A Study on Dynamic Relationship between Gold Price and Stock Market Price in India

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Abstract

Using daily data, this paper examines the relationship between the returns of gold and seven sectoral indices in the Bombay Stock Exchange (BSE) for the period from January 2000 to May 2018. Given the importance of gold in India, there are significant issues in a portfolio selection in that country. By addressing the hedged robust portfolio problems, this paper focuses on three vanilla portfolio problems: the maximum return portfolio allocation, the global minimum variance portfolio problem, and the Markowitz portfolio allocation by using various multiple generalized autoregressive conditional heteroskedasticity (GARCH) models. The paper finds that gold returns are significantly independent of the returns of the BSE sectoral indices. Besides, gold returns can help predict the future returns of the Consumer Durables and the Fast-Moving Consumer Goods indices as well as the Oil & Gas equity indices. Finally, the findings also show that gold hedges against the information technology stock index and serves as a robust portfolio diversification tool. With these new results, this paper offers several implications for investors and risk management purposes.

Keywords: Return, co-integration, unit-root, stationery, stock market.

Introduction

Stock market is one of the top preferred investment avenues for investors, since it gives fair return on investment in equity market. Primary nature of share market is fluctuation; investors make money through fluctuation in stock market. Market movement can be understood with the help of index system. Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) are the leading stock exchanges in India with the share of 99.5 per cent of total share transaction together in the country. Sensex of BSE and Nifty of NSE are the popular indices and they include 30 and 50 companies respectively. These stock exchanges maintain broad based indices also, among them BSE500 and NSE500 are popular and wide based indices with including top 500 companies in terms their market capitalisation. Stock market is being fluctuated on account of various reasons. Among various reasons, macro economic factors are playing an important role in affecting the market movement. Generally national macro

economic factors are affecting the movement of stock market, such as GDP growth rate, inflation rate, wholesale price index and so on. After globalisation international economic factors are also affecting the movement of stock market such as, gold price, silver price, FII investment and so on. Among them gold price is one of the key international macro economic factors which is affecting the movement of Indian stock market. Investors prefer to invest in equity market when the market is favour, otherwise they move for commodity market for fair earnings. In commodity market gold is most liked commodity by investors on account of frequent fluctuation in its price. As an alternate investment avenue for equity market, it is considered that gold price fluctuations

it is considered that gold price fluctuations affect the movement of Indian stock market. The researchers have studied the impact of gold price on the movement of Indian stock market.

Review of Literature

Amalendu Bhunia and Sanjib Pakira (2014) studied the impact of Gold Price and Exchange rates on the movement of SENSEX for the period of 23 years from 1991 to 2013 on yearly basis. The study found that gold price and exchange rate influenced the movement of SENSEX. Kumar Saurabh (2012) studied the impact of gold price, WPI, CPI, IIP and FII investment on Indian stock market for the period of nine years from 2004 to 2012. The study found that gold price, crude oil price, and FII had significant impact on the returns of the Indian stock market. Banumathy K and Azhagaiah R (2014) analysed causal relationship between stock price and gold price in India using Granger causality test for the period of ten years from 2004 to 2013. The study found causal relationship between stock price and gold price in Indian stock market. Mukhopadhyaya (2011) in his study evidenced that American Stock exchange, Crude oil price, FII and Gold price did not influence Indian stock market Sujit and Rajesh Kumar (2011) volatility. analysed dynamics relationship among gold price, oil price, exchange rate and stock market returns for the period from January 2003 to September 2008. They found that gold price, oil price and exchange rate had direct impact on market returns. Srinivasan (2014) in his study found that Gold price and exchange rate did not have impact on the movement of Indian stock market. Balwinder Singh and Kriti Chitkara (2016) assessed the impact of gold price and crude oil on stock market volatility in India for the period of 7 years from May 2005 to March 2011 based on yearly data. The result showed that there was impact of gold price and crude oil price on Indian stock market.

Statement of the Problem

Gold is one of the commodities, which is traded globally. Generally, investors prefer to invest in many investment avenues. They do not invest in a particular type of investment always, they try to have a profitable portfolio. An investor does not like to invest in equity alone all the time. If the equity market is not favorable, the investor seeks alternate investment avenues namely commodities market, debt, another type of securities and so In the commodity market, on. many commodities are traded, of which gold is playing a pivotal role since frequent fluctuation is present in the gold prices. So, Investors like to invest in gold for making fair returns, sometimes high returns. As a global and most traded commodity in the world, the price of gold in the market may influence the movement of stock markets. Hence the researcher has taken the gold price as an

independent variable to study the impact on the movement of the Indian stock market.

Objectives

The study has been undertaken with the following objectives.

- To study the relationship between and impact of gold price and movement of Indian stock market.
- To assess the co-integration relationship between gold price and Indian stock market and
- To analyse causal relationship between gold price and Indian stock market.

Methodology

The present study deals with examining the impact of gold price on the movement of Indian stock market. For this purpose world gold price has been taken as independent variable and Indian stock market in terms of broad based indices BSE500 of Bombay Stock Exchange (BSE) and NSE500 of National Stock Exchange (NSE) have been taken as dependent variables. Gold price and indices data were collected for the for a period of 16years on daily basis from 1.1.2002 to 31.12.2018. It comes 3740 observations for each index and gold price. The data of BSE500 was collected from official website of BSE (www.bseindia.com) and the data of NSE500 was collected from official website of NSE (www.nseindia.com). The data of Gold price was collected from the financial website of www.in.investment.com. The study has employed descriptive statistics, Kurtosis and Skewness test to test the shape of distribution and Jarque-Bera test was applied to test whether the data were normally distributed. For the purpose of testing unit root of selected indies and gold price, Augmented Dickey

Fuller (ADF) Unit root test was applied. This test was made whether the time series data are stationary or not. Generally this test is made before making the analysis of co-integration test, since the test can be made on nonstationary time series data. The researchers have also applied Johansen co-integration test after confirming that the considered indices had unit root (non-stationary) by applying ADF unit root test. The test is made to examine co-integration relationship between Indian stock market and gold price. It also explores the long-run equilibrium relationship among the time series variables. If two variables are co-integrated, it means they would not drift apart over a period of time on an average. This test gives the results whether two variables co-integrate or not, so the study has also employed Granger casualty test to examine causal relationship between two time series data. In this study the test has been applied to know causal relationship between Indian stock market and gold price. This test gives result of which variable causes another one vice versa.

The correlation model used for the study is,

Where, N indicates number of observations, x indicates return on gold price and y indicates return on Indian stock market (BSE500/NSE500).

The regression model used for analysing the impact of gold price on the movement of Indian stock market is,

$$IM_i = \alpha + \beta GP_i + \varepsilon_t$$
(2)

Where, IM indicates Indian stock market, α represents intercept, GP represents return on gold price and ϵ indicates error term.

For the purposes of correlation and regression analysis, return on Indian stock market indices are calculated as follows.

$$MR_c = \frac{IM_{ct} - IM_{ct-1}}{IM_{ct}} \times 100.....(3)$$

Where, MR indicates market return, IM indicates Indian stock market, c indicates index (BSE500/NSE500), t represents current year and t-1 represents previous year.

Return on gold price was calculated as follows,

$$GPR_c = \frac{GP_t - GP_{t-1}}{GP_t} \times 100$$
(4)

Where, GPR indicates return on gold price, GP indicates gold price, t represents current year and t-1 represents previous year.

The model used to calculate ADF Unit root test is presented below (Gujarati, 2003).

$$\Delta Y_t$$

$$= \beta 1 + \beta 2_t + \delta y_{t-1}$$

$$+ \sum_{i=1}^m a \, i \Delta y_{t-i} + \varepsilon_t$$
(5)

Where ε_{t} is error term, Yt is a random walk with drift around a stock trend, 't' is current day, 't-1' is previous day, 'm' is the lag order of the first difference autoregressive process, β is the coefficient on a time trend,

The model used to calculate Johansen cointegration test between Indian stock market and gold price is as follows.

r = number of separate series

T = number of usable observations

 λ = estimated Eigen values

The models used to calculate Granger causality test is presented below.

$$IM_{t} = \sum_{i=1}^{n} a_{i}GP_{t-i} + \sum_{j=1}^{n} \beta_{j}IM_{t-j} \qquad(8)$$
$$+ u_{1t}$$

GP+

Where, IM is Indian market, GP is Gold Price, ult and u2t are error term and assumed that they are uncorrelated, 'n' is the maximum number of lagged observations and λ are the parameters to be estimated.

Results and Discussion

Table 1 presents descriptive statistics of indices BSE 500, NSE 500 and gold price for the study period of 16 years from 2002 to 2018. It gives mean, median, maximum and minimum values, standard deviation, skewness, kurtosis, Jarque-Bera test and its P value. In order to know normal distribution of data a null hypotheses that the selected indices and gold price are not normally distributed the hypothesis has been tested using Jarque-Bera test.

Table 1: Descriptive Statistics of	Gold	Price
and Indian Stock Market		

	BSE500	NSE500	GOLD
Mean	5889.91	3712.44	946.44
Median	6386.89	3970.55	954.25
Maximum	12074.35	9436.95	1888.70
Minimum	1002.93	671.55	278.10
Std. Dev.	3069.01	1919.75	448.09

Skewness	0.09	0.13	0.07
Kurtosis	2.08	2.14	1.75
Jarque-Bera	137.54	126.36	248.52
Probability	0.00	0.00	0.00
Observations	3740	3740	3740

Source: Computed from Secondary Data

Table 1 shows that the mean value of the indices BSE 500 and NSE 500 stood at 5889.91 and 3712.44 respectively and the mean value of the gold price is 976.44 US\$ per ounce. The standard deviation of the selected indices and gold price show that there was a moderate level of deviation in the indices and gold price from their mean values. The indices of BSE500, NSE 500 and gold price are normally distributed during the study period, since the calculated values of Skewness are near zero. It is also observed that both the indices and gold are positively skewed; hence there are more chances for positive returns than negative returns. The calculated values of hypothesis of BSE 500, NSE 500 and gold price are 2.08, 2.14 and 1.75 respectively, they are less than 3, hence both the indices and gold price are less peaked than normal distribution. The results of the Jarque-Bera test of BSE500, NSE500 and gold price stood at 137.54,126.36 and 248.52 respectively, they are statistically significant at 1% level, hence the null hypothesis is rejected and therefore the indices of BSE500, NSE500 and gold price are normally distributed during the study period.

Correlation Analysis

In order to know relationship between gold price and Indian stock market, correlation analysis has been made between gold price and market proxies of BSE500, NSE500. Apart from correlation analysis regression analysis also applied and the results are presented subsequently.

Table 2: Correlation between Gold Priceand Indian Stock Market

Variables	BSE500	NSE500	Gold Price
BSE500	1	0.851	0.076
	1	(0.000)	(0.000)
NSE500	0.851	1	0.071
	(0.000)	1	(0.000)
Gold Price	0.076	0.071	1
	(0.000)	(0.000)	1
No. of Observations	2	3739	

Source: Computed from Secondary Data

Table 2 shows that the correlation between BSE 500 and NSE 500 is very high and positive (0.851), it is also significant. It shows that both the markets BSE and NSE are moving simultaneously during the study period. Correlation between Gold and BSE 500 is 0.076 and between Gold price and NSE 500 is 0.071, both the results are statistically significant at 1 percent level. Hence Indian stock market and gold price have significant positive relationship, but the quantum of relationship is very low.

Regression Analysis

Regression analysis has also been made between gold price and Indian stock market to know the quantum of impact of gold price changes on the movement of Indian stock market. For this purpose return on BSE 500 and NSE 500 are calculated for 3739 trading days and return on gold price is also calculated. Gold price has been taken as independent variable and market proxies of the indices BSE500 and NSE500 are taken as dependent variables. Table 3 gives ANOVA results and regression results for gold price and movement of Indian stock market in terms of return on BSE500 and NSE500.

2023	

		BSE	500					
MIL		Unstandardized Coefficients		Standardized Coefficients		a.		
	Model	В	Std. Error	Beta		51g.		
1	(Constant)	0.07	0.02		3.01	0.00		
	Gold Price	0.09	0.02	0.08	4.68	0.00		
	Adj. R ²	0.006						
	F Value under ANOVA	21.88 (0.00)						
		NSE	500					
	Madal	Unstandardized Standardized Coefficients Coefficients		Unstandardized Coefficients		Standardized Coefficients	4	Sia
	Model	В	Std. Error	Beta		Sig.		
1	(Constant)	0.07	0.03		2.60	0.01		
	Gold Price	0.10	0.02	0.07	4.38	0.00		
	Adj. R ²	0.005						
	F Value under ANOVA	19.18 (0.00)						

Table 3: Regression Analysis of Gold Price and Indian Stock Market

ANOVA results between gold price and return on BSE500 show that the calculated value of F-statistics is 21.88, it is statistically significant at 1 percent level. Hence the regression model is fit for the study. The calculated value of F-Statistics in ANOVA under regression analysis is 19.18, it is significant at 1 percent level as shown by the result of P value. Hence the regression model framed for the variables changes in gold price and return on NSE 500 is the fit for the study.

It could be known from 3 that the calculated value of co-efficient between gold price and BSE500 is 0.08, it is significant as shown by the results of t-statistics and P value. Hence changes in gold price have significant impact on movement of BSE 500. One point change in gold price has positive change in BSE500 to the extent of 0.08 points. The calculated value of adjusted R² is 0.006, it means changes in gold price explained the variation in BSE500 to the extent of less than a percent. Many factors are responding for movement of stock

market in India, gold price is one among them. Even though it has significant impact, but the quantum of impact is very low. Table 3 also reports that the regression co-efficient between gold price and movement of NSE 500 index is 0.07, it is statistically significant at 1 percent level as per the results of t-statistics and P value. Hence gold price has significant and positive impact on movement of Indian stock market in terms of return on NSE 500.But the quantum of impact is very low. The independent variable (gold price) explained the dependent variable (NSE 500) to the extent less than a percent. It is considered to low.

ADF Unit Root Test

The above results show the nature of relationship and quantum of impact of gold price on stock market of India. In the view of analysing deeply, the researcher has applied Johansson co-integration test to know whether gold price and Indian stock market are moving together, this analysis is appropriate only when the time series data are non-stationary, for the purpose of testing stationary of the variables. Augmented Unit Root test has been applied. The researcher has also applied Granger causality test to know ADF, which variable influence another are and vice versa. Table 4 gives the results of ADF Unit root test for the variables gold price, the indices of BSE500 and NSE500. For this purpose the following null hypothesis is framed.

Ho1: Gold price, BSE500 and NSE500 are non-stationary.

Table 4: Unit Root Test

Variable	ADF Statistics	P- Value	Critical Value	Hypothesis
Gold Price	-1.44	0.56	1% -3.4319 5% -2.8621 10% -2.5671	Accepted
BSE500	-0.82	0.81	1% -3.4319 5% -2.8621 10% -2.5671	Accepted
NSE500	-0.81	0.81	1% -3.4319 5% -2.8621 10% -2.5671	Accepted

It is observed from table 4 that the calculated value of ADF statistics of Gold price, BSE500 and NSE500 are -1.44, -0.82 and -0.81 respectively, They are not statistically significant as shown by the results of P value, Since they are less than the table value. Hence the null hypothesis is accepted and therefore the variables gold price, BSE500 and NSE500 have unit root and they are unpredictable. In other words, the time series data of these variables are not stationary and they are fit for further analysis such as co-integration and causality test.

Johansen co-integration Test

Johansen co-integration test analyses whether gold price and Indian stock market are moving together or not. In other words, it tests whether these two variables are have co-integration relationship or not. For this purpose a null hypothesis has been framed as follows and the results are presented in table 5.

Ho: Gold price and Indian stock market in terms of BSE500 and NSE500 do not have co-integration relationship.

	Unrest	tricted Co-i	ntegration I	Rank Test (Frace) at 5%		
Hypothesized No. of CE(s)	Eigen Value		Trace Statistic		Critical Value	Pro	b.**
	BSE500	NSE500	BSE500	NSE500		BSE500	NSE500
None	0.0006	0.0006	2.90	2.90	15.49	0.97	0.98
At most 1	0.0002	0.0002	0.64	0.68	3.84	0.42	0.40
U	nrestricted (Co-integration	on Rank Tes	st (Maximu	m Eigen Value)	at 5%	
Hypothesized	Eigen Value		Trace Statistic Critical		Critical	Pro	b. **
$\mathbf{NO}, \mathbf{OI} \mathbf{CE}(\mathbf{S})$	BSE500	NSE500	BSE500	NSE500	value	BSE500	NSE500
None	0.0006	0.0006	2.90	2.26	15.49	0.98	0.97

Table 5: Johansen Co-Integration Test

Source: Computed from Secondary Data

Table 5 shows that the calculated values of trace value and maximum eigen value of gold price and BSE500 are 2.9095 and 2.2694 respectively, they are less than the critical value, so they are not statistically significant. Hence the null hypothesis is accepted and therefore gold price and Indian stock market in terms of BSE500 are not co-integrated, in other words, these variables are not moving together.

It is also known from table 5 that the calculated values of trace statistics and maximum eigen value of the index of NSE500 are 2.9087 and 2.2766 respectively, they are less than the respective critical values. So, the results are not statistically significant. Hence

the null hypothesis is accepted and therefore gold price and Indian stock market in terms of NSE500 are not co-integrated. In other words, these two variables are not moving together.

Granger Causality Test

The regression analysis tests the impact of an independent variable on dependent variable. There, a particular variable has been assumed as dependent and another one or few as dependent. But in stock market it cannot be said that variable X influences variable Y, variable Y may influence variable X. So, the researcher has applied Granger causality test. It tests which variable causes another one. For this purpose null hypotheses are framed and the results are presented in table 6.

Table 6: Granger Causality Test

BSE500						
Null Hypothesis	Obser -vations	F-Statistic	Prob.	Ho		
BSE500 does not Granger Cause Gold price	2720	0.52	0.59	Accepted		
Gold price does not Granger Cause BSE500	5739	0.33	0.71	Accepted		
NSE500						

Null Hypothesis	Obser -vations	F-Statistic	Prob.	Ho
NSE500 does not Granger Cause Gold price	2720	0.65	0.52	Accepted
Gold price does not Granger Cause NSE500	5759	0.50	0.60	Accepted

Table 6 shows that gold price did not have granger cause on Indian stock market in terms of return on BSE500 and BSE500 did not have granger cause on gold price, since the calculated F-statistics are 0.52 and 0.33 respectively and they are not statistically significant as shown by the results of P values. The calculated values of F-statistics of hypotheses one and two between gold price and the index of NSE 500 are 0.65 and 0.50, they are not statistically significant, hence both the null hypotheses are accepted and therefore gold price did not have granger cause on NSE 500 and NSE 500 did not have granger cause on gold price.

Conclusion

The study intended to analyze the impact of gold prices on the movement of the Indian stock market. It has been done with market proxies of broad-based indices of BSE500 and NSE500. The correlation analysis reveals that gold price and the movement of Indian stock market have a significant positive relationship and regression analysis show that changes in the gold price have a significant positive impact on the movement of Indian stock market, but the quantum of impact is very low since many factors are responsible for the movement of the stock market, the gold price is one among them. Gold price, BSE500, and NSE500 had unit root during the study period, so these variables are non-stationery. It is found from the results of the Johansen cointegration test that the gold price and Indian stock market in terms of both BSE500 and NSE500 are not moving together and they are moving independently in their own direction since they do not have a co-integration

relationship during the study period. It is also evidenced that gold prices did not have a granger cause on the Indian stock market in terms of BSE 500 and the NSE 500 and Indian stock market also did not have a granger cause on gold price during the study period. It is concluded that fluctuations in the gold prices have a significant impact on the market movement in India, but that impact is not notable.

The paper also discusses potential implications for investors (traders) and risk management purposes. Precisely, the investors must adjust their hedging positions with time according to the bull- and bear market conditions. The paper also finds that gold can be used as an investment tool to reduce the portfolio risk when investors ignore the return and instead focus on the risk only. Finally, the risk facing an Indian investor can be hedged by different strategies. For instance, the IT sector can be hedged by an opposite position in gold since there is a negative relation of the IT sector returns with gold. Therefore, gold can be used for safe haven purposes. For other sectors, gold cannot serve to hedge their risk.

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