Interconnectedness of Commodities Share Price

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Abstract
Commodity markets are essential determinants in the global economy. The interconnectedness among commodities has a highly important bearing on price, volatility, and stability within a market. Therefore, the present study seeks to investigate the link among five most-traded commodities, such as Crude Oil, Gold, Silver, Nickel, and Soybeans-for the period from 2021 to 2024. Through the application of statistical tools like correlation, covariance, standard deviation, variance, and regression analyses, the study aims to assess the co-movement among these commodities and also trace the major forces that cause them to move in price. Various degrees of interdependence among commodities are inferred from findings that macroeconomic conditions, political events, speculation trading, and supply versus demand imbalances all heavily influence volatility in commodity prices. Such analysis is essential for investors, policymakers, and traders by alerting them to the requirement for an understanding of commodity interlinkages to be used in the formulation of risk management strategy and in making sound investment decisions. The study proceeds to say that whereas some commodities show significant levels of co-movement, others follow rules depending on industry-specific reasons; therefore, market participants need to analyze the behaviour of commodities in a broader economic context.

Keywords: Commodity markets, price volatility, futures trading, crude oil, gold, silver, nickel, soybean, macroeconomic factors.

I. Introduction
Commodity markets can be represented in an interconnected system where the condition of one commodity and the price of a commodity can deeply impact others in the global markets. This paper focuses on determining relationships between core commodities including crude oil, gold, silver, nickel, and soybean for the 2021-2024 period. Using correlation, covariance, standard deviation, and regression analyses on price data series, this study aims to establish the degree of co-movement of these commodities and to trace driving forces behind price variations. The importance of interdependence among commodities at various levels wherein macroeconomic variables, geopolitical happenings, speculative trading activities, and supply-demand disorders impact commodity price volatility is reputedly discerned by research. Such analysis is essential for investors, policymakers, and traders by alerting them to the requirement for an understanding of commodity interlinkages to be used in the formulation of risk management strategy and in making sound investment decisions. While some commodities show high co-movement, others follow sector-specific rules, which necessitates that market participants analyse commodity behaviour in a broad economic context.

This paper draws the conclusion that some psychological factors such as investor behaviour and overconfidence have weighed heavily on decision-making during market volatility. This research indicates that policymakers and investors should adopt interdependency as a consideration in the interest of optimal investment and policymaking. Therefore, this research narrows down into commodity markets and provides insights that policymakers, investors, and researchers may act upon.

The study investigates relationships between key commodities such as crude oil, gold, silver, nickel, and soybean over the period of 2021-2024. The research seeks to establish the causes of fluctuations in price that drive commodity market behaviour using correlation, covariance, and regression analyses. Market volatility was found to be induced from the macroeconomic-geopolitical interface, supply-demand forces, and speculative trading behaviours, along the lines of a specific commodity and general economic conditions.

The study provides insight into co-movement of commodity prices and risks by identifying differences in the level of integration, the basis on which authors suggest different patterns of movements and volatility. For instance, the study

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found that crude significantly and moderately affected other commoditized primarily due to its importance in the energy and transport sectors. Gold and silver showed their dual nature of being an actual input and a safe-haven asset during periods of economic instability. Old soybean behaviour has been dominated by agricultural cycle and condition, while nickel-price fluctuation was predominantly determined by the industrial usage and chain disruptions.

This means that the psychological factors of herd behaviour and overconfidence of investors significantly affected market price behaviours in the episodes of volatility. Therefore, the interdependencies need to be adequately considered for optimal decision-making by policy makers and investors. Thus, this research provides insights into filling the gaps in the commodity markets that investor, policy makers, and researchers can work upon. Apart from these other factors, speculation is another cause of price disturbances in the commodity market.

More and more, financial instruments such as commodity futures, options, and exchange-traded funds (ETFs) have been employed, thereby allowing institutional as well as retail investors greater access to commodities. Such instruments are being used to gain insights about the future price of a commodity, without ever engaging in the actual buy/sell, thereby leading to greater volatility and sometimes prices that stray from the core supply and demand fundamentals. Such speculative action is relevant when considering the nature of interrelatedness in how much sentiment, momentum or hedging activity will take investors toward correlated commodities. As such, it can be concluded that speculative trading makes forecasting commodity prices beyond difficult and underlines the degree of interconnection between different commodities.

In that context, this study aims to bridge the gaps pertinent to understanding interconnectivity among significant commodities with respect to price changes, volatility metrics, and the behaviour of the actors in the commodity markets for the period 2021 to 2024.This paper aims to find out how the interdependencies of crude oil, gold, silver, nickel and soybean impacts the price variability, volatility andthe investment for decision-making process. By examining the factors such as geopolitical events, macroeconomic indicators, and speculative trading activity, this research seeks to provide insights into how commodities influence one another and how these dynamics affect broader economic and financial landscapes. This analysis will be invaluable for investors, corporations, and policymakers in making informed decisions, navigating risks, and formulating strategies that consider the intricate web of dependencies within commodity markets.

II. Data and Methodology

2.1 Data
The research adopts an exploratory research design, the study focuses on a quantitative model designed to investigate the relationships between various commodities, identifying the factors that affect price change, and the impact of these changes on investors within the commodities market. It involves the study of Crude Oil, Gold, Silver, Nickel and Soybean for a period of 3 years from the year 2021-2024, to find out the function of the commodity under consideration in market. These commodities are benchmarked to the S&P Goldman Sachs Commodity Index (S&P GSCI) to evaluate the performance of a single commodity or indeed commodities in general.

2.2 Methodology
Given the intended objective of the study and the need to provide clear and robust insights into the interconnections between commodity prices, the study employs a combination of econometric techniques, including correlation analysis, regression models, and volatility analysis. These methodologies are designed to quantify the relationships among Crude Oil, Gold, Silver, Nickel, and Soybean and to determine the factors that influence price fluctuations within the commodities market.

To effectively analyze the interconnectedness of these commodities, the research utilizes time-series econometric techniques. Time-series analysis is essential for identifying trends, patterns, and cyclical behaviours in the commodity markets over the period of 2021-2024. Specifically, the study applies the Correlation and Covariance Analysis, Standard Deviation and Variance, Regression Analysis to determine the relationships between the selected commodities and assess the spillover effects.

2.3 Objectives of the study
The primary objectives of the research are:
1.　　To evaluate the extent of interconnectedness among commodities and identify the factors influencing their relationships.
2.　　To identify factors contributing to price volatility in the commodities market
3.　　To study investor behaviour and decision-making in commodity trading

2.4 Hypotheses
This study examines the relationships between different commodities and how changes in one affect others, impacting investor decisions. The key hypotheses are:

- **H1:** The prices of major commodities like crude oil, gold, silver, nickel, and soybean are closely linked. A change in one often leads to changes in others.
- **H2:** Commodity prices fluctuate due to economic factors such as inflation, politics, and supply-demand shifts, creating different price movement patterns.
- **H3:** Investors' decisions in the commodities market are influenced by price fluctuations, risk-taking behaviour, and portfolio adjustments based on market conditions.

2.5 Analytical Tools Used:

- **Correlation and Covariance Analysis:** Measures the degree of interdependence between commodities.
- **Standard Deviation and Variance:** Assesses volatility patterns.
- **Regression Analysis:** Determines the influence of macroeconomic indicators on commodity price fluctuations.

III. Data Analysis & Findings

3.1 Price Volatility and Interconnectedness

- **Crude Oil:** High volatility; moderate correlation with Gold and Silver due to macroeconomic factors.
- **Gold & Silver:** Strong co-movement; serve as safe-haven assets during economic instability.
- **Nickel:** Inversely related to broader commodity indices, influenced by industrial demand shifts.
- **Soybean:** High sensitivity to supply shocks, climate conditions, and trade policies.

3.2 Statistical Findings

Table 1Statistical Measures of Commodity Performance and Market Interconnectedness

Commodities	Standard Deviation	Average Return	Variance	Correlation	Covariance
Crude Oil	0.0128	0.0159	0.0002	0.11	7.93E-06
Gold	0.0054	0.0062	2.9936	0.054	1.65E-06
Silver	0.0112	0.0113	0.0001	0.004	2.90E-07
Nickel	0.0085	1.5523	7.2416	-0.039	-1.88E-06
Soybean	0.0086	0.9943	7.0411	0.055	2.67E-06

Table 1 presents key statistical measures of five major commodities—Crude Oil, Gold, Silver, Nickel, and Soybean—analyzing their risk, return, and relationship with the broader commodity market, particularly the **S&P GSCI (S&P Goldman Sachs Commodity Index).** These metrics include **standard deviation, average return, variance, correlation, and covariance**, which provide insights into their market behaviour and interdependencies.

3.2.1 Risk and Volatility
The standard deviation and variance in Table 1 indicate the risk levels associated with each commodity. **Crude Oil (0.0128), Silver (0.0112), and Nickel (0.0085)** exhibit higher standard deviations, suggesting they experience significant price fluctuations, making them riskier investments. In contrast, **Gold (0.0054)** has the lowest standard deviation, reflecting its historical stability as a safe-haven asset. The variance values confirm this pattern, with **Nickel (7.2416) and Soybean (7.0411)**

showing exceptionally high variance, indicating greater unpredictability in their price movements.

3.2.2 Average Return and Performance
Among the commodities analyzed in Table 3**Nickel (1.5523) and Soybean (0.9943)** exhibit the highest average returns, implying strong performance over time. **Crude Oil (0.0159)** offers moderate returns, balancing risk and reward. In contrast, **Gold (0.0062) and Silver (0.0113)** generate relatively lower returns, aligning with their traditionally stable nature. These differences highlight how industrial metals like **Nickel** and agricultural commodities like **Soybean** tend to yield higher returns but at the cost of greater price fluctuations.

3.2.3 Correlation and Market Interconnectedness
The correlation values in Table 1 shed light on how these commodities interact with the broader market. **Crude Oil (0.11) and Soybean (0.055)** exhibit a slight positive correlation with the **S&P GSCI**, indicating that their prices generally move in line with overall commodity trends. **Gold (0.054) and**

Silver (0.004) show near-zero correlation, emphasizing their role as independent assets that do not necessarily follow the commodity index. Interestingly, **Nickel (-0.039)** has a slight negative correlation, suggesting that its price movements sometimes diverge from the overall market trends, making it a useful asset for portfolio diversification.

3.2.4 Covariance and Market Influence
The covariance values in Table 1 further highlight the influence of these commodities on the overall commodity index. **Crude Oil (7.93E-06)** exhibits the highest covariance, signifying its significant impact on the S&P GSCI. **Soybean (2.67E-06) and**

Gold (1.65E-06) also contribute to the market but to a lesser degree. **Silver (2.90E-07)** has the least influence, while **Nickel (-1.88E-06)** moves somewhat against market trends**.** This suggests that **Crude Oil** remains a dominant driver of commodity price movements, while **Gold and Silver** retain their independence as safe-haven assets.

Regression results indicate limited predictability of commodity price movements based on macroeconomic indicators, suggesting other influencing factors such as investor sentiment and market speculation.

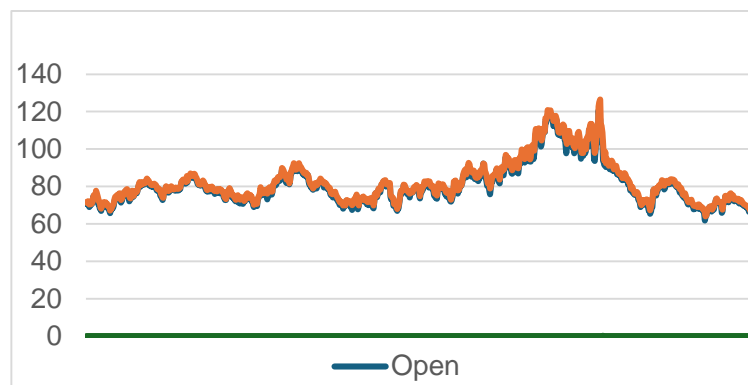**3.3 Price Analysis**

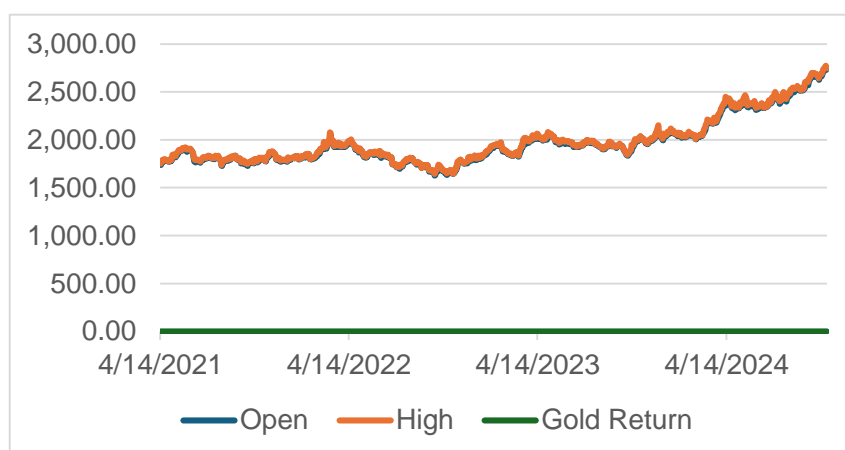**Figure 1 : Crude Oil Price**

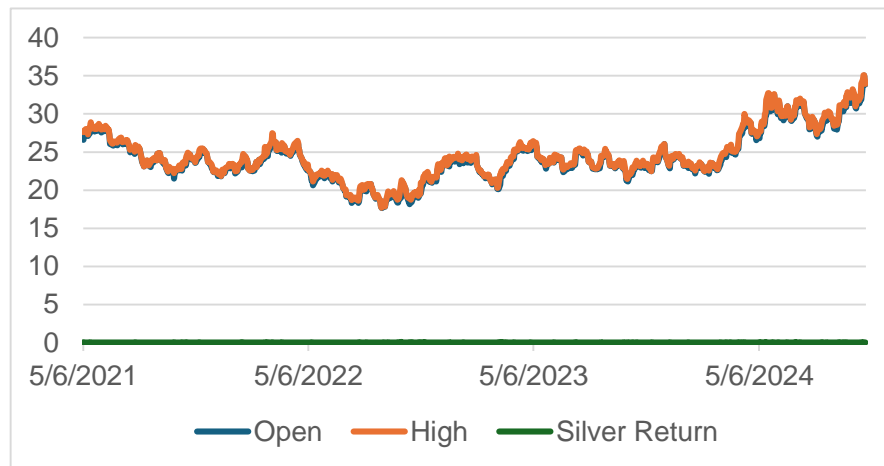**Figure 2 : Gold Price**

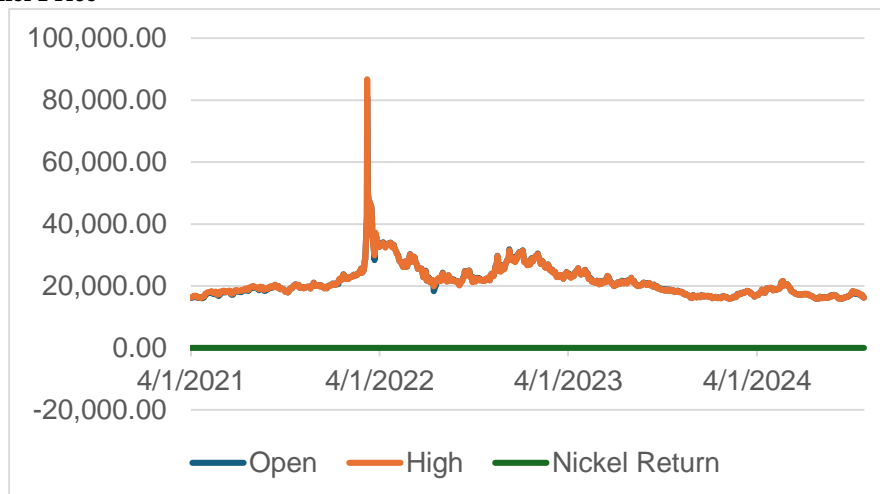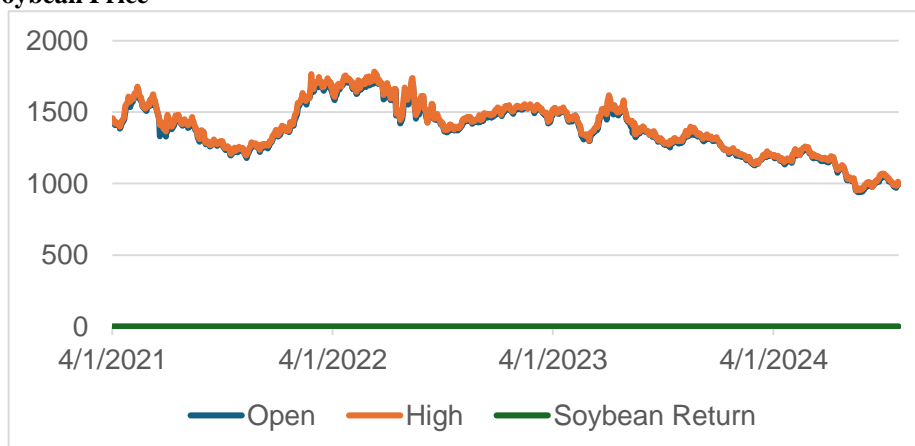**Figure 3 : Silver Price**

Figure 4 : Nickel Price

Figure 5 : Soybean Price

IV.   Conclusion

This study confirms that commodity price interdependence varies by sector and economic conditions. While Crude Oil influences industrial commodities, gold and silver act as safe-haven assets. Nickel and Soybean exhibit unique volatility patterns. Understanding these relationships is crucial for investors, policymakers, and traders to navigate market risks effectively. The findings emphasize the importance of considering market-specific factors when analyzing commodity interconnections, as different commodities respond uniquely to external influences. Future research could explore the impact of emerging market policies and alternative investment instruments on commodity price dynamics.

References

[1]. Ahmed, H., & Garcia, P. (2021). Macroeconomic influences on commodity price volatility: Evidence from GARCH models in energy and metal markets. Journal of Commodity Markets, 9(4), 125-138.

[2]. Anderson, S., & Hwang, J. (2019). The geopolitical impacts on oil prices and the commodity ripple effect. Energy Economics, 75, 247-261.

[3]. Chen, M., Li, Y., & Johnson, T. (2019). Speculative trading and its role in economic downturns: Insights into volatility in critical commodities. International Journal of Financial Markets, 22(1), 85-101.

[4]. Chong, T., & Green, A. (2019). Safe-haven assets during economic recessions: A focus on gold and metals. Economics of Precious Metals, 14(2), 194-205.

[5]. Huang, J., & Zhao, K. (2021). Behavioural finance in commodities: The contrasting approaches of institutional and retail investors. Journal of Financial Behaviour, 17(3), 150-168.

[6]. Johnson, D., & Li, X. (2020). Environmental and supply-demand factors in agricultural commodity volatility. Agribusiness Journal, 28(5), 210-226.

[7]. Kwon, S., & Lee, Y. (2021). The impact of environmental disruptions on global commodity prices: A network analysis. Environmental Economics Review, 33(2), 122-140.

[8]. Li, C., & Chan, T. (2018). Overconfidence in commodity trading and its market implications. Financial Behaviour and Commodities, 12(4), 97-110.

[9]. Miller, J., & Hsu, B. (2020). The influence of futures markets on commodity volatility: A case study of energy commodities. Journal of Futures Markets, 34(6), 132-145.

[10]. Ortega, R., & Rivers, P. (2020). Renewable energy and demand for metals: How shifts in energy affect commodity interdependence. Energy and Natural Resources, 31(4), 321-345.

[11]. Patel, A., & Singh, M. (2022). Investor risk aversion and commodity preferences during economic uncertainty. Commodity Markets and Sentiment, 29(2), 89-104.

[12]. Silva, R., & Sun, J. (2019). Quantifying interconnectedness in commodity markets: The application of network analysis. Financial Networks, 22(1), 55-78.

[13]. Torres, F., & Jackson, L. (2018). The role of media and sentiment in commodity price volatility. Journal of Economic Psychology, 19(2), 72-88.

[14]. Walker, R., & Patel, S. (2022). Technological advancement and its impact on metal commodity prices. Metal Markets Review, 40(3), 160-179.

[15]. Wang, H., & Cooper, M. (2019). Demand in emerging markets: The influence of industrial growth on global commodities. International Journal of Emerging Markets, 16(2), 200-217.

[16]. Zhang, W., & Fung, D. (2018). Energy and metals interconnections: Insights from VAR models. Resources Economics, 35(1), 101-118.