Does Gold Futures Architect Price Innovation in NSE Indices?: A Volatility Analysis

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The present research explored Karl Pearson Correlation between Gold Futures; and NSE Indices as well as Gold Spot individually and collectively with respect to volatility clustering, Regression and Granger Causality Test for period 1st, June, 2009 to 31st, March, 2014. The volatility analysis of Gold Futures with Gold Spot and NSE Indices was done using GARCH (1, 1) Model to manage challenges in uncertain environment. It revealed that Gold Futures is an independent variable and put no pressure of NSE Indices returns and Gold Spot; but Gold Futures when studied as a dependent variable; there was least impact.

KeyWords: Gold Futures, Gold Spot, NSE Indices, GARCH, Granger Causality.

1. Introduction

Where to invest in the risky or risk free assets? This seems to be a very common question arising in the minds of investors globally in this dynamic environment. The typical avenues of investments where especially the institutional investors can take significant exposures include Equity, Fixed Income Securities like, Bonds, Derivatives, Commodities, Investable Funds, etc. During recent years, commodities prices and the level of investment in commodities rose significantly. Commodities could provide the yield to investors were they were looking for but, more important, investors began taking greater advantage of the negative price correlation of commodities to bonds and equities to diversify their portfolios. Unlike the traditional assets like bonds or equities, the opportunities and challenges in commodity investments has made the scope of investment considerably wider for the investors in the world economy. Investors can take reasonably good amount of exposure in commodity markets, either through direct investments in different commodities or through various indirect channels. Direct commodity investment has historically been a small part of investors' overall asset allocation. Owning equity or debt issued by companies specializing in commodity markets has been the principal means of obtaining commodity exposure. In recent years, however, the number and variety of commodity-linked investments, offering direct exposure to commodity markets, has considerably increased. Commodity based indices, commodity futures contract are some of the important means to get a direct exposure into the commodity market. However, the investors' benefits of commodity or commodity-based products lie primarily in their ability to offer risk and return trade-offs that cannot be easily replicated through other investment alternatives and avenues.

The gradual evolution of commodity markets in India has been of great significance for both the country's general economic prosperity and the financial sector in particular. From an investment viewpoint, a commodity is considered as an alternate asset class and investing in commodity futures is thought provoking to investors as commodities have a significantly lower degree of association with other traditional asset classes and offer an effective hedge against inflation. Besides being a unique hedging instrument, it also provides for efficient portfolio management ensuring diversification benefits, which result in improved returns to domestic as well as international investors. Financial derivatives, futures and options, have emerged as widely traded instruments around the world, including emerging markets. Commodity futures form a small part of that trading but have important hedging implications against positions taken in various financial instruments. Financial markets help in transferring risk from some agents to other. One is hard pressed to think of a business venture more risk-prone than commodity. It is hardly a surprise then, that commodity futures have been among the earliest derivatives thought of by man and the daily trading volume of commodity futures worldwide runs into several billion dollars. A well developed spot commodities market with pure commercial interest helps in discovering the true price of the commodities.

An effective spot market is a barometer for efficient pricing mechanism as it is the market which is made of direct participation from farmers/producers, intermediaries, wholesalers, consumers, investors, etc. However, spot market will heavily depend on physical market infrastructure as well as cost of moving goods from one place to another, tax rate applicable to the particular commodity, etc. A well-developed and effective commodity derivatives market facilitates price discovery and thereby reduces price risk associated with extreme seasonal variations in demand and supply of commodities. Futures prices are generally referred as predictors of future spot prices (Samuelson, 1965). It tends to provide direction to spot prices thereby helping in price discovery as well as minimization of price fluctuations. Hence, price determination in derivatives markets becomes crucial as it sends signals to spot markets of the underlying commodities and the efficiency of a futures exchange depends upon their ability to ensure that the prices of the contracts traded on the exchange reflect supply and demand (World Bank, 1996). If the futures' prices do not reflect the prevailing demand supply situation due to any reason

then they may tend to disseminate wrong signals to the spot markets and thereby lead to increase in price risk. In addition, increase in price risk could be witnessed in the conditions of deficit supply of commodities.

The Indian commodity exchanges have observed a sharp growth in trade volumes and turnover in recent years and are increasing rapidly. Investment in commodity futures is now serving as a noticeable alternative to traditional investments in stock markets. Further, with a revision in FDI policy for commodity markets on the anvil, investor prerequisites include transparency and assurance on the enforcement of future contracts. While the Forward Market Commission serves as a regulatory body, the exchange defines its own day-to-day functioning, which encompasses setting the norms of trading and settlement, insuring adequate arrangement for surveillance and following the best practices for risk management, which are premeditated to be in line with international standards. Futures trading in commodities results in transparent and fair price discovery on account of large-scale participation of entities associated with different value chains. This reflects upon the views and expectations of a wide section of investors related to that commodity. It provides an effective platform for price-risk management for all segments of players ranging from producers, traders, processors, exporters/importers and the end-users of a commodity. The delivery and settlement procedure differs for each commodity in terms of quality implications, place of delivery, options, penalties and margins, and are defined comprehensively by the exchanges. Members of an exchange can perform and clear transactions in only those contracts which are exchange specified and approved by the FMC (Mishra, 2009).

Gold is often seen as an alternative to the stock market. Buying shares can give a higher return because investors receive dividends and possible growth in share capital. In times of economic turmoil or recession, the value of shares tends to fall. So, investors may sell shares and buy gold. Thus, fear over a recession tend to increase the value of gold as people move from more risky stock market to gold (Pettinger, 2011). Rising gold prices can become self-fulfilling as investors pile capital into gold to take advantage of rising prices. The price of gold can be highly volatile. It is believed that there is gold bubble, when the economy returns to normal, people may feel gold is highly overvalued and people could see a fall in the price of gold like, the early 1980s (Bhansali, 2009). A change in supply could alter the price of gold. If there is a sharp increase in production, the price is likely to fall. However, the supply of gold is relatively stable. The fluctuations in price tend to relatively occur due to changes in demand. It can be estimated reliably that gold and macroeconomic variables are interdependent factors and complement each other as and when required (Pettinger, 2011).

Considering these developments in Indian commodities futures market, an attempt has been made to investigate whether the gold futures trading has led to rise or fall in various NSE Indices prices and volatilities. This paper attempts to investigate the effect of the gold futures on the performance of various indices of National Stock Exchange, India as well as gold spot and get insights into the effect upon the volatility of the NSE indices and gold spot caused by gold futures. The Gold Spot market and NSE Indices volatility were estimated using symmetric GARCH methods. Any increase in NSE Indices volatility that has followed the onset of gold futures trading has generally been taken as justifying the traditional view that the gold futures price induces change in price behavior of various indices of NSE and even in gold spot. This paper attempts to investigate the change, if any, in the volatility observed in the various NSE indices and gold spot due to the volatility of gold futures. The change in the volatility is compared not only in absolute levels of volatility but also in terms of the structure of the volatility. This has been done to give insights into the way the gold futures prices influence the Indian stock market's volatility taking NSE indices as samples.

2. Literature Review

A study focused on bounds testing approach to co-integration, which tested the relationships between the prices of two strategic commodities i.e., oil and gold and the financial variables i.e., interest rates, exchange rates and stock prices of Japan, suggested that the prices of gold and stock can help to form expectations of higher inflation rate over time. In short run gold stocks can be a better option and in long run gold as commodity can be a better source to hedge portfolio (Le and Chang, 2011). The gold price exhibited highly correlated behaviour with extreme outliers, such as a breakdown of governance, war, or disasters. These rising gold prices in particular, can be attributed at least in part to the announcement of the Central Bank and the event had little direct relationship, if any at all, with the economic cycle; it was concluded that gold appears to be independent of cycles in contrast to other commodities, making it worth considering as a good portfolio diversifier (Lawrence, 2003).

The effects of macroeconomic variables on the Turkish Stock Exchange indicated that interest rate, Industrial Production Index, oil price, foreign exchange rate have a negative effect on ISE-100 Index returns, while money supply positively influenced ISE-100 Index returns and Inflation rate and gold price do not appear to have any significant effect on ISE-100 Index returns (Büyükşalvarcı, 2010). The long-run relationship between oil and gold spot and futures prices at various levels of maturity was examined and found that the relationship was rooted in investors using the gold market to hedge against inflation rate, which results from a shock in oil prices that leads to a rise in oil prices. Using co-integration test, it was found that gold and oil spot and futures markets were co-integrated and implies that investors do use the gold market as a hedge against inflation rate, and the oil market can be used to predict the gold market prices and vice versa with markets inefficiencies (Narayan, Narayan and Zeng, 2010).

The empirical studies point up that Indian stock market counting SENSEX was very much prejudiced through few serious features, that is, Indian gold price and exchange rates (dollar and rupee). Generally, gold price and stock market moves in an opposite direction. When the economy is in a downturn and stock markets are going down, investors tend to park their funds in gold and wait out the storm. As the gold price rises, Indian investors tend to invest less in stocks, causing stock prices to

fall (Yahyazadehfar and Babaie, 2012; Bhunia and Mukhuti, 2013). The co-movements of four macro-economic variables in terms of gold price, stock price, real exchange rate and the crude oil price based on 21 years data using econometric models for the periods from January, 1989 to September, 2009. The study unfolded that there was a co-integration relationship between the variables (Samanta and Zadeh, 2012).

The researchers have made a study to examine the impact of macroeconomic variables such as interest rate, house price and gold price on stock price in capital market of Iran based on monthly data from March, 2001 to April, 2011 using VAR and Johansen-Juselius Model. From the study, it was concluded that most of fluctuation in stock price can be recognized to itself, nevertheless among the selected variables, the house price had main role on stock price fluctuation (Yahyazadehfar, Shams and Matan, 2010). A study examined relationship between gold price and stock market for the period from June, 2009 to June, 2010; it proved that there is no relationship with the stock market and gold price and stock market is not a ground for rising gold price (Kaliyamoorthy and Parithi, 2012). In another study, the researchers had made efforts to examine the long-run and short-run relationships between SENSEX and four key macroeconomic variables (wholesale price index, index of industrial production, exchange rate and call money rate) of Indian economy by using monthly data from April, 2007 to March, 2012 with the application of financial econometrics. Empirical results of the study showed that there are no short-run causal relationships between SENSEX and the four macro-economic variables but confirmed long-run relationships between BSE SENSEX with index of industrial production and call money rate (Sharma and Mahendra, 2010).

A study documented the long-run and short run relationships among stock price index and gold price in developed and developing countries which confirmed that there is no relationship with the stock market and gold rate and stock market is not a reason for increasing gold rate (Shahzadi and Chohan, 2012; Coudert, Couharde and Mignon, 2010; Kaliyamoorthy and Parithi, 2012). The researchers confirmed that there was a significant relationship with the stock market and gold rate and stock market was a reason for increasing gold rate (Le and Chang, 2011). It was documented that Indian stock market is not associated with gold market and gold prices have not been increased continuously due to Indian stock market crash (Kaliyamoorthy and Parithi, 2012).

A study was undertaken to find the association between commodity market variables and stock market of one European country and two South Asian countries, based on monthly time series data between 1999 and 2008. The study confirmed that stock market of the European country is considerably associated with two macro-economic indicators but the stock markets of two selected countries were not associated with macroeconomic indicators in the long period (Wang, Wang and Huang, 2010). It was illustrated that stock market index was linked with gold mining companies' gold price index in the long period after utilizing the daily time series data between 1996 and 2007 and furthermore illustrated that both the variables persuaded each other in the short run (Gilmore, et. al., 2009). It was found that the relationship between the price of gold and stock price indices for the United States over the period beginning in January, 1991 and ending in October, 2001 using co-integration test and Granger Causality Test. Over the period examined, there was no co-integration involving a gold price and US Stock Price Index. There was no long run equilibrium and the series did not share a common stochastic trend. Only short run relationships were evident (Smith, 2001).

3. Objectives

The research objectives are as follows:

NOTE: CNX NSE Indices used in study are : (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap)

- To study the relationship between returns of Gold Futures, CNX NSE Indices and Gold Spot.
- To study the impact of returns of Gold Futures on CNX NSE Indices and Gold Spot.
- To study the impact of returns of CNX NSE Indices and Gold Spot on Gold Futures.
- To study the causal relationship between returns of Gold Futures, CNX NSE Indices and Gold Spot i.e., the variables Granger Cause each other.
- To study the volatility caused by CNX NSE Indices and Gold Spot on Gold Futures.
- To study whether returns of CNX NSE Indices Gold Spot and Gold Futures are serially correlated.
- To study whether returns of CNX NSE Indices Gold Spot and Gold Futures are normally distributed.
- To study whether there is an ARCH Effect caused by CNX NSE Indices, Gold Spot and Gold Futures.

4. Hypotheses

The research hypotheses are as follows:

H_{01}: There is no significant relationship between returns of CNX NSE Indices, Gold Spot and Gold Futures.

H_{02}: There is no significant impact of returns of CNX NSE Indices and Gold Spot on Gold Futures.

H_{03}: There is no significant impact of returns of Gold Futures on NSE Indices CNX and Gold Spot.

H_{04}: There is no significant the causal relationship between returns of Gold Futures, CNX NSE Indices and Gold Spot, i.e., the variables does not Granger Cause each other.

H_{05}: There is no volatility caused by CNX NSE Indices and Gold Spot on Gold Futures.

H_{06}: There is no serial correlation between the returns of CNX NSE Indices Gold Spot and Gold Futures.

H_{07}: The residuals of CNX NSE Indices, Gold Spot and Gold Futures are not normally distributed.

H_{08}: There is no ARCH Effect caused by the returns of CNX NSE Indices, Gold Spot and Gold Futures.

5. Research Methodology

5.1 Research Questions

Does there is any co-relationship between returns of CNX NSE Indices, Gold Spot and Gold Futures.
Do CNX NSE Indices and Gold Spot impact on Gold Futures returns?
Does there exists any interactive cause and effect relationship between CNX NSE Indices Gold Spot and Gold Futures?
Does volatility in CNX NSE Indices and Gold Spot affect the volatility in Gold Futures?

5.2 Data

The study is based on secondary data obtained from various sources as databases of MCX and NSE. The study considered daily data comprising the closing prices of Gold Futures, Gold Spot and CNX NSE Indices for finding their returns. Hetroscedastic data were converted into homoscedastic data for the period span from April 1st, 2010 to March 31st, 2014. There are total 997observations under the studied period.

5.3 Tools Used

In the course of analysis of the study, statistical tools comprising econometric tools like, Correlation Analysis, Granger Causality Test, Regression Analysis, GARCH (1, 1) Model, Serial Correlation, Jarque-Bera Test and ARCH (LM) Test have been applied. e-Views 7.0 Package Program has been used for arranging the data and implementation of econometric analysis.

6. Results & Interpretation

6.1 Correlation

	DY GOLDFUT		DY GOLDFUT
DYCNX 200	-0.0186393	DYCNX MIDCAP	-0.0027629
DYCNX 500	-0.0180879	DYCNX NIFTY	-0.0269842
DYCNX AUTO	-0.0019539	DYCNX NIFTYJR	-0.0008155
DYCNX BANK	-0.032244	DYCNX PHARMA	-0.0087517
DYCNX ENERGY	-0.015174	DYCNX PSU	0.0067037
DYCNX FINANCE	-0.0308151	DYCNX REALITY	0.0214249
DYCNXIT	-0.0234774	DYCNX SMALL	-0.0036856
DYCNX MEDIA	-0.0050207	DYGOLDSPOT	-0.0669614
DYCNX METAL	-0.0238809		

On applying Karl Pearson's Coefficient of Correlation at 5% level of significance, as shown in Table 1 above, there is a low degree of positive correlation between returns of CNX Nifty PSU and CNX Nifty Reality individually. There is a negative correlation between returns of Gold Futures, CNX NSE Indices and Gold Spot. Thus, the null hypothesis that, H_{01}: There is no significant relationship between returns of CNX NSE Indices, Gold Spot and Gold Futures, is rejected. So, there exist significant relationship between returns of Gold Futures, CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot.

6.2 Regression

Table 2a (Be Read with Table 2b) shows results of Regression as follows:

Variable	Prob.		Prob.
C	0.8248	DYCNX 500	0
DYCNX 200	0.0403	DYCNX AUTO	0.3865
DYCNX 500	0.0297	DYCNX BANK	0.0081
DYCNX AUTO	0.6888	DYCNX ENERGY	0.2576
DYCNX BANK	0.4801	DYCNX FINANCE	0.0403
DYCNX ENERGY	0.6087	DYCNXIT	0.3974
DYCNX FINANCE	0.92	DYCNX MEDIA	0.0875
DYCNXIT	0.872	DYCNX METAL	0.8307
DYCNX MEDIA	0.7912	DYCNX MIDCAP	0

DYCNX METAL	0.7802	DYCNX NIFTY	0
DYCNX MIDCAP	0.2445	DYCNX NIFTYJR	0
DYCNX NIFTY	0.2258	DYCNX PHARMA	0.422
DYCNX NIFTYJR	0.0168	DYCNX PSU	0.5221
DYCNX PHARMA	0.1867	DYCNX REALITY	0
DYCNX PSU	0.7029	DYCNX SMALL	0.0117
DYCNX REALITY	0.9797	DYGOLDSPOT	0.936
DYCNX SMALL	0.2207	C	0.2092
DYGOLDSPOT	0.5165	DYGOLDFUTURES	0.0297
R-squared	0.018555	R-squared	0.999347
Prob(F-statistic)	0.382454	Prob(F-statistic)	0

As shown in Table 2a above, the regression model of returns of Gold Futures as dependent variable and CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot as independent variable has yielded an R-squared value of 0.018555 collectively, indicating that, 1.85% of the variation in independent variables was causing changes in returns of Gold futures. The subsequent F-statistics (Goodness of Fit or Good Fit) was 1 .066524 and the corresponding P Value was 0.382454, pointing out that it was not significant at 95% level of significant, as P Value is greater than 0.05. Further, the regression test proves that the independent variables out of seventeen variables only two affect the dependent variable significantly because their P Values (Gold Spot and CNX Nifty 200) are less than 0.05 i.e. .0403and 0.0297 respectively at 95% level of significance. So, the null hypothesis that H_{02}: There is no significant impact of returns of CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot on Gold Futures, is accepted. Hence, it is inferred that the studied variables CNX NSE Indices (500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) have no significant impact on the returns of Gold Futures.

The regression test in Table 2b above shows that the returns of CNX NSE Indices and Gold Spot as dependent variable and returns of Gold Futures as independent variable has yielded an R-squared value of 0.99347 collectively, indicating that, 99.34% of the variation in dependent variables CNX Indices and Gold Spot was caused by returns of Gold Futures. The subsequent F-statistics (Goodness of Fit or Good Fit) was 86353.16 and the corresponding P Value was 0.00, pointing out that it was significant at 95% level of significant, as P Value is less than 0.05. Further, the regression test proves that out of seventeen dependent variables eight variables namely CNX (500, Bank, Finance, MIDCAP, Nifty, NiftyJR, Reality and Small Cap) were affected by the independent variable significantly because their P Values are less than 0.05 at 95% level of significance. So, the null hypothesis that H_{03}: There is no significant impact of returns of Gold Futures on NSE Indices CNX and Gold Spot, is rejected. Hence, it is inferred that the studied variable i.e., Gold Futures have significant impact on the returns of Gold Sot and CNX NSE Indices.

6.3 Granger Causality

Table 3 shows results of Granger Causality Test as follows:

Lags: 2				
Null Hypothesis:	Obs	F-Statistic	Prob.	Direction
DYGOLDFUT does not Granger Cause DYCNX200	975	0.61345	0.5417	Bidirectional
DYCNX200 does not Granger Cause DYGOLDFUT		0.39004	0.6771	
DYGOLDFUT does not Granger Cause DYCNX500	975	0.69962	0.497	Bidirectional
DYCNX500 does not Granger Cause DYGOLDFUT		0.44165	0.6431	
DYGOLDFUT does not Granger Cause DYCNXAUTO	975	1.05355	0.3491	Bidirectional
DYCNXAUTO does not Granger Cause DYGOLDFUT		0.38537	0.6803	
DYGOLDFUT does not Granger Cause DYCNXBANK	975	0.08984	0.9141	Bidirectional
DYCNXBANK does not Granger Cause DYGOLDFUT		1.82333	0.162	
DYGOLDFUT does not Granger Cause DYCNXENERGY	975	0.26454	0.7676	Bidirectional
DYCNXENERGY does not Granger Cause DYGOLDFUT		0.17389	0.8404	
DYGOLDFUT does not Granger Cause DYCNXFINANCE	975	0.06968	0.9327	Bidirectional
DYCNXFINANCE does not Granger Cause DYGOLDFUT		1.66687	0.1894	

DYGOLDFUT does not Granger Cause DYCNXIT	975	0.3348	0.7156	Bidirectional
DYCNXIT does not Granger Cause DYGOLDFUT		0.15899	0.853	
DYGOLDFUT does not Granger Cause DYCNXMEDIA	975	0.26954	0.7638	Bidirectional
DYCNXMEDIA does not Granger Cause DYGOLDFUT		0.01498	0.9851	
DYGOLDFUT does not Granger Cause DYCNXMETAL	975	2.52783	0.0804	Bidirectional
DYCNXMETAL does not Granger Cause DYGOLDFUT		0.65829	0.518	
DYGOLDFUT does not Granger Cause DYCNXMIDCAP	975	0.77431	0.4613	Bidirectional
DYCNXMIDCAP does not Granger Cause DYGOLDFUT		0.59925	0.5494	
DYGOLDFUT does not Granger Cause DYCNXNIFTY	975	0.51174	0.5996	Bidirectional
DYCNXNIFTY does not Granger Cause DYGOLDFUT		0.30187	0.7395	
DYGOLDFUT does not Granger Cause DYCNXNIFTYJR	975	1.21981	0.2957	Bidirectional
DYCNXNIFTYJR does not Granger Cause DYGOLDFUT		0.63664	0.5293	
DYGOLDFUT does not Granger Cause DYCNXPHARMA	975	0.86812	0.4201	Bidirectional
DYCNXPHARMA does not Granger Cause DYGOLDFUT		0.99695	0.3694	
DYGOLDFUT does not Granger Cause DYCNXPSU	975	0.17614	0.8385	Bidirectional
DYCNXPSU does not Granger Cause DYGOLDFUT		0.11879	0.888	
DYGOLDFUT does not Granger Cause DYCNXSMALL	975	0.98246	0.3748	Bidirectional
DYCNXSMALL does not Granger Cause DYGOLDFUT		0.40848	0.6648	
DYGOLDSPOT does not Granger Cause DYGOLDFUT	975	5.7321	0.0034	Bidirectional
DYGOLDFUT does not Granger Cause DYGOLDSPOT		4.02261	0.0182	

On applying Granger Causality Test at 5% level of significance, as shown in Table 3 above, there is a Bi directional relationship between returns of: NSE Indices CNX (200, 500, Auto Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap), Gold Spot and Gold Futures individually. Thus, the null hypothesis that H_{04}: There is no significant causal relationship between returns of Gold Futures, CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot, i.e., the variables does not Granger Cause each other, is rejected. So, there exist significant bidirectional between returns of Gold Futures, CNX NSE Indices and Gold Spot.

6.4 GARCH (1, 1) Model

Table 4a (Be Read with Table 4b) shows results of GARCH (1, 1) Model as follows:

Table 4a & 4b *Shows Results of GARCH (1, 1) Model* **Table 5a & 5b** *Shows Results of (Student's t Distribution*)

Variable	Prob.	Variable	Prob.
C	0.3281	DYCNX500	0
DYGOLDFUT	0.0692	DYCNXAUTO	0.7556
Variance Equation		DYCNXBANK	0.2569
C	0	DYCNXENERGY	0.7085
RESID(-1)^2	0	DYCNXFINANCE	0.4271
GARCH(-1)	0	DYCNXIT	0.765
DYCNX200	0.971	DYCNXMEDIA	0.5571
DYCNX500	0.928	DYCNXMETAL	0.9271
DYCNXAUTO	0.0908	DYCNXMIDCAP	0
DYCNXBANK	0.9072	DYCNXNIFTY	0
DYCNXENERGY	0.2778	DYCNXNIFTYJR	0
DYCNXFINANCE	0.3777	DYCNXPHARMA	0.7771
DYCNXIT	0.5253	DYCNXPSU	0.8138
DYCNXMEDIA	0.7488	DYCNXREALTY	0.0493
DYCNXMETAL	0.4323	DYCNXSMALL	0.2909

Variable	Prob.	Variable	Prob.
C	0.005	DYCNX500	0
DYGOLDFUT	0.2671	DYCNXAUTO	0.8166
Variance Equation		DYCNXBANK	0.4185
C	0.951	DYCNXENERGY	0.7749
RESID(-1)^2	0.9508	DYCNXFINANCE	0.5582
GARCH(-1)	0	DYCNXIT	0.8216
DYCNX200	0.99	DYCNXMEDIA	0.6548
DYCNX500	0.9642	DYCNXMETAL	0.9466
DYCNXAUTO	0.951	DYCNXMIDCAP	0.0007
DYCNXBANK	0.9641	DYCNXNIFTY	0
DYCNXENERGY	0.9516	DYCNXNIFTYJR	0
DYCNXFINANCE	0.9554	DYCNXPHARMA	0.8309
DYCNXIT	0.9568	DYCNXPSU	0.859
DYCNXMEDIA	0.9515	DYCNXREALTY	0.1412
DYCNXMETAL	0.9509	DYCNXSMALL	0.4258

DYCNXMIDCAP	0.5238	DYGOLDSPOT	0.9773	DYCNXMIDCAP	0.951	DYGOLDSPOT	0.9823
DYCNXNIFTY	0.7537	C	0.6185	DYCNXNIFTY	0.9803	C	0.7165
DYCNXNIFTYJR	0.6573	DYGOLDFUT	0.4749	DYCNXNIFTYJR	0.9523	DYGOLDFUT	0.591
DYCNXPHARMA	0.3122	Variance Equation		DYCNXPHARMA	0.9553	Variance Equation	
DYCNXPSU	0.0108	C	0.0005	DYCNXPSU	0.9513	C	0.0561
DYCNXREALTY	0.7618	RESID(-1)^2	0.0277	DYCNXREALTY	0.9532	RESID(-1)^2	0.1557
DYCNXSMALL	0.3201	GARCH(-1)	0	DYCNXSMALL	0.9579	GARCH(-1)	0.0023
R-squared	0.004267	R-squared	0.999347	T-DIST. DOF	0	T-DIST. DOF	0.1764
Durbin-Watson stat	2.14338	R-squared	0.002673	Durbin-Watson stat	1.976296	R-squared	0.999347

Table 6a (Be Read with Table 6b) shows results of (Student's t Distribution) as follows:

Variable	Prob.	Variable	Prob.
C	0.129	DYCNX500	0
DYGOLDFUT	0.2221	DYCNXAUTO	0.2395
Variance Equation		DYCNXBANK	0.765
C	0	DYCNXENERGY	0.1243
RESID(-1)^2	0	DYCNXFINANCE	0.9964
GARCH(-1)	0	DYCNXIT	0.025
DYCNX200	0.9606	DYCNXMEDIA	0.0025
DYCNX500	0.9179	DYCNXMETAL	0.5279
DYCNXAUTO	0.1504	DYCNXMIDCAP	0
DYCNXBANK	0.4795	DYCNXNIFTY	0
DYCNXENERGY	0.0944	DYCNXNIFTYJR	0
DYCNXFINANCE	0.0793	DYCNXPHARMA	0.6882
DYCNXIT	0.8474	DYCNXPSU	0.0082
DYCNXMEDIA	0.5579	DYCNXREALTY	0
DYCNXMETAL	0.1203	DYCNXSMALL	0
DYCNXMIDCAP	0.7898	DYGOLDSPOT	0.637
DYCNXNIFTY	0.7062	C	0.0582
DYCNXNIFTYJR	0.7283	DYGOLDFUT	0.1953
DYCNXPHARMA	0.2479	Variance Equation	
DYCNXPSU	0.1031	C	0.001
DYCNXREALTY	0.6539	RESID(-1)^2	0.0023
DYCNXSMALL	0.2639	GARCH(-1)	0
R-squared	0.003599	R-squared	0.999313
Durbin-Watson stat	2.141765	Durbin-Watson stat	1.952844

As per Table 4a, 5a and 6a the GARCH (1, 1) Model, Normal GAUSSIAN Test, Students t Distribution Test and GED With Fix Parameter confers and show that the P Values of CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot i.e., ARCH (α), and Gold Futures i.e., GARCH (β)), is lesser than 0.05 in all the three tests so there is no GARCH effect. Hence the null hypothesis that H_{05}: There is no volatility caused by CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot on Gold Futures is accepted. More over the R-square values in all the three cases is negligible; conforming that there is no GARCH Effect. In other words there is Arch Effect. It means Gold Spot and the different CNX NSE Indices does not affect the Volatility of Gold Futures.

Moreover, where as in Table 4b, 5b and 6b GARCH(1,1) Model, Normal GAUSSIAN Test, Student t Distribution Test and GED with Fix Parameter Test and Variance Equation Results, confers that CNX NSE Indices and Gold Spot are affected by Gold Futures; as they have P Values smaller than 0.05; Hence, the null hypothesis that the volatility in the returns of Gold

Futures does not affect the volatility of NSE Indices CNX and Gold Spot is rejected. It means that the volatility of Gold Futures volatility affect CNX NSE Indices and Gold Spot. More over the R-squared value in all the three cases are very high; it states that there is GARCH Effect. It means that the volatility of Gold Spot and CNX NSE Indices are caused by Gold Futures.

6.5 Serial Correlation Test

Table 7a (Be Read with Table 7b) shows results of Serial Correlation Test as follows:

AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob
-0.039	-0.039	1.4749	0.225	0.021	0.021	0.4483	0.503
0.044	0.043	3.3794	0.185	-0.05	-0.05	2.881	0.237
0.034	0.037	4.4827	0.214	-0.041	-0.039	4.5554	0.207
0.036	0.037	5.7345	0.22	-0.007	-0.008	4.6095	0.33
-0.005	-0.005	5.7578	0.331	-0.043	-0.047	6.4674	0.263
-0.024	-0.029	6.3351	0.387	0.035	0.035	7.7028	0.261
0.029	0.025	7.1762	0.411	-0.065	-0.072	11.895	0.104
0.03	0.034	8.0756	0.426	0.016	0.019	12.152	0.145
0.047	0.05	10.254	0.33	-0.016	-0.023	12.418	0.191
-0.067	-0.067	14.717	0.143	-0.02	-0.025	12.81	0.235
-0.024	-0.039	15.278	0.17	0.015	0.018	13.028	0.291
0.005	0.003	15.304	0.225	0.059	0.048	16.529	0.168
-0.023	-0.016	15.834	0.258	0.025	0.029	17.134	0.193
-0.035	-0.028	17.047	0.254	-0.033	-0.036	18.193	0.198
0.015	0.016	17.267	0.303	-0.043	-0.032	19.989	0.172
-0.031	-0.034	18.217	0.311	-0.014	-0.013	20.182	0.212
0.031	0.03	19.161	0.319	0.002	-0.002	20.186	0.265
-0.019	-0.008	19.503	0.361	-0.017	-0.021	20.489	0.306
-0.004	0	19.521	0.424	-0.009	-0.009	20.577	0.361
0.033	0.033	20.642	0.418	-0.005	-0.006	20.599	0.421
-0.023	-0.023	21.194	0.447	-0.013	-0.017	20.757	0.474
-0.014	-0.017	21.403	0.496	-0.002	-0.003	20.759	0.536
0.009	0.011	21.487	0.551	-0.015	-0.022	20.993	0.581
-0.028	-0.034	22.279	0.563	-0.018	-0.024	21.324	0.62
-0.039	-0.037	23.775	0.532	-0.002	-0.01	21.327	0.674
-0.02	-0.024	24.168	0.566	0.01	0.008	21.427	0.72
-0.058	-0.058	27.556	0.434	-0.037	-0.035	22.82	0.695
0.015	0.017	27.784	0.476	0.03	0.03	23.754	0.694
-0.062	-0.056	31.684	0.334	-0.033	-0.041	24.876	0.685
-0.019	-0.016	32.042	0.366	0.015	0.015	25.09	0.721
0.007	0.015	32.087	0.413	0.029	0.026	25.932	0.725
-0.057	-0.059	35.373	0.312	-0.017	-0.025	26.212	0.754
-0.004	0.005	35.386	0.356	0.054	0.066	29.162	0.659
-0.063	-0.055	39.439	0.24	-0.065	-0.083	33.407	0.497
0.021	0.012	39.9	0.261	-0.044	-0.025	35.398	0.449
-0.015	0.001	40.118	0.293	0.048	0.044	37.772	0.388

The Serial Correlation in Table 7a and 7b indicates that the P Values of all the variables are greater than 0.05 and hence the null hypothesis that H_{06}: There is no serial correlation between the returns of CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) Gold Spot and Gold Futures, is accepted. Similarly Table Value of the Q-statistics in Table 7a and 7b are 1.4749 and 0.4483 respectively after

wards the calculated values of Q-statistics are gradually increasing and as because there is a trend of consistent rise in the values from lag 1 hence, it is justified that there is no serial correlations among the variables. Moreover, in all the cases the P Values are greater than 0.05 so, it can be conferred that there is no serial correlation and hence the null hypothesis is accepted.

6.6 Jarque-Bera Statistics

Table 8a & 8b shows results of Jarque-Bera Statistics as follows

Table 8a

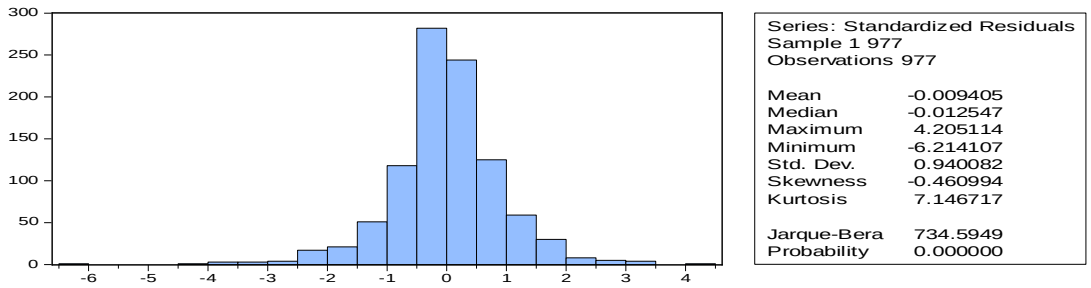
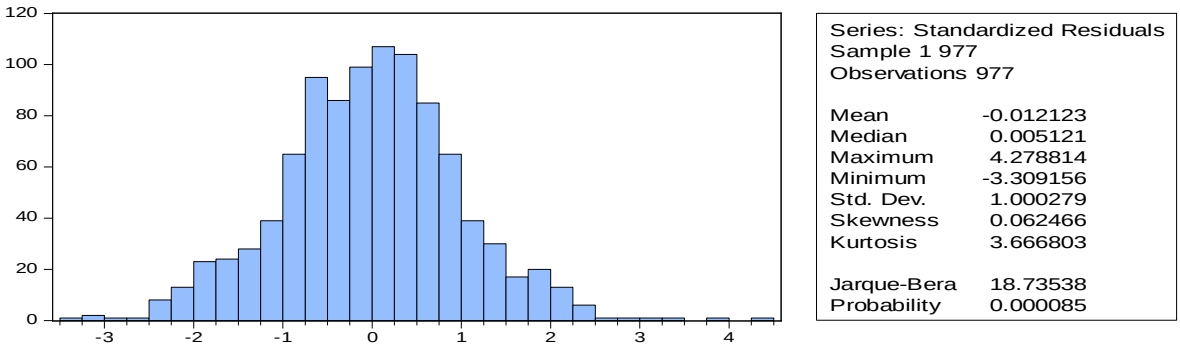


Table 8b



The Jarque-Bera Test is a popular test of normality that incorporates both Skewness and Kurtosis. As per Table 8a and 8b, it appears that Gold Futures, all the CNX NSE Indices and Gold Spot price returns are not normally distributed which is shown in the charts above. The empirical distribution has a large dispersion; the Mean/Standard Deviation Ratios are very low. The distribution is right skewed, implying that upward jumps are more frequent than downward jumps, and has fat tails; meaning that large jumps tend to occur more frequently than in the normal Bell Shape Curve. The corresponding P Values are less than 0.05 in both the testes of Jarque-Bera Statistics Test. The Kurtosis values are greater than 3; they are 7.146 and 3.666803 respectively in all the cases indicating that the null hypothesis H_{07}: The residuals of CNX NSE Indices, Gold Spot and Gold Futures are not normally distributed, is accepted. This concludes that the Kurtosis Values are not normally distributed.

6.7 Arch Effect

Table 9a &9b shows the results of ARCH Effect as follows

F-statistic	**6.367045**	**Prob. F(1,974)**		**0.0118**
Obs*R-squared	6.338683	Prob. Chi-Square(1)		0.0118
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.812533	0.075493	10.76299	0
WGT_RESID^2 (-1)	0.080604	0.031944	2.5233	0.0118
R-squared	0.006495	Mean dependent var	0.88358	
Adjusted R-squared	0.005475	S.D. dependent var	2.194322	
F-statistic	6.367045	Durbin-Watson stat	2.011046	
Prob(F-statistic)	0.011784			

F-statistic	**0.065539**	**Prob. F(1,974)**		**0.798**
Obs*R-squared	0.065669	Prob. Chi-Square(1)		0.7978
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.007763	0.06134	16.42918	0
WGT_RESID^2 (-1)	-0.0082	0.032042	-0.256006	0.798
R-squared	0.000067	Mean dependent var	0.999558	
Adjusted R-squared	-0.00096	S.D. dependent var	1.633196	
F-statistic	0.065539	Durbin-Watson stat	2.000379	
Prob(F-statistic)	0.798			

The ARCH (lm) Test in Table 9a is based on two statistical tests F-Statistic and R-squared and their associated probabilities. The Tabulated Value of F-statistics is 1and the Calculated Value under this study is 6.367which is greater than 1; The corresponding Probability Values are 0.0118 which is less than 0.05; hence, the null hypothesis that H_{08}: There is no ARCH Effect caused by the returns of CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap), Gold Spot and Gold Futures, is rejected. So it is concluded that there is an ARCH effect caused by the returns of CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap), Gold Spot on Gold Futures.

The ARCH (lm) Test in Table 9b is based on two statistical tests F-Statistic and R-squared and their associated probabilities. The Tabulated Value of F-statistics is 1and the Calculated Value under this study is 0.06559 which are lesser than 1. The corresponding Probability Values are 0.798 which are more than 0.05; hence, there is no ARCH Effect caused by the returns of Gold Futures on CNX NSE Indices and Gold Spot is accepted. So it is concluded that there is GARCH Effect.

7. Discussion

As Gold Futures is negatively correlated with CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot. So this conclusion justifies that the fluctuations in Gold Futures prices will move in opposite direction. It is also observed that Gold Futures is considered as alternative investment vehicles; investors prefer to swap their positions from one market to other as Gold Future is an asset to hedge market adversities. This needs further empirical validation. On the basis of regression, the impact of CNX NSE Indices (200, 500, Auto, Bank, Energy, Finance, IT, Media, Metal, MIDCAP, Nifty, NiftyJR, Pharma, PSU, Reality and Small Cap) and Gold Spot found to be insignificant so it can be said that these variables discover their prices according to Gold Futures price behavior. If Gold Futures prices come down the capital market rises due to greater risk exposure by investors. The Granger Causality revealed that there is a bidirectional relationship among the studied variables. But the GARCH (1, 1) model proves that the volatility in Gold spot and CNX NSE Indices is caused by Gold Futures. This has led to call for greater regulation to contribute towards price innovation in Indian capital market as well as Gold Spot market. Probably it shows level of the Market Efficiency. It probably further indicate that future lies in Gold Futures. In other words share market and Gold Spot Prices takes directives from Gold Futures.

8. Conclusion

There is a negative correlation between Gold Futures, CNX NSE Indices and Gold Spot. There is a high impact of Gold Futures on CNX NSE Indices and Gold Spot. There is a bidirectional relationship among the studied variables. Volatility of Gold Futures prices affect CNX NSE Indices and Gold Spot.

9. Suggestions

This is suggested that Gold Future should be treated as a risk hedging instrument and not a speculative instrument. Government should take an advantage of the study in fixing import duties and fighting against black money and parallel economy and control prices of gold as commodity so as to facilitate economy to determine prices of Gold Futures. Gold price mechanism should be monitored and regulated by the government and transparency in the both the markets should be created. Simultaneous investment in Gold Spot should be done while dealing with share market, especially when dealing with various indices.

10. Implications

Investors can take benefit of the results, discussion and suggestions in their investment strategies considering external and internal environment of the country. Gold Futures may be used as hedged investment and hedging instrument as it affects the prices of various indices in capital markets. It also implies that, it should be a part of any financial portfolio and basket of assets when deciding the investment avenues. It implies that Gold Futures architect price innovations in NSE indices and thus, in Indian capital market. Moreover and surprisingly, it also architects price innovations in Gold Spot.

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