

An Empirical Study of Price Action, Return, Volatility and Risk in MCX vs International Exchange: A Comparative Analysis of Gold, Silver, Oil, Gas and Copper

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Abstract:

This project is a comparative study of five major commodities like Gold, Silver, Copper, Crude Oil, and Natural gas are traded in India's MCX (Multi Commodity Exchange) and in international markets like COMEX & NYMEX. The main goal was to understand how prices behave in both markets, how much return each commodity gives, how risky or volatile they are, and how closely the Indian prices follow global trends. Using 10 years of data (2015–2024), the study calculated returns, measured volatility, and used tools like correlation, regression, and Johansen cointegration tests. The results showed that international markets generally provided slightly higher returns, but MCX performed well too, especially in Copper and Silver. Volatility levels varied, with some MCX commodities showing higher short-term risk. Strong correlations and long-term relationships were found between MCX and global prices for most commodities. These findings highlight that Indian commodity prices are strongly influenced by global market movements. This study helps investors, traders, and policymakers better understand market behavior and make informed decisions.

Keywords: Commodity markets; MCX; COMEX; NYMEX; Volatility; Correlation; Cointegration; Financial integration

1. Introduction:

Commodity markets play a crucial role in the global financial system by facilitating price discovery, investment diversification, and risk management. Commodities such as Gold, Silver, Crude Oil, Natural Gas, and Copper are not only important industrial inputs but also significant financial assets that respond rapidly to economic and geopolitical developments (Anand & Mishra, 2023; Chahid & Handika, 2022). Their price movements influence inflation, trade balances, and investment decisions across countries.

In India, the Multi Commodity Exchange of India (MCX) serves as the primary commodity derivatives market, while international benchmark prices are largely determined by exchanges such as COMEX and New York Mercantile Exchange (NYMEX). Although domestic factors such as currency fluctuations, taxation policies, and government regulations influence MCX prices, Indian commodity markets remain strongly connected with global markets (Sonia & Narwal, 2023; Bhunia, 2013). Understanding the relationship between domestic and international commodity markets is therefore important to identify the degree of market integration and the transmission of price volatility.

Over the last decade, commodity markets have experienced significant fluctuations due to major global events such as the COVID-19 pandemic, geopolitical conflicts, and persistent inflationary pressures. These shocks have increased uncertainty and strengthened the interconnectedness between global and domestic commodity markets (Jebabli et al., 2021; Hasan et al., 2022). Energy and metal markets have shown strong co-movements and volatility spillovers during periods of crisis (Cunado et al., 2024; Umar et al., 2023)

The key objectives of the study are to examine the price movements of Gold, Silver, Copper, Crude Oil, and Natural Gas in Indian and global commodity markets. The study also aims to compare the returns of these commodities to identify the best performing assets, analyse volatility to assess the risk levels associated with each commodity, and examine the relationship between domestic and international prices using statistical tools such as correlation, regression, and cointegration analysis.

2. Review of Literature:

Several studies have examined volatility transmission, price co-movement, and connectedness among commodity markets across different countries and asset classes. Anand and Mishra (2023) conducted a meta-literature review on market connectedness and volatility spillovers across commodity markets. Their findings indicate that global commodity markets are increasingly integrated, and shocks in one market can easily transmit to other markets through financial and economic linkages. Similarly, Chalid and Handika (2022) analyzed co-movement and contagion effects in commodity markets and found strong interdependence among energy and metal commodities during periods of market stress.

Bhunia (2013) investigated volatility and co-movement between Indian and international crude oil markets and reported significant linkages between domestic and global price movements. Supporting this view, Sonia and Narwal (2023) examined volatility spillovers within the Indian commodity market and concluded that domestic commodity prices are strongly influenced by global market dynamics. Rajamani, Gopi, and Athilakshmi (2024) analyzed price discovery and volatility in gold and silver derivative markets and identified strong cointegration between MCX and international exchanges such as COMEX. Their results indicate that global benchmark prices play a crucial role in determining domestic commodity price movements.

Recent studies have also highlighted the role of uncertainty and geopolitical risk in commodity market volatility. For example, Hasan et al. (2022) found that commodities can act as hedging instruments during periods of economic uncertainty, while Jebabli et al. (2021) showed that volatility spillovers between stock and energy markets intensified during crises such as the global financial crisis and the COVID-19 pandemic. Furthermore, Cunado, Gabauer, and Gupta (2024) analyzed realized volatility spillovers between energy and metal markets using a time-varying connectedness framework and found that spillover effects increase during periods of market turbulence. Similarly, Umar et al. (2023) reported strong volatility transmission among energy and metal commodities, particularly during global economic disruptions.

3. Data and Empirical model:

3.1 Sample and data:

This study examines the price behaviour, return performance, volatility, and risk characteristics of major commodities traded in both domestic and international markets. The sample consists of five widely traded commodities: Gold, Silver, Copper, Crude Oil, and Natural Gas. These commodities are actively traded on India's Multi Commodity Exchange of India (MCX) as well as on major global exchanges such as Commodity Exchange Inc. (COMEX) and New York Mercantile Exchange (NYMEX). The study uses monthly price data covering a ten-year period from 2015 to 2024. Gold, Silver, and Copper prices were obtained from COMEX and MCX, while Crude Oil and Natural Gas prices were collected from NYMEX and MCX. The data were gathered from official exchange sources and financial databases such as Investing.com. To ensure consistency and comparability across markets, closing price data were used to compute returns and other statistical measures. The dataset was carefully cleaned to remove missing observations and ensure continuity across the entire sample period.

3.2 Variable Measurements

The study uses several statistical measures to analyze commodity performance in terms of returns, volatility, and market relationships.

3.2.1 Return

Commodity returns are calculated using percentage price changes over time. Returns help measure the profitability of investing in a commodity.

The return formula is expressed as:

$$R_t = ((P_t - P_{t-1}) / P_{t-1}) \times 100$$

where:

- R_t - Returns at the time t
- P_t - Commodity price at time t
- P_{t-1} - Commodity price at time $t-1$

This measure allows comparison of performance across different commodities and markets.

3.2.2 Volatility

Volatility measures the degree of fluctuation in commodity prices and represents the level of risk associated with an asset. In this study, volatility is measured using the standard deviation of returns, which indicates how much the returns deviate from their average value. Higher standard deviation values indicate greater price fluctuations and higher investment risk.

3.2.3 Market Relationship Variables

To examine the relationship between domestic and international commodity markets, the study applies the following statistical measures:

Correlation: Correlation analysis is used to measure the strength and direction of the relationship between MCX prices and international benchmark prices.

Regression Analysis: Regression analysis evaluates the extent to which international commodity prices influence MCX prices. The coefficient of determination (R^2) indicates how much variation in MCX prices can be explained by global prices.

Cointegration: The Johansen cointegration test is used to determine whether a long-run equilibrium relationship exists between MCX and international commodity prices.

In addition, Augmented Dickey–Fuller (ADF) tests are used to examine stationarity of the price series, and the Johansen cointegration test is applied to identify long-run equilibrium relationships between MCX and international commodity prices.

4. Empirical Results:

4.1 Descriptive statistics:

Table – 1 shows the analysis of monthly returns from 2015–2024 shows clear differences in performance and risk across commodities and exchanges. Gold delivered identical average returns on COMEX and MCX, but MCX Gold exhibited sharper fluctuations, making it relatively riskier than the more stable COMEX Gold. Silver generated slightly higher returns on MCX than on COMEX, although this came with noticeably greater volatility. Copper displayed steady and almost identical returns across both markets, with minimal extreme movements, making it the most stable commodity in the sample. In contrast, Crude Oil recorded low average returns, especially on NYMEX, along with frequent sharp losses, highlighting its high-risk nature. Oil on MCX performed slightly better but remained volatile. Natural Gas produced low returns and significant price swings in both markets, reinforcing its classification as a high-risk asset. Overall, Copper and COMEX Gold emerged as the safest commodities, whereas Oil and Gas were the most volatile, with MCX markets generally showing higher return variability than their international counterparts.

Table – 1:

Commodity Names	Mean	Standard Deviation	Maximum	Minimum	Skewness	Kurtosis
Gold COMEX Return	0.0085	0.0410	0.1360	-0.0810	0.389	0.187
Gold MCX Return	0.0085	0.0634	0.4002	-0.3905	-0.055	24.008
Silver COMEX Return	0.0056	0.0753	0.2659	-0.1900	0.560	0.986
Silver MCX Return	0.0073	0.0646	0.2691	-0.1164	0.911	1.631
Copper COMEX Return	0.0064	0.0576	0.1747	-0.1473	0.053	0.194
Copper MCX Return	0.0074	0.0563	0.1978	-0.1266	0.478	1.042
Oil NYMEX Return	0.0010	0.1171	0.2373	-0.7818	-2.503	15.766
Oil MCX Return	0.0063	0.1292	0.6677	-0.6638	-0.227	10.678
Gas NYMEX Return	0.0049	0.1596	0.4168	-0.5072	-0.298	1.470
Gas MCX Return	0.0025	0.1506	0.3615	-0.5222	-0.382	1.482

4.2 Comparison of returns:

Table – 2 shows the comparison of average returns shows that gold was the top-performing commodity, with Gold COMEX and Gold MCX leading the list. This means investors in gold, whether in the international or Indian market, saw the most consistent gains. Copper MCX and Silver MCX also showed good performance, making them reliable options among base and

precious metals in the Indian market. On the other hand, commodities like oil and gas, especially Oil NYMEX, gave the lowest returns, showing weaker performance over the years. Overall, the data suggests that precious metals, especially gold, provided the best returns, while energy commodities were more volatile and gave less consistent profits.

Table -2

Commodity	International Avg. Return COMEX/ NYMEX	MCX Avg. Return
Gold	0.00857	0.00854
Silver	0.00569	0.00733
Copper	0.00642	0.0074
Oil	0.00100	0.00605
Natural Gas	0.00497	0.00254

4.3 Correlation analysis:

Table – 3 shows the correlation analysis indicates strong positive relationships between MCX and international markets across all commodities. Natural Gas shows the highest correlation ($r = 0.977$), suggesting near-perfect co-movement between MCX and NYMEX prices. Silver, Copper and Crude Oil also exhibit very high correlations above 0.85, confirming that global price movements are quickly transmitted into the Indian market. Gold shows moderate correlation ($r = 0.525$), indicating partial but weaker price linkage due to domestic factors such as currency effects and import duties. Overall, the results highlight strong short-run integration between MCX and international commodity exchanges.

Table – 3:

Commodity	Correlation Coefficient (r)
Gold (MCX – COMEX)	0.525
Silver (MCX – COMEX)	0.918
Copper (MCX – COMEX)	0.878
Crude Oil (MCX – NYMEX)	0.876
Natural Gas (MCX – NYMEX)	0.977

4.4 Regression:

Table – 4 shows the regression results show that international prices strongly explain MCX price movements across all commodities. Natural Gas exhibits the highest explanatory power ($R^2 = 0.955$), indicating that almost all of its price variation on MCX is driven by global market movements. Silver, Copper and Crude Oil also show very strong predictive relationships, with R^2 values above 0.75, confirming high integration with COMEX/NYMEX prices. Gold has a moderate relationship ($R^2 = 0.275$), suggesting that domestic factors, including currency fluctuations and import costs, influence its MCX pricing. Overall, the regression evidence highlights the dominant role of international markets in shaping MCX commodity returns.

Table – 4

Commodity	R	R ²	Std. Error of Estimate
Gold (MCX – COMEX)	0.525	0.275	0.0542
Silver (MCX – COMEX)	0.918	0.842	0.0258
Copper (MCX – COMEX)	0.878	0.770	0.0271
Crude Oil (MCX – NYMEX)	0.876	0.768	0.0304
Natural Gas (MCX – NYMEX)	0.977	0.955	0.0322

4.5 Johansen Co-integration test:

Table – 5 shows Johansen test results reveal long-run equilibrium relationships for Gold, Copper, Oil and Natural Gas, as indicated by statistically significant trace and max-eigen statistics ($p < 0.05$). This means these MCX commodities adjust to international price deviations over time, reflecting strong long-term integration. Silver is the only commodity without cointegration, implying its long-term pricing in India is influenced by additional domestic factors such as import duties, liquidity differences, and local supply-demand conditions.

Table – 5:

Commodity	Trace Stat (Rank 0)	p-value	Max-Eigen	p-value	Cointegration
Gold (MCX – COMEX)	23.169	0.0023	23.040	0.0011	Yes
Silver (MCX – COMEX)	9.0617	0.3664	8.8234	0.3082	No
Copper (MCX – COMEX)	19.272	0.0115	18.625	0.0081	Yes
Crude Oil (MCX – NYMEX)	21.399	0.0048	16.761	0.0178	Yes
Natural Gas (MCX – NYMEX)	16.711	0.0245	14.893	0.0317	Yes

5. Findings:

Objective 1: Price Movements

Prices of all five commodities moved in similar directions in both MCX and international markets. Gold and Copper showed steady growth, while Oil and Gas had many ups and downs due to global events. Silver showed more irregular movement in India. Overall, price trends match globally with small differences caused by currency and local market factors.

Objective 2: Returns

Gold gave the highest and most consistent returns in both markets. Copper and Silver also performed well, especially in MCX. Oil and Natural Gas had the lowest and most unstable returns. Overall, Gold was the best-performing commodity over the period.

Objective 3: Volatility

Natural Gas and Oil were the most volatile and risky commodities. Gold, especially on COMEX, had the lowest volatility. Copper also remained stable with limited price swings. In general, MCX commodities were slightly more volatile than international ones.

Objective 4: Relationship (Correlation, Regression, Cointegration)

There is a strong positive relationship between MCX and international prices for all commodities. International prices strongly influence MCX movements, especially for Silver, Copper, Oil and Gas. Long-term cointegration exists for Gold, Copper, Oil and Gas, meaning their prices move together over time. Silver does not show long-run integration.

6. Implication of the study:

1. For Investors: Metals such as Gold and Copper offer relatively stable long-term behavior, while Crude Oil and Natural Gas require careful risk management due to high volatility. Strong integration implies that global price movements should be closely monitored when making MCX trading decisions.

2. For Hedgers and Traders: The high correlations and regression linkages indicate that international benchmarks provide effective signals for hedging strategies. Price shocks originating in COMEX or NYMEX are quickly transmitted to MCX, enabling traders to anticipate and manage risks using global market information.

3. For Policymakers and Regulators: The presence of long-run cointegration for most commodities suggests the need for continuous alignment of domestic commodity policies with global market trends. Enhancing liquidity, reducing transaction costs and promoting transparency can further strengthen India's price discovery mechanism.

7. Conclusion:

This study examined the price behavior, returns, volatility and market integration of Gold, Silver, Copper, Crude Oil and Natural Gas between MCX and major international exchanges from 2015 to 2024. The results show that price movements in India largely follow global trends, with Gold and Copper displaying steady long-term growth, while Oil and Natural Gas remain highly sensitive to global shocks. Return analysis confirms Gold as the strongest performer across markets, whereas energy commodities produce lower and more unstable returns. Volatility findings highlight that Oil and Natural Gas carry the highest risk, while Gold and Copper remain comparatively stable. The correlation and regression results demonstrate strong short-run linkages, indicating that international prices significantly influence MCX price movements. Long-run cointegration is observed for Gold, Copper, Oil and Gas, confirming that these commodities share a stable long-term relationship between Indian and global markets. Overall, the study concludes that MCX is closely integrated with international commodity markets, especially for metals and energy commodities, although domestic factors continue to play a role in shaping price behavior for certain assets such as Silver.

8. Reference:

1. Antonakakis, N., Chatziantoniou, I., & Gabauer, D. (2020). Refined measures of dynamic connectedness based on TVP-VAR. *Journal of Risk and Financial Management*.
2. Arouri, M. E. H., Jouini, J., & Nguyen, D. K. (2011). Volatility spillovers between oil prices and stock sector returns. *Energy Policy*.
3. Baffes, J. (2007). Oil spills on other commodities. *Resources Policy*.
4. Basher, S. A., & Sadorsky, P. (2016). Hedging emerging market stock prices with oil, gold, and commodities. *Energy Economics*.
5. Behmiri, N. B., & Manera, M. (2015). The role of oil price shocks in determining commodity prices. *Energy Economics*.
6. Bouri, E., Gupta, R., Tiwari, A. K., & Roubaud, D. (2017). Does gold hedge against stock market uncertainty? *Finance Research Letters*.
7. Cunado, J., Gabauer, D., & Gupta, R. (2024). Realized volatility spillovers between energy and metal markets. *Financial Innovation*.
8. Diebold, F. X., & Yilmaz, K. (2012). Better to give than to receive: Predictive directional measurement of volatility spillovers. *International Journal of Forecasting*.
9. Diebold, F. X., & Yilmaz, K. (2014). On the network topology of variance decompositions. *Journal of Econometrics*.
10. Dutta, A., & Bouri, E. (2020). Commodity market risks and volatility spillovers. *Resources Policy*.
11. Gorton, G., Hayashi, F., & Rouwenhorst, K. (2013). The fundamentals of commodity futures return. *Review of Finance*.
12. Hammoudeh, S., Malik, F., & McAleer, M. (2011). Risk management of precious metals. *Energy Economics*.
13. Ji, Q., Bouri, E., & Roubaud, D. (2018). Dynamic connectedness between commodities and stock markets. *Energy Economics*.
14. Kang, S. H., McIver, R., & Yoon, S. M. (2017). Dynamic spillover effects among crude oil, precious metals, and agricultural commodities. *Energy Economics*.
15. Mensi, W., Hammoudeh, S., Reboredo, J. C., & Nguyen, D. K. (2014). Do global factors affect commodity prices? *Energy Economics*.
16. Narayan, P. K., Narayan, S., & Sharma, S. (2013). An analysis of commodity markets and financial markets. *Economic Modelling*.
17. Pindyck, R. S. (2004). Volatility in natural gas and oil markets. *Journal of Energy and Development*.
18. Pinho, C., & Maldonado, I. (2022). Commodity and equity markets: Volatility and return spillovers. *Commodities*.
19. Reboredo, J. C., & Ugolini, A. (2016). Quantile dependence between oil and metals. *Energy Economics*.
20. Sadorsky, P. (2014). Modeling volatility and correlations between emerging market stock prices and commodities. *Energy Economics*.
21. Shahzad, S. J. H., Bouri, E., Roubaud, D., & Kristoufek, L. (2017). Safe haven properties of gold and commodities. *Resources Policy*.
22. Shen, Y., & Huang, Y. (2022). Commodity price volatility and global economic uncertainty. *Journal of Commodity Markets*.
23. Silvennoinen, A., & Thorp, S. (2013). Financialization, crisis, and commodity correlation dynamics. *Journal of International Financial Markets*.
24. Sari, R., Hammoudeh, S., & Soytas, U. (2010). Dynamics of oil price shocks and commodity markets. *Energy Economics*.
25. Tessmann, M., Carrasco-Gutierrez, C., Khodr, O., Magalhães, L., & Passos, M. (2024). Volatility transmission and market connectivity of metals and energy commodities. *International Journal of Energy Economics and Policy*.
26. Zhang, Y. J., & Tu, Y. (2016). Relationships between crude oil and metal markets. *Energy Economics*.
27. Zhang, Y. J., & Wei, Y. M. (2010). The crude oil market and gold market relationships. *Energy Economics*.
28. Zivot, E., & Wang, J. (2006). Modeling financial time series with S-PLUS. *Springer*.
29. Narwal, K. P., & Sonia. (2023). Volatility spillover in the Indian commodity market. *Indian Journal of Finance*.
30. Shahbaz, M., Kumar, R., & Ali, S. (2019). Global commodity markets and price volatility. *Resources Policy*