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DO INTERNATIONAL GOLD PRICES AND NSE NIFTY 50 MOVE TOGETHER?

A. Sidhu and R. Katoch[1]

ABSTRACT. With gold's persistence performance over erratic periods since the catastrophic event of global financial crisis in 2008, attention is focussed on gold to substitute stock market investments in the times of crisis. Exploring such causal nexus between NSE NIFTY 50 index and Gold prices in Indiapost 2008 crisis is the main focus of the present research. The daily data of International Bloom berg Gold prices and NSE NIFTY 50 Index series has been used over the time period of November 13, 2008 to January 24, 2020. By applying unit root and Toda-Yamamoto granger causality test, study primarily shows stationarity of the variables at different order. The study evidenced the significant bidirectional short-run causal relationship in between NSE NIFTY 50 prices and International Gold prices. Hence, International Gold prices hold significant information which can be used to predict NSE NIFTY 50 returns and vice-versa. The results of present study can be used by Indian stock market policymakers to implement new structural restructuring to augment efficiency of Indian equity sector. Present study is limited in scope to account for gold's nexus with only stock market index which in future can be furthered by establishing association with other commodity markets, mutual funds, exchange rate, derivative, etc.

1. INTRODUCTION

Gold has been considered as a dependable and innocuous investment worldwide and protects the investor against an extensive array of risks associated with

[1]*corresponding author*

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high global inflation, interest rate and exchange rate fluctuations, geopolitical unrest, natural havocs, say; spread of CORONAVIRUS and has proved to be an element of smoothing across economic ups and downs. As per World Gold Council report 2020 [9], the demand for gold across the world has shown 14 percent growth rate annually on an average since 2001. The demand for gold is supported by growth of middle income group in Asian countries, where gold is a symbol of social wellbeing, initiation of exchange-traded funds(ETFs) which are backed by gold in the physical form and renewed risk management strategies followed in United States (US) and Europe post 2008-09 global financial crisis. Besides, Gold has many inherent properties that fuel the demand for gold like full security offered by gold with no credit risk as long as central banks retain gold for expansion of their foreign reserves as a measure of diversification and security, a near money asset which outperform fiat currencies and helps to meet liabilities timely in the situations of market turmoil, used for portfolio diversification to augment overall portfolio returns as less volatile than equities and a centrepiece in the world monetary system used by many countries as a correction measure to improve their Balance of Payments (BoP) condition. Hence, Gold becoming mainstream since the turn of millennium has become the central focus of research in the arena of finance today.

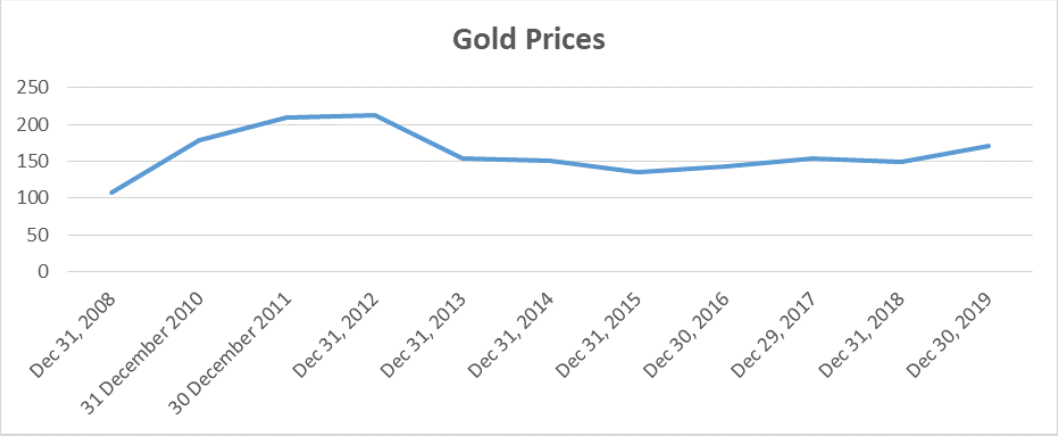

FIGURE 1. Gold price movement from November 2008 to January 2020

As gold is recurrently traded, its nexus with equity markets is significantly assumed from the viewpoint of the investor, brokers, policy formulators, and researchers. Gold as a substitute to stocks is often bought to thwart the risk

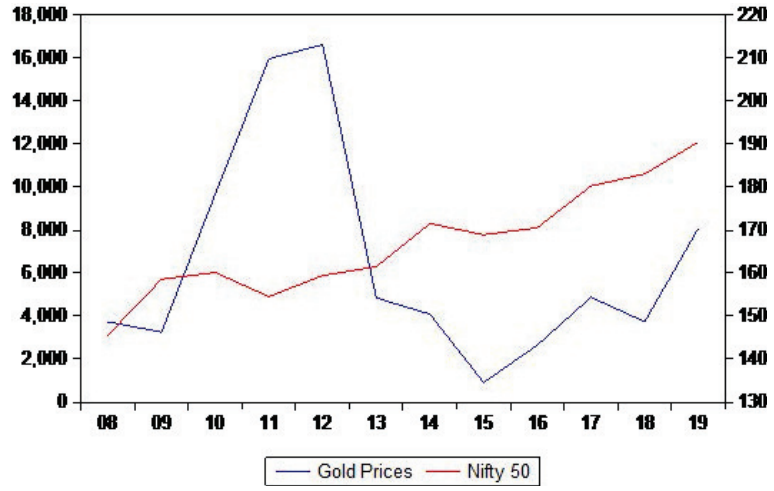

FIGURE 2. Trend in the movement of NIFTY 50 and Gold prices

of stock market downturns. Gold is presumed to have an inverse association with stock markets returns as whenever stock markets are highly unpredictable and show bearish trends, investors will switch over from volatile assets to safe and reliable assets like physical gold. The evidence on co-movements of gold and stock prices in emerging economies like India from the period November 13, 2008 to January 24, 2020 in Figure 1 indicates that the crash of the stock market is accompanied by surge in safe haven investment viz. gold because of translation risk [5]. In this background, close watch over both the markets is essential for inferring the impact of return behaviour of one market over another market.

Figure 2 evidently reveals the trend in the movement of NIFTY 50 and Gold price. It appears that the both of underlying sample variables move in opposite direction after 2008 global financial crisis. NSE NIFTY 50 was down when the gold price reached a new height in 2012. This clearly points out that there can be possibility of inverse relationship between the two variables.

2. REVIEW OF LITERATURE

A varying literature has been found on the causal relationship by using different co-integration tests for examining the efficiency of gold market. Ananzeh and Al-Zararee(2016) [1] found long-run unidirectional causality running from

gold market to stock market in Jordan which believes to have practical implication's for investors. Raza et al. (2016) [8] applied Auto Regressive Distribution Lag (ARDL) modelling in emerging economies and identified results were mixed wherein gold prices positively influenced stock market prices of BRICS (Brazil, Russia, India, China, South Africa) nations and a asymmetric impact has been found on the equity markets of Malaysia, Indonesia, Thailand, Mexico and Chile. Gold however negatively correlated with all emerging economies' underlying stock markets in both short-term and long-term, which subsequently proved the hypothesis of asymmetric effect i.e., bad news in gold market has more effect on stock market performance. On the other hand, Bouri et al. (2017) [3] used daily high- and low-price frequencies to check causality. Results concluded that the gold and stock market of India and China showed bi-directional causality. Paper concluded that the gold as an investment tool can not be consistently considered as safe heaven. Bhuyan and Dash(2018) [2] established long-run cointegration between the two markets by using Johansen's Cointegration methodology. However, the study failed to establish any short-run causality between the gold price movements and stock market returns in India. Mukhuti (2018) [7] found positive correlation between stock markets and gold markets. Granger causality test had been applied and found no short-term relationship between Nifty and Gold prices. Existence of very thin literature supporting interaction between gold and stock markets supplemented by contradictory findings, challenges the academic fraternity to re-examine the undercurrents of the linkage between gold prices and stock market movements in India.

3. Data and research methodology

Daily statistical secondary data for the period from November 13, 2008 to January 24, 2020 has been used in the present work. The data concerning BLOOMBERG GOLD and NSE NIFTY 50has been taken from the official websites ofwww.Investing.com and www.Investing.com respectively.

To begin with, descriptive statistics has been calculated for both the variables under study. Then other econometric tests like UnitRoot, and Toda-Yamamoto Granger Causality tests have been used to further the research. First of all, before examining causal relationship both the time-series are tested for stationarity and order of integration. Augmented Dickey-Fuller (1979) [4] (Parametric)

tests have been deployed to reject the null hypothesis of unit root.Ideally, two tests have been applied to have a cross-check in empirical results. The ADF model has been explained as follows:

$$\Delta_{i=1}^{n} Y_t = \alpha_0 + \alpha Y_{t-1} + \sum \delta_i \Delta Y_{t-1} + \xi_t.$$

Y_t,α_0, ξ_t and Δ show sample time-series, a drift, an error term and first difference function respectively. To remove autocorrelation in the error terms, the number of lagged variance ($i = 1$ to n^{th} term) are to be determined empirically.

After deciding the order of integration i.e., $I(n)$ from the unit root tests ADF and KPSS tests, next step is to choose the suitable time series model in order to establish the vibrant association between sampled time series. If both the Gold Prices and NSE NIFTY50 series are integrated of order zero i.e., $I(0)$, then simple Vector AutoRegressive (VAR_p) model helps to test their relationship over the sampled period. Second, if the both series are integrated at first difference i.e., $I(1)$, then long-run relationship can be established by deploying Johansen's Cointegration test. Third, if both underlying time-series are having different order of integration then Toda-Yamamoto model can be used to examine the short-run impact [6]. The present study has used Toda-Yamamoto Granger causality test procedure on the sample variables because underlying methodology has following assumptions, say, integration order of both time series are not same ($I(0)$ and $I(1)$) or unknown and more than two ($I(2)$ and $I(2)$) or underlying variables are not integrated at zero level (Worlde-Rufael, 2005). The underlying methodology of Granger causality test is considered superior than traditional Granger causality test procedure as it cures the shortcomings of traditional Granger causality test procedure which suffers from the drawbacks of model specifications and spurious regressions. The Toda-Yamamoto modelling uses coefficient values of VAR methodology which ultimately reduces the risk of wrong selection of integration order in sample time-series (Kelly, 2001). After that maximum order of integration($dmax$) is examined and assumed as m (for the underlying time-series). Hence, study will consider maximum order of integration as m = 1 or 2 (depending on combination) if two time-series are found to be integrated at integration order of $I(0)$ or $I(1)$ or $I(2)$. To solve the problem of autocorrelation in the sample series the lag-length is carefully chosen as per Akaike Information Criteria (AIC), Schwarz information criterion(SIC), etc.

After choosing optimum lag-length (k), in the third step, the Seemingly Unrelated Regression (SUR) is used to estimate order of VAR ($p = k + dmax$). At last, standard Wald statistic (W) is to be used to test null hypothesis (H_0) of no-causality.

In order to test Granger non-causality, study tests the two regression equation as X and Y. To test the hypothesis, the coefficients of all the lagged values of X (Y) are zero in Y (X) equation, using a standard Wald test. Granger non-causality can be estimated by the following VAR model:

$$X_t = \alpha_0 + \alpha_1 Y_(t-1) + \cdots + \alpha_p Y_(t-p) + \theta_1 X_(t-1) + \cdots + \theta_p X_(t-p) + \varepsilon_t,$$

$$Y_t = \beta_0 + \beta_1 X_(t-1) + \cdots + \beta_p X_(t-p) + \gamma_1 Y_(t-1) + \cdots + \gamma_p Y_(t-p) + \omega_t.$$

4. Results and interpretations

The methods of central tendency, measures of dispersion and jarque-bera statistics are used to narrate data. Results (Table 1) exhibit that the mean returns of both sample variables are positive. It is marked that the NSE prices are highly volatile ranging from minimum value of 7.8451 to the maximum value of 9.4224 with mean being 8.8595. Standard deviation of 0.3276 asserts instability in NSE prices. The kurtosis statistics confirms NSE NIFTY 50 has little platykurtic distribution being followed as less peakedness than normal distribution (mesokurtic) whereas gold prices has high peakedness distribution as compared to NSE NIFTY 50. Both tests (skewness and kurtosis) violate normality assumptions of frequency distribution. It is apparent from the Table 1 that Jarque-Bera statistic further adds to the previous confirmation of non-normality. P-value being zero in both the series means rejection of null hypothesis of Jarque-Bera test at 1 percent significance level.

4.1. **Unit root test (ADF and KPSS).** The empirical results Table 2 (Part A) of ADF test are reported the t-statistics value of Gold prices are under control as compare to its test critical values at 5 percent level of significance. Thus, Gold has no unit root and integrated at first difference order; $I(1)$. But another variable NSE NIFTY 50 is integrated at level; $I(0)$. In case of Gold (NSE NIFTY 50) prices, the null hypothesis of non-stationarity is rejected at its first difference level (its level) (including trend and intercept in test equation). Hence, the under study shows maximum integration order for testing stationarity as one

TABLE 1. Descriptive statistics

Particulars	**BLOOMBERG GOLD**	**NIFTY 50**
Mean	5.0837	8.8595
Median	5.0671	8.9105
Maximum	5.4878	9.4224
Minimum	4.5265	7.8451
Standard Deviation	0.1529	0.3276
Skewness	0.1671	-0.4476
Kurtosis	3.5192	3.0736
Jarque-Bera	48.3146	102.2371
Probability	0	0
Observations	3041	3041

($dmax$ =1) as confirmed by KPSS test. So, to control the probable cointegration between the sample variables the understudy has used one additional lag in both sample variables by implicating Toda-Yamamoto granger causality test.

TABLE 2. Result of Unit Root test

Variables	**t-statistics (P-value) At level** With trend and Intercept	**t-statistics (P-value) At first-difference** With trend and Intercept	**Integration Order** I()
Part A- ADF			
BLOOMBERG GOLD	-3.1106 (0.1039)	-25.6381 (0.0000)	**I(1)**
NIFTY 50	-4.6742 (0.0007)	-	**I(0)**
Part B- KPSS			
BLOOMBERG GOLD	0.7728	0.1991	**I(1)**
NIFTY 50	0.1688	-	**I(0)**

4.2. **Selection of optimum lag length.** Selection of the ideal lagged level is the fundamental thing in application of efficient methodology. Before performing

TABLE 3. Selection of required lag-value

Lag	LR	HQ	SIC	AIC	FPE
0	NA	-0.2749	-0.2722	-0.2763	0.0026
1	14789.07	-5.3496	-5.3417	-5.354	1.62e-05
2	1287.358	-5.7864	-5.7733	-5.7938	1.04e-05
3	457.9484	-5.9382	-5.9199	-5.9486	8.95e-06
4	282.1720	-6.0297	-6.0061	-6.0431	8.14e-06
5	139.2220	-6.0719	-6.0431	-6.0882	7.78e-06
6	77.5484	-6.093	-6.0588	-6.1122	7.60e-06
7	51.2462	-6.1049	**-6.0656***	-6.1271	7.48e-06
8	**28.2712***	**-6.1091***	-6.0644	**-6.1341***	**7.43e-06***

* shows lagged level picked by the individual criterion, LR: Likelihood-Ratio, HQ: Hannan-Quinn information criterion SIC: Schwarz information criterion, AIC: Akaike information criterion and FPE: Final prediction error

the Toda-Yamamoto granger causality test, the selection of best possible lag-length for VAR modelling is very much required. Final Prediction Error (FPE), Akaike Information Criterion (AIC), etc. techniques has used in the present study for deciding the optimal lagged term. The empirical results of optimal lag value (k = 8) are presented in Table 3.

4.3. **Augmented VAR.** After that, Seemingly Unrelated Regression (SUR) is used to estimate augmented VAR order 9 (p=k+$dmax$). Further, by applying standard chi- square distribution, Wald test has been applied to test null hypothesis. The final empirical results of Toda-Yamamoto Ganger non-causality test are reported in Table 4. The final results reveal bidirectional short-run relationship between underlying variables. Results show the dominance of Gold prices over NSE NIFTY 50 as leading indicator in short-run.

5. CONCLUSION

The study has examined the nature and direction of causal relationship between International Gold prices and NSE NIFTY 50 index of India by connecting

TABLE 4. Selection of required lag-value

Null Hypothesis	Chi-Square Statistic	(d.f)	Probability	Decision
NIFTY 50 does not Granger Cause Gold Price	21.0911	-8	0.0069	**Rejected**
Gold Price does not Granger Cause NIFTY 50	71.4557	-8	0	**Rejected**

daily data for the period 13 November 2008- January 24, 2020. The empirical Toda-Yamamoto granger causality test has been used to analyse the lead-lag relationship between the two sample variables. The empirical outcomes draw attention to the proof of bidirectional causal relationship between International Gold prices and NSE NIFTY 50 for the sample time period. Present results supported the same finding of Bouri et al. (2017) [3] and differs from the recent study of Raza et al. (2016) [8] and Mukhuti(2018) [7].The significant effect of this conclusion is that in, India, there is a synchronized cause and effect relationship between International gold prices and NSE NIFTY 50 index. This kind of relation is there due to the secure returns on the physical commodity like gold in financially good as well as in bad times. Present result discloses that Indian stock market is silently trusting on the price movements of the international gold in short-run. The foremost policy implication resultant from present study is that Indian stock market is not that much efficient for taking its individual decision-making. Hence, Indian stock market policy makers should take into contemplation of this inference and should implement new structural restructurings to augment efficiency of Indian equity sector. Present study is limited to only stock index which will further lead to create a future scope for more variables, like, commodity market, mutual fund, exchange rate, derivative, etc.

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MITTAL SCHOOL OF BUSINESS
LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA, PUNJAB.
Email address: arpit123.sidhu@gmail.com

MITTAL SCHOOL OF BUSINESS
LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA, PUNJAB.
Email address: rupinderkatoch@gmail.com