Indo-Asian Journal of Finance and Accounting
Vol. 1, No. 1, **2020**, pp. 27-34

ARF INDIA
Academic Open Access Publishing
www.arfjournals.com

Is Gold Price Related to the Sensex During 2014 - 2019? An Econometric Analysis

Amalendu Bhunia

Professor, Department of Commerce, University of Kalyani, West Bengal, India
E-mail: bhunia.amalendu@gmail.com

Received: 27 January 2020	Revised: 26 February 2020	Accepted: 11 March 2020	Publication: 15 May 2020

Abstract: *This study examines the causal relationship between gold price and Indian stock market. In recent times, both domestic gold price and Indian stock price are rising in times of economic uncertainty, high inflation rates and discounting economic reforms. Then it is obligatory to know whether gold price is affecting the stock price in India and vice-versa. This study is based on daily time series data obtained from world gold council database and BSE database. The sample period spans from June 2014 to December 2019. While analyse the data, unit root tests, cointegration and error correction model has been used. Bivariate cointegration test results reveal that gold price is not related to the Sensex in the long run. Vector autoregression model test results confirm that there is a no equilibrium relationship of gold price with Sensex.*

Keywords*: Gold price, stock price index, India, cointegration, vector autoregression.*

1. INTRODUCTION

Recently, both domestic gold price and Indian stock price are rising. Gold price is rising because Indian consumers sight it as an investment and a beautification. So, consumption demand positively affects the gold prices. Again, Indian consumers view gold as a refuge when other financial assets are losing worth and uncertainty in economy. Furthermore, rising inflation decreases the value of currency and Indians invest in gold because gold turns out to be an instrument to hedge against inflationary situations. Therefore, gold prices in India are rising (Dhawan, 2019). Stock prices are rising because the stock market has high beliefs of a slash in personal income-tax and/or goods and service tax rates. Corporate tax has already been reduced and the market is discounting economic reforms regardless of a feeble condition of the economy. At the same time, Indian investors think that reforms in land, labour, reforms in the areas of production and general governance along with more ease of doing business will be considered, and personal income tax and dividend distribution tax will be reduced (Mudgill, 2019). Again, foreign

institutional investors are rising in India and positively affect the stock prices (Shah, 2019).

When stock prices go down, Indians are pulling their money out of the stock market and search for the safest alternative to invest their money. In India, in several cases, the protected alternative is gold because there is no credit risk, its liquidity in times of crisis and its diversification (Tripathi, 2016; Bhunia and Das, 2012). A lot of investors choose to invest both in the stock market and gold, so as to reduce or remove the systematic risk. This is considered as a wrap against risk to invest in gold and as a hedging instrument (Bhunia, 2013). This is for the reason that gold is observed as store of value and the stock market is observed as a return of value (Shahzadi, 2016). These features of the gold and stock market are what force the investor's behaviour while investing in gold or stocks. Therefore, gold has some association with the stock market that may be influenced by diverse economic variables (Al-Ameer et al., 2018). So, it is high time to measure the relationship between gold price and Indian stock market.

2. LITERATURE REVIEW

A minimum numbers of previous literature analyse the causal relationships between the gold price and Indian stock market. Almost all the papers have tried to examine the relationships between the gold price and Sensex. These studies review those studies and found that only long-run relationship and causal relationship have been used through cointegration and causality tests.

Narang and Singh (2019) investigated the causal relationship between Indian gold price and Sensex based on monthly time series data for the period from 2002 to 2012 using unit root tests, cointegration and causality test. They established that there was no relationship between Indian gold price and Sensex under the study period.

Bhuyan and Dash (2018) investigated the causal relationship between gold price and Nifty based on monthly time series data for the period from 2001 (January) to 2017 (December) with the help of unit root tests, cointegration, causality test and impulse response function test. Johansen cointegration test results designated that there was a long-run equilibrium association between gold price and stock market returns, the Granger causality test results indicated that there was no causal association between gold and stock return and the impulse response function tests illustrated that the gold and the response of the stock return was positive at each time reactive period.

Kaur (2018) examined the long-run association between Indian gold price and Indian stock market Index (Sensex) based on daily time series data for

the period from 2010 (January) to 2015 (December) using unit root tests, cointegration and causality test. He confirmed that there was no causality between the gold price and Sensex.

Mukhuti and Bhunia (2013) observed the association between gold price and stock price indices of India based on daily time series data for the period from 1991 (January 2) and 10th August 2012 (August 10) using both cointegration test. Bivariate cointegration test results confirmed that there was no cointegration association between gold price and stock market indices of India.

Bhunia and Das (2012) observed the association between gold price and stock market returns of India based on daily time series data for the period from 2001 (April) to 2011 (March) using unit root tests, cointegration and causality test. Empirical results showed that there existed a long-run association as well as causal relationship between gold price and stock market returns of India.

This study uses error correction model to measure the short-run and long-run causality between the gold price and Sensex because it is hardly available.

3. DATA AND METHODOLOGY

This study is based on daily time series data obtained from world gold council database and BSE database. The sample period spans from June 2014 to December 2019. Gretl software has been used for organizing the data and performing econometric analyses. In this study, Augmented Dickey-Fuller (ADF) and Philips-Perron Unit Root Tests, Bivariate cointegration Test and Error Correction Model have been used. In order to measure the causal relationship between the gold price and Sensex, this study uses the natural logarithm of the daily values of the gold price and Sensex in our sample in order to reduce heteroskedasticity problem.

4. EMPIRICAL RESULTS AND ANALYSIS

4.1 Unit root test results

To make significant results, regression analysis on time-series data needs stationary data. When there is non-stationary data, Johansen cointegration test is useful to examine relationships between variables. An essential characteristic for cointegration between variables is that the selected variables are non-stationary and integrated in an order greater than zero. So, the cointegration test has been applied. This study uses three information criteria to ascertain the optimum lag length in the cointegration tests and subsequently error

correction model. This study considers the null hypothesis that the variables in our sample have a unit root against the alternative hypothesis that these variables have no unit root.

Table 1
Unit Root Test Analysis

This table shows the unit root tests on the gold price and Sensex in our sample. The natural logarithm of the daily prices of these indices has taken and denotes these prices as lngp for gold price and lnsx for Sensex (India). We employ Augmented Dickey-Fuller (ADF) and Phillips–Perron (PP) unit root tests. NS denotes non-stationary series while S denotes stationary series.

Variable	*At level*				*At 1st differenced*			
	ADF t-stat	*PP t-stat*	*C.V. at 5%*	*Decision*	*ADF t-stat*	*PP t-stat*	*C.V. at 5%*	*Decision*
lngp	-0.14	-0.15	-2.86	NS	-17.13	-16.99	-2.86	S
lnsx	-1.28	-1.24	-2.86	NS	-22.55	-22.48	2.86	S

Table 1 shows the results of our unit root tests. The results show that none of the variables are originally stationary. Nevertheless, when it converts it in the first difference, they turn into stationary. So, we cannot reject the null hypothesis as the gold price and stock indices are not stationary at level. As the time series data was non-stationary at level, it is obvious that usual regression will make false results. Consequently, the Johansen cointegration test to find out the survival of long-run relationships between gold prices and Sensex.

4.3 Bivariate Cointegration tests

Before carry out the cointegration tests, it is necessary to determine the optimal lag length of the sample. This is vital for the vector error correction test, besides the bivariate cointegration test. The three main information criteria for lag determination are useful, these are the Akaike Information Criterion (AIC), the Schwarz-Bayesian Criterion (SBC) and the Hannan-Quinn Criterion (HQC). To measure the optimal lag length in our model, we use a maximum lag order of 2 and previous studies have revealed that the lower this value the better is the model statistically.

The results in table 2 demonstrate the results to recognize the optimum lag in the model. In this table, the BI and HQC tests point to lag order 1 and the AIC criterion indicates a lag order of 2 as optimal. Since we use daily data, we select a lag length of 2 for our sample as the AIC tests produces its minimum value (-10.64) at this lag length.

Table 2
Optimum Lag Selection

This table illustrates the optimum lag selection in the sample. The sample consists of gold prices and stock indices from India. The natural logarithm of the daily prices of these indices have considered and denote these prices as gold prices (lngp) and lsx for Sensex (India). The Akaike Information Criterion (AIC), the Schwarz-
Bayesian Criterion (SBC) and the Hannan-Quinn Criterion (HQC) criteria are used to determine the optimum lag.

Lag	*LogL*	*p(LR)*	*AIC*	*BIC*	*HQC*
1	12064.08		-10.63	-10.62*	-10.63*
2	12070.49	0.01	-10.64*	-10.61	-10.63
* indicates lag order selected by the criterion			LR test statistic (each test at 5% level)		

In our Johansen cointegration test, a critical value of Osterwald-Lenum (1992) test at 5 percent level is used. Additionally, a related creative deduction method of the deterministic factors has been computed on the condition that the linear trend can be assumed to be linear and not quadratic (Luutkepohl and Saikkonen, 2000).

Table 3
Bivariate Cointegration Test Results

This table shows the bivariate cointegration tests for determining the long-run relationship between gold prices and Sensex. This table uses a lag interval of 2. Trace test indicates 1 cointegrating equation at the 5% level. * denotes rejection of the hypothesis at the 5% level. Probability is the MacKinnon-Haug-Michelis (1999) p-values. Max-eigen value test indicates 1cointegrating equation at the 5% level.

Unrestricted Cointegration Rank Test (Trace)			
Rank	*Eigenvalue*	*Trace Statistic*	*Prob.***
0	0.0013	0.65	0.64
1	0.0011	1.01	0.21
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
Rank	*Eigenvalue*	*Max-Eigen Statistic*	*Prob.***
0	0.0013	0.02	0.69
1	0.0011	0.99	0.24

Table 3 demonstrates the results of the bivariate cointegration tests. In this table, two likelihood ratios of the maximum-eigen value statistics and trace statistics are measured. The results indicate that the probability of

trace statistics is higher than alpha. The probability of maximum eigen value statistics is also higher than alpha, which is not significant at 5% level. Thus, both the test statistics demonstrate that there is no long-run relationship between Sensex and gold price.

4.4 Vector Autoregression Analysis

Bivariate cointegration test results above showed that gold prices and stock market indexes were not cointegrated in the same order. As a result, vector autoregression (VAR) model based on the AIC test with lag length 2 is useful to determine the equilibrium relationship.

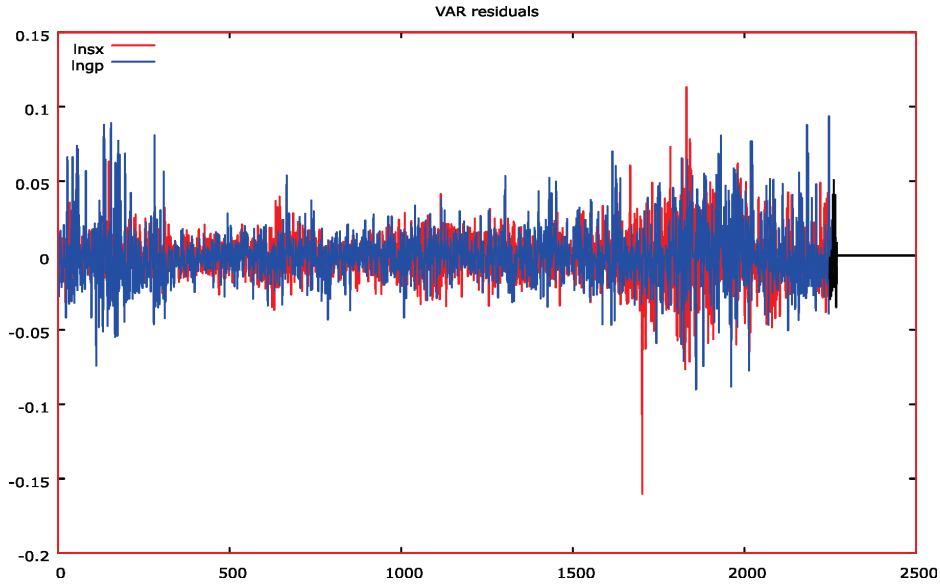
Table 4 illustrates the results of VAR tests. The VAR test results confirm the coefficients were not significant. This result indicates that the Indian stock market has no association with gold prices.

Table 4
Vector Auto Regression Analysis

This table shows the VAR systems between gold prices and Sensex. The natural logarithm of the daily prices of these indices has taken and denotes these prices as lngp for gold prices and lnsx for Sensex (India). In this model the natural logarithm of gold price and Sensex are the variables, t-statistics are and the probabilities are considerd.

Equation 1: lnsx				
Variable	Coefficient	S.E.	t-stat	Prob.
Constant	0.0197458	0.0145895	1.353	0.17605
lnsx_1	1.07029	0.0209752	51.026	<0.00001 ***
lnsx_2	-0.0722740	0.0209738	-3.446	0.00058 ***
lngp_1	-0.00859559	0.0176750	-0.486	0.62679
lngp_2	0.00853719	0.0176741	0.483	0.62912
F-statistic = 160423 (p-value < 0.00001)			Durbin-Watson statistic = 1.9935	
Equation 2: lngp				
Variable	Coefficient	S.E.	t-stat	Prob.
Constant	0.0149604	0.0173566	0.862	0.38881
lnsx_1	0.00967557	0.0249535	0.388	0.69824
lnsx_2	-0.00911102	0.0249518	-0.365	0.71504
lngp_1	1.01457	0.0210273	48.250	<0.00001 ***
lngp_2	-0.0171653	0.0210263	-0.816	0.41437
F-statistic = 115388 (p-value < 0.00001)			Durbin-Watson statistic = 1.99813	

LM test for autocorrelation shows that the probability is 0.53 in both the cases, which indicates that there is no autocorrelation problem in the residuals. The combined residual plots have been shown in the following figure.



5. CONCLUSIONS

In this study, we examine the relationship between gold prices and Sensex. The unit root test results indicate that gold prices and Sensex are not stationary at level but stationary at 1st differenced. Bivariate cointegration test results demonstrate that gold price was not related to Sensex under study. VAR model test results confirm that there is no equilibrium relationship of gold price with Sensex. This result indicates that both domestic gold price and Indian stock price are rising by different reasons. Therefore, gold price is not affecting the stock price in India and vice-versa.

References

Al-Ameer, M., Hammad, W., Ismail, A. and Hamdan, A. (2018). The Relationship of Gold Price with the Stock Market: The Case of Frankfurt Stock Exchange. *International Journal of Energy Economics and Policy,* 8(5), 357-371.

Bhunia, A. (2013), Relationships among crude price, gold price and stock market - an evidence of Bombay stock exchange. *International Business Journal,* 5(4), 5-18.

Bhunia, A. and Das, A. (2012). Association between Gold Prices and Stock Market Returns: Empirical Evidence from NSE. *Journal of Exclusive Management Science,* 1(2), 1-7.

Bhuyan, A.K. and Dash, A.K. (2018). A dynamic causality analysis between gold price movements and stock market returns: Evidence from India. *Journal of Management Research and Analysis,* 5(2), 117-124.

Dhawan, S. (2019). Factor that affect gold price. Retrieved from *https://economictimes.indiatimes.com/wealth/invest/factors-that-affect-gold-price/articleshow/64464960.cms?from=mdr*

Kaur, K. (2018). Relationship of Indian Gold Market and Stock Market. *International Journal of Management Studies, 2(4), 71-76. Retrieved from https://pdfs.semanticscholar.org/fb4c/79fde3bd6e463e009bf3c7e92f92c265864d.pdf*

Mudgill, A. (2019). Why is Sensex rallying despite poor health of the economy? Retrieved from *https://economictimes.indiatimes.com/markets/stocks/news/why-is-sensex-rallying-despite-poor-health-of-the-economy/articleshow/71950029.cms* Mukhuti, S. and Bhunia, A. (2013). Is it true that Indian gold price influenced by Indian stock market reaction? E3 *Journal of Business Management and Economics,* 4(8), 181-186.

Narang, S.P. and Singh, R.P. (2019). Causal Relationship between Gold Price and Sensex: A Study in Indian Context. *Vivekananda Journal of Research, 33-37. Retrieved from https://vips.edu/wp-content/uploads/2019/11/vjr_causal.pdf*

Shah, A. (2019). FIIs back to investing in India, but are very cautious right now. Retrieved from *https://economictimes.indiatimes.com/markets/stocks/news/fiis-back-to-investing-in-india-but-are-very-cautious-right-now/articleshow/72037295.cms Tripathi, N. (2016). A study on dynamic Relationship between Gold price and Stock market price in India. European Journal of Economics, Finance and Administrative Sciences, 88, Retrieved from file:///C:/Users/Win7/Downloads/EuropeanJournal-Goldpaper.pdf*

Shahzadi, C. (2016), Gold and oil prices versus stock exchange: A case study of Pakistan. *Journal of Business Economics and Management,* 10(4), 349-360.