ASSOCIATION BETWEEN GOLD PRICES AND STOCK MARKET RETURNS: EMPIRICAL EVIDENCE FROM NSE

*Dr. Amalendu Bhunia **Mr. Amit Das

*Reader, Department of Commerce, Fakir Chand College, West Bengal, India
**Assistant Professor, Department of Commerce, Fakir Chand, West Bengal, India

ABSTRACT

The stock markets of a country become more sensitive to both domestic and external factors, and one such factor is the price of gold. In recent times gold price volatility has attracted the attention of many researchers, academicians and analysts. This study examines the gold price volatility and the causal relationship between gold prices and stock market returns in India. Taking into consideration the domestic gold prices and stock market returns based on NSE, the study investigates the Granger causality in the Vector Error Correction Model for the period from April 2001 to March 2011. Empirical results provide the support of feedback causality between the selected variables and indicate that the Gold prices Granger-causes stock market returns and stock market returns also Granger-causes the gold prices in India during the study period. The results indicate that the co-movement of gold prices and stock prices even during the period global financial crisis and thereafter. Indians have started considering gold not only as jewellery but also an important mode of investment like investment in bonds and equities.

I. INTRODUCTION

The study of the capital market of a country in terms of a wide range of macro-economic and financial variables has been the subject matter of many researches since last few years. Empirical studies reveal that once financial deregulation takes place, the stock markets of a country become more sensitive to both domestic and external factors, and one such factor is the price of gold. Historical experiences show that the trend of gold prices is always higher during period of stock market slump.

However, in India stocks do not seem to be perceived as an alternative to gold. The reason for holding gold is, to a large extent, guided by the individual sentiments. The gold investing habits of Indians strongly ingrained in the Indian Social Psyche. In India gold has been held by individuals for years and have passed hands of many generations. This tendencies offer positive returns during a crisis of such a magnitude has renewed the interest in gold. It has also reactivated the old common knowledge of gold being a safe haven, inherited from its monetary role throughout history. Nevertheless, apart from the studies by Baur and Lucey (2010) and Baur and McDermott (2010), there have been few papers analysing the role of gold during economic and financial crises. Again, Baur and Lucey (2010) state that risky assets such as gold can qualify as safe havens for an initial portfolio of stocks if they have negative (or at least zero) correlations with stocks during crises.

In addition, the equity culture in India is not as developed as in some other parts of the world. Gold has not yet lost its prime importance as a hedge against loss of wealth in times of crises. In this backdrop, the paper proceeds to investigate the direction of causality between domestic gold prices and stock market returns in India. The rest of the paper is organized as follows: Section II explains the data and methodology, Section III includes the analysis, and Section IV concludes.

II. BRIEF REVIEW OF LITERATURE

Prior to the introduction of economic liberalization in July 1991, gold prices in India showed an increasing trend. In the post liberalization period, the average annual prices of gold also showed an increasing trend from the year 1991 to 1996. But, it showed a decreasing trend in 1997 and 1998 and again showed an increasing trend since 2000 till date.

The domestic gold price in India is continuously increasing due to its heavy domestic demand. The most important reasons for high demand of gold in India are:(i) *Security (*gold offers full security as long as it is retained by central banks and there is no credit risk attached to gold), (ii) Liquidity *(*gold is able to maintain its liquidity even at times of crisis like high global inflation or political turbulence), and (iii) Diversified Portfolio (many prefer holding gold is to build a diversified portfolio). Gold also plays the role of an asset of last resort. World Economic History shows that countries have repeatedly used gold as security against loans when they have had difficulties with their balance of payments.

The domestic gold prices in India are associated strongly with the import parity prices which are determined by the global spot prices, Dollar-Rupee rate and local taxes and levies. Any change in the global prices gets transmitted very quickly and gets reflected in domestic prices, particularly for countries like India who are price takers in gold with a major part of the demand met by imports. The twin factors, namely, (i) increase in global spot gold prices (as the commodity becomes dearer to those looking for safe haven during times of economic crisis), and (ii) appreciation of USD against INR, led to sharp rise in gold prices in India in the recent past.

Since the gold prices are influenced by international factors, its volatility is very important. Volatility involves short term (monthly, weekly or even hourly) fluctuations in gold prices as measured by their absolute percentage changes during a particular period. If we look at the rolling standard deviation of monthly gold prices since 2000, the prices are more volatile after July 2007 which is almost the same time when the slow down started in USA as a result of the sub-prime crisis.

A number of studies have examined the relationship between gold prices and gold mining company returns, including Twite, G. (2002) and Faff and Hillier (2004). Based on regression analysis, gold mining company stocks were found to have a greater exposure to gold price returns than to stock market returns (gold betas were higher than market betas). But little attention has been devoted to investigating the time series characteristics and possibilities of a long-term co-integrating relationship between these variables. In fact, we are aware of only one study that tests for non-stationarity in any of these variables (Smith, 2001). Smith examined the short-term and long-term relationships between four gold price series and six different US stock price indices over the 1991-

2001 time periods. Smith reported that gold prices and US stock index levels were non-stationary, but were stationary in first differences. He found no bilateral long-term relationship, or co-integration, between a gold price series and a stock market index. There was, however, some evidences of a negative short-term Granger causality running from US stock index returns to gold returns, but not the reverse.

A look at the historic data brings out that when the stock market crashes or when the dollar weakens, gold continues to be a safe haven investment because gold prices rise in such circumstances (Gaur and Bansal, 2010). It is no surprise that many investors, big and small have chosen to hedge their investments through gold at the time of crises. Gold prices have been on an up tick since 2000, while the stock market declined from 2000 to 2003 and then again in 2008. In 2008 when the market was suffering from bearish phase worldwide, gold prices spiked as panic spread across global markets. However, signs of recovery in the Indian stock markets have emerged since March 2009.. At the same time gold continues to forge ahead, albeit at a slower pace. In 2008, the prices of two assets – equity and gold, were moving in opposite directions, displaying the ability of the yellow metal to protect one's portfolios at the time of a dip. In fact, during each of the two prolonged bear phases over the past decade, gold has provided an effective hedge.

Wang et al (2010) explored the impacts of fluctuations in crude oil price, gold price, and exchange rates of the US dollar vs. various currencies on the stock price indices of the United States, Germany, Japan, Taiwan, and China respectively, as well as the long and short-term correlations among these variables. Empirical results show that there exist co-integrations among fluctuations in oil price, gold price and exchange rates of the dollar vs. various currencies, and the stock markets in Germany, Japan, Taiwan and China. This indicates that there exist long-term stable relationships among these variables. Whereas there is no co-integration relationship among these variables and the U.S. stock market indices which indicates that there is no long-term stable relationship among the oil price, gold price and exchange rate and the US stock market index.

III. DATA AND METHODOLOGY

The present study is based on secondary data obtained from various data sources of the Ministry of Finance, Government of India, NSE database and the Bloomberg database. We have considered monthly data comprising the stock return of National Stock Exchange (NIFTY) and the gold prices. The sample period spans from April 2001 to March 2011. After matching monthly stock return with the corresponding gold price, there are 120 observations. Eviews 6.0 package program has been used for arranging the data and conducting econometric analyses using Augmented Dickey-Fuller (ADF) Unit Root (1981) Test, Johansen's (1995) Co-integration Test and Granger (1969) Causality Test. For the purpose of analysis, linear deterministic trend and lags interval in first differences have been used.

The Augmented Dickey-Fuller unit root test has been used to examine the stationarity of the time series data used for the study and to find the order of integration between them. The ADF unit root test has been performed by estimating the regression:

$$\Delta y_t = a_0 + \gamma y_{t-1} + \Sigma b_i y_{t-1} + e_t$$

The ADF unit root test is based on the null hypothesis (H_0): Y_t is not I (0). If the calculated ADF statistic is less than the critical value, then the null hypothesis is rejected;

otherwise accepted. If the variable is stationary at level, the variable is said to be integrated of order zero, I(0). If the variable is non-stationary at level, the ADF test can be conducted and the first difference of the variable can be used for testing a unit root. In this case, the variable is said to be co-integrated of order one, I(1).

In the second step, the Johansen's co-integration test has been applied to check whether the long run equilibrium relation exists between the variables. The Johansen approach to co-integration test is based on two test statistics, viz., the trace test statistic, and the maximum eigenvalue test statistic.

The trace test statistic can be specified as: $\lambda_{trace}(r) = -T\Sigma\log(1 - \lambda_i)$ where λ_i is the i^{th} largest eigenvalue of matrix Π , and T is the number of observations. In the trace test, the null hypothesis (H_0) is that the number of distinct co-integrating vector(s) is less than or equal to the number of co-integration relations (r*)*.

The maximum eigenvalue test examines the null hypothesis of exactly '*r'* co-integrating relations against the alternative of '*r* + 1' cointegrating relations with the test statistic: $\lambda_{max} = -T \log (1 - \lambda_{r+1})$ where λ_{r+1} is the $(r+1)^{th}$ largest squared eigenvalue. In the trace test, the null hypothesis of $r = 0$ is tested against the alternative of '*r* + 1' co-integrating vectors.

At the end, the Granger Causality test has been used to determine whether one time series is useful in forecasting another thereby finding out the direction of relationship between the variables of the study.

In the Granger Causality test, the vector of endogenous variables is divided in two sub-vectors, Y_{1t} and $Y_{2t,}$ with dimensions K_1 and K_2 respectively, so that $K = K_1 + K_2$. The sub-vector Y_{1t} is said to be Granger-causal for Y_{2t} if it contains useful information for predicting the latter set of variables. For testing this property, the levels VAR following form without exogenous variables of the model is considered.

$A_0Y_t = A_1Y_{t-1} + ……..+A_{p+1}Y_{t-p-1}+B_0X_t+…..+B_qX_{t-q}+C*D*_t+ u_t$

If that model contains p +1 lags of the endogenous variables as in the above model, the test is based on a model with p + 2 lags of the endogenous variables proposed by Dolado and Lütkepohl (1996). The null hypothesis that 1t Y is not Granger-causal for 2t Y is tested by checking the null hypothesis i $\alpha = 0$, i =1, 2... p +1

A Wald test statistic, divided by the number of restrictions $pK_1 K_2$, is used in conjunction with an F ($pK_1 K_2$, KT − n *) distribution for testing the restrictions. Here n* is the total number of parameters in the system (Lütkepohl, 1991), including the parameters of the deterministic term. Of course, the role of Y_{1t} and Y_{2t} can be reversed to test Granger-causality from Y_{1t} to Y_{2t}.

IV. EMPIRICAL ANALYSIS & FINDINGS

The Augmented Dickey-Fuller unit root test has been used for the purpose of verifying data series and the results of such test are reported in Table 1.

Table 1: Results of Augmented Dickey-Fuller Unit Root Test

Variables in their First Differences	ADF Statistic	Critical Values	Decision
Gold Prices	-14.61	At 1%: -3.459 At 5%: -2.874 At 10%: -2.573	Reject Null hypothesis of no unit root
Stock Market Returns	-12.01	At 1%: -3.459 At 5%: -2.874 At 10%: -2.573	Reject Null hypothesis of no unit root

It is clear from Table 1 that the null hypothesis of no unit roots for both the time series are rejected at their first differences as the ADF test statistic values are less than the critical values at 10%, 5% and 1% levels of significances. Thus, the variables are stationary and integrated of same order, i.e., I(1).

In the next step, the co-integration between the stationary variables has been tested by the Johansen's Trace and Maximum Eigenvalue tests. The results of these tests are shown in Table 2. The Trace test indicates the existence of two co-integrating equations at 5% level of significance. And, the maximum eigenvalue test makes the confirmation of this result. Thus, the two variables of the study have long-run or equilibrium relationship between them.

Table 2: Results of Johansen's Co-integration Test [Unrestricted Co-integration Rank Test] (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.264883	83.69901	15.49471	0.0000
At most 1 *	0.062248	14.46069	3.841466	0.0001

* denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Table 2: Results of Johansen's Co-integration Test [Unrestricted Co-integration Rank Test] (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.264883	69.23832	14.26460	0.0000
At most 1 *	0.062248	14.46069	3.841466	0.0001

* denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Table 3: Results of Granger Causality Test

Null Hypothesis	F-Statistic	Probability	Decision
Gold Prices do not Granger Cause Stock Market Returns	11.678	0.000	Reject
Stock Market Returns do not Granger Cause Gold Prices	32.997	0.000	Reject

Now, the Granger causality test can be performed to determine the direction of causation between these two variables in the Vector Error Correction Model. The results of the Granger causality test shown in Table 3 confirm rejection of the null hypothesis of 'Gold Prices do not Granger Cause Stock Market Returns' and 'Stock Market Returns do not Granger Cause Gold Prices'. Therefore, it may be inferred that both the variables contain some significant information such that they cause each other.

The findings of the study on the gold price volatility and the causality between domestic gold prices and stock market returns in India over a period of 10 years (2001-02 to 2010-11) are summarized below.

- The Augmented Dickey-Fuller test shows that the time series data used for the study are stationary and all integrated of order one.
- The Johansen's co-integration test reveals that there exists long run equilibrium relation between gold prices and stock market returns in India.
- The Granger causality test in the vector error correction model suggests the evidence of feedback causality running between the gold prices and Nifty based stock returns in India. Thus, each variable contains some significant information so that one can be used to predict the other.

V. Conclusion

During the period of global financial crisis, stock markets crashed but gold price continues to increase in India. Unlike stock, the extent of holding of gold in India is widespread, though retail participation in the Stock Markets has gone up in the last few years. Indians consider gold the safe haven investment as a financial asset as well as jewellery (ornaments). World Gold Council Report says that India stands today as the world's largest single market for gold consumption. Traditionally, gold has been more attractive than bank deposits, stocks and bonds. In developing countries, people have often trusted gold as a better investment. In many countries including India, gold remains an integral part of social and religious customs, besides being the basic form of savings. However, Indians have started considering gold not only as jewellery but also an important mode of investment like investment in bonds and equities. Perhaps, this explains the co-movement of gold prices and stock prices even during the period global financial crisis and thereafter.

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