of India, and then it takes time to deep learn it to forecast better. Therefore, eventually the volumes might pick up once the financial trading communities visualise some dependable patterns.

Chapter 7: Insights from Survey of Value Chain Players

This chapter forms the heart of the research project where we develop insights from an extensive survey of value chain players in the base metal industry across India. Insights are generated on the following aspects.

- Value Chain of a typical Base Metal Industry
- Sources of Commodity Price Risk
- Forecasting Commodity Prices
- Choice of Reference Prices
- Motivation to Hedge
- Operational Hedging of Commodity Price Risk
- Derivative Hedging of Commodity Price Risk
- Choice of Hedging Instrument
- Why Derivative Hedging is not Preferred
- Preference for OTCs or Exchanges and MCX

For the sake of easy read, the summary of survey findings on the above aspects is provided in the initial pages in a box. A detailed description and discussion on the aspects of the sample, approach to survey, analysis, visualisations, and excerpts of interviews are provided in the later pages.

Insights from the Survey

Value Chain of Base Metals:

Miners and Scrap Aggregators are at the top end of the Base metal Supply Chain, followed by the **Refiners and Primary Producers**. The primary products are distributed by **Large Stockists and Distributors** and **Small Stockists and Distributors** at major cities. There are large number of unorganised MSMEs who do the manufacturing of **Value-Added Products**, which further are consumed directly by large listed or unlisted **Manufacturers of Value Added Products** belonging to various engineering, utility, transport, auto, and consumer durables etc., or are retailed and stocked at various cities across the country by **Retail Stockists of Value-Added Products.**

Insights from the Survey

Implications for Exchange Based Derivative Hedging:

Hedging and Size of a firm are positively related, therefore large sized players at the two distal ends, are expected to hedge. Stockists and Distributors would maintain low inventories and depend on bid and ask spreads for their business, they would hedge when they have inventory or when they have locked in long term fixed price contracts. Value Added manufacturers in the MSMEs and Retail Stockists would not have the size, scale, scope and skill to hedge.

Source of Commodity Price Risk:

Geopolitical Risk, Supply Disruptions, Foreign Currency Reference Pricing, are external factors causing commodity price risk. **Inability to Forecast commodity prices and Inability to Pass them to Customers** are the firm specific factors.

While **70% of the suppliers of primary producers can pass on 90% of the price variation** to their customers, only **40% of the value-add manufacturers are able to pass 90%** of the price variations to their customers. Around **85% value chain players opine that commodity price risk is a short-term risk** (less than 1 year).

60% of the value chain players receive their base metal ordered from the supplier **within 10 days**, and **70% receive** it **within 15 days**. **46% of the value chain players do not hold inventory more than 15 days of production/sales, and 85% of them not more than 30 days.** Only in case of import oriented entities, does this inventory days increase upto 90 days maximum. **50% of the value chain players** are **hurt by price changes of above 5%** in their relevant base metals, **irrespective of the kind of player** they are. **Price changes of above 2% and 8% would hurt another 11% and 13% firms respectively.**

Implications for Exchange Based Derivative Hedging:

While black swan events cannot be hedged with derivatives, matured Futures and Options market can provide solutions for demand and supply related price fluctuations, and some supply disruptions with strong lead indicators.

Indian players can also resolve issues related to price forecasting, and resolve the risks related to foreign currency pricing and inability to pass through to customers. Indian players have streamlined their operations to reduce such lead times and the levels of inventories to mitigate commodity risk through operational techniques.

Therefore, derivative contracts with short maturities only would be most sought after. The 5% threshold of price change is supported by empirical analysis. Average Monthly or Quarterly spot price changes of any base metal on LME or MCX have not been greater than 5% since 2006. Unless the volatility of the market crosses this threshold price change, interest for derivative hedging might not improve.

Insights from the Survey

Forecasting of Commodity Prices:

2/3rd of the value chain players do not forecast commodity prices, and the rest 1/3rd does forecast. **Around 60% of value chain players state that futures prices are not the best predictors,** and **80% feel that they do not converge on the date of maturity too. Around 90% of the value chain players do not have a budgeted rate** in their costing or pricing to protect. Further, **only 25% of the value chain players feel that commodity prices can be forecasted with an accuracy of above 70%,** otherwise majority of them feel that it is a 50-50 chance for a forecast to be accurate. This could be due to the extremely uncertain times that the survey is undertaken, and hopefully it would improve as the geo-politico-economic situation stabilises.

Implications for Exchange Based Derivative Hedging:

The lack of budgeted commodity price does not augur well for the use of exchange-based derivatives. Derivatives hedging is more beneficial when there is a particular price or range to lockin. Therefore, there is considerable space for a futures exchange to service the value chain players with unbiased futures prices, for various maturity periods, to build future clientele for price referencing and derivative hedging.

Choice of Reference Prices:

LME dominates the reference prices in the **importing and exporting transactions**, because it is the internationally accepted reference price. Even **in the domestic transactions it features in the second most popular** reference price, **after the "unique" buyer's and seller's reference prices. Indian Price Reporting Agencies** either with pan India and regional presence have **developed their own network of players**, and poll the prices from various players and provide the information either on a daily or weekly basis, at discrete points in time. **NALCO listed prices are the most popular reference prices for aluminium**, **LME for Copper, Zinc and Nickel,** and **BME for Fabricated and Scrap** based primary producers. An important trend that came out of the discussions is that the **various industry associations have been nudging their members towards their chosen reference prices** – which are sometimes not exchange determined and are available with a lag, reported by price aggregators - to solve the reference price related issues of their supply chain players.

Implications for Exchange Based Derivative Hedging:

To fall in line with LME the Indian exchange and derivative products must display a good amount of correlation to it, to be popular reference prices. ***If not, the Indian exchanges need to develop credibility of their futures prices, which can happen when there is a strong organised spot physical market, reflecting more of the Indian demand and supply conditions, which would daily feed in the spot prices and the futures prices can be derived out of them.*** *Commodity derivative exchanges need to partner with the price reporting agencies to improve the representativeness of their spot and futures prices. It is another debate at the macroeconomic level whether the base metal commodity sector should follow an import parity pricing model, or should have India specific reference prices, atleast for the Indian markets. This is beyond the scope of this project.*

Insights from the Survey

Motivation to Hedge:

"Minimising Risk" and **"Possibility to gain"** are the two most important motivations of the value chain players to hedge. **"Reducing risk to Zero"** and **"Achieving a Budgeted Price"** also do feature in the third and fourth ranks.

Implications for Exchange Based Derivative Hedging:

Theoretically hedging should not be motivated by gains, rather it should be only for minimising losses. The prevalence of motivation to gain shows the potential for option contracts and selective or partial hedging using futures contracts. Reducing Risk to Zero is a myth which need to be busted through continuous education and training. Players which are motivated by achieving the budgeted price should be the prime targets of hedging through futures or options.

Operational Hedging of Commodity Price Risk:

Timing the buying of metal, passing on the price changes to the customers if possible, or try and push a price variation clause in the contract is what majority of the manufacturing value chain players (around 70%) do to manage commodity price risk without using derivatives. **Long term fixed price contracts, Price Now Deliver Later type of contracts (OTC forward contracts with suppliers), managing the bid and ask spread without holding inventory, or pay premium for price constancy** is what the Primary Producers, Large Stockists, Distributors are adopting. Primary producers also use **historical monthly or quarterly average pricing** for the contracts, by settling the aggregate deviations at the end of month or quarter. Large manufacturers that consume value added products of the MSMEs push for **historical monthly or quarterly average prices** for the forthcoming contracts.

Retailers manage with a belief in **price averaging**. Value Added manufacturers of unique products use **mark ups on costs** to absorb the likely price changes or **buy the metal at the same price, at which it is priced to the customers**. Dependable sub-contracting companies with long standing relationships with their large-scale manufacturers, negotiate only to undertake the fabrication part, by **asking the client to deliver the metal.** Multiproduct manufacturers, also use **cross subsidising, and altering material mix** to supply products without price variation clauses. Exporters, enjoy the **buffer created by depreciation of Indian Rupee** to absorb the increases in commodity price risk. One complaint that featured in the interviews is that, aggregated settlements for favourable price deviations (Popularly known as "Credit Note") by the primary producers does not happen on time.

Implications for Exchange Based Derivative Hedging:

The success of these techniques and the passive price taking by customers, will make such practices sustain in the industry and take away a significant share of the market for derivative hedging. It is also an opportunity for the derivative exchanges to educate the value chain players about the costs and limitations of some of the hedging practices like historical average pricing when there is a sustained positive trend in the metal prices.

Insights from the Survey

Derivative Hedging of Commodity Price Risk:

Only around 15% of the value chain players hedge commodity price risk **using exchange based derivative contracts.** There are **no formal organised OTC based forward contracts**. However, large manufacturing downstream players, or Stockists and Distributors, **enjoy fixed price contracts provided by the primary producers** who are large scale refiners or smelters, but with a premium. Suppliers who provide fixed price contracts hedge using exchange-based derivatives, and hence they either charge a premium on the price, stipulate fixed quantity offtake, or seek an initial deposit to provide an MOU status. Such practices take care of the hedging charges, which range from around 5$ to 10$ per tonne of the metal. **Price Now Delivery Later, Deliver Now Price Later are contract variants** which are **innovations** of the upstream supply chain players to protect the downstream from commodity price risk. However, it is only for maximum 1 to 2 months. Those **value chain players that hedge, hedge either anticipated exposure, or existing exposure, or both using derivatives** (Each category has approximately 1/3 of players). **Only 25% of the hedgers consider 100% of the exposure** for hedging. The rest **75% undertake only partial hedges**. Around 50% hedge only upto 50% of the exposure, and the rest upto 90% of the exposure.

Implications for Exchange Based Derivative Hedging:

OTC based forward contracts take away the market share for exchange-based futures and options contracts. They are attractive due to their cost, quantum and timing flexibility, and absence of maintaining a margin that constrains the liquidity of the players. However, such forward contracts do not provide any opportunity to gain on a favourable price movement, further the price which they might be quoting might not always be transparent and market determined. The prevalence of hedging only anticipated exposure and adopting partial hedging, does not augur well for derivative exchanges, as the estimated volumes from the hedgers might not be equivalent to the aggregate exposures of the industry. Further partial hedging by value chain players could be an indication of higher transaction costs or desire to gain due to some favourable price movement. Option contracts could be a solution for addressing the need of the hedgers to gain.

Choice of Hedging Instrument:

35% of hedgers **prefer forward contracts, 45% futures,** and the **rest 20% options. Ease of Operation, Ease of Access, All in Costs, Upfront Costs, and Scope for Upside Potential** are the top five features that value chain players prefer while choosing derivative instruments.

Implications for Exchange Based Derivative Hedging:

While technological innovation and softer regulations created the necessary ease for operations and access to derivative products; transaction costs and taxes should be continuously monitored and kept attractive to sustain the interest of the hedgers. Further, highlighting the hidden costs of OTC forward contracts and competitively costing the futures and option contracts is important to retain the market share of exchange traded derivative contracts.

Insights from the Survey

Why Derivative Hedging is not Prefered:

Small Scale of Operations, lack of expertise in hedging, lack of awareness of commodity exchanges and their services, lack of awareness of warehouses and physical delivery, lack of trust in exchange traded prices, basis risk, biased future prices, lack of participation of sellers, contract size, corporate policy, focus on value addition than risk management, fear of failure of delivery, quality specifications, unavailability of specific form of product, lack of liquidity to maintain margins, cost of financing the margins are the most reported causes of why the firms do not hedge. A few have experimented with hedging and did not find it beneficial.

Implications for Exchange Based Derivative Hedging:

Lack of awareness and lack of trust in price discovery, will shift value chain players to OTC type contracts provided by suppliers. Further, the lack of participation by sellers to place their metal inventories on the exchanges, will only nudge the value chain players towards OTC contracts, thereby reducing the volume of hedge transactions. The unique forms and specifications in which the metal is consumed is something which the exchanges might not be able to address with new variant of metal contracts unless there is adequate volume of transactions. Knowledge, Skill, and Policy related issues require larger debate and continuous motivation to improve the preference for hedging, which is not unique only to India.

Preference for OTCs or Exchanges and MCX:

75% of the hedgers prefer commodity exchanges for hedging, the rest 25% prefer OTC structures. **Around 80% of Indian entities, that hedge come to Multi Commodity Exchange** and the rest 20% go to London Metal Exchange. This 20% lot relates to those players who use LME reference prices and have imports and exports in their operations. **Almost 98% of the respondents don't take physical delivery** on the MCX for their futures contracts. 80% of the value chain players are aware about MCX, the rest 20% are not aware. **Around 60% of the value chain players do not know about possibilities of physical delivery** in MCX, and the rest 40% know about it. **"Transparency", "Liquidity", "Price Volatility", "Transaction Costs",** and **"Network of Players"** are the top five features which attract the value chain players towards any commodity exchange. **"International Status", "Accessibility" and "Speed of Execution"** are the next three features. **MCX fares better than LME on "Transparency", "Price Volatility" and "All in Cost of Transacting", but is not better than LME on "Liquidity" and "Network of Players".**

Implications for Exchange Based Derivative Hedging:

There is potential and willingness of the value chain players to participate in commodity exchanges. MCX has also been successful enough to attract the purely domestic Indian entities to hedge on its platform. MCX needs to improve the awareness of its services and reach out to the various domestic value chain players. Also, the warehouse locations and their number may be increased to improve the participation of the value chain players, which would improve their rating on network of players and liquidity.

7.1 Sample and Survey Method

Table 41: Base Metal Wise Composition of Databases and the Sample of Companies

Metal	Proportion In CMIE Prowess Database	Proportion in Private Database	Companies in Surveyed Sample
Aluminium	46%	33%	48%
Copper	38%	35%	34%
Nickel	2%	12%	8%
Lead	6%	12%	3%
Zinc	8%	8%	7%
Total	**100%**	**100%**	**100%**

Source: Calculated by the Authors based on data provided in the databases and Survey

We initially extracted the list of companies from CMIE's Prowess IQ Database by filtering companies which are related to the base metals either at the input stage or output stage. The filtration process did not distinguish between companies belonging to either manufacturing, mining, utilities, or services. The entire value chain of companies was considered, as required by the guidelines of MCX, India. After commencing our interviews, and verifying each of the companies, we found that a significant portion of companies were either closed, liquidated, bankrupt, merged, and not found physically at the given addresses. Further, Prowess IQ database had only firms which were registered as Companies. But our initial survey gave us the understanding that there were many firms in the Partnership and Sole Proprietor form of business, with significant volume of business. Then we subscribed to another database that was hoisted in the "99 Electrical World. Com" website with the name and style "99datacd.com". In this website, the database of firms with metal and metal products was curated. When we filtered this database for base metal firms it resulted in 3256 firms. Apart from these firms, we also used "Snowballing" technique to secure appointments for interviews. Table 41 above shows the metal wise proportion of companies in both CMIE's Prowess Database and the 99datacd database. Our survey has attempted to maintain the metal wise proportion (to the extent possible) to generalise inferences and draw meaningful conclusions. There is a significant number of firms, which deal in more than one commodity. This is crucial for hedging the price risk. **A portfolio approach to hedging**

the price risk, reduces the size of the exposure and only the residual risk is going to be hedged. This also reduces the one-to-one mapping between quantum of production or sale and the potential size of the derivative contracts.

Table 42: State Wise Composition of Respondent Firms

State	Firms Responded	State	Firms Responded
Andhra Pradesh	7.5%	Maharashtra	11.5%
Bihar	0.5%	Odisha	1%
Chhattisgarh	1.2%	Punjab	0.8%
Delhi & NCER	19%	Rajasthan	9%
Gujarat	5%	Tamil Nadu	5%
Haryana	0.5%	Telangana	18%
Jharkhand	1.6%	Uttarakhand	0.79%
Karnataka	5.9%	West Bengal	10%
Madhya Pradesh	4%		

Source: Calculated by the Authors based on Survey data

Table No. 42, provides the spread and concentration of the respondent firms. Maharashtra, Delhi & NCER, Gujarat, Tamil Nadu, Kolkata, and Telangana have most of the responding firms, followed by Uttar Pradesh, Haryana, and Karnataka. They also have the significant producers and consumers of base metals.

7.2 The Respondents

Table 43: Type wise composition of Respondent Firms

Firm Type	Proportion
Unlisted	33.4%
Listed	15.6%
Partnership	15.3%
Sole Proprietor	24.7%
Associations Leaders, Experts	11%

Source: Calculated by the Authors based on Survey data

Our team of researchers embarked on the survey and interview process, initially, by verifying the details of each of the firm given by CMIE's Prowess IQ database or 99datacd.com, with that which is available on the firms' websites. After having confirmed their correct telephone numbers and email ids, a minimum of 2 to 3 cold calling attempts were made to secure the names, mobile numbers, and email ids of the relevant officials, who could interact with us on "Challenges of Price Risk in Base Metals and its management". We were directed to Purchase/Procurement/ Finance Heads in large firms or Managing Directors/Managing Partners/Proprietors in small firms and then appointments were confirmed for an interview. Table 43 above shows the respondent firms and their form of organisation. Around 50% of them are registered as companies, and the rest are either partnership or sole proprietor firms. We avoided direct reference to "Hedging Practices" and "Commodity Risk Management", while seeking appointment, so that we are not pre-empted from any further discussion. There are 4 channels through which we solicited responses. **First**, through personal interviews involving the research team of this project, **Second** through a third party research agency, Datamation International, New Delhi, **Third**, through our MBA students who are doing their Summer Internship and **Fourth**, by sending the questionnaire to firms in a "Google Forms", and reminding them to fill it up. The fourth channel did not get any response. Therefore, whatever data we received was all through personal interviews. 90% of the interviews were in person at the firms, 10% were online. 85% of them were by the Core Research Team.

We understood from our initial attempts that references are important in getting candid interviews. Therefore, we attempted to get one or two references of the suppliers or customers of the companies whom we interviewed, and then also snowballed our sample to get new companies which were not in our original list.

Beyond the value chain partners, we also interacted with experts, consultants, and association heads. Our interactions with the association heads have generated some references and contacts. The association heads were relatively clearer about regulatory, infrastructural, market and operational challenges, rather than practices of commodity risk management. They were aware about the heightened volatility in the prices of base metals,

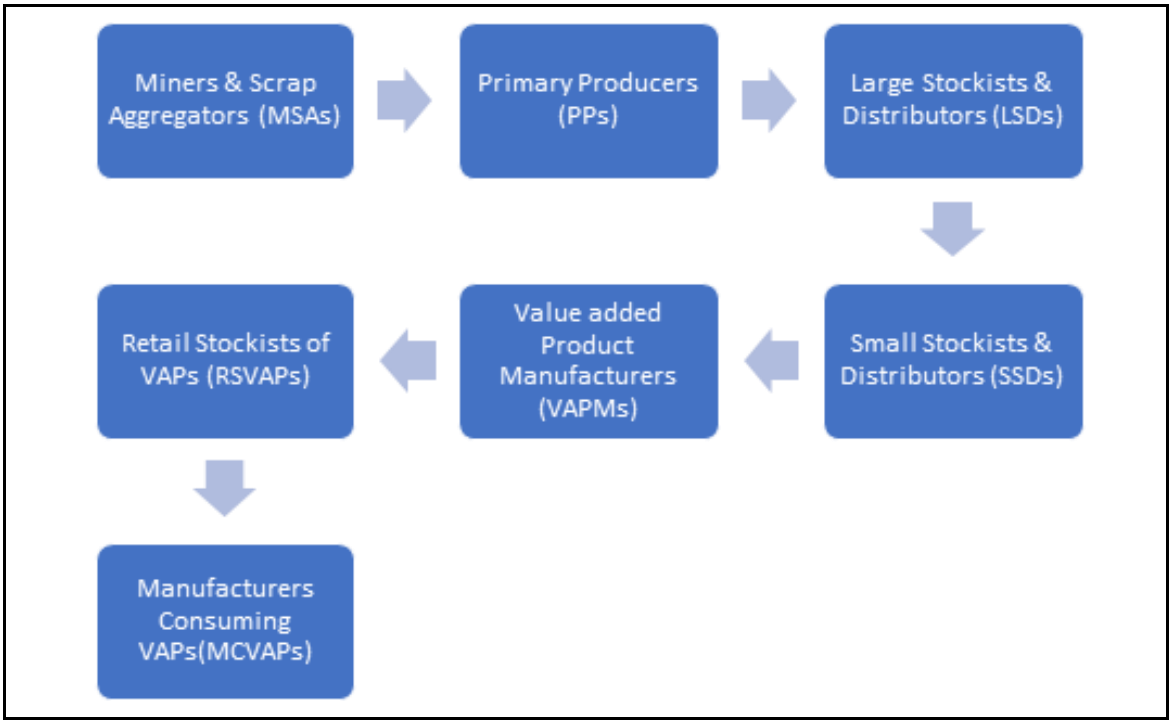
import duties of base metals, IGST, and antidumping duties related case studies, but could not add value regarding, hedging, reference prices, why the players do not choose MCX, how the players in their industry segment are hedging or managing their commodity price risk etc. A few of association members were extremely top-level corporate executives, who would not entertain us, because we do not have any authorisation from the government or industry association, that is seeking this survey or interview. Yet we managed to get references of their past office bearers and interviewed them.

7.3 Structure of the Value Chain of Base Metal Sector in India

The base metal sector of India has Miners and Scrap aggregators (MSAs), Refiners, and Smelters and the producers of Primary Producers (PPs) like ingots, cathodes, rods, wires, billets, sheets etc.. at primal end. Manufacturers Consuming Value Added Products (MCVAPs), like automotive companies, construction, utilities, electric appliances, batteries, consumer durables, packaging and pharma companies, at the distal end. At the primary end of the value chain NMDC, National Aluminium Company Limited (NALCO), HINDALCO, VEDANTA, JINDAL Group are the major players who either mine, import, refine, or produce the virgin primary products. There is a reasonable number of scrap recyclers who also produce the primary products. Later these products are distributed downstream by Consignment Agents, MOU Traders, who are the Large Stockists and Distributors (LSDs). Below them in the chain are relatively Small Stockists and Distributors (SSDs), in various major cities. Below the SSDs the value chain comprises of a large fragmented MSMEs (VAPMs) registered as unlimited companies, partnerships or sole proprietors, who do customised extrusions, profiles, and manufacture various other value-added products to be consumed by the MCVAPs. These value-added products are either standardised or customised. The standardised value-added products enter into the retail segment through the Retail Stockists of Value Added Products (RSVAPs), which are located in the various cities and towns across the country. The customised products are directly sent to the final consuming industries, as mentioned above. The RSVAPs cater to the needs of household or institutional maintenance related orders coming through technicians and contractors. See Fig 31.

The producers of primary products and the end consumption industries are more organised and large in size, the middle segment of value-added manufacturers is in varied forms and scale of operations. This structure provides the pricing power to the few primary producers, who dictate the price of the base metals. They maintain import parity prices in India, pegged to London Metal Exchange. At the same time, there is also a strong buying power at the distal end with the MCVAPs. The VAPMs in between are squeezed from both sides devoid of any power to price and are to be satisfied bargaining or negotiating for their fabrication charges.

Figure 31: The Value Chain Partners and the flow of metal in the Base Metal Sector



Source: Created by the Authors based on data from Survey

This structure is important from the perspective of risk management and hedging. International research literature suggests that large companies, with more liquidity and robust margins can pay for hedging. On the other hand, small companies operating with thin margins, lack of skill, and meagre financial resources would not be able to hedge and hence be the worst affected for even minor changes in commodity prices. Therefore the structure of base metal industry in India suggests that hedging of commodity price risk would be prevalent amongst the PPs and MCVAPs.

Theoretically, PPs would benefit from an increasing trend in prices of base metals, and would use their power to alter supplies and inventory, therefore would not need hedging, though they maintain inventory. However, they should hedge to protect themselves against price volatility in the short and medium term (1-2 years), just in case the prices fall down to a level below their cost of production.

Similarly, LSDs would also benefit from an increasing trend in prices and need to hedge short term (upto 1 year) volatility. Provided they adopt a strategy of maintaining inventory and are confident that their spending on warehousing and financing the inventory would be recovered from the price increases. However, LSDs or SSDs that maintain zero inventory benefit mainly from the bid-ask spread and volumes. Due to their strategy of "Back to Back Booking" they often quote a price to their customers based on the price they can acquire. Such LSDs would not benefit from hedging.

VAPMs neither have buyers' nor sellers' power, and therefore have a definite need to manage their commodity price risk. Hedging is needed more when they cannot pass on the risk to downstream players or use the price variation clause effectively or make to order a highly customised product. Their hedging horizons would be short term, upto 6 months, to take care of risk in orders in the pipeline; on bids without inventory on hand; or for long term orders with staggered delivery.

RSVAPs should technically hedge considering that they carry inventory of multiple forms of the value-added base metal products. But considering their size of operations, lack of expertise, access, and cost of hedging, they would shy away from hedging and satisfice with price averaging technique or marking up their selling prices.

> *"Back-to-Back Hedging Strategy" is misconceived by market players. The Bid and Ask spreads on commodity prices do not offset each other over long time.*
>
> ***– A Commodity Risk Management Consultant***

MCVAPs again should take a long-term view and consider hedging for longer terms, as they would not be able to alter their final product price – on a regular basis - in tune with the volatility of the prices of base metals used as inputs. However, this cannot be applicable to

every MCVAP. Wherever, the weight of base metals is quite low in their branded, highly value added and transformed product, such volatilities would be insignificant. The price risk would be comfortably absorbed through the markup of their final product prices, hedging would not be preferred due to its additional cost.

The above are the expected hedging strategies based on theories. These theoretical justifications would be verified with the responses of the firms being interviewed as part of this research.

Table 44: Category wise Respondent Firms

Value Chain Partner	Number of Firms
LSD	6%
MCVAP	11%
MSA	1%
PP	13%
RSVAP	6%
SSD	22%
VAPM	30%
AL&E	11%

Source: Calculated by the Authors based on data from Survey

Table No. 44 above depicts the distribution of respondent firms according to their position in the value chain. Where AL&E means Association Leaders and Experts.

Table 45 below shows the number of respondent firms we contacted according to the kind of product they manufacture or deal. This classification can generate insight by verifying theoretical expectation about their hedging practice and the practices in vogue. Typically, we believe that **firms making-to-order a customised product might not have significant commodity price risk, because they can include the volatility in their mark-ups,** and they also do not have to maintain inventory of the finished product. They buy the raw material at the price they locked in their costing of the orders. **Making to order a standardised product does not give the same advantage**, because there **may be many other players**

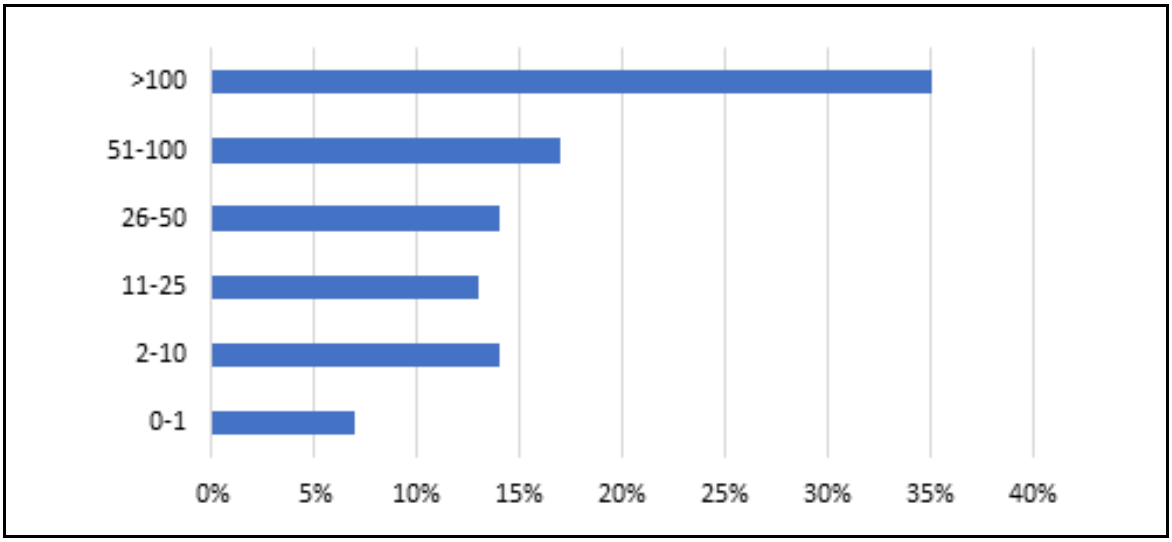
who can provide the same, hence markup in their costing might not work, so we need to understand what do they do? **Making to stock a standardised product potentially has the highest commodity price risk among the three types,** because the firms need to anticipate demand, compete with or without an advantage of a brand, and then carry inventory. Therefore, **markup on cost cannot be a natural commodity price risk mitigating method. This is** because if any other major player/s engage in hedging, then they can offer stiff price-based competition.

Table 45: Product Wise Composition of Respondent Firms

Nature of Product	Respondents
Order-Customised	18%
Oder-Customised, Order-Standardised	6%
Oder-Customised, Stock-Standardised	21%
Order-Customised, Order Standardised, Stock-Standardised	3%
Oder-Standardised	17%
Stock-Standardised	29%
Stock-Standardised, Order-Standardised	6%

Source: Calculated by the Authors based on data from Survey

Figure 32: Turnover Wise Composition of Respondents (Turnover in Crores of Rs.)

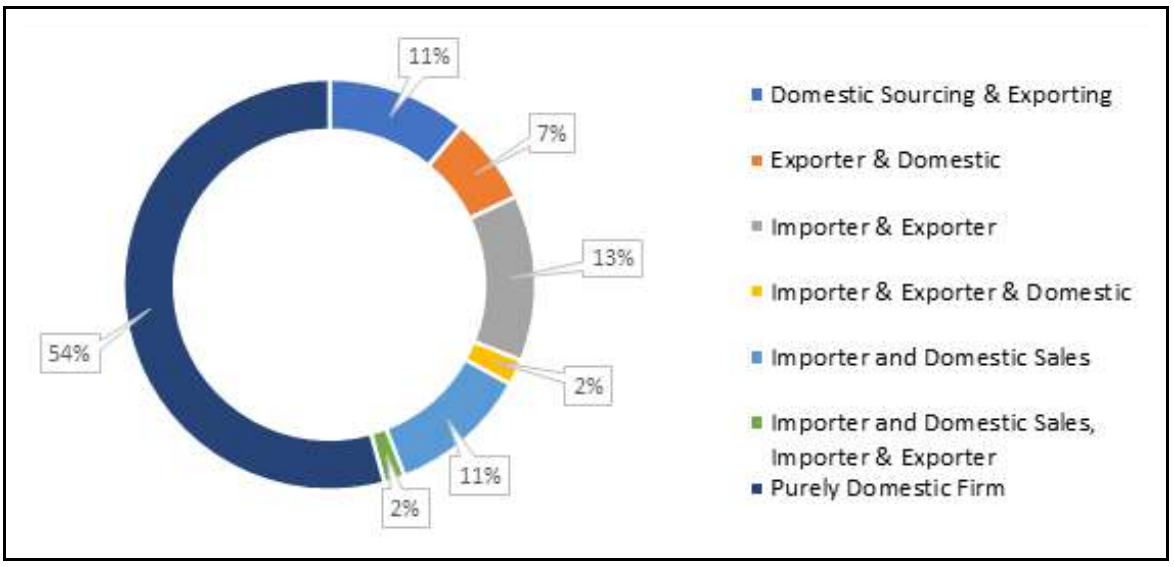


Source: Visualised by the Authors based on data from Survey

Our survey **included firms of varying turnover, to capture the effect of scale of operations and indirectly the ability to hedge**. Scale of operations also defines the quantum of exposure of the firm.

Figure 32 shows the turnover wise distribution of respondent firms. Around 35% of the firms' interviewed have > 100 crores annual revenue, another 18% are in the range of Rupees 50 to 100 crores annual turnover. Overall, 50% of the sample comprises of firms with large size revenues, and the rest of the fifty percentage belong to less than Rupees 50 crores revenue. The respondents of Rupees 2 crores to 10 crores revenue segment have most of the RSVAPs.

Figure 33: International Orientation of Respondent Firms

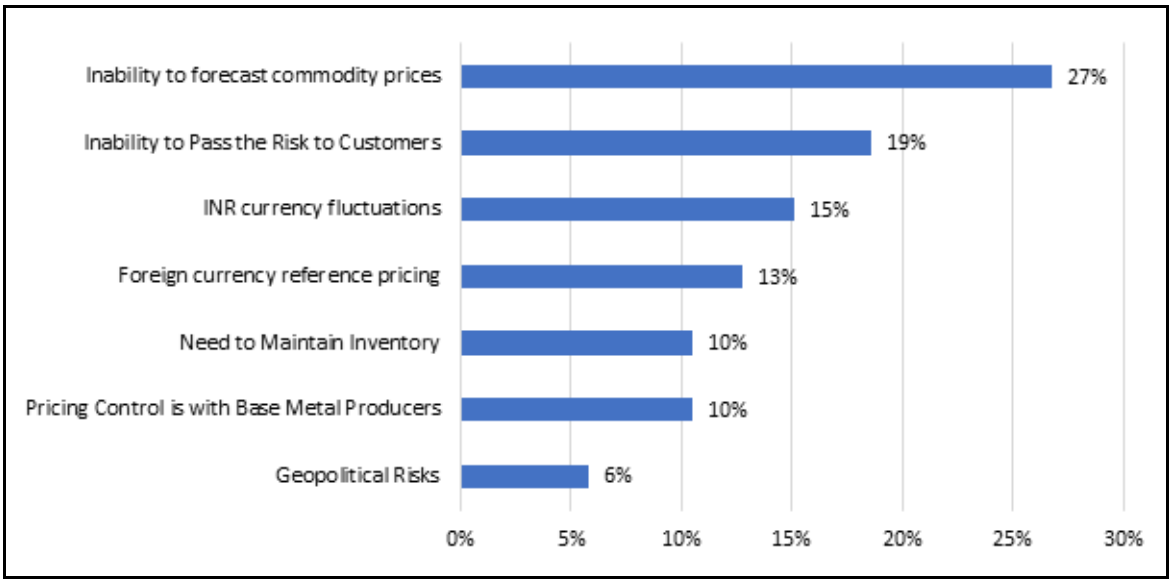


Source: Visualisation by the Authors based on data from Survey

Figure 33 shows international orientation wise distribution of the respondent firms. A **pure domestic firm and a firm engaged in international business are different** when it comes to **facing commodity price risks**. Their foreign currency reference **prices, the risk of conversion at volatile currency rates, geo-political tensions, regulatory and accounting compliances make international business firms more vulnerable** than purely domestic ones. **International firms also have ability to charge higher profit margins**, and in case they can source their commodities for a lower local price, they can add further profits. Our Survey captures firms with varying degree of international business orientation.

7.4 Factors causing Commodity Price Risk

Figure 34: Cause of Commodity Price Risk



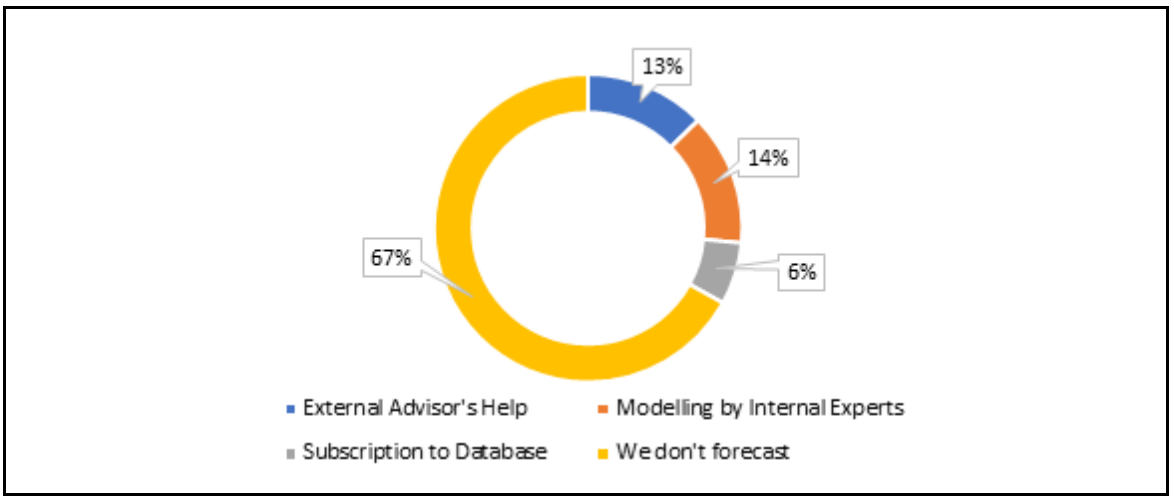
Source: Visualisation by the Authors based on data from Survey

Figure 34 shows that **Inability to forecast commodity prices is the most often reported cause** of commodity risk, **followed by inability to pass the price risk** to the customers in the downstream. **Foreign currency reference pricing** and hence INR currency fluctuations **feature as the third major cause** of commodity risk. There was **unanimity amongst the respondents about the absence of any pricing rivalry amongst the base metal producers**. The respondents felt that there is more of a cartel pricing dynamic. There is a **price stranglehold by few large smelters** and refiners in the upstream, who follow Import parity pricing. Therefore, their advantages of low cost of production does not pass on to the downstream players.

While **"inability to pass on the risk"** and **"need to maintain inventory"** depend on the type of firm and type of product, hedging can help resolve this. **"Foreign currency reference pricing" and "price control by base metal producers"** cannot be resolved due to the import parity pricing followed by the base metals miners, importers, refiners and smelters. Similarly global demand and supply factors and "black swan type geopolitical shocks" are bound to exist. If the USD/INR fluctuations seem to be the major cause, then firms would hedge the currency risk, rather than commodity price risk. **"Inability to forecast**

commodity prices" gives hope to commodity derivative markets. **Highly liquid commodity derivative markets and long dated contracts can address this aspect of the industry, by given an unbiased forecasted future price of commodities.**

Figure 35: Firms & Price Forecasting

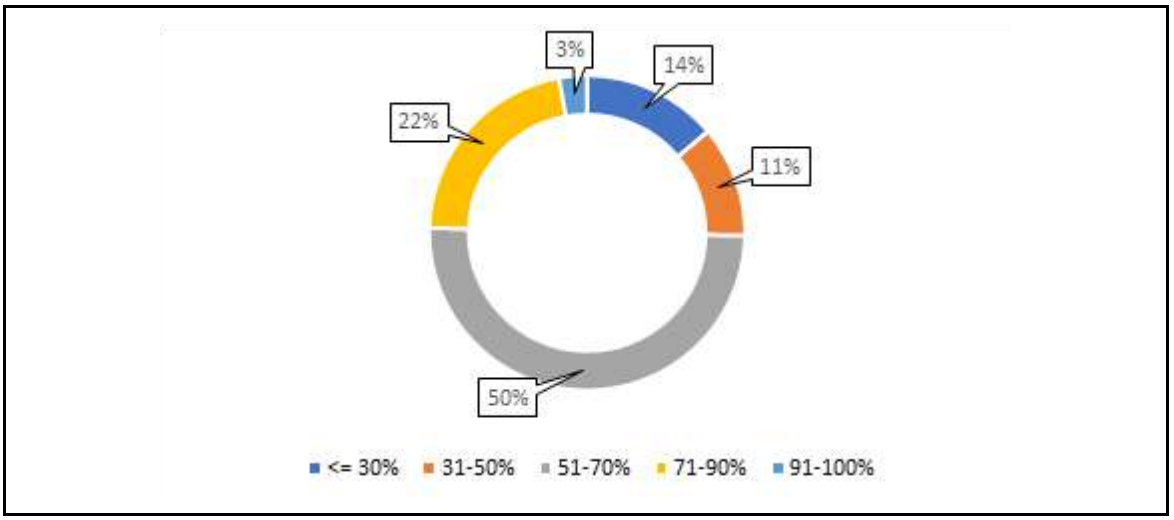


Source: Visualisation by the Authors based on data from Survey

> *"We do not believe anyone who comes to us saying we will predict metal prices for you"*
>
> **– a seasoned MSME or sub-contracting company, which exports value adds**

We asked **two other related questions** to find out **"whether the firms engage in forecasting", if so, then "their forecasting accuracy levels", and "whether they knew that commodity futures prices are relatively good unbiased predictors of expected spot prices in future".** Figure 35 shows that 67% of the firms contacted do not attempt to forecast commodity prices, but 33% of them do undertake some kind of forecasting or take a view about future, with either internal models or advice from others. Respondents opine that **it is a sellers' market, therefore it is not advisable to attempt forecasting of commodity prices, because prices are not dependent on any demand and supply model**. Further the **inventory visibility is also very poor in India,** whether it is either through exchanges or the suppliers. This does not provide any handle to estimate the likely demand supply and gap to feed into forecasting exercises. *If one has a view about future and if that is unfavourable then logically steps will be taken to mitigate the related risk.*

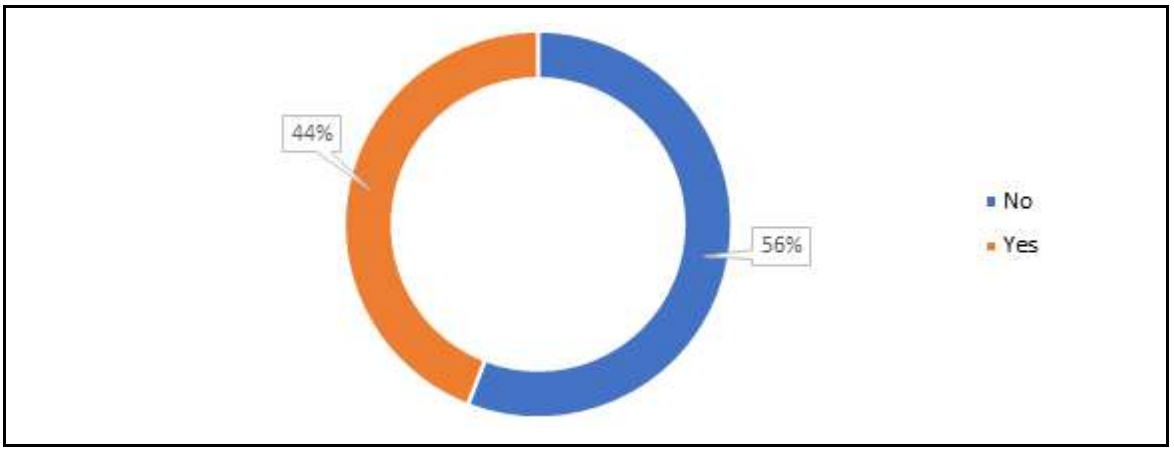
Figure 36: Forecasting Accuracy



Source: Visualisation by the Authors based on data from Survey

Figure 36 shows the accuracy of forecasting commodity prices either by the firms themselves or a third party, or based on a belief that any professional could predict. **75% of the respondent firms feel that the predictive accuracy can be above 50%.** *This indicates that majority of the firms feel that commodity price forecasts can provide atleast a base case of future prices.*

Figure 37: Futures as Best Predictors of Spot



Source: Visualisation by the Authors based on data from Survey

Figure 37 shows that there is **considerable ignorance about the concept of future's prices** and the often promoted "price discovery" aspect of futures markets. **56% do not know about the predictive accuracy of futures price.** Neither do they monitor them too. There is some confusion regarding the "price of futures contract" that is currently available and

the "spot price". While the suppliers, who are traders, might be making some adjustment to ongoing futures price by deducting the estimated contango charge to bring it to expected spot, the buyers are not clear about this.

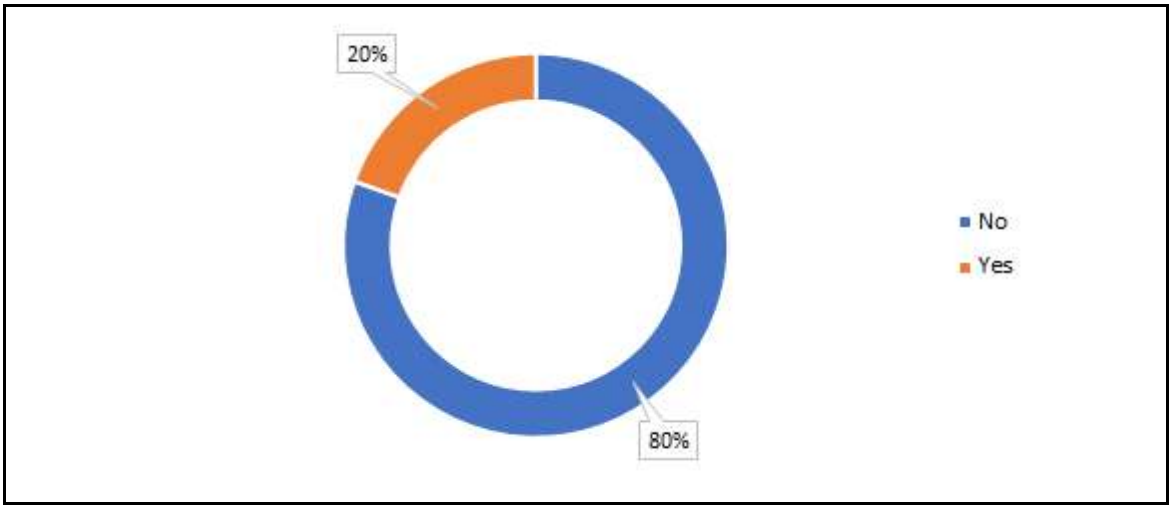
> *"Yes Yes! I monitor the Spot Prices (Showing the one month futures price of an exchange on the mobile)*
>
> **– Managing Director of a copper wire rod manufacturer company**

This indicates that there is need to educate and build awareness amongst the decision makers (the purchase and finance managers) about the importance of monitoring commodity futures prices of any liquid exchange they choose. Regular following of derivative markets slowly builds the confidence to consider derivative hedging in future.

7.5 Futures and Spot Price Convergence at Maturity

The respondent firms seem to be **very clear about the non-convergence of futures prices and spot prices** on the date of maturity (Figure 38). **80% of them feel that the prices do not converge**. Our Chapter 4 on Empirical Analysis also shows that futures and spot prices on MCX do not converge. While it is still a matter of doubt, whether the respondents have done some analysis and then have found this non-convergence or have reported based on the discussions in the peer circles or based on few instances they faced.

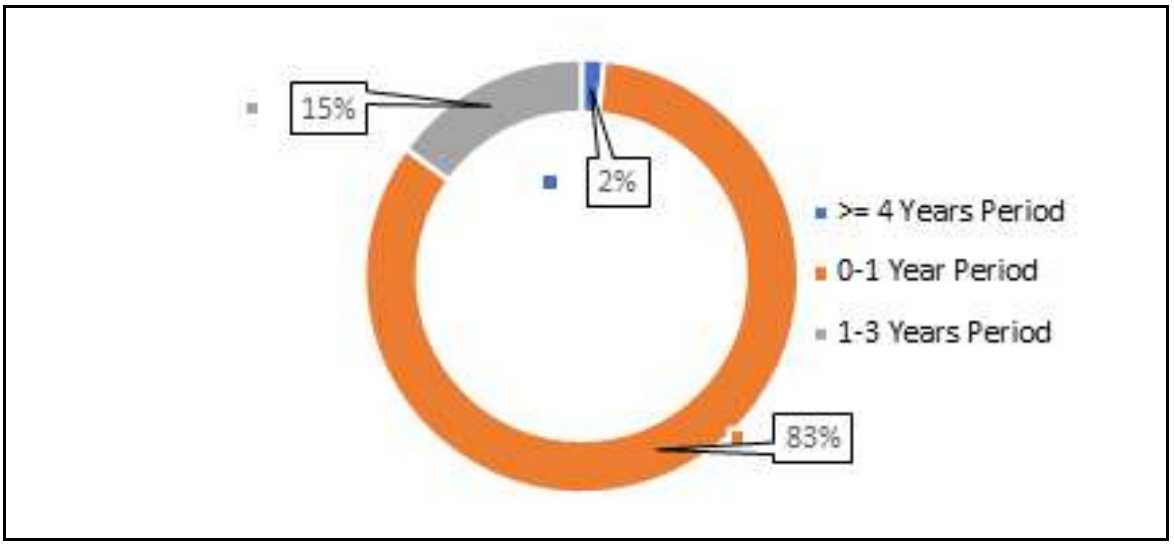
Figure 38: Futures and Spot Prices Converge at Maturity



Source: Visualisation by the Authors based on data from Survey

7.6 Duration of Commodity Price Risk

Figure 39: Commodity Price Risk Horizon



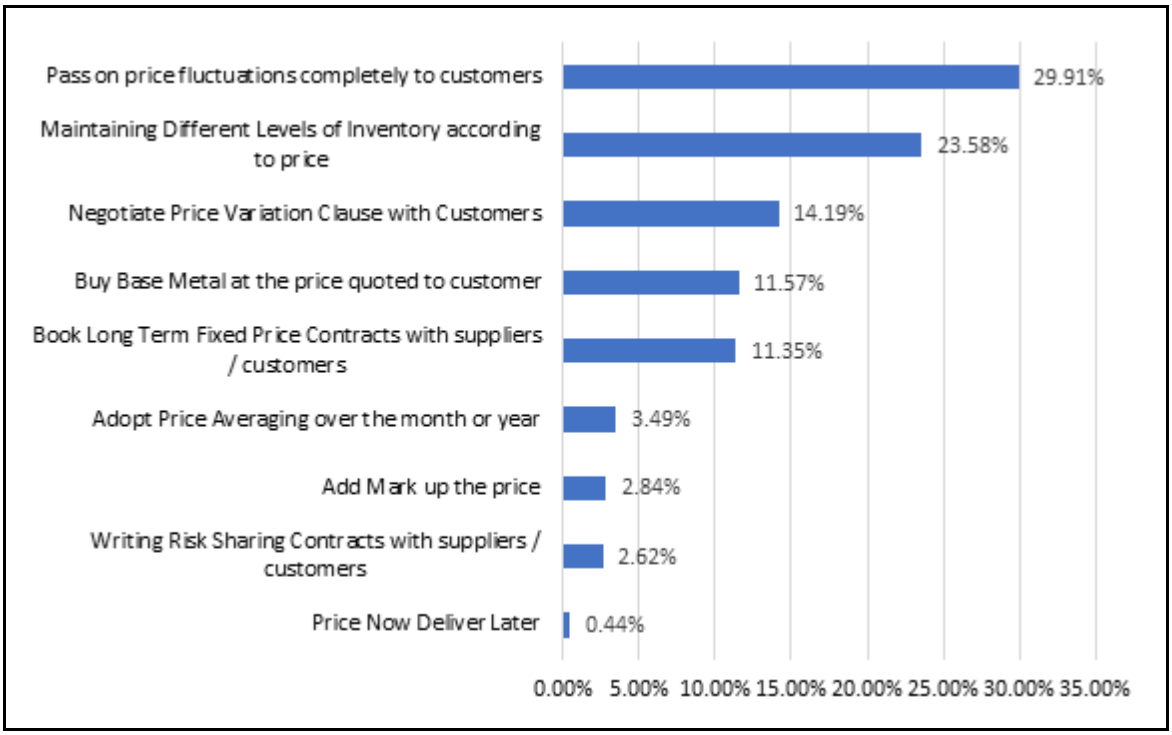
Source: Visualisation by the Authors based on data from Survey

Figure 39 shows that **most of the firms,** that responded, **consider that commodity price risk** hits them adversely **only in the short term**, that is within a period of 1 year. This may be due to their operating cycle; customer's order to their delivery time; their inventory holding period; or a fixed price contract negotiated by the customer with staggered delivery. There are a few exceptions to this generalised trend. Firms with longer gestation fixed price contracts, where raw material is procured in a staggered manner, perceive commodity price risk beyond the 1-year period, upto 2 years. These are sub-contractors to EPC companies or their subsidiaries.

Customers of equipments, tools, and auto component firms negotiate a 1-year fixed price contract, based on the average prices of the previous year. These types of contracts have price variation clauses, but with threshold percentage price changes ranging from 5 – 10%. In base metals with high price volatility, like Copper and Zinc, the quoted price to a customer has a time validity of around 1 week. Failing to fix the deal in a week, the price is renegotiated. *This indicates that most of the firms would prefer to hedge themselves for a maximum period of upto 1 year and try to renegotiate their prices at regular intervals.*

7.7 Managing Commodity Price Risk without the Use Derivatives

Figure 40: Commodity Price Risk Management Techniques



Source: Visualisation by the Authors based on data from Survey

Figure 40 shows the various risk management techniques adopted by the Indian firms that responded. **"Passing on the risk completely to the customers"** is the **most popular approach**, adopted by **RSVAPs, LSDs, SSDs and some of the VAPMs who make unique customised product to order**. In this case there is complete pass through of the commodity price risk. **VAPMs which are making standardised products or are sub-contractors to large MCVAPs, negotiate "Price Variation Clauses".** This technique offers some degree of protection, **but still leaves residual risk for price changes beyond 5 – 10%** . **"Managing different level of Inventory" is adopted by the RSVAPs, LSDs, SSDs and some VAPMs, who have a loyal customer base and a sales pipeline visibility** of upto 1 to 2 years (like alloy wheel manufacturers, auto component manufacturers, transformer, switch gear manufacturers). This approach is constrained by the availability of storage space, and cost financing. Another improvisation which LSDs, SSDs and some VAPMs have devised is to enter a **"long term quantity-based contracts with their suppliers",** with the freedom to choose the pricing and delivery according to

favourable times in the market **(Deliver Now Price Later).** "**Buying base metal at the same price that is factored into the cost"** is amenable for large VAPMs that have relatively lower proportion of base metals entering the final product. **MCVAPs who are into manufacturing of consumer durables, automobiles, packaging, or pharmaceuticals,** which are essentially B2C kind of products, engage in **"markup adjustments"** to absorb the price volatility of inputs.

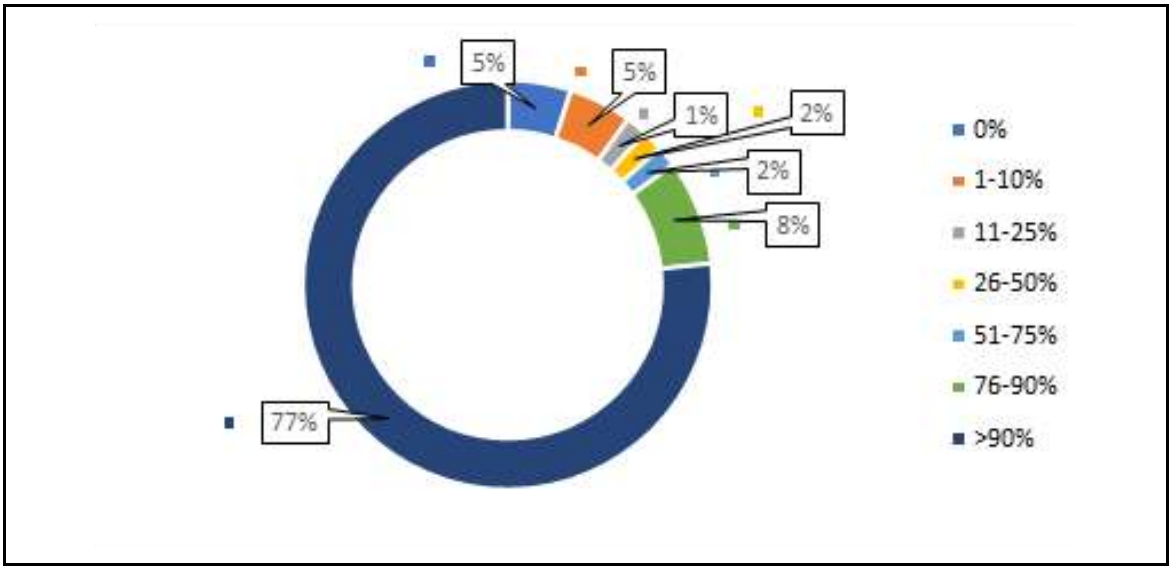
Price Variation Clause (PVC) is available in government contracts, and that too due to the lobbying power of the industry associations. Contracts with **private entities do not provide this protection**, leading to commodity price risk. The significant time lag between the order, delivery, and final cash receipt from customers adds to the problems. Business-to-Business contracts are always negotiated with **PVCs** and Business-to-Customer with **price markups**, to absorb the historical volatility of commodity prices. **Risk Sharing Contracts** also use PVC, where the price is adjusted upward or downward only when it crosses the threshold of 5 to 10%. Associations of manufacturers bring the entire supply chain on an accepted reference price and everyone follows that de-facto standard. For instance in the transformer industry LME price is the reference price. Having a common reference price also helps forecasting or taking a view about the futures price movements.

Long-term quantity-based contracts, without price indication, are in vogue with suppliers of primary form of base metals. In some cases, the production schedule is also shared by the VAPMs. **Price is crystallised on the date of dispatch** whenever it materialises. This provides the necessary handle to the suppliers to hedge, and also to pass on some price discounts to the VAPMs.

Use of **previous month or quarter's average price** is prevalent in the transactions between the VAPMs and MCVAPs, where the base metals' price is not very volatile. Further the price for reference could be either the "**Cash Settlement Price" of "Spot Price" of LME** in majority of the cases, or MCX in few cases. Urgency for delivery and regular transactions has created this convention. Firms which have the practice of preparing budgets use these historical average prices with an increase of 5% to 10% for the coming period.

This finding has lot of significance for use of derivatives products for hedging the commodity price risk. Best practices of ***risk management recommend the use of derivatives only to manage the residual risks****, that are leftover, after adopting operational techniques. This is because hedging entails costs and upfront fees. Therefore, firms should find value in hedging that is more than using the above cost-free techniques****. Barring, the complete pass-through technique*** *adopted by the respondent firms,* ***every other technique discussed above leaves residual commodity price risk*** *to the firms. Therefore, there is strong reason why these firms should consider hedging.*

Figure 41: Suppliers' Pass-Through



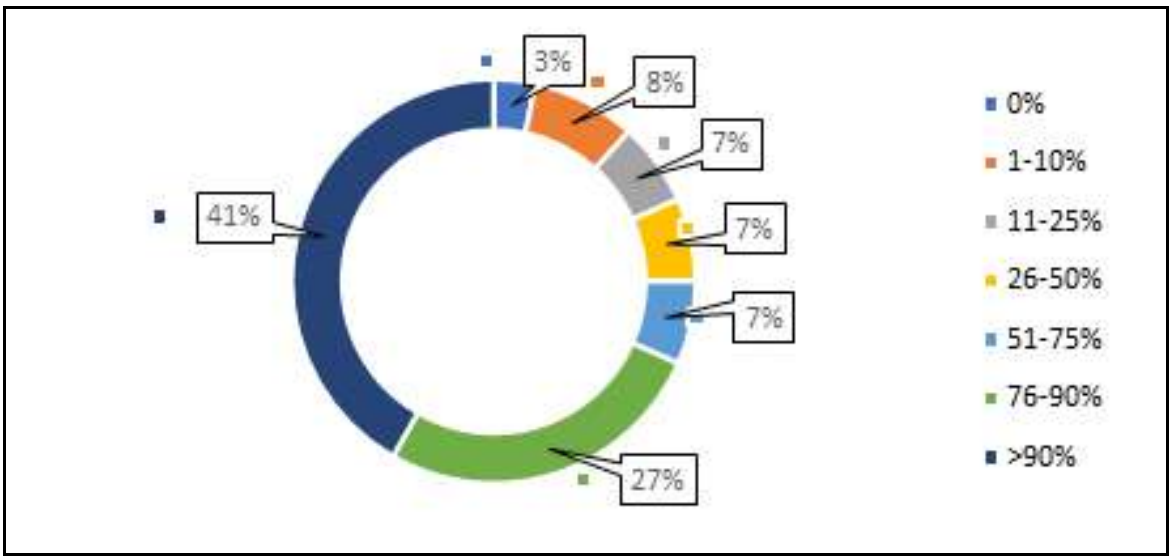
Source: Visualisation by the Authors based on data from Survey

> *"If cost of my base metal increases by 5%, then my profits will go down by 1.5%".*
>
> **– Managing Director of a Medium Size Private Limited Manufacturing Transformers**
>
> *If we put it differently it also means that if cost of hedging is around 1.5%, then it is as good as not hedging.*

Then we examined how much do the suppliers pass-through the commodity price fluctuations and how much do the firms pass-through to their customers. Figure 41 shows that **85% of the respondent firms reported that their supplier passes more 75%** of the commodity price changes on to them, of which **77% say more than 90% is passed on to them.** Only 10% of the respondent firms reported that their supplier absorbs around

90% of the price change and passes only about 10%. PPs, LSDs, and SSDs pass on a significant proportion of price changes to the firms in the downstream. These are the firms which feature in the 41% sector in Figure 42 which talks about pass-through to customers.

Figure 42: Pass-Through to Customers

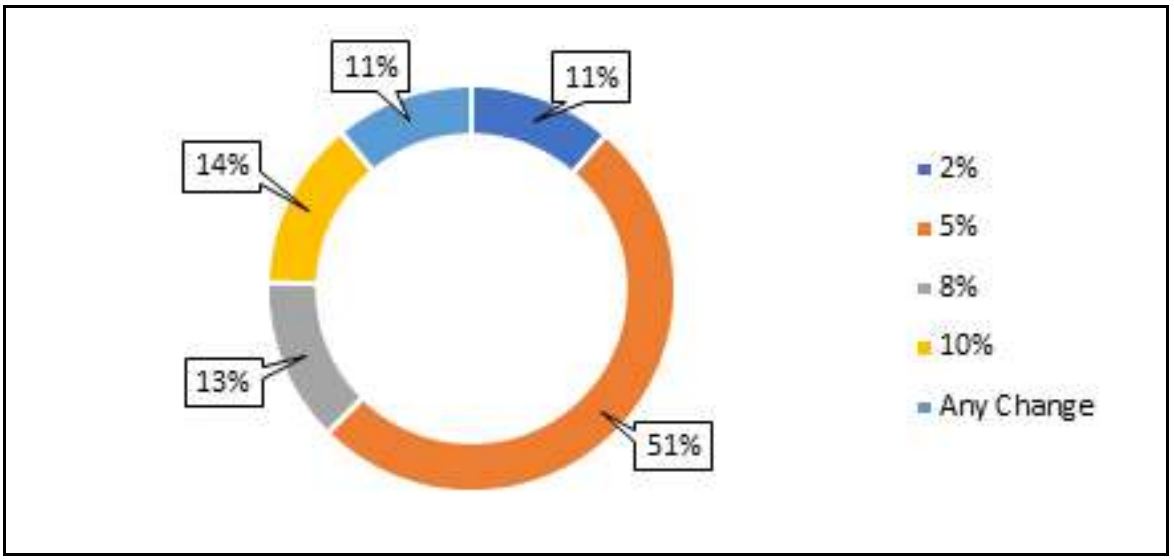


Source: Visualisation by the Authors based on data from Survey

VAPMs are unable to pass on the entire price change to the MCVAPs and hence they negotiate using a price variation clause. This is the reason for relatively heavier category wise distribution in Figure 42 compared to Figure 41, which is relatively more dichotomous. When we use the term "pass-through" it means that the suppliers are passing both price increases and decreases to their downstream customers. In most of the cases their terms of sale are "cash and carry", with occasional credit, for long standing customers.

Because of this finding, we expect there should be a ***need for hedging across the value chain,*** *because* ***PPs, LSDs, SSDs should hedge to protect against falling prices, and manufacturers should hedge to protect themselves from both increasing and falling prices, because their pass-through ability is not 100%*** *and the price variation clauses are not protecting them fully.* ***Atleast, 60% of the respondents contacted are bearing a minimum of 25% of commodity prices changes.*** *The scene of PPs, and LSDs, SSDs suggests directional hedging, that is to hedge when the prices fall, and the MCVAPs should engage in partial hedging because some portion of the price change will be compensated by price variation clause.*

Figure 43: Price Change that Hurts



Source: Visualisation by the Authors based on data from Survey

When the responding firms were quite clear about the pass-through, we wanted to cross verify what percentage change in price of the commodity can hurt them. Figure 43 shows that **51% of the responding firms feel that they are hurt when the price change is beyond 5%. Another 27% of the respondents get hurt only when the range of price change is between 8-10%.**

Few respondents from transformer industry, provide a thumb rule that a 5% increase in copper prices will decrease their profit margin by 1.5%.

*This has implication of the kind of profit mark up or risk tolerance they have built into the business. Either they might be feeling that one cannot reduce the commodity price risk to zero and hence this residual should be taken as part of their business, or they are confident that their customers would not object paying for the same. The **28% of the respondents who feel that any change can hurt them, are those who are operating with wafer thin margins,** like traders and sub-contracting companies.*

The empirical chapter of this report shows the variation in the average price changes across the five base metals and across various time periods. The following tables 46-49 summarise the same.

Table 46: Average Spot Price Changes on LME for various Time Horizons in Percentage (2006-3'2019)

Descriptive	LMCOPSPOT	LMALUSPOT	LMZINSPOT	LMLEDSPOT	LMNICSPOT
Monthly mean	0.44	0.03	0.45	0.77	0.46
Quarterly mean	1.65	0.13	1.23	2.60	1.31
Yearly mean	7.56	-0.91	4.05	9.94	-2.64

Source: Calculated by the Authors based on data from Survey

Table 47: Average Spot Price Changes on MCX for various Time Horizons in Percentage (2006-3'2019)

Descriptive	MCXCOPSPOT	MCXALUSPOT	MCXZINSPOT	MCXLEDSPOT	MCXNICSPOT
Monthly mean	0.68	0.38	0.70	1.04	0.62
Quarterly mean	2.34	1.13	1.99	3.39	2.09
Yearly mean	10.16	2.14	7.55	12.43	-1.10

Source: Calculated by the Authors based on data from Survey

Table 48: Average Spot Price Changes on LME for various Time Horizons in Percentage (4'2019-2024)

Descriptive	LMCOPSPOT	LMALUSPOT	LMZINSPOT	LMLEDSPOT	LMNICSPOT
Monthly mean	0.65	0.57	0.10	0.21	0.89
Quarterly mean	2.04	1.98	0.16	0.59	3.87
Yearly mean	8.43	6.44	2.67	0.78	14.55

Source: Calculated by the Authors based on data from Survey

Table 49: Average Spot Price Changes on MCX for various Time Horizons in Percentage (4'2019 – 2024)

Descriptive	MCXCOPSPOT	MCXALUSPOT	MCXZINSPOT	MCXLEDSPOT	MCXNICSPOT
Monthly mean	1.07	0.72	0.41	0.63	1.17
Quarterly mean	3.21	2.44	1.20	1.73	4.28
Yearly mean	13	11.33	7.32	6.46	21.06

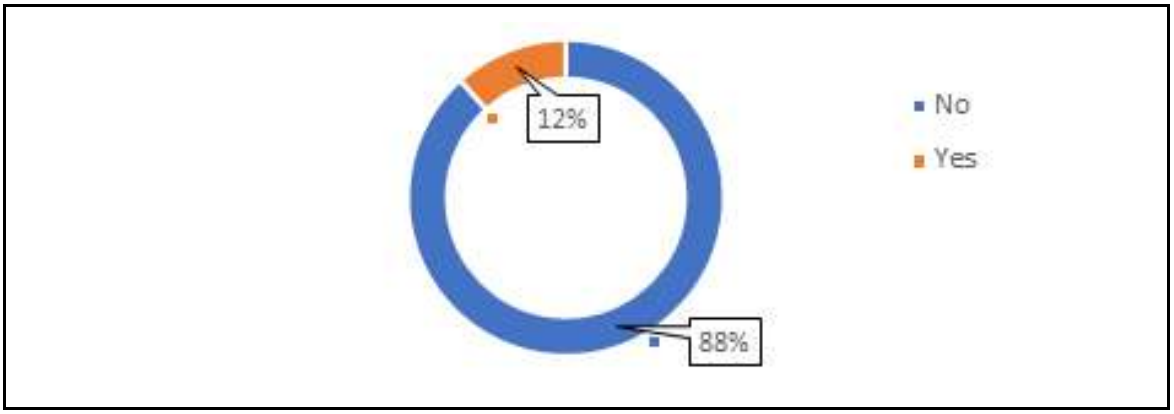
Source: Calculated by the Authors based on data from Survey

A key insight emerges when we combine the actual percentage changes and the responses of our survey, regarding the threshold percentage that hurts the value chain players. Majority of the respondents feel that 5% price change hurts them. And we can

see that the 18-year average monthly and quarterly percentage change in commodity prices have been less than 5%. Only the yearly changes have been above 5%. The yearly changes are adjusted as part of their price variation clause negotiations or through mark ups in their pricing. This also might be another reason for majority of the value chain players not preferring to hedge.

7.8 Budgeted Commodity Price

Figure 44: Budgeted Commodity Price



Source: Visualisation by the Authors based on data from Survey

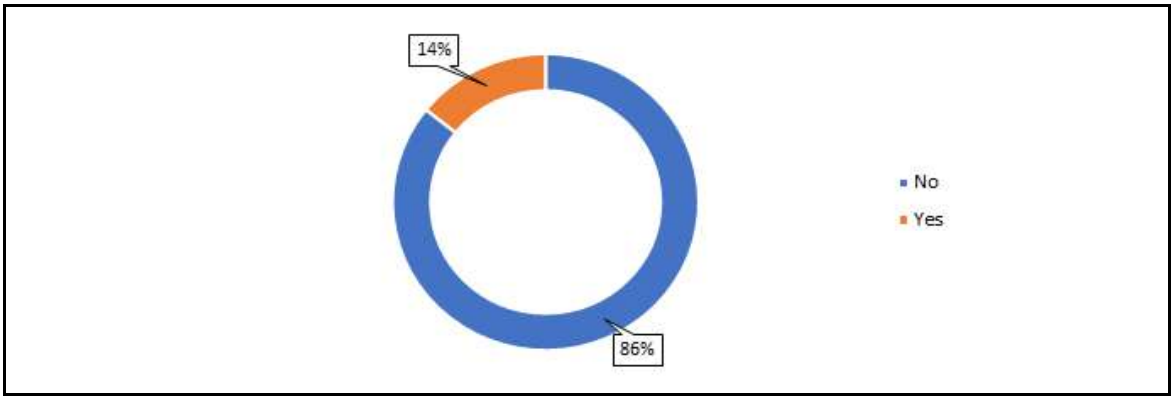
This question naturally followed, to know whether the firms have the practice of **using any budgeted commodity price** in their forecasting exercises. This was important to verify their response on "what percentage change in the commodity price hurts them?". Figure 44 shows **the answer is a resounding "NO".** This is quite intriguing. **How can a firm have a view about a percentage change in commodity prices that hurts them and not have a budgeted commodity price.** *Considering the volatility of the prices of the base metals, the* ***firms contacted*** *considered that,* ***it was not practical to have any budgeted commodity price****. Further,* ***those few firms which had a budgeted rate,*** *it was the* ***last 1 year monthly average price*** *with some* ***arbitrary percentage addition (of around 8-10%).*** *The available Futures price of any exchange was not considered by them to be a good proxy for a budgeted commodity price. Knowledge of budgeted commodity price is essential to convey the intention of a firm to protect itself through some kind of hedging by locking it. This finding is not in contradiction of the techniques which the firms are predominantly using.*

7.9 Hedging Commodity Price Risk Using Derivatives

> *"We consider the previous one-year average prices of Copper and Aluminium and adjust it upwards by 8 % to 10% for our next year budgets for raw material"*
>
> **– General Manager Finance of a branded B2C electrical appliance manufacturing company**

Figure 45 below shows that predominantly the respondent firms do not hedge. The 14% firms who are hedging are traders in base metals, and VAPMs with exports and visibility of sales pipeline beyond 6 months. This finding required a little more understanding of why firms do not hedge, when they are hurt by commodity price fluctuations?

Figure 45: Do Firms Hedge?



Source: Visualisation by the Authors based on data from Survey

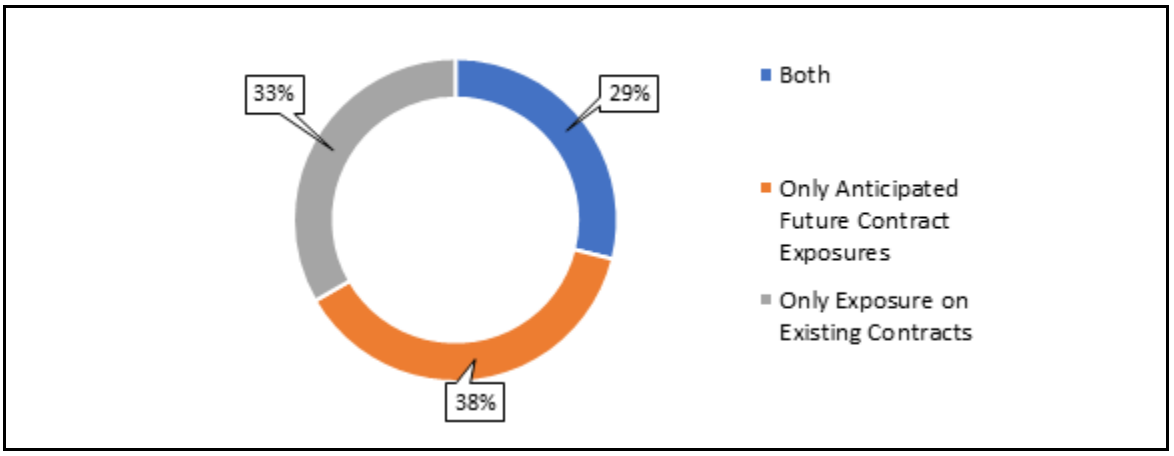
We asked an open-ended question and created an environment for a freewheeling discussion, to extract the various nuances from their answers on "why don't they hedge". The following bullet points are the unique summarised excerpts of the responses that provide key insights. (They are not reproduced verbatim). Some more are in the Appendix: I of this report.

> *Our size and scale of operations is quite small therefore there is no need to hedge*
>
> **– Owner, MSME sub-contracting company**
>
> *We do not have the necessary knowledge and expertise to trade in derivative exchanges. It requires a different department and team of experts regularly monitoring the same.*
>
> **– Procurement manager, medium size exporting company of Aluminium Extrusions**
>
> *Hedging requires physical delivery, but we do not know whether MCX in India provides physical delivery*
>
> **– Managing Director, Lead recycler and traded**

7.10 Respondents' Approach to Hedging- Existing Vs Anticipated Exposure

We asked the firms that hedge about their approach to hedging. Whether they hedge only existing contracted exposure or even the anticipated exposure too. This question was important to understand their level of aggression related to hedging. This insight can be of use to commodity exchanges in assessing demand for various maturities. Based on this exchanges can design long term contracts in case they are not already present. Figure 46 summarises the responses. It appears to be more like a triangular contest. **A third of the companies that hedge, consider both existing and anticipated exposures to hedge, another third hedge only the existing exposures. The rest hedge anticipated exposures.** One of the issues related to existing exposures is that the price is already locked into these, and hence finding an appropriate and accurate hedge would be difficult, thereby dampening the interest of the hedger if a suitable hedge contract is not found. However, in the case of anticipated exposures, there is still freedom w.r.t. to the price and the contract size. As of now the number of hedgers is very small. However, it may increase in future, leading to increased demand for longer term maturity contracts.

Figure 46: What do the Respondents Hedge?

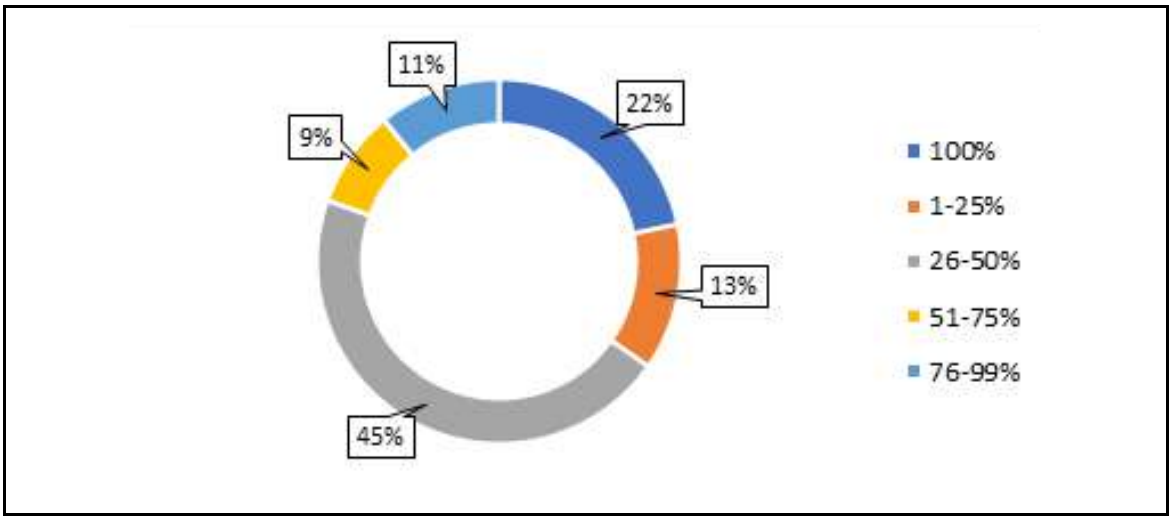


Source: Visualisation by the Authors based on data from Survey

Figure 47 below depicts the responses of the question that followed the one on existing and anticipated exposures. How much of the exposure would the firms hedge? The visualisation shows that only 22% of the hedging firms, take 100% cover. The other 78% of the hedging firms, hedge their underlying exposure upto 25%, 50%, 75% and 99%. A

clear majority of 45% of hedgers cover 50% of their underlying exposure. This aspect has an implication for the commodity exchanges especially when they estimate the volumes that hedgers would bring in. A one-to-one correspondence should not be expected between the annual turnovers or exposures and the hedge contracts in the exchange. It is seen that 78% of the hedging firms would not like to cover 100% of their underlying exposure.

Figure 47: Partial Hedging by Respondent Firms



Source: Visualisation by the Authors based on data from Survey

Table 50: Motivation to Hedge

Motivation	Weighted Score*	Weighted Rank#
Minimising Risk	165	1.89
Gaining	95	2.60
Making Risk Zero	80	2.80
Achieving the Budgeted Price	80	3.04
Long Term Wealth Creation	69	3.13

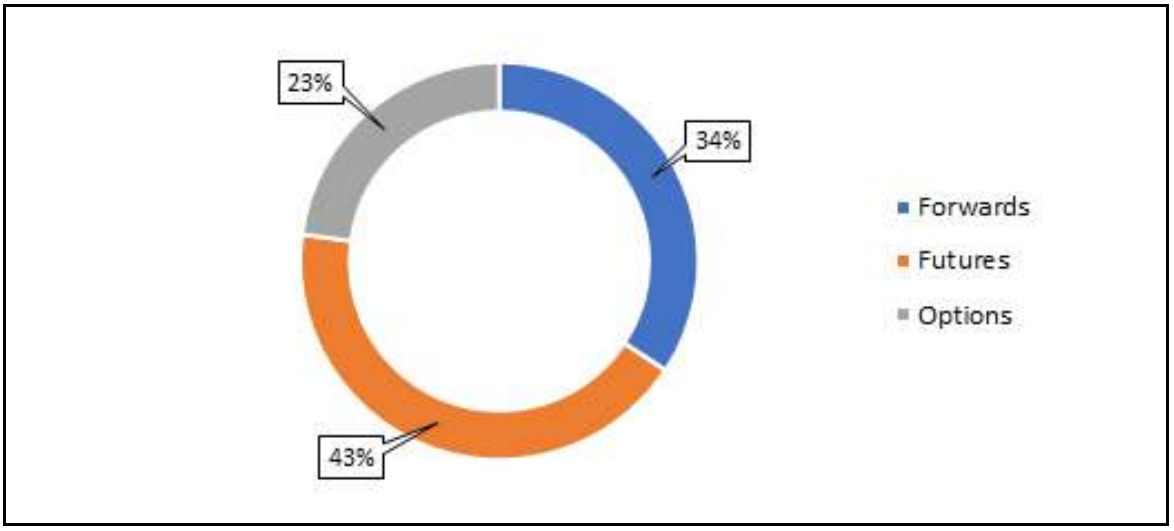
** Weighted Score is a sum product of number of respondents who gave a particular rank to the respective motivation and the score which is assigned to the rank. Rank 1 is given a score of 5, and Rank 2 is given 4 and in the same order Rank 5 is given 1 mark. # Weighted rank is the weighted average rank achieved by a particular motivation, where the weights are the number of respondents who have chosen it.*

Table 50 depicts the responses to the question, "What is your motivation to hedge?". A weighted score shows that "Minimising risk" is the most sought-after objective, followed by "Gaining". Theory clearly states that the objective of hedging should only be minimising risk. However, the respondents have other motivations too. When a value chain player is motivated by gains also, then they would not be satisfied with a no loss no gain hedge, rather they would also explore for speculative gains by selective hedging. A different ranking method did not change the ranking of motivations.

7.11 Choicest Instrument for Derivative Hedging

Figure 48 below clearly shows that 34% of the hedging firms prefer forward contracts, around 43% prefer futures contracts, and 23% prefer Option Contracts. Though explicitly there are no formal outright forward contracts in the Domestic Markets, the respondents have still chosen them. *The firms whom we contacted have reported that there is no formal OTC forward contract in India.*

Figure 48: Choice of Hedging Instrument of Respondent Firms



Source: Visualisation by the Authors based on data from Survey

But the firms due to their long-term relationship with their suppliers of PPs of base metals, devised a home-made forward contract, which is popularly known as PNDL, which means Price Now Deliver Later. Firms which expect increasing price trend, prefer this type of contract. The supplier also charges something extra towards hedging charges.

7.12 Top 5 Factors that Influence Choice of Instrument for Commodity Price Risk Hedging

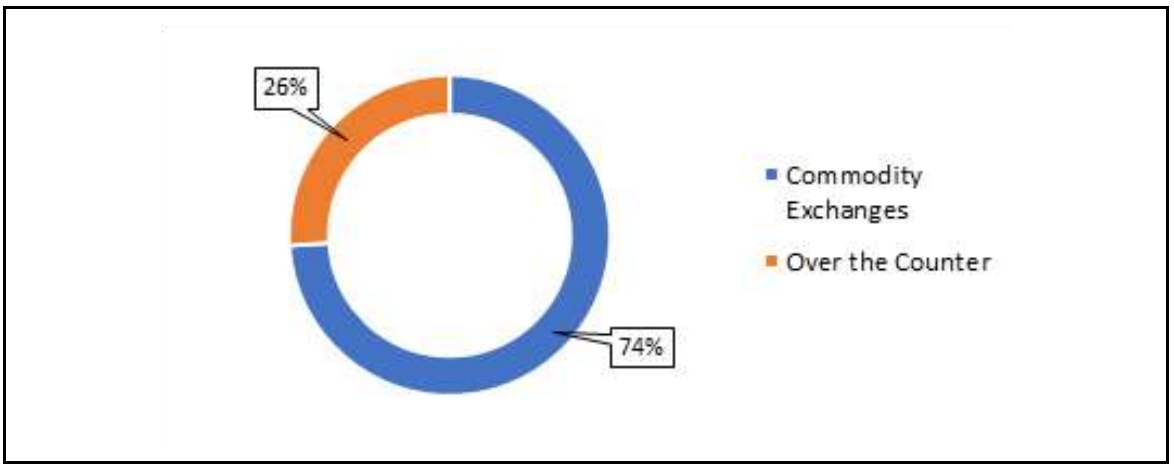
Table 51: Most Preferred features of a commodity price risk Hedging Instrument

Feature	Weighted Score	Feature	Weighted Rank
Ease of Operation	449	Ease of Operation	2.53
All in Cost	311	All in Cost	3.48
Ease of Access	309	Upfront Cost	3.48
Upfront cost	288	Ease of Access	3.53
Delivery Restrictions	269	Upside Potential	3.93
Downside Lockin	202	Delivery Restrictions	4.24
Upside Potential	177	Downside Lockin	4.36
Liquidity in Hand	177	Liquidity in Hand	4.59
Documentation	172	Compliance	4.63
Compliance	166	Financing Cost	4.82
Reporting Requirement	156	Documentation	4.88
Transaction Costs & Tax	128	Disclosure Requirements	5.63
Financing cost	112	Reporting Requirement	5.83
Disclosure Requirements	75	Transaction Costs & Tax	5.86

Table 51 above provides the weighted score of the ranks given by the hedging firms to each of the feature of a hedging instrument. Each factor is given a weighted rank-score, which is calculated as number of respondents who gave “n”th rank, multiplied by a score assigned to that rank. To highlight the importance of first rank, the highest marks 14, (because there are 14 factors) were awarded to it and the marks were awarded in a descending manner till 1. Therefore, say “Upfront Costs” as a factor was ranked ‘1’ by 10 respondents and 2 by 15 respondents, then its score would be (10 * 14) + (15 * 13) = 335. In this manner each factor’s aggregate score is gathered and sorted in the descending order. **“Ease of Operation”, “All in Costs”, “Ease of Access”, “Upfront Costs”, “Delivery Restrictions”** feature to be the top 5 factors in the minds of hedging firms. For calculating

the weighted rank, all the ranks received by a factor were considered and a weighted average rank was calculated, where weights are the number of respondents who chose a particular rank to that factor.

Figure 49: Markets that Respondent Firm Choose to Hedge

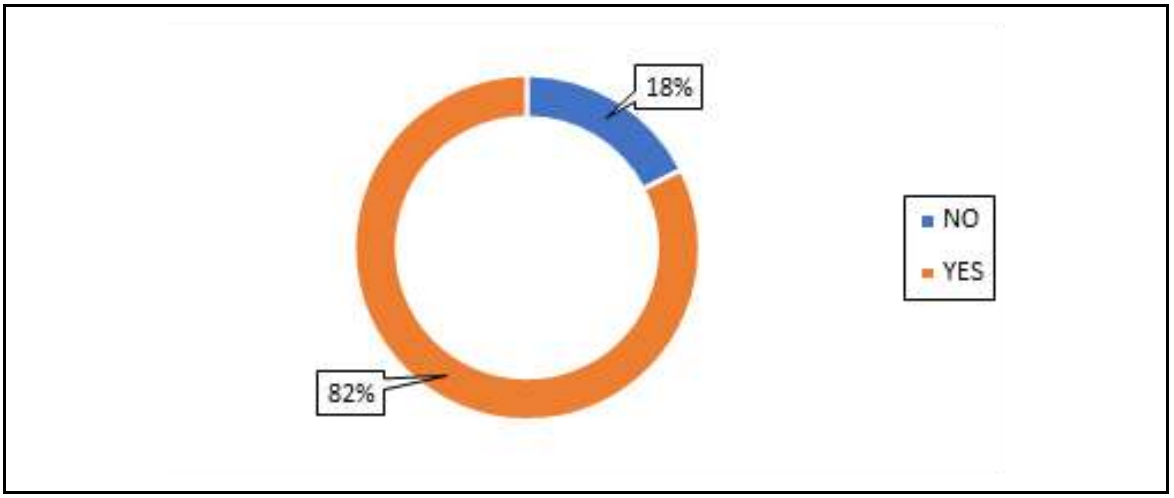


Source: Visualisation by the Authors based on data from Survey

Figure 49 above depicts the preference of hedgers for either over the counter markets or commodity exchanges. 74% of the firms that hedge prefer exchanges for any price direction and hedging.

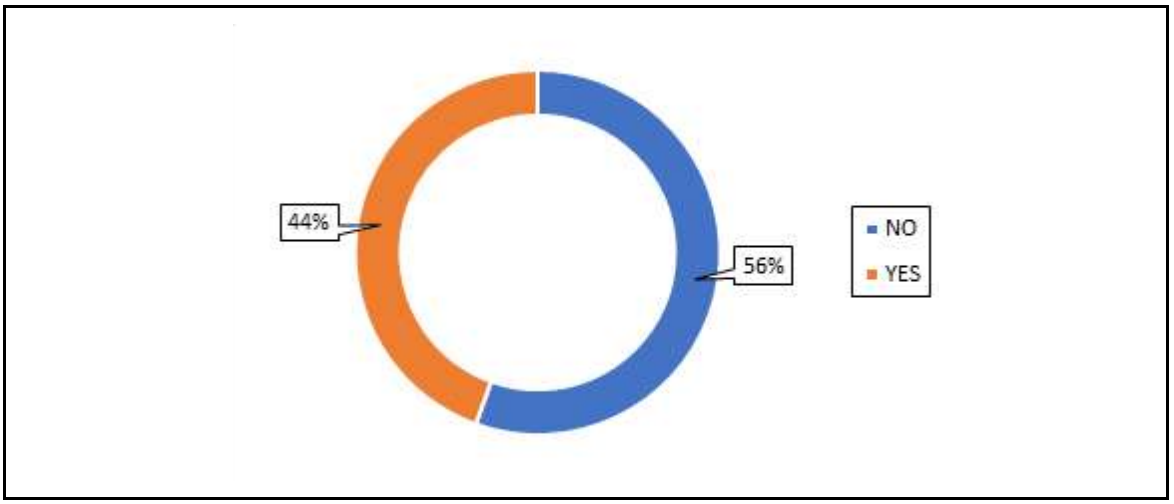
7.13 Knowledge about MCX and its Warehouses

Figure 50: Do they know about MCX?



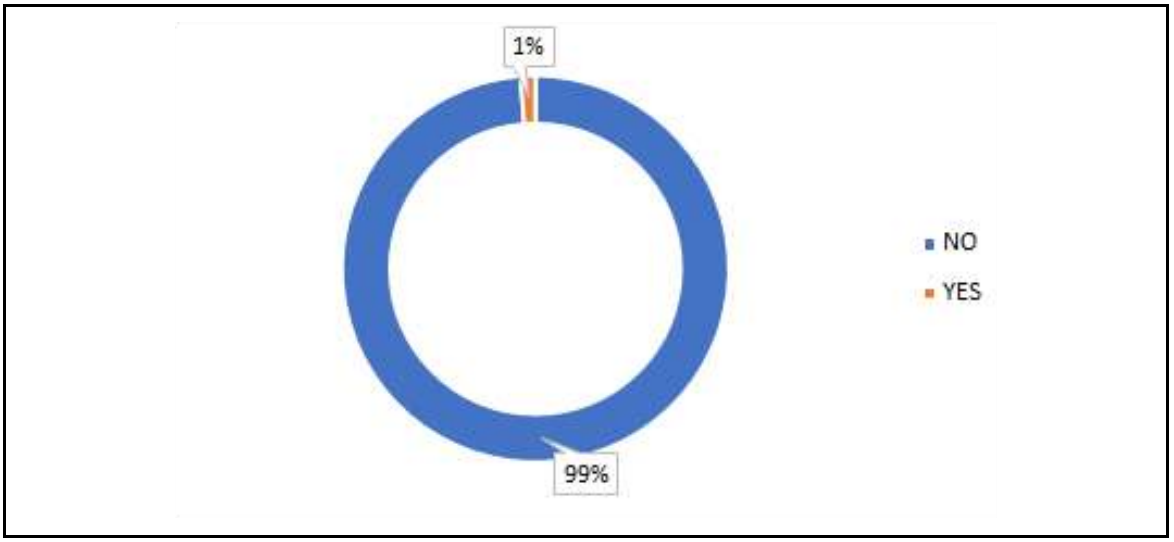
Source: All Visualisation by the Authors based on data from Survey

Figure 51: Knowledge about Physical Delivery



Source: All Visualisation by the Authors based on data from Survey

Figure 52: Physical Delivery on MCX Exchange

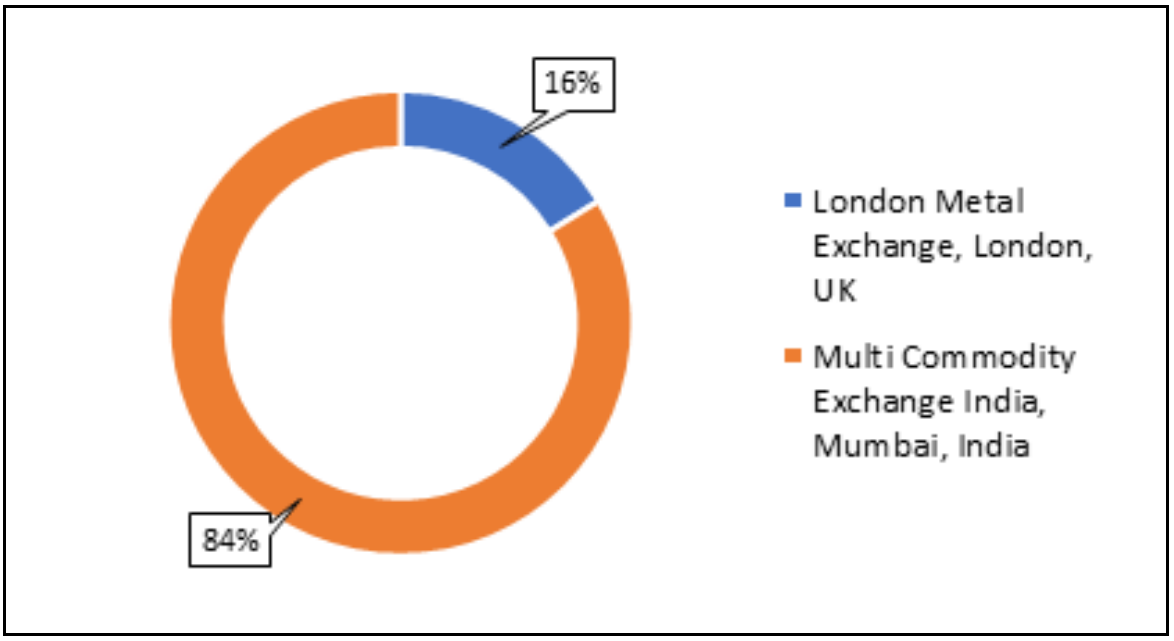


Source: All Visualisation by the Authors based on data from Survey

> *"MCX does not have any option for physical delivery"*
>
> **–(A large physical metal trader)**

Figures 50, 51, and 52 answer the questions raised in the side heading in section 7.13 about MCX. It is very clear that 82% of the hedging respondents know about MCX. However, their knowledge about the warehouses that MCX has created across the country in India, is relatively low. Only 44% know about the warehouses of MCX. May be, therefore, 99% of the firms responded have not chosen to take physical delivery on MCX.

Figure 53: Exchange Chosen for Hedging



Source: Visualisation by the Authors based on data from Survey

Figure 53 above depicts the responses of a follow-on question about their choice of exchanges, domestic or foreign. 84% of the firms that hedge prefer to hedge on MCX, Mumbai. They have compared the all-in-costs between LME and MCX, and have chosen MCX over LME.

7.14 About Futures Contracts

None of the respondents take physical delivery in futures hedging on the exchanges. One of the respondents reported that they were one of the very first players to have preferred physical delivery on MCX, but due to the random allocation of the warehouses and the GST credit issues, they have stopped taking physical delivery. Most of the responding and hedging firms, have chosen contracts upto 3 months duration. There was no uniform contract size.

The responses ranged from 3 MT, to 25 MTs, to 50 MTs. One of them reported that their contract size depends on the sale contract in the negotiation stage. None of them were using cross hedging technique.

7.15 Reference Price for the Transactions in the Value Chain

Table 52: Exchange Wise Reference Prices the Respondents Adopt (in percentages)

Exchange	Importing	Exchange	Exporting	Exchange	Buying India	Exchange	Selling India
LME	77%	LME	37.5%	UNIQUE	28%	UNIQUE	36%
UNIQUE	7%	MCX	17.5%	LME	20%	LME	23%
BME	5%	NALCO	12.5%	NALCO	16%	NALCO	15%
NALCO	5%	UNIQUE	12.5%	HINDALCO	11%	BME	8%
HINDALCO	4%	BME	10%	BME	10%	HINDALCO	8%
MCX	0%	HINDALCO	7.5%	VEDANTA	8%	MCX	5%
VEDANTA	2%	VEDANTA	2.5%	MCX	7%	VEDANTA	5%

Table 52 above shows that the pricing of Base Metals is quite complex and each of the 5 metals has its own price dynamics. London Metal Exchange (LME) happens to be reference price for Importing and Exporting transactions, especially in the copper, zinc, and nickel transactions. LME prices also dominate the domestic buying and selling transactions, followed by supplier and buyer specific reference prices. NALCO's listed price happens to be the reference price for all domestic aluminium transactions, being a government and low-cost primary producer. Bombay Metal Exchange (BME) dominates the recycled and market for fabricated products, related to copper and lead. Multi Commodity Exchange (MCX) of India does not feature significantly as a reference price for the domestic transactions in India. However, it features in the exporting transactions, may be due to the unique buying preferences of the international importers who may be insisting on an exchange determined commodity price rather than a uniquely negotiated commodity price. The buyers and suppliers negotiated "unique price" arises due to the recycling industry and the scrap based primary producers. Their dealings are based on regional or local demand and supply conditions, though weakly pegged to LME prices. The reference prices for the transactions of the value chain partners in India are different and quite a few. World over a country or region-specific base metal industry has evolved to develop its regional Price Reporting Agencies[5] (PRAs), which compile the spot prices, premia and

[5] LME's insight on Premiums and Discounts, April, 2018

discounts to the basic LME reference price of the base metal in the primary produced form. These premia or discount are the aggregate of cost of transformation of the base metal into the transacted form, insurance, freight from the nearest port for LME's warehouse, foreign currency conversion and import duties. So typically, "All-in-Price" for any metal in India, could be arrived using the following formulae.

[{LME's reference price (typically cash settled price) + Main Japanese Port Premium} x (1 + Relevant Import Duty with surcharges) x (USD/INR) = Price of the metal in its primary form at the landed port (Ex-Port Price in INR[6])

Then further in India, the Ex-Port price gets loaded with the following additions due to transport and further fabrication or physical transformation.

[Ex-Port Price in INR] + ["x" INR per tonne (Cost of transformation by the primary producer into the required form)] – [quantity discounts] + [Freight from nearest port to buyer's warehouse]

Most of the respondent firms related to aluminium and copper, especially, those who are purely domestic in their orientation (i.e. no imports and exports), consider NALCO or Vedanta's price as the reference price to buy the metal in the spot market. Both these reference prices are told to be pegged to LME with some unknown lag. Those aluminium players who have international orientation, use LME as the reference price as per the requirements of their foreign trade partners. All players related to copper use LME's prices as reference for their transactions. Zinc players use either LME or Vedanta's (HZL) prices as reference for their transactions. Lead has both LME and Vedanta's (HZL) price for transactions requiring a higher level of purity of the base metal, else they have a Delhi based Price Reporting Agency (PRA)'s. These regional prices are circulated daily based on a subscription fee. Broadly pure virgin metals' prices are pegged to either LME or set by dominant primary producers in India, and the recycled metals' prices are set by the respective recyclers or gathered from a PRA.

[6] Coined by the authors

Apart from this it is also found that there are 5 other types of pricing conventions that are in vogue amongst the value chain partners. They are **Deliver Now Price Later (DNPL); Price Now Delivery Later (PNDL); Previous Months' Average price, Cash and Carry, Advance and Pay Balance on dispatch.** All these pricing conventions use a reference price for the same, and LME price dominates every other reference price. LME's Cash Settlement Price or Spot Price are the specific prices that are chosen to operate in these four pricing conventions. **LSDs and SSDs trade with their PPs on cash and carry basis or with atleast 30% advance payment on the date of order. The balance is to be paid on the date of dispatch.** Crystallisation of dues depends on the prices prevalent on the date of dispatch. Down the value chain, copper market is dominated by "cash and carry" convention, while the other base metals, provide some flexibility with varied credit periods negotiated between the seller and the buyer, usually not exceeding 30 days.

> *"Our supplier offers previous month average pricing, then at the end of each month they compare the actual prices and their average and settle the difference with a debit note of credit note. However, there is delay in such month end settlements, which does not help us reap our hedging gains".*
>
> **– Vice President, Metals of Large Physical metal Trader**

DNPL convention is widely used between the LSDs and the PPs. It is invoked especially by the LSDs or SSDs who have an MOU with the PPs. As per this convention, the buyer of base metal can take delivery immediately and then enjoys a window of 0-30 days to price the very consignment. It requires around 30% advance payment. The 30% advance payment is made based on the previous month average price or the ruling spot price on the date of booking the supply order. 70% is paid on the date of dispatch, which usually happens within a maximum of 7 days. Then the final price is chosen within the 30 days window and the supplier would either credit or debit the balance amount depending on the price decreases or increases respectively. DNPL is quite useful when the buyer is expecting the prices to fall. *It appears to be a kind futures contract where the benefit is credited back to the buyer's account, however, it is an OTC future's contract, rather than an exchange version.*

PNDL is another kind of pricing convention, where the buyer is bullish about the prices into the future. This is akin to an OTC forward contract, quite popular amongst the LSDs and PPs. The 30% advance and 70% balance payment on dispatch, hold good here too, but the difference is that the delivery of the metal from the supplier is staggered or dated into future. The price is fixed on the date of order.

Previous Months' Average pricing is relatively less popular amongst the PPs and LSDs, but more popular at the distal end of the value chain between MSME VAPMs, and MCVAPs. In this convention the buyer negotiates to pay the seller the previous month or qurater average price of the metal for the order which is going to be delivered in the forthcoming months or quarter. This convention is not to the advantage of a seller, especially when the price of the metal is trending upward.

Cash and Carry pricing is quite prevalent in high priced and highly volatile metals like copper. Further, the quoted price is valid only for a period of a week, and it is renegotiated if the deal is not fixed during that week.

Associations nudge their players to follow certain prices given by certain Price Reporting Agencies or LME. The entire value chain related to the association follows the same reference price to be in sink on both buying and selling side. Joint ventures with a foreign company or subsidiaries of foreign parent companies peg their reference to international benchmarks. The requirement of their parents and the need for unique quality, makes importing unavoidable. Therefore their reference prices are international.

It is evident that there are varied conventions, different "all-in-prices" though the reference price happens to be LME. This is not ideal for promoting hedging. Both theoretically and practically hedging is preferred in the same underlying commodity, whose price is also referenced and extracted from the same exchange. As discussed earlier, the typical price of a primary, intermediary and the finally transformed base metal product has four components, namely "LME Price + MJP + Transformation Cost + Markup. Of which LME prices fluctuate more frequently than all the other components. MJP changes once in a quarter. Transformation Cost can change when there are changes in macro-economic and

energy prices. Markup is usually kept constant or is amenable for negotiation or cross subsidised. Effectively this pricing structure creates a complex transmission of the LME's price movement onto the final price to a buyer. Therefore, residual basis risk is bound to exist. Further investigation is required to find out the "ideal number of futures contracts that need to be bought" to cover the risk arising out of this complex price structure.

7.16 Factors attracting Firms to any Exchange for Derivative Hedging

"Transparency", "Liquidity", "Price Volatility", "Transaction Costs", and **"Network of Players"** are the top five features which attract the value chain players towards any commodity exchange (Table 53 below). **"International Status", "Accessibility" and "Speed of execution"** are the next three features which influence the choice of a commodity exchange. Interestingly Price discovery is featuring below, "Inventory visibility" and "contract durations". This might be an indication that the value chain players are looking at commodity exchanges as places for hedging and trading, with or without physical delivery, rather than for price discovery. When the supply side market is more oligopolistic or cartel like, the suppliers become the price setters and the information is disseminated through their own network of clientele. The cost of production, holding costs, financing costs, of the suppliers ideally follow an increasing trend therefore future prices would be higher than the spot prices. The weighted score is calculated in the same manner as explained in section 7.12, (about Table 51, page number 86).

Table 53: Weighted Score of Required Features of an Ideal Exchange

Feature of the Exchange	Weighted Score
Transparency	759
Liquidity	596
Transaction Cost	508
Price Volatility	437
Network of Players	368
International Status	340
	Contd…

Contd…	
Accessibility	334
Speed of Execution	292
Inventory Visibility	286
Contract Durations	265
Price Discovery	254
Value Added Services	239
Warehouse	207
Analytics & Insights	183
Relevant Commodities	150
Quality Specifications	135
Risk Advisory Services	128

7.17 LME Vs MCX

LME has higher ratings for **"Liquidity", "Price Volatility", and "Price Discovery"** than MCX**.** It features lower on **"All in Cost of Transacting".** MCX features better than LME on **"All in Cost of Transacting".** The All in Cost of Transacting refers to the total cost of transacting on a particular exchange by an Indian player. Only one participant has suggested that Shanghai Futures Exchange is very good for **"Price Discovery",** though one cannot trade on the platform. In terms of **"Speed of Execution"** both LME and MCX are rated high. The weighted ratings represent the weighted average of ratings received by a factor, weighted by the number of respondents who gave a particular rating between 1 to 5, where 1 is the lowest and 5 is the highest.

Table 53: Weighted Rating of required features of an Ideal Exchange

Feature	MCX	LME
Ease of Access	3.73	3.67
Speed of Execution	3.56	3.93
All in Cost of Transacting	3.50	3.17
		Contd…

Contd…		
Warehouse Facility	3.42	3.07
Contract Durations	3.33	3.83
Quality Specifications	3.29	3.44
Price Discovery	3.22	3.38
Price Volatility	3.21	3.16
Network of Players	3.18	3.37
Relevant Commodities	3.17	3.60
Inventory Visibility	3.13	3.91
Transparency	3.03	2.63
Analytics & Insights	3.00	3.76
Liquidity	3.00	3.83
International Status	2.88	3.88

What emerges from this analysis is that LME, which provides the reference prices, is undoubtedly high on the factors which attract players to exchanges but is costly for Indian players to hedge on that exchange. The liquidity it offers, the availability of long duration contracts, discovery of a regular spot price or the cash settlement price and the spread of warehouses[7] seem to be the greatest attraction of LME for the value chain players. We feel that inspite of all these advantages, domestic exchanges can highlight the "ready all-in prices", "lower cost of transacting" and "lesser compliance costs" to promote hedging on the domestic exchanges.

> *"I would like to write commodity swap contracts for 9 months but I feel that there would be no takers for the same".*
>
> ***– Managing Director of a Listed Recycler and Copper Primary Producer***
>
> *"Though the transaction costs of MCX are lower than that of LME, we are not venturing into derivatives here due to the liquidity issues. LME is costly due to the initial margin money, minimum lot size, and USD pricing. Instead MCX is better. But there is 4 to 5 INR difference between LME and MCX prices"*
>
> ***– CEO, Private Limited Company, Trading Zinc and Copper***

[7] As per LME there are around 450 warehouses in 32 locations, in USA, Europe, and Asia

7.18 Annual Consumption of Base Metal and the typical Purchasing Lot Size

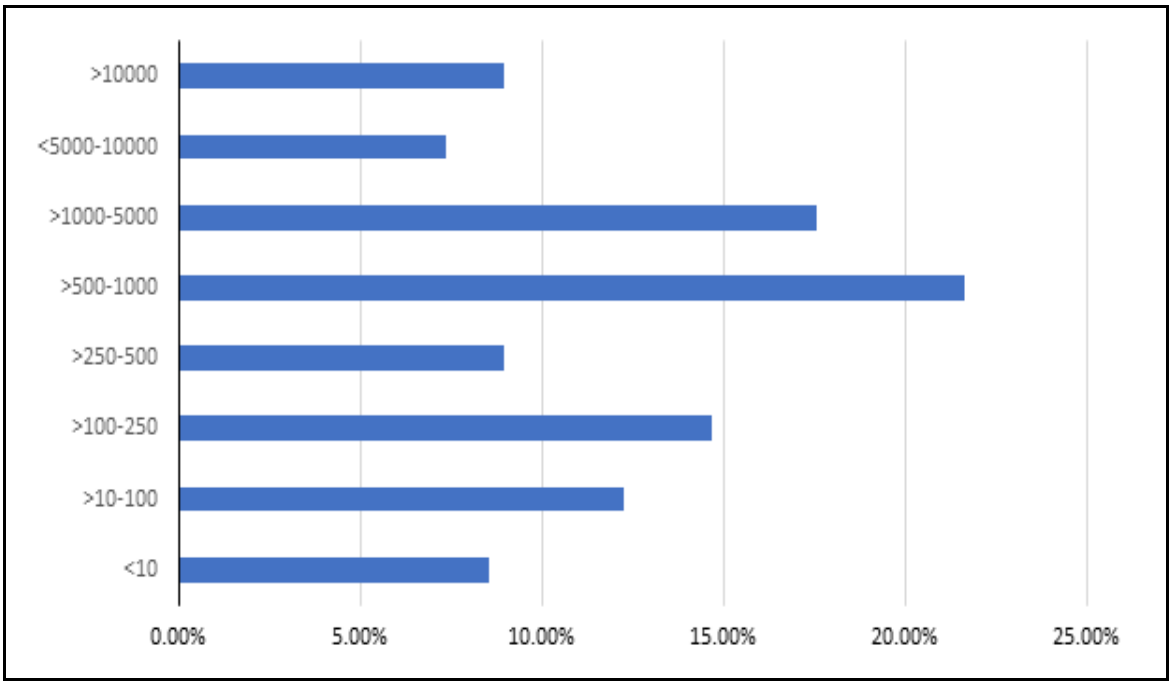
We wanted to know the annual consumption of base metal of the various players. It also helps to understand the market size for hedging and the quantum of exposure amongst the value chain players.

Further, understanding typical purchasing lot size would help us match it with the existing minimum contract size of the exchanges and the number of contracts one would prefer.

Figure 54 shows that the various players we met consume more than 100 metric tonnes of base metals in a year.

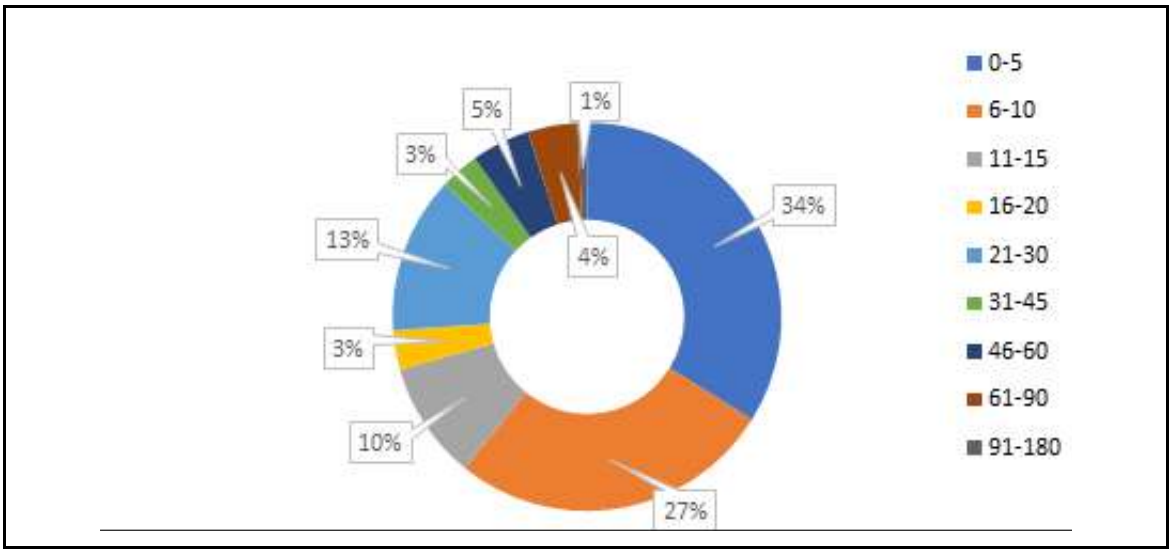
The others who have a bigger purchase lot can always buy "x" number of contracts for hedging. The contract sizes offered in the exchanges are good enough for the value chain partners for hedging.

Figure 54: Annual Tonnage Wise Composition of Respondent Firms



Source: Visualisation by the Authors based on data from Survey

Figure 55: Supplier's Lead Time Wise Distribution of Respondent Firms



Source: Visualisation by the Authors based on data from Survey

7.19 Typical Order to Delivery Operating Cycle of Value Chain Players

Figure 55 shows that around 61% of the respondents receive their base metal procurement orders, delivered within 10 days, another 26% within 30 days. Together 87% of the companies whom we contacted receive their orders within 30 days. The rest fall in the importing category who take more time to receive the orders.

The time gap between the date of order and date of receipt of raw material is going to create "Lead Time Exposure" to commodity price fluctuations, especially for those firms who do not have ready sales orders on hand and for those SSDs or RSVAPs. Lead time exposure creates risk when the price of purchases is more the price of sales. The longer lead times shown in Figure 55 belong to importers of nickel, importers of scrap who convert it into PPs. Most of the traders and VAPMs in large cities feature in the "upto 5 days" category, the other RSVAPs and VAPMs in smaller cities feature in the" upto 10 days" category. The MCVAPs in larger cities feature in the "Upto 30 days" category due to manufacturing lead time of their sub-contractors.

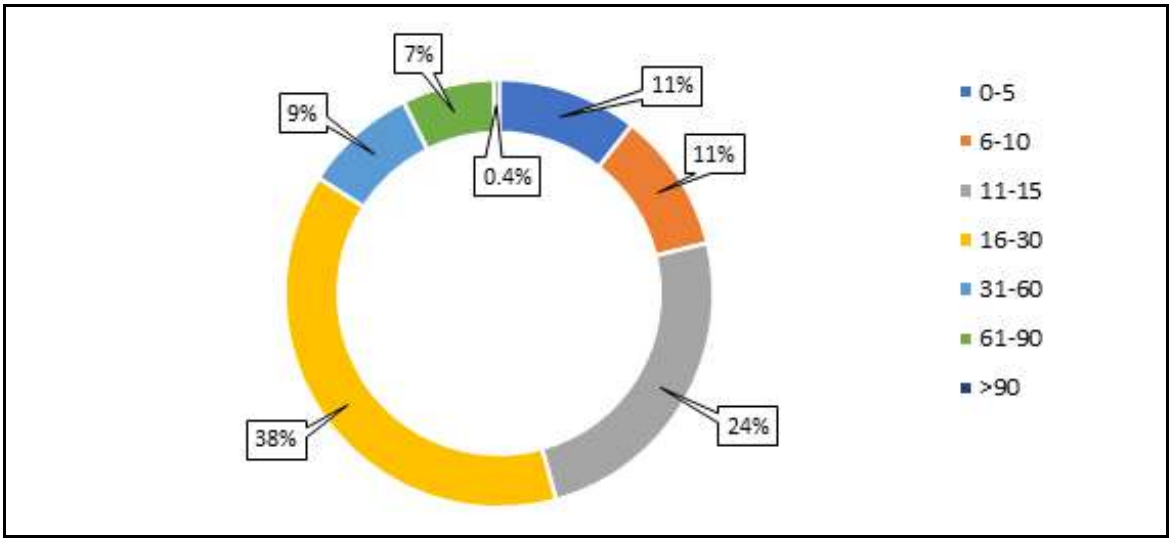
For the traders the order to delivery time is very short and hence there is no great need to consider hedging, moreover they pass on the price fluctuations downstream. VAPMs have developed the art of buying the base metal input, at the cost they factored into their revenues.

Because they usually "make to order", this time lag is of no relevance for commodity price risk management. MCVAPs with longer lead times and staggered delivery contracts are using markups in their prices, passing price risk to the customers, and wherever possible negotiating half yearly or quarterly fixed price or risk sharing contracts, instead of hedging.

7.20 Average Levels of Inventory

Figure 56 shows the average inventory period of the value chain partners. Understanding the inventory period of base metals is important to identify commodity price risk due to holding the inventory amidst price fluctuations. Larger the inventory holding period, higher would be the risk facing the value chain players. Around 43% of the respondent firms say that they hold inventory for upto 20 days of sales or production. Around 35% hold inventory for upto 30 days. Therefore, around 75% of the companies hold inventory for upto 30 days. A few of the respondents have stated that cost of carrying inventory is around INR 75 per tonne per day.

Figure 56: Inventory Days Wise Distribution of Respondent Firms

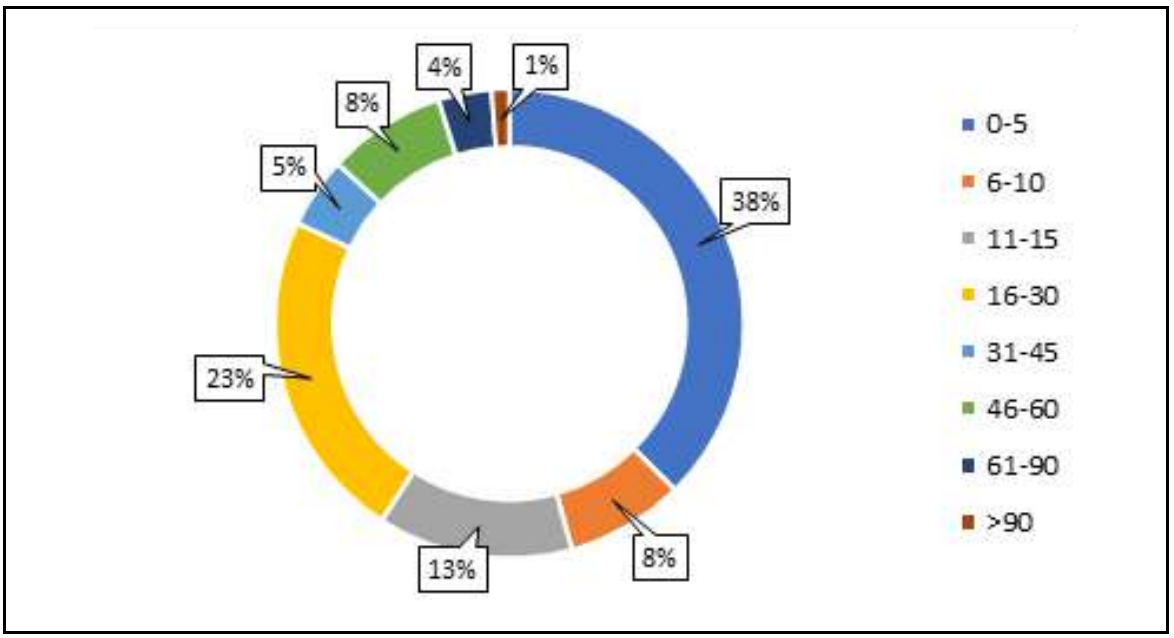


Source: Visualisation by the Authors based on data from Survey

The empirical analysis in tables (46-50) shows that average monthly price change in base metals over the previous 18 years is within 1%, therefore holding inventory for upto 30 days does not pose any serious risk warranting a derivative hedge. Traders are maintaining not

more than 7 days of inventory, VAPMs in the small cities maintain inventory to maintain a seamless production schedule on the confirmed order. RSVAPs, are undertaking Fast, Slow and Non-Moving stock analysis to maintain inventory accordingly. RSVAPs are replenishing inventory at the price at which it is sold, which averages the price fluctuations over period and does not require derivative hedging. So the analysis of inventory period suggests that derivative hedging is not required to manage the commodity price risk arising due to carrying inventory.

Figure 57: Payables Period Wise Distribution of Respondent Firms



Source: Visualisation by the Authors based on data from Survey

7.21 Average Credit Period

The amount of working capital finance that is locked up in the base metal by the supply chain partners is important to assess the liquidity they possess to spend for hedging using derivatives. To understand this we captured both supplier's credit period and credit period given to the customers.

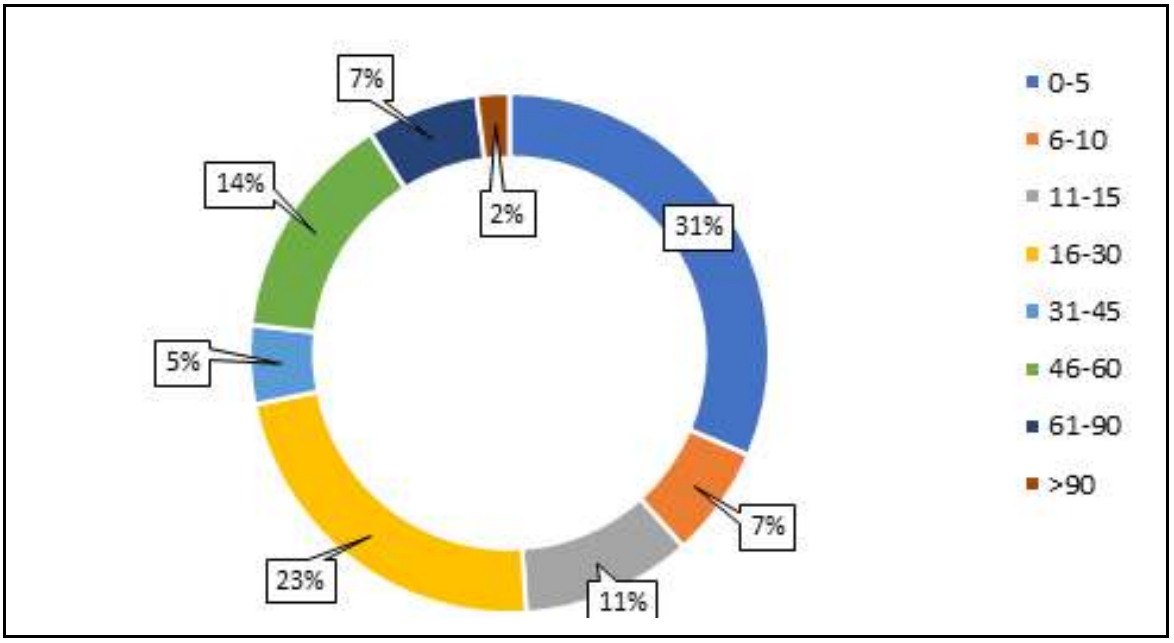
Figure 57 shows the proportion of respondent firms that fall into various buckets of payables period. 38% of the respondent firms enjoy a credit period of maximum 5 days. Most of the transactions are on "cash and carry" basis, especially in metals with high price

volatility. Another 44% of the respondent firms get credit upto 30 days. Approximately, another 18% of the respondent firms get credit beyond 30 days. This scenario looks unfavourable for derivative hedging. Putting it differently, around 82% of the respondent firms have to pay their suppliers within upto 30 days, and the credit which is provided by the supplier is also not free of cost.

Therefore, they would not possess liquidity to hedge. Analysis of credit to customers (Figure 58) shows that only 72% of the customers pay within 30 days (as against 82% of the suppliers asking within 30 days), and the rest 28% after 30 days.

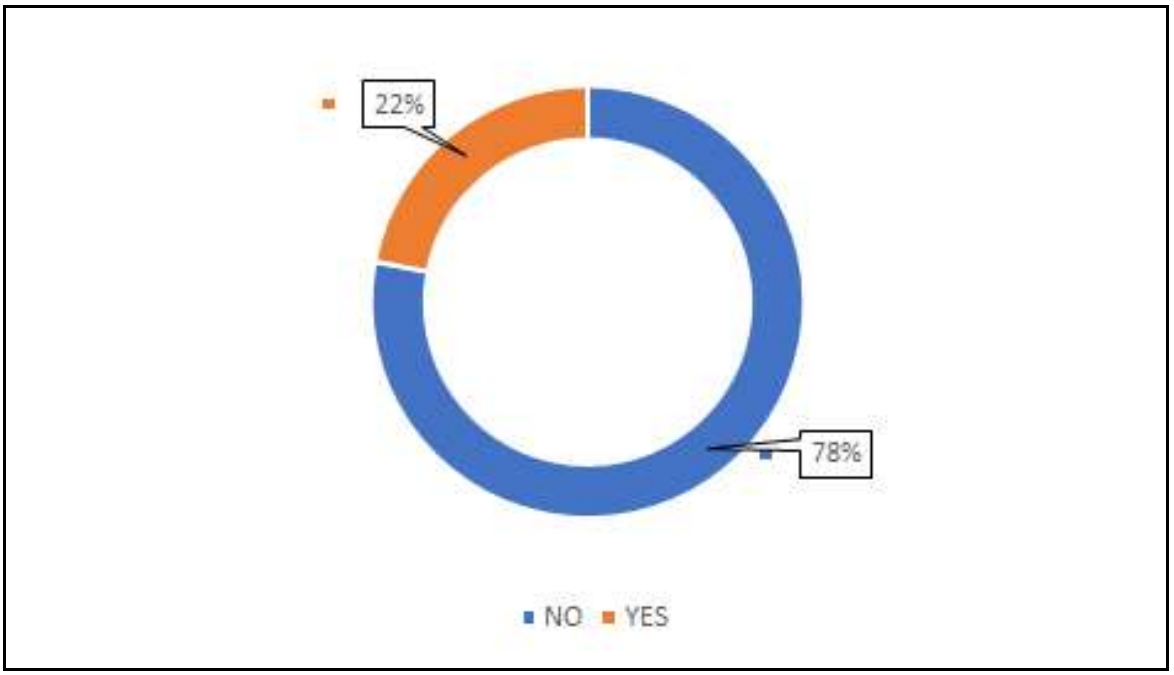
This situation is not favourable for hedging, especially using futures, which requires maintenance margin calls. Lack of liquidity and need for bank finance has been highlighted by policy research works on risk management. It appears to be true, when we combine the response of predominant "NO" for hedging, and the liquidity issue found due to the time lag in realising sale revenue.

Figure 58: Receivables Period Wise Distribution of Respondent Firms



Source: Visualisation by the Authors based on data from Survey

Figure 59: Do they use Recycled Metal?



Source: Visualisation by the Authors based on data from Survey

7.22 Use Recycled Material?

Recycled metal is also a significant source for consumption, especially due to the possibility to recycle the base metals without losing their technical properties to use. The use of recycle metal as a low-cost substitute for mixing has been found in our interactions and literature. Therefore, we devised a question on whether they use recycle metal? Further we also asked whether they find any difference between pure virgin material and the recycled one based on cost, quality, and availability. Figure 59 shows that around 78% of the companies who responded do not use recycled material, but 22% of them do. Almost everyone opined that recycled material is inferior in terms of quality and hence costs less. Further, its availability is on par like the pure virgin material. In the case of lead, the respondents feel that a major portion of the Indian market uses recycled lead. Getting pure lead from Vedanta is quite difficult. Further, they also opined that pure metal does not go into the grey market due its price and use and to target customers. The anti-dumping duty on lead has made it relatively costlier to import. Quality of Scrap in India is low, International scrap has 5% higher yield, hence the import of scrap continues.

> *"Indian Companies have a trading mindset, rather than an industrialist and business mindset. This comes in the way of hedging that requires a long term view"*
>
> **– Managing Director of an India Chapter of a Metal Association**

Though the recyclers or buyers of scrap use the same pure virgin metal prices for price discovery, the product seems to be not of the same quality specification compared to that of a pure virgin material. It is for further investigation to find whether there is a need for a separate scrap based recycled copper contract, like the way the secondary products of base metals are priced.

Chapter 8: Insights from Experts

As per the requirements of the research project, the views of consultants, experts and association leaders are also taken to understand hedging patterns of value chain players and their preference for MCX. The following are some of the unique insights that emerge from the interviews with experts.

8.1 About Commodity Prices

- Average daily spike in commodity prices has increased during the last 3 years due to COVID and geopolitical tensions.
- Refiners and smelters can ramp up and ramp down their production of primary product, therefore they have a strong influence on the prices of commodities through supply distortions.
- There is no “one to one” correspondence between actual physical metal transactions and commodity derivatives exchange anywhere in the world.
- Correlation of MCX prices with those of LME is dropping. This may be due to the mandatory physical delivery guidelines of SEBI. The polled spot prices of MCX, which are based more on Thane prices, also might be the reason for such divergence.
- MCX prices are being monitored by many people, but the physical metal transactions are never based on that.
- There is still grey market in the base metal sector, especially in the recycled metal market and among the Retail Stockists of Value-Added Products. The grey market is usually unrecorded and operates on cash basis, with the reference price of MCX.
- An organised spot market for base metals is non-existent in India. There are too many centres for delivery, which makes physical delivery very difficult and costly affair, and hence people would not like to get into MCX even form futures contracts.

- There is need for a robust spot polling mechanism which could be a weighted average of 60% for actual consummated trades, 30% for intentions to trade, and 10% on future expectations.

8.2 About Commodity Price Risk Hedging

- Only large players are interested to hedge and are hedging. Small players are not interested to hedge and they would not hedge. Large players prefer LME, and medium size players prefer MCX. It is the consultants who nudge companies to hedge. They usually advise that 60% of the exposure needs to be hedged with the supplier, and the rest with LME.
- 98% of the transactions are cash settled and only 2 percent go in for physical delivery in a futures hedging.
- There is a misconception that "back-to-back hedging", means using "price averaging". They are not one and the same. Further, back-to-back hedging does not always help because the bid and ask spread on commodity prices on an average might not be offsetting the commodity price movements[8].
- We are pestered for tips to speculate in the commodity market rather than following our requests to hedge.
- The mark-to-market phenomenon of futures contract and the related maintenance margin requirements create liquidity pressure and force the companies to maintain adequate cash balances to meet such requirements. Financing such margins, either through their equity or short-term borrowings proves costly for medium and smaller companies.

[8] Our understanding of the statement made by the expert is that "Back-to-Back Hedging is not equivalent to "Price Averaging". Usually a trader's explanation of "Back-to-Back Hedging" is they buy only when there is a sale order from a customer. Their gain is due to the bid and ask spread. When the maturity of both the transactions are same, then the price risk is mitigated. The experts argue that traders keep the bid and ask spread relatively constant, but the commodity prices are more volatile, hence back to back hedging might not effectively hedge the price risk. "Price Averaging" is a technique of regularly buying a specific amount of commodity, whatever is the price, and then selling it with a fixed price markup. Over a chosen period, due to this technique, the average purchase price of the commodity will be effectively lower than the highest price paid during that period. The small retailers (RSVAPs) are suggesting that they are using price averaging, however their meaning of "price averaging" is **buying on the same day whatever quantity they sold**.

- Considerable use of the metals takes place in the form of alloys, using these base metals in various compositions. Further, there is lot of value addition that happens in the form of extrusions, profiling, and customised fabrication before a typical virgin base metal is consumed by the downstream industries. Therefore, hedging for physical delivery is not usually preferred by the base metal players. Exchanges offer contracts in the purest forms of the base metals. The players are not interested to take efforts in deciphering the correlation between the price changes of the pure metal and the form in which they buy.

8.3 Dealing with MCX

- Price discovery at MCX is not comprehensible for various players, hence they do not develop any confidence in using it as a reference price and therefore for hedging too.
- Due to unavailability of long dated futures contracts, serious hedgers are forced to roll-over the most liquid near month contracts, increasing their cost of hedging and make it non-beneficial.
- MCX has increased the number of warehouses across India. However, the random allocation of warehouses for delivery creates issues to genuine buy side hedgers for physical delivery. Over and above the interstate GST related impediments also create issues for holding warehouse receipts.
- The contract sizes are in line with the international standards, but maintenance margins are not.
- MCX approaches the value chain players through their brokers. Consultants are of the opinion that brokers would prefer to advice firms to speculate and trade rather than hedge. In the process the firms are burning their fingers. After some wrong bets and tips, they have become once bitten twice shy w.r.t. MCX.

Chapter 9: Conclusions

From "India in the Global Base Metal Market"

- India occupies 2nd position in global Aluminium production. There is adequate domestic production to meet the domestic demand and also to export. There is scope to increase the per-capita consumption of aluminium in India, which would eventually develop a robust reference rate for the domestic transactions.
- India is dependent on the world for Copper and is not a significant player in the world. Due to the declining domestic production and the need for high grade copper for use in Energy Industries, import dependency would continue and hence a foreign reference price for transactions also would continue.
- In the case of Zinc, production is greater than consumption, and hence the exports of Zinc, however, India is a not significant player in the world markets. There is scope for nurturing a domestic reference price for this metal.
- Globally Lead mining is on the decline, and therefore Lead is a highly recycled product including India. Pure virgin lead is difficult to procure, therefore there are multiple players who recycle lead. Even in this metal, India may be self-sufficient but not a significant player in the world. There is scope for domestic reference pricing in this metal.
- India is dependent on imports for Nickel, and it does not feature in the global export or production scene. International reference is bound to be prevalent.

Overall, India's position, w.r.t. domestic production and consumption of base metals is weak. In Aluminium, India can be a significant player in future due to the bauxite reserves and import based copper refining and smelting can also catch up considering the impetus to manufacturing in India in the recent past. Barring Aluminium, Zinc and Lead, International reference price in foreign currency would continue to be the norm for Copper and Nickel.

From "Review of Relevant Literature"

- Base metal prices are globally determined on LME, and in US Dollar denomination. Each country has their own regional equilibrium price influenced by transportation, exchange rate fluctuations, government levies, and transactions costs on derivative exchanges. Regional equilibrium prices rule their respective spot markets; however, the acceptable long term reference price happens to be LME.
- Large firms pass on as much price volatility as possible to the downstream supply chain players, and hedge only the residual risk using derivatives. Medium and small firms are price takers, therefore, feel more comfortable in developing strong relationships with their large suppliers for price constancy.
- Efficient price discovery, hedging efficiency, low basis risk, depicted by Spot-Future price alignment attracts hedgers towards any commodity derivative market. Presence of speculators with long term view, along with risk absorbing capacity, and impact of market balancing arbitragers adds to the attraction of any commodity derivative exchange.
- There is consensus on the price discovery efficiency of Indian Commodity derivative exchanges but there is divided opinion on hedging efficiency. Absence of long dated futures, high transaction costs, transaction taxes, lack of awareness and skill among personnel of physical metal value chain players, lack of inventory visibility, inaccessible commodity exchange warehouses, absence of an organised and dependable spot market, and a spot price polling mechanism affect the Indian Commodity Derivative markets.

From "Hedging Patterns of Global Base Metal Players"

- Companies have a long term and short view about commodity price risk. Short term price fluctuations are managed using both operational and derivative techniques. Long term price fluctuations are managed more strategically, by altering the cost structure, scope and scale of operations, improving productivity, undertaking R&D for niche and customised products for higher price realisation.

- Due to high price fluctuations, buying and selling is done on a provisional price basis and final settlement is done once in 3 or 6 months, with an accepted reference rate. Players who enter long-term buying or selling contracts, of upto 6 months, hedge their exposure using derivatives. To reduce the hedging costs companies do netting of exposures on their sales and purchases and only net exposure is hedged.
- Electricity and Energy costs form a significant proportion of the total cost of smelting and refining. Therefore a few firms also hedge the electricity prices to offer stable prices and improve profit margins.
- All Chinese companies use Shanghai Futures Exchange to hedge the price risk along with LME. Other major players in the world use LME to hedge and consider LME's price as the reference price. There is growing use of MCX as a reference price in base metals like Zinc.
- There is a clear pattern of selective hedging in the international players, especially to take advantage of opportunistic movements in the prices, especially when they have been trending upwards over the years. Hedging would not allow them to profit, and hence wealth creation for shareholders might not happen.
- A pricing convention, i.e. pricing on the date of dispatch is taking care of the time lag between the date of order and date of dispatch.
- Internationally there is prevalence of OTC based forwards contracts in the downstream supply chain, where the smelters and miners and primary producers would hedge their revenue using market based derivative hedges, and provide long term fixed contracts to their clients.

Our survey results of Indian players show more of operational, strategic and supplier network-based risk management techniques than derivative hedging. Due to the relative stability in the pricing of electricity, Indian players have not considered volatility of electricity prices to a major risk to hedge. Unlike China, Indian players do not choose only a domestic commodity exchange, rather would like to depend on LME rather MCX.

From "Retail Participation in Commodity Markets":

- There is need for any commodity exchange to attract investors, with varying risk appetite, investment horizon, views on the commodity prices, and motivations to engage with derivatives.
- Over the years, cash settlement, sophisticated research in the field of investment management, emergence of various managed investment services, has made commodities an attractive alternative asset class.
- "Financialisation" of commodity markets lead to the participation of financial institutions and retail investors.
- Retail participation is expected to increase market volatility, however technology and regulation can control the same.
- Low awareness about commodity markets, more interest in equity markets, low analyst following about commodities, and higher cost of trasnaction leads to low interest of retail participants in commodity markets
- Partnering with Brokers, increasing awareness, creating new products with less costs and more ease of transactions, promoting alternate investment funds, and mini contracts are the approaches adopted in the popular global commodity exchanges to improve retail participation with success.

From "Empirical Analysis"

- On an average the monthly, quarterly and yearly MCX spot and near month futures returns have been higher in the period after the regulation of mandatory delivery i.e. after 2019. Aluminium, Copper, and Nickel's return are higher, but Zinc and Lead returns are lower. On the other side, the monthly, quarterly, and yearly volatility of MCX Spot and Futures returns have decreased after 2019, across all the metals.

- Correlation of MCX spot prices with that of LME spot prices has decreased since 2019. Each metal has its own unique correlation pattern. Copper is slowly moving more in tune with LME than other base metals, after its departure in 2019.
- MCX futures prices are underestimates of actual spot prices based on near month futures prices across all metals and with period breaks during 2006-2019. MCX prices have been predominantly on backwardation since April, 2019, across all metals. However, the percentage changes in futures' prices and spot prices across various frequencies are almost the same.
- Volumes and Open Interests on MCX have dropped since April, 2019, across all metals. Aluminium is regaining its pre-2019 levels.

The Indian commodity markets – both spot and futures - have generated positive returns with lower absolute volatility. Ever since the change in mandatory physical delivery regulation, the volumes and correlation with LME have dropped. This may be due to various reasons, COVID, supply uncertainties, and adjustment to the India's polled spot price and inventory visibility through disparate price reporting agencies. Therefore, it is more like a cooling period for the traders. The retracing of correlation towards LME in the case of Copper is an indication for it. Due to the negative basis of futures prices, hedgers would have to buy a greater number of contracts to create a perfect hedge. This would increase the cost of hedging. Once there is adequate historical data on spot prices in India, both human and algo trading would pick up, because there is data to build India specific trading models. Hopefully, in the coming future, the VUCA world would become more stable for the risk appetite to increase.

From "Survey of Value Chain Players":

- **Structure**: Indian base metal industry is a sellers' market in the upstream supply chain and buyers' market in the distal end of the same. The value adding medium and small players in between are squeezed to work on thin margins and carry the commodity price risk. The traders of either the primary or value-added products are surviving on bid ask spreads, low inventory, and price averaging. The

oligopolistic market structure at the primary product stage, does not allow for any clear market determined price for the physical transactions, and would not provide a view about the inventory levels in the entire market for the financial speculators or arbitragers to take a forward view in the commodity exchanges of India. Supply to the base metals markets comes from broadly three channels, Domestic mining-refining-smelting, Importing Ore Concentrates-Refining-Smelting, Sourcing Scrap locally or abroad and Recycling. Ingots for Aluminium, Zinc, Lead, Nickel, and Cathodes for Copper are the primary forms of the refined metal for further downstream consumption. These are the underlying in which futures are available.

- **Source of Commodity Price Risk:** Inability to predict future prices is one of the significant concerns of value chain players, and therefore there is definite need for a benchmark price, apart from that of LME. The base metal players of India would like to create a separate equilibrium price for its markets. Though currency exchange rate features as a source of commodity price risk, the empirical analysis for various period breaks show that LME prices and USD/INR prices are weakly negatively correlated at around 0.3, which should not be of great concern. The other two sources of commodity risk, namely order to delivery time lag from the suppliers, and the inventory holding period in the firm, are also less than 15 days and a month for most of the players. Therefore, there is not much commodity risk concentrated due to these lags. Only a 5% change in the commodity prices can throw most of VAPMs out of gear, indirectly meaning that they have a cushion of upto 5% as a markup on their cost in their prices. Such changes happen not quite often. And any change beyond this is protected through a price variation clause.

- **Forecasting:** Indian value chain players do not attempt forecasting commodity prices too far, neither do they believe that any one can predict commodity prices beyond a predictive accuracy of 50%. Due to lack of any dependable long term commodity price forecasts, firms do not entertain estimating a budgeted commodity price and try to protect it. The shipment-to-shipment kind of manufacturing and renegotiation of contracts within 1 year is not requiring the

need for long term forecasting. Therefore, only primary producers and the end of the supply chain manufacturers should be worried about long term price movements. In the case of manufacturers using value added products, long term price forecasting makes sense if the base metals constituted a major portion of its cost structure.

- **Reference Price:** LME would dominate the prices of the primary products of base metals, especially those manufactured by the refiners and smelters. LME price reference has received the acceptance from both the suppliers' and customers' side, at the primary product stage. When the metal is recycled, various regional price aggregators are making their presence felt through their network of players and their price polling methods. MCX is not yet featuring as a pan India reference price.

- **Operational Hedging:** Passing on the price risk, price variation clauses and markup seems to be the most comfortable approaches to mitigate commodity price risk. The lower-costs of these approaches, and weak final customer power, are sustaining this kind of commodity price risk management. Until there is competition based on cost, among the value chain players, firms would not be jolted to consider commodity risk management as their responsibility. As of now it appears that price-mark-up, across the various players in the supply chain players, has inflated the cost of tertiary consumer facing products, that consume the base metals in large quantities. Refiners and smelters and the primary producers of base metal products have devised ways to protect their loyal customer base, by offering their MOU contracts and homemade OTC forward contracts like "Price Now and Deliver Later", "Deliver Now and Price Later". This suits well to devise their hedging strategies based on the guaranteed quantum of sales (demand visibility) and their cost of production. Further, volume discounts from listed prices attract the loyal customers to stick to this channel of buying.

- **Derivative Hedging:** Around 15 to 20% of the players adopt exchange traded derivative contracts. These are knowledgeable entrepreneurs, and they understand the benefits of hedging. Almost none of them takes physical delivery,

thereby making it truly financial hedging. Cost and Ease of Use are the top-ranking features which attract them to derivatives. This fits in well for a sizeable number of hedgers to prefer OTC type contracts. Those who do not prefer exchange based derivative hedging show, their small scale of operations, lack of knowledge and expertise, lack of the underlying commodity they use, and the random allocation of delivery centre, as the primary reasons.

- **Awareness about Exchanges:** 80% of the Indian hedgers go to MCX for hedging and the rest 20% go to LME. There is still lack of awareness about MCX warehouses and physical delivery possibilities. Transparency, liquidity, price volatility, transaction costs, and network of players are the top 5 features that attract players to commodity derivative exchanges. MCX is rated high on transparency, price volatility, and transaction costs.

Chapter 10: Recommendations

The recommendations in this chapter are based on the conclusions we have drawn in the previous chapter. These are also based on the growing importance and prospects of base metal sector, increasing sensitivity towards ESG compliance, India's push for "Make in India" and the success of manufacturing in defence, aerospace, railways, automobiles and infrastructure sectors in the recent years. Some of these recommendations have already featured in previous research studies. We felt the need to re-assert them and reiterate their importance considering their validity even in the current scenario. We have also added some new recommendations. We would like to present the recommendations in two segments. One for MCX to explore, the other for Policy Makers, Regulators, Industry Associations, and Promotion Councils for macro level Policy Changes. While the recommendations of MCX can compliment to what they are already doing and they are in their control, the macro level recommendations are more to do with building a nationwide ecosystem, involving the cooperation of multiple stakeholders and lobbying efforts of MCX. Ultimately in intangible service type entities, like a marketplace, the value cannot be independently created by mere infrastructure. Perceptions, behavioural biases of significant stakeholders matter a lot.

To MCX for Further Exploration/Implementation

1. Educate, Educate, Educate:

- **Ignorance about hedging and its benefits is quite prevalent**. The myths that hedging is only about physical delivery, or it would not work, if there is a mismatch in the underlying form of base metal, should be dispelled. **Customised Workshops for specific value chain players** of scale and size, by bringing similar players across the country is needed. The sessions should include **understanding commodity price data**, with MS excel tools, **explaining with and without hedging scenarios, existing technique, and derivative hedging scenarios**, and **sensitising** the need for a **short, medium, and long-term perspective** on commodity. MCX may **partner with training or academic institutions**, to avoid overt promotion.

- **Case studies comparing the existing methods of operational hedging with that of derivative hedging, to highlight fallacies in pricing conventions** like price averaging, historical monthly average price for future transactions, are much needed. Such case studies should be added to the learning resources. These **case studies** should **be readily implementable and relatable to the existing products** traded in MCX. Instead of a generic hedging example for a buyer and seller, more **customised examples, creating a context for a specific type of business entity,** like importer, exporter, domestic vs foreign sourcing company, standard vs customisable product, B2B vs B2C product etc are needed.

2. Hedge on Mobile:

- The **existing MCX's mobile app can have another module for physical metal players**, including **hedging relevant information, contract size calculators, likely all-in costs, out of the money alerts, estimated life cycle margin calls, warehouse inventory etc.** The current MCX mobile app is designed more for traders and students for certifications. A virtual trading module like a mini simulator, can also be included for hedgers to practice before they act.

3. Engage with Nudgers:

- MCX needs **to bust the myth of misguided value chain players, like "this market is all about speculating, and price manipulation".** To reach out to the target segment of hedgers, MCX may consider **strategic partnerships with reputed Consultants and reputed Price Reporting Agencies,** for two purposes namely,
    - To **promote hedging** through consultants and not brokers
    - To **poll representative robust spot prices** through price reporting agencies across the country

This **approach builds trust, because there is a known face to which the network of players** relate to, and it also **dispels myths, manages negative word of mouth**, by making nudgers the partners in creating credible commodity exchange.

4. Experiment with New/Value Add Contracts:

- One of the **major reasons for not hedging** on an exchange is that **"the underlying metal form being traded is not what we use".** Most of the value chain players in the downstream **supply chain, use semi-fabricated forms of the primary metal**, of which "Billets" in the case of Aluminium, and "Wires" or "Rods" in the case of copper are quite popular forms. As of now the primary producers who offer ingots are offering these products at their listed prices. The region-specific price aggregators with the network of recyclers are providing the reference prices of the transformed products directly. If such **value-added contracts be created with standardised quality and cost specifications, taking the expert guidance of metallurgists and industry leaders,** MCX can initially, attract the attention of the target market - at least as a reference price - and later build a loyal customer base. LME is going to experiment on similar lines. It reduces the burden of price formulas to decipher opaque fabrication charges for the physical metal users.

- With **huge impetus to ESG compliance across the world, sustainable practices are promoting the use of scrap** in the base metal industry, wherever it is feasible. Scrap based metal industry is highly fragmented with quality issues and non-standardisation. When an exchange traded scrap contract exists industry practices would align and reduce a lot of search and inspection costs. Purification, Packaging, and Logistics practices would streamline eventually because the prospective all-inclusive price on forward curve is visible across the value chain players. **MCX should consider Aluminium, Copper, and Lead scrap contracts,** to bring the currently unorganised and opaque value chain into more visibility, benefiting many recyclers of base metals.

- Considering India's position in the global base metal markets and the relatively inward oriented position in **Zinc and Lead, MCX should capture the hedgers in these two metals**. Here India specific demand consumption dynamics influence the prices. This would bring in the primary producers, recyclers to align with MCX pricing. MCX can also compete effectively against the polled price

aggregators which are dominating this sector now, and slowly build the trust with these players. There is a **positive externality to this strategy**, because there are significant number of **players who deal in multiple base metals**. **Their experience** with these metals, will automatically **build trust for Aluminium, Copper and Nickel too.**

5. Cost of trading by Retail Investors

- MCX should **reduce the transaction costs for retail investors,** which is also a practice by international exchanges. This can bring in retail traders into the market and increase the volume and liquidity.

6. Cost of hedging in Commodity Derivatives:

- Value Chain Players complain that hedging is costly and it does not add to their profits. MCX can consider reducing the cost of hedging, by **reducing select margins, especially for genuine hedgers, with underlying exposure, with limits on number of contracts.**

- Due to lack of supportive banking environment, that finances the margin calls on futures trading, **MCX can nudge the existing deep pocketed members or nurture a new breed of risk aggregators, to wait and collect the cumulative margin calls on the date of maturity from their customers,** instead of calling for margins frequently. This approach has its flipside especially during high price volatility, in other situations it can help attracting the MSMEs and smaller players to hedge using futures on MCX.

7. Creating Inventory Visibility

- **The Tech-Way:** Inventory visibility is crucial for long term players to develop forward prices in a commodity market. This is one of the issues in the base metal sector, due to the presence of a few primary producers and multiple recyclers, who create the opacity they need. Currently this situation is barring both financial services players and physical metal players from forming a view about the likely future price. **A platform for spot physical metal transactions**, **like FX Clear of**

CCIL, may be considered, by **convincing the major players on both supply and demand side of the base metals to interact, transact, and settle their trades on this platform.** The **logistics and delivery centres would continue as they are now**. Therefore, there is no disruption to existing age-old networks. This **approach creates visibility of transactions and inventory with** historical data **for traders, speculators, and algorithms.** This would eventually increase their participation on MCX with **better price forecasting models**. An **online platform can provide real time data and also offer stiff competition to the stale and lagging prices reported by PRAs.** This is more of a market nurturing activity that MCX needs to take for a more vibrant and credible commodity exchange of India. **MCX can either create a subsidiary, or consider partnering with a technology firm,** like it is doing for investor education for this platform.

- **Warehouse Partnering Way:** MCX can extend its existing partnership with LME to bring in **India specific warehouses to place commodities which Indian players import significantly**. This would create the required inventory visibility and reduce the time lag especially during the sudden upsurge of geo-political tensions and the resultant supply disruptions. This suggestion was also provided in a previous research work, we are amplifying it. The interest evinced by LME's in 2018 can be carried forward, now that COVID19 and other disruptions have settled down. [9]

8. Polling the Spot Price:

- There is a **negative perception created by Price Reporting Agencies,** about **the robustness of MCX's spot polling mechanism** and the **way the prices are gathered**. The **PRAs are competing with this unique selling proposition,** that their price is better. MCX should address this issue, by **conveying more information about the spot price polling mechanism and educating by communicating regularly about the methodology of polled prices**. Currently

[9] We are interested in having a warehouse in India: LME CEO - The Hindu; LME eyeing tie-ups in India to set up warehousing chain across country - The Hindu BusinessLine

the website shows prices as "Ex-Thane", "Ex-Rajkot". Prices polled only from a particular city, might not convey the message that it is a Pan Indian representative price. Further, MCX can consider a **weighted average methodology by giving appropriate weights to actual and consummated trades, intention to trades.**

9. Rolling Settlement:

- MCX can also **attempt to provide opportunities for physical delivery at various points before maturity of a futures contract** like the **prompt dates based settlements in LME**. This would definitely build the convergence between the spot and future's prices. **This was also suggested in one of the previous studies at MCX.** But **we feel that it would be a long time for this to happen,** considering the **lack of stocks in the warehouse, not so encouraging banking sector that finances warehouse receipts on base metals, and lack of interest of sellers to place their stocks in the MCX warehouses.** If this ecosystem develops, then everyday there can be an active spot future price convergence.

10. MSME Outreach:

- Like how stock exchanges have created less stringent norms for MSME platforms, **MCX can also reduce the relevant margins for the MSME players,** build the volumes of such hedgers, which may bring in the speculators ("risk absorbers") and some agencies which can pool the risk of these MSMEs and place their bets. This would be a great service to the sector that contributes to Indian economy the most, and reduce their transaction cost and vulnerabilities due to "M-1" or "Q-1" pricing conventions adopted by large B2C manufacturers. **Pegging to MCX would be a win win situation for both MSME sellers** and the large manufacturing buyers. The MSME sellers **are the defacto manufacturers for the large, branded players in India** (who eventually assemble, package and delivery). **Then one of them would peg, and the other would hedge.** Providing a fixed price contract can be a competitive pricing strategy to compete globally.

11. Communicating Quality Assurance:

- MCX should **effectively communicate the quality specification methodology** and about the inventories in the warehouses or about the certified primary producers.

  This is **being already done by MCX** in the name of **Good-Delivery empanelment**. **If it befits a pure virgin metal and recycled metal to be segregated let it be so. To allay fears of lack of standardisation**. **Two separate contracts can be created**. This would be a credibility building measure.

12. Long-Dated Derivative Contracts:

- Many of the genuine large scale primary producers and manufacturers of value-added products complain that **MCX does not provide long dated futures contracts**. Therefore, they prefer LME for the same. Our Survey results show that very few large size players need it. Learning from international experience, **both the primary producers and recyclers can be nudged to participate in these long-dated contracts for their strategic hedging.**

  This would be a win-win situation for producers because they can align their production; for the buyers the forward price curve emerges for their sales bids and budgeting; for the traders and market makers, a new maturity horizon window opens. Many financial traders, alternate investment funds, would also come forward to place their bets when long-dated futures contracts are visible on the exchange. Creation of such contracts needs the cooperation of both buyers and sellers.

- **ETFs based on the iCOMDEX indices of MCX can be floated**, which would bring in various players to trade in it without the need for physical delivery, and MCX can generate the necessary volumes and liquidity into the respective metals, which can feed into the commodity specific futures contracts for long term.

- **Cross-Listing of LME long-dated contracts especially in Aluminium, Copper and Nickel** with a separate name and style may be considered for long-dated futures contract, where the settlements would be based on LME prices but in INR terms. Therefore, Indian players can save a lot on cost of compliance, currency, and international brokerage to trade in such contracts. The entire permitted financial institutional investors also can be roped in, If the existing MOU and license agreements of MCX with LME permit this. It would anyway promote the LME pricing, but for India, achieving long dated contracts in this manner would be faster, otherwise a decade or so would be needed to build in the necessary physical market ecosystem for the same. As of now LME is planning for cross listing futures of SFHE[10]

13. Outreach to Industry Associations and Promotions Councils and Centres of Excellence:

- **MCX should engage** with Indian Electrical and Electronics Association, Aluminium Casting Association, Automotive Component Manufacturing Association, Indian Transformers Manufacturing Association, Metal Recycling Associations, Aluminium Association of India, International Lead and Zinc Association India Chapter, FIEO, CII, ASSOCHAM, Chambers of Commerce etc, on continuous basis, **because some of them issue guidelines to their value chain players about which reference prices needs to be followed and they also set the price formulas and price variation clauses.**

  Majority of them are for the purpose of protecting the MSME interests and to develop manufacturing excellence and improve the global competitiveness of Indian players. **MCX should feature in their top 3 list for price referencing. Unprofessional PRAs cannot take the rightful position of MCX** at these places. It is a **bottom-up way to develop the leader's position**, rather than bringing it top-down with government directives like China.

[10] LME Plans New Metals Contracts Using ShFE Prices -Sources (usnews.com)

To Macro-Level Policy Makers, Industry Associations, Promotions Councils for Further Exploration/Implementation:

1. Fiscal Policy:

- **GST on Copper at 18% is too high and it might be one of the reasons for a grey market, if it exists.** This further **accentuates the fake GST bills problem also**. Believing the **authenticity of supplier is becoming a scare** among various medium and large buyers and manufacturers, especially in the lead market. This aspect would also hit commodity exchanges, especially when such sellers place their stocks in the warehouses.

  Atleast, certain critical metals in India should receive a favourable GST treatment, and stricter monitoring on the authenticity of suppliers.

2. Stability in Regulatory Environment:

- **Stability in regulatory environment related to import duties, anti-dumping duties, trading and hedging commodity derivatives** is needed. Otherwise, speculation about it by various value chain players, will make them shun these markets. **Frequent changes create uncertainty** for market makers like the recent stipulation of underlying exposure in the Forex markets.

3. Cost of Trading on Commodity Derivatives

- **Commodity Transaction Tax (CTT) should be reduced** if not made nil, **on genuine hedging transactions, and retail investors.** Unlike equity markets, such taxes on commodity derivatives create price distortions that feed into input prices. Therefore, to promote manufacturing in India, atleast, for critical metals **until commodity markets achieve some critical mass and momentum**, **reduction in CTT even on liquidity creating transactions can be considered**.

  This is important to promote a participation in the commodity markets, bring in the financial traders who would perform the crucial roles of liquidity creating, risk absorbing, in both short and medium term.

4. Competition among Exchanges:

- There should be healthy competition between markets and exchanges. However, considering the poor liquidity and decreasing volumes on popular commodity exchanges, it is important **to restrict the trading to one or two specialised commodity exchanges**. This will reduce the distribution of liquidity across markets.

5. Broadening the Market:

- Even though the regulations have allowed selective financial institutions to play in the commodities market, **Banks, Foreign Portfolio Investors, and all Alternate Investment Funds (AIFs) can be allowed to participate in all segments of the commodities derivatives** market which would make the exchange driven derivatives liquid.

6. Concerted Action:

- **Credit Rating agencies should factor in commodity price risk management policy of a company while giving it a rating**. This can act as a nudge to companies which currently do not give importance to a structured commodity risk management.
- Companies should be **encouraged to hedge in Indian commodities market rather than in global markets** as hedging in global markets involves substantial costs for margins, currency risk, and compliance. **RBI should nudge and incentivise purely domestic companies, and those with domestic sourcing and exporting to hedge their exposure in the Indian commodity exchanges**, like China

7. Availability of Finance

- Availability of bank financing is crucial for hedging. Especially to promote a daily rolling window settlement with physical delivery, **financing of base metal inventory in exchange accredited warehouses is recommended**. Currently

agriculture stocks are being financed by the banks. **Bank financing for margins of derivatives contracts is available in most markets, globally. RBI may consider that too.**

- Banks are the major financers for companies especially for working capital and they can help encourage an environment around hedging. **RBI could mandate banks to follow a discounted lending rate to companies which hedge their commodity risk as the cash flow is more stable and certain.** Credit Risk models of banks should factor in the volatility of cash flows versus stable cash flows while pricing the finances. Banks should also encourage their borrowers to hedge their commodities exposure preferably in market determined, regulator monitored exchanges rather than on OTCs.

8. Policy on Domestic Pricing of Critical Metals:

- All the **Copper smelters, refiners and extruders should come together** to agree upon a **common price across the country,** to reduce the multiple price references and the role of unprofessional price aggregators.
- **Either MCX should be considered as the national price benchmark for Critical Metals** or **a national index like National Coal Index could be developed**, especially to capture the price changes across the country. This would help various players on commodity exchanges to factor in the information into their expectations. Indices for Aluminium, Zinc and Lead, with **appropriate weights given to actual consummated trades, intention to trade and future expectations may be created,** for a domestic reference price.
- Government **should intervene and suggest that the cost of bank guarantee be not loaded onto copper prices especially when the required quality of copper is being imported due to non-availability** of a domestic producer. Similarly, **Government should consider removing anti-dumping duty on certain products, which are not manufactured in India**, with the desired quality parameters.

9. Developing the Base Metal Ecosystem:

- **Downstream applications of Aluminium and Copper should be improved and promoted. MCX should also take part in this activity, like the "Millets Push" by India.** This can have **two positive externalities. One,** the country would be **building "Functional Reserves"** for **more sustainable recycling in future and lesser mining,** and two, there would be an **emergence of an Indian reference price due to significant consumption.** This is better than importing ores and concentrated and build strategic reserves like China.
- The **large refiners, smelters, and primary producers of the country** must proactively or with the collaborative efforts of MCX should consider **placing their forward sales on commodity derivative exchanges,** while **continuing their spot sales as they are**. Unless the primary producers consciously develop the ecosystem for a derivative exchange, effective price discovery and delivery-based hedging would not take off in India.

10. Requiring intervention of SEBI:

- **Differential Lot Sizes** can be permitted to increase the participation of the market participants, especially in costlier metals like Copper and Nickel.
- **Reviewing the decision on mandatory physical settlement** is suggested, considering the decline in trade volumes on MCX after the guidelines; lack of clarity on the GST treatment of holding warehouse receipts by interstate buyers and sellers; lack of supportive margin financing environment in India; lack of interest amongst the primary producers to place their stocks in MCX warehouses across the country; and the criticality of metals like aluminium, copper and nickel for Indian economy. The spot prices ruling the physical transactions of the base metals are set by the dominating influence few primary producers in India. Further, MCX's futures prices do not show any significant influence on the spot prices.

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Appendix: I

Insightful Statements by Respondents

*"The commodity **derivative futures prices are not at all dependable,** they can be manipulated by the traders and speculators."*

– Managing Director, Copper Value Added Products

*"On the date of **maturity we do not find any convergence of the futures price and spot price"***

– Managing Director of a Lead Recycling Company

*"We would **prefer long dated futures contracts beyond 3 months, which we do not have in India and MCX**, therefore we do not consider hedging. The **rolling over** of the monthly contracts is **costlier due to higher pricing and higher requirement for margins**. Rollover cost is Rs.6 per Kg on MCX, Futures premium is approximately half of the cost of financing the inventory".*

– Managing Director of a public limited company of Copper Recycling and Value Added Products

*"We were the first ones to take physical delivery from MCX, but later when the **warehouse was getting assigned randomly,** we stopped and **did not find it feasible to have two or three GST** registrations, to claim credit. Every physical lifting of base metal from the warehouse of an Indian exchange would be treated as a sale in that state. When we bring it to our state, we are unable to claim input tax credit because it is not covered under interstate tax."*

– Managing Director, Large Private Limited Metal Trading Company

*"The **minimum size of the contract in MCX is quite higher** compared to average inventory or orders we place in our business. Therefore, it does not help hedging."*

– Proprietor, Small Fabrication Enterprise

*"We were hedging in the previous company, but the **policy of this company is very conservative** and they are not convinced about the benefits of hedging. So we are not hedging."*

– Procurement Manager of Electrical Transformers and Switch gears company with significant exports

*"We want to **keep our business simple** without adding any complexity and risk due to playing with derivatives. **Our Business is not playing with derivatives.** Therefore, we would not hedge."*

– CEO, of Copper and Aluminium Wires and Cables Division

*"We are a bit **cautious in** entering into a derivative contract due to **failure of delivery**, which happened in India. This is because the exchanges do not insist the seller to demonstrate their existing stock when entering a contract."*

– Managing Partner of a Brass Recycling Firm

*"The **futures contracts do not distinguish between different varieties/grades of a metal** and their qualities, which is not agreeable to us.."*

– Managing Director, Physical Metal Trader of Zinc, Nickel and Steel.

*"There is **no hedging gain** possible **after I have experimented** with three advisors and risk managers. They could not show any sustained benefit due to hedging".*

– Manging Director of a Private Limited Company doing Aluminium Recycling.

*"**Repeat orders of MSMEs** are always **negotiated with previous prices**"*

– Managing Partner of Aluminium Castings Firm

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