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AN EMPIRICAL STUDY ON PRICE DISCOVERY OF GOLD COMMODITY FUTURES IN INDIA

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Abstract

This study examined the price discovery function of spot and futures prices of Gold as a commodity from 2019 – 2021. In this study, the daily closing spot and future prices of gold obtained from Multi commodity exchange in India are used to analyze price discovery. Econometric tools unit root test (ADF), Johansen's and Juliesus cointegration test is carried out in the empirical process. The result of the study implied that the price is discovered in the spot market for gold during the sample period.
Keywords: Commodity, Gold, price discovery

1. Introduction

Commodities are important for the survival of living beings. India is a commodity-based economy and is considered a production hub for crops. The commodity futures market performs the functions of price discovery and risk management. The futures market plays a vital role in providing price signals and price risk management services to the stakeholders in the value chain (Trivedi, Nair, 2018). Price stability is a concern for investors and it also has far-reaching repercussions on the economy as a whole. Futures prices give necessary indicators to producers and consumers on future spot prices based on demand and supply conditions. Hence price discovery is essential to ensure efficiency and transparency in a competitive market environment. Price discovery provides the inter–temporal inventory allocation function to market participants can compare the current and futures prices and take a decision on allocation of their stocks between an immediate sale as well as storage for futures sale. The futures market also facilitates offsetting the traders for risk management and boosts competition who have market information and price decision to trade as traders in these commodities (Barreto, Ramesh, 2018). An efficient futures market should send price signals to the spot market quickly to remove supernormal profit from arbitraging on price differences or at maturity; the future prices are equivalent to spot prices excluding transaction costs.

Price discovery is very much useful to all segments of the economy which helps producer gets an idea of the price to prevail at a future time and they can decide on various commodities which helps to choose the best available in the future and guides them in buying decisions. The trading platform in the commodity market helped in integrating Indian and global markets by reducing price distortions.

Price discovery has been researched numerously for mature markets with more focus on equity markets. This research is limited to commodity markets in emerging markets in general and India in particular. Commodity future trading has played a vital role in economic development due to its ecosystem linkages and major role in employment generation (Sehgal et al, 2012). In this regard, it is important to empirically analyze the price discovery mechanism of gold as a commodity. Commodity futures markets in developing economies like India have fewer volumes and low market depth, lack of well-developed spot markets, poor delivery systems, policy restrictions and taxes on the commodities, and market imperfections. Given these situations, it is important to examine empirically the Indian commodity futures markets to throw light on the role played by the futures markets in the price discovery process. Hence, this study attempts to address the question: Are futures prices useful in the price discovery mechanism of spot prices?

2. Literature review

Vijayakumar (2021) examined price discovery and its necessity to commodity market participants in the trade. The study also found that there is a non-existence of the day of the week effect in the high-value cardamom e-auction system in India. The study indicated that the e-auction of cardamom is more active in price discovery than a Cardamom future. This research suggested policymakers discover interferences of online forward market mechanisms at the country level to ensure price discovery and market efficiency. Ali and Gupta (2011) found that there is a long-term relationship between future and spot prices for the majority of agricultural commodities. The short-term analysis indicates that the future market has a stronger capability to predict spot prices. Gupta et al(2018) analysed empirically market efficiency and price discovery of the commodity market in India. This study concluded that the use of future prices can be used to identify the new equilibrium and earn profits by transferring it to the spot market. The lag values of future and spot prices have displayed the autoregressive nature to reconfirm the inefficiency of the futures market. The price discovery process happened in the futures market in commodities. The rate of convergence of information is slow, especially in the non-expiration weeks. For copper, gold, and silver, the convergence rate was rapid during the expiration week of the futures contract confirming the value of the futures contract as an effective hedging tool. With respect to chickpeas, nickel, and rubber the convergence was weak during the maturity week implying the non-usability of a futures contract for hedging. Manogna and Mishra (2019) analyzed price discovery and volatility spillover of spot and futures agricultural commodity markets in India. In connection to these, the results of the EGARCH model to test the volatility revealed that there is a mutual spillover impact on futures and spot markets. Hence, it can be concluded that the futures market is more efficient in the price discovery of agricultural commodities in India. The future market plays a dominant role in the price discovery process, which is proved through price discovery exists for some of the commodities. Hence futures contract performs the primary function of price discovery in addition to the hedging facility (Inani, 2017).

Sanjay Sehgal (2012), analyzed the price discovery relationship of 10 agricultural commodities and found that price discovery is confirmed in all commodities except Turmeric. This study suggested that well–organized spot markets must be developed, ensuring transparency and trading efficiency. The precious metals futures serve s a price discovery function for spot market movement. The spot price is a price discovery tool for silver. The co –

integration test indicates that silver's futures and spot prices are co – integrated and the causality test shows that there is no causal relationship between futures and spot prices (Sridhar et al., 2016). Moonis Shakel(2014) attempted to study the price discovery relationship of the 3 agricultural commodities on NCDEX. The co-integration results confirm the existence of a long-run relationship between the spot and the futures price of Caster seed, Channa, and Soya bean. The vector error correction model confirms bidirectional causality between spot and futures prices of Castor seed, Channa, and Soya bean which indicated that select agricultural commodity plays the leading role in the price discovery process in India. Brahma (2018) examined the price discovery and volatility spillovers between futures and spot prices of ten metal commodities. The results confirmed that price discovery between futures and spot prices shows strong information transmission from futures markets to spot markets in the majority of metal commodities.

An existing review of literature on price discovery shows that spot and futures markets react to the same information. Exhaustive research has been conducted on the same area, but only a few notable studies have attempted on the Indian commodity market with reference to metal commodity futures. This study implies contributing to the literature on price discovery by focusing on the select agricultural commodity.

3. Methodology

Commodity prices absorb market information in an efficient market system to maintain equilibrium. The investor's emotional behavior and perceived value of an asset shortly reflect on the movement of prices. These movements cause volatility in the short and long run in different market situations. This paper considering the spot and futures markets of gold explores price discovery and market efficiency. This study is based on a causal research method that used daily price data of spot and futures prices of gold traded in India from the domains of the bullion market and Multi commodity exchange of India Limited. The study in total considered 772 observations from 1st January 2019 to 31st December 2021 of all trading days except public holidays. This data was analyzed using the e-view software package. The study first converted the variables into log-returns and tested for stationarity, as well as administered a co – integration test for long-run association.

Test of stationarity and lag order criteria

The data were converted into log returns and tested for stationarity with the Augmented Dickey-Fuller test (ADF). The lag order for Co – integration, and VECM were considered from Akaike Information Criteria (AIC) (Dicky and Fuller, 1981). Johansen co-integration test has been applied for testing the long-run relationship of the spot and the future price of Gold as developed by Johansen and Juselius (1990). The tests are represented as under

$$\Delta X_t = \alpha_o + \alpha X_{t-1} + \sum \beta_i \Delta X_{t-i} + \varepsilon_t$$

$$Y_t = \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots \dots + \beta_k y_{t-k} + u_t$$

Here, ΔF = Future price, ΔS = Spot price taking respective lags, co -integrating vectors, and error terms. This method helps to analyze the existence of long-run causality among selected variables of market efficiency.

4. Result and Analysis

The spot and futures price movements over a study period have been presented in Figure 1. The prices are moving in trend at various time periods. Table 1 represents descriptive statistics of selected variables considered for the study such as mean, median, standard deviation, kurtosis, and skewness.

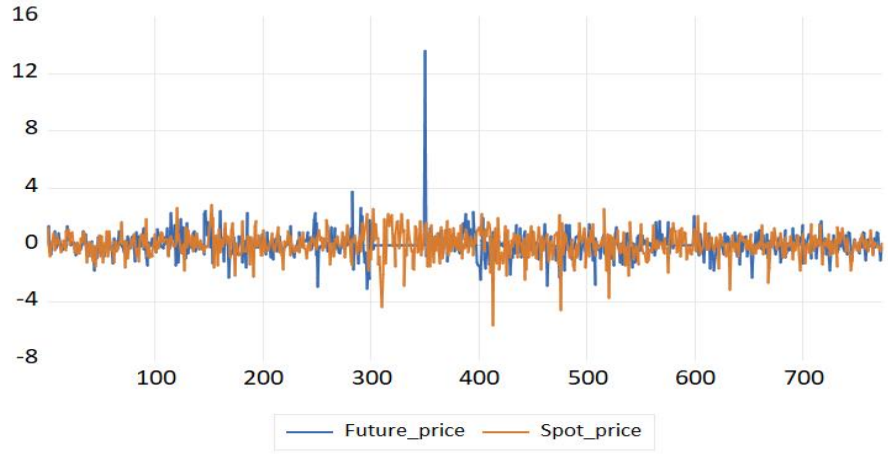

Table 1 Showing descriptive statistics of gold

Particulars	Spot price	Future price
Number of observations	772	772
Minimum	-5.61	-3.04
Maximum	2.82	13.59
Mean	0.0577	0.0581
Median	0.072	0.000
Sum	44.53	44.94
Std.dev	0.897	0.892
Skewness	-0.805	4.469
Kurtosis	7.011	71.47
Jarque-bera	601.02	153371.9
Probability	0.00	0.00

Source: Author's calculation based on secondary data

4.1 Results of stationarity test

The study diagnosed the stationarity of log series data using the Augmented Dickey-Fuller test (ADF). Below table 2 presents ADF test results of spot and futures prices of gold indicating stationarity with P values.

H_0: The spot and futures prices have a unit root

From Table 2, it is noted that all the series are non-stationarity consisting of a unit root. At level, the test implies that the T statistic value is significant and by taking differences, all the series are stationary at a 1% level significance level for the sample period. Hence, the null hypothesis is rejected.

From table 3 it is seen that there are five significant values in lag 1. This shows that there exists a long-run relationship between spot and futures price.

Table 2 Results of unit root test(ADF)

Particulars	Statistic	Spot price	Future price
With constant	T – statistic	-25.95	-26.38
	Probability	0.00**	0.00**
With constant &Trend	T – statistic	-25.97	26.40
	Probability	0.00**	0.00**
Without constant &Trend	T – statistic	-25.87	-12.50
	Probability	0.00**	0.00**
At first difference			
With constant	T – statistic	-15.97	-15.75
	Probability	0.00**	0.00**
With constant &Trend	T – statistic	-15.96	-15.76
	Probability	0.00**	0.00**
Without constant &Trend	T – statistic	-15.98	-15.74
	Probability	0.00**	0.00*

Source: Author's calculation based on secondary data

4.2 Cointegration test of Gold

After testing the stationarity of gold futures price and spot price, Johansen's and Juliesus cointegration test is applied to analyze the long-run relationship between the variable (Table 4)

H_0: There is no cointegration between future and spot prices of gold

From the cointegration test with lag 1 at a 5% level, it is seen that H_0 is rejected

Table 3 VAR Lag order selection criteria

Lag	LagL	LR	FPE	AIC	SC	HQ
1	-280.21	354.32	154.30	-9.05	-28.07	15.4
2	-280.21	4.26	154.21	-9.04	-28.08	-28.2
3	-280.24	6.23	154.25	-9.04	-28.09	-28.1
4	-280.25	6.21	154.26	-9.03	-28.07	-28.3

Source: Author's calculation based on secondary data; indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

Table 4 Cointegration test with lag 1 at 5% level (trace test)

	Model 2	Model 3	Model 4
None*	320.22	18.40	17.15**
At most 1*	142.34	3.84	3.84

*Source: Author's calculation based on secondary data. ** denotes rejection of the hypothesis at the 0.05 level;*

Gold. Intercept and trend in CE – No intercept in Var
Trend assumptions: linear deterministic trend(restricted)
Series:Spot price future price
Lags interval (in difference): 1 to 1

Unrestricted Coointegrated Rank test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None*	0.2069	320.22	18.40	0.00
At most 1*	0.169	142.34	3.84	0.00

Source: Author's calculation based on secondary data

The above values imply a trace test cointegrating equation at the 0.05 level

*denotes rejection of H_0 at the 0.05 level

** indicates the MacKinnon – Haug – Michelis (1999) p-values

Unrestricted Coointegrated Rank test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 Critical value	Prob.**
None*	0.2070	177.87	17.15	0.00
At most 1*	0.169	142.34	3.84	0.00

Source: Author's calculation based on secondary data

The above Max-Eigen value test implies cointegration at the 0.05 level

*denotes rejection of H_0 at the 0.05 level

**indicates the Mackinnon -Haug-Michelis (1999) p – values

Table 5 indicates that the results of no cointegration are rejected as the trace statistics(14.26), and Max Eigen statistics (3.84) is more significant than critical value and denotes rejection of H_0 at 0.05 level which implies the presence of at most cointegration is confirmed.

The gold future price and spot prices move together in the sample period

Table 5 Cointegration test with lag 2 at 5% level (trace test)

	Model 2	Model 3	Model 4
None*	1019.51	15.49	14.26**
At most 1*	473.99	3.84	3.84

*Source: Author's calculation based on secondary data. ** denotes rejection of the hypothesis at the 0.05 level;*

5. Conclusion

This study examines the price discovery of the Indian commodity market using Gold. The study has considered daily data of closing prices of spot and futures prices from 2019 – 2021. Future research can be carried out on another sampling period. The study has applied various econometric tests like unit root tests and cointegration tests to examine the spot and futures prices of gold. The unit root test (ADF) confirmed that variables are stationary at the first difference 1(1). Further, the cointegration test indicated that gold spot and futures prices

cointegrated at most once in the contract by implying a long-run relationship. The result of the study revealed that new information impacts the prices.

The present study can be supported with further research by analyzing more underlying assets in the commodity market and studying the impact of economic indicators on the commodity market also can be considered.

References

- Bhabani Sankar(2021), Competence and efficacy of commodity futures market: Dissection of price discovery, volatility, and hedging, IIMB Management Review (2021) 33, 146–155
- Brahma Edwin (2018), Price Discovery and Volatility Spillover in Metal Commodity Market In India, Indian Journal of Accounting (IJA) Vol. 50 (1), pp. 97-106
- CRS Report for Congress (2006), Price Determination in Agricultural Commodity Markets: A Primer
- Kapil Gupta (2015), Price Discovery and Arbitrage Efficiency of Indian Equity Futures and Cash Markets.
- Minakshi(2018), Price Discovery Mechanism in Spot and Futures Market of Agricultural Commodities: The Case of India, FOCUS: Journal of International Business Volume 5, Issue 2, July-December 2018, pp. 44-67
- Moonis Shakeel (2014), Price Discovery Mechanism of Spot and Futures Market in India: A Case of Selected Agri-Commodities, International Journal of Business and Management, Vol. VII, Issue 8
- Pushpa L Trivedia and Vishal V Nair (2018), Price discovery and arbitrage linkage in the Indian agricultural commodity futures market: a study of gram futures Economics Research Review 2018, 31 (2), 187-195
- Raushan Kumar, (2017) "Price Discovery in Some Primary Commodity Markets in India", Economics Bulletin, Volume 37, Issue 3, pages 1817-1829
- Sanjay Sehgal (2013), Price Discovery and Volatility Spillover: Evidence from Indian Commodity Markets, The International Journal of Business and Finance Research volume 7 number 3
- Sanjay Sehgal et al (2012), Price Discovery in Indian Agricultural Commodity Markets, International Journal of Accounting and Financial Reporting ISSN 2162-3082 2012, Vol. 2, No. 2
- Sarveshwar Kumar Inani(2017), Price Discovery and Efficiency of Indian Agricultural Commodity Futures Market: An Empirical Investigation, The Indian Econometric Society.
- Sridhar (2016), Price Discovery in Commodity Market – An Empirical Study on the Silver Market IOSR Journal of Economics and Finance (IOSR-JEF), Volume 7, Issue 2. Ver. III (Mar. - Apr. 2016), PP 88-95
- Vijayakumar (2021), Price discovery and market efficiency of cardamom in India, Vilakshan - XIMB Journal of Management Vol. 19 No. 1, 2022 pp. 28-44