# VOLATILITY SPILLOVER BETWEEN INDIAN STOCK MARKET AND GOLD PRICES: EMPIRICAL EVIDENCE FROM POST LIBERALIZATION PERIOD

[1]Raktim Ghosh, [2]Soumen Saha

[1,2]Ph.D Scholar

[1,2]Department of Commerce

[1,2]University of Gour Banga, Malda, India

*Abstract:* The Indian stock market has witness a phenomenal growth during the post liberalization period even after combating several challenges both at national and international domain. In this paper we have considered the Indian stock market and gold prices as the variable where we tried to inspect the volatility between them and the spillover effect. During the post liberalization period it was observed that the investors were keen to invest in the stock market even after knowing that the gold is a comparatively safer haven in terms of appreciation in their investment. Theoretically it was witnessed from different existing literatures that there is an inverse relationship between stock market and gold prices. Empirical study in our paper shows that there exists ARCH effect and GARCH effect in the model with data from January, 1992 to July, 2020. We have found that due to any external shock created one month back (n-1) is affecting the BSE SENSEX of the present month (n) which has a spillover effect on gold prices due to a significant p value of ARCH model. Also, a significant p value of GARCH model suggests that volatility of BSE SENSEX of one month before is having an influence in the present month BSE SENSEX which is leading to a spillover effect on gold prices. This indicates that any good news at national and/or international level influences the BSE SENSEX in a positive way leading to a spillover effect on gold prices in a positive way and any bad news at national and/or international level influences the BSE SENSEX in a negative manner leading to a spillover effect on gold prices in a negative way which is confirmed from the coefficient of the empirical test. The reason behind such occurrence is the perception of investors to consider gold as a secure investment avenue than stock. It is also noted that investors can also prefer stock to gold if they prefer short term return and if they lack in sufficient idle funds. During the study period certain events like Harshad Mehta scam, Ketan Parekh scam, subprime crisis and the recent COVID-19 pandemic can be identified as the shocks that can create volatility and spillover effect among the variables.

*Index Terms*- **Volatility, Spillover Effect, Gold Prices, Stock Market, ARCH, GARCH**

# I. INTRODUCTION

The Indian Stock Market plays a vital and significant role behind the development of Indian economy and so does the gold prices. There noteworthy role has remained a matter of discussion and analysis to the researchers across many decades. During 1900 to 1971, the worldwide systems of gold standard and USD standard controlled gold price. But, since 1972, gold has been detached from the USD. Particularly in 1976 when the International Monetary Fund (IMF) passed Jamaica Agreement, gold commence to develop from currency to ordinary merchandise and since then gold price has been indomitable by market supply and demand. (Mishra, et al., 2010) India is on a gold mine and has the probability to be world's major gold trading hub.

During the post liberalization period, Indian Capital Market has witnessed a tremendous growth with an ever growing interest of the prospective investors to invest in different shares both from India and foreign countries. Even the demand for gold has also increased in India considering it to be a safe haven with an appreciation in investment in comparison to mutual funds, equities, real estate, and fixed deposits.

However, a contrast of the historic valuation of the gold with the Indian equity market illustrates that gold has largely underperformed the equity market. (http://archive.indianexpress.com/news/gold-has-underperformed-sensex-over-last-three-decades-fe-study/782554/)

Standing in today's time, we should acknowledge the fact that though emerging countries are in focus of the investors for significant inflow of capital, but emerging markets are more susceptible to negative news and events leading to a high volatility.

Theoretically, there exists an inverse relationship between stock market and gold prices. We should inspect the volatility spillover between them empirically.

# II. STATEMENT OF PROBLEM

Following situation can take place with Gold Prices in regard to volatility. First, a shock in stock market can create a negative spillover effect on gold prices; second, a shock in stock market can create a positive spillover effect on gold prices.

# III. LITERATURE REVIEW

The researcher has gone through so many literatures at international and national level. After a minute screening of all available literatures, the researcher has mentioned some pertinent and relevant literatures below:

**Bhuyan & Dash (2018)** investigated the relationship between the gold price and the NSE Nifty stock index in India by using the monthly data from January, 2001 to December, 2017. They found that there was no long-run relationship between the gold price and stock returns by using Johansen's Co-Integration test. It also concluded that there was no casual relationship between the variables.

**Kaur, K (2018)** analyzed the relationship between Indian gold market and Indian stock market index SENSEX by using daily data from January, 2010 to December, 2015. The study observed that there is no long-run and casual relationship between the variables by using Johansen's Co-Integration test and Pair wise Granger Causality test.

**Mittal, D (2017)** investigated whether the microeconomic conditions like inflation, interest rate US Dollar etc can effect on the price of gold or not by using theoretical analysis. This paper concluded that microeconomic conditions were determining the investment demand for gold and also pull the price of gold up or down. For that reasons, the prices of gold are difficult to determine and unpredictable in nature.

**Jebran & Iqbal (2016)** examined volatility spillover effects between stock market and foreign exchange market in selected Asian countries; Pakistan, India, Sri Lanka, China, Hong Kong and Japan for the period of January, 1999 to January, 2014. They observed that bidirectional asymmetric volatility spillover between stock market and foreign exchange market of Pakistan, Sri Lanka, China and Hong Kong. It also observed that unidirectional transmission of volatility from stock market to foreign exchange market of India and no evidence of volatility transmission between the two markets in Japan.

**Kumar, D (2014)** investigated volatility transmission between gold prices and Indian industrial sector using generalized VAR-ADCC-BVGARCH model. The study found that it indicates unidirectional significant return spillover from gold to stock sectors.

**Srinivasan, P (2014)** analyzed the relationship between gold prices, Stock price and exchange rate in India using monthly time series data from June, 1990 to April, 2014. The study established a long-run relationship between gold price and exchange rate in India and no evidence of long-run relationship between gold price and stock price in India. It also found that there was no causality between gold price and stock price in India.

**Contuk, Burucu & Gungor (2013)** checked daily gold prices using the GARCH model for the period of January, 2009 to December, 2012. They found that gold price and the stock exchange yields both have been affects by their own shocks and by the shocks of each other.

**Mishra, Das & Mishra (2010)** examined the volatility of gold price and stock market return in India for the period of January, 1991 to December, 2009. They found that the gold prices Granger- Causes stock market return and vice-e-versa.

## IV. RESEARCH GAP

Minute survey of existing literature serves us with some research gaps that have been enlisted below:
- Practically no such work exists that has been conducted considering a long time frame
- Application of econometric models like ARCH and GARCH are rarely found
- No such work exists that has been done considering the post liberalization period comprehensively

## V. RESEARCH OBJECTIVES

On the basis of the research gaps, following objective has been identified:
- To measure the volatility in BSE SENSEX in the post liberalization period
- To measure the spillover effect of BSE SENSEX on Gold Prices in the post liberalization period
- To measure the spillover effect of BSE SENSEX volatility on Gold Prices in the post liberalization period

## VI. RESEARCH METHODOLOGY

### VI. I Type of Research

The study is empirical in nature based on secondary data. Theoretical study is also included by way of studying the existing research works for recognition of research gap and finalization of the objectives of the study

### VI. II Sample Period

In this research work, we have considered the time from January, 1992 to July, 2020 to make sure that the study can be conducted during the post liberalization period

### VI. III Sample

The sample size was finalized at 343 considering the post liberalization period

### VI. IV Data and its Source

In order to accomplish our objectives, we have collected monthly data of BSE SENSEX which represents the Indian Stock Market and Gold Prices. The time series data of BSE SENSEX was collected from BSE India website and gold prices data was collected from investing.com website. All the data were converted into log natural to remove the problem of unit root which is usually found in a time series data.

### VI. V Tools Used

- Graphical Representation
- Descriptive Statistics
- Autoregressive Conditional Heteroskedasticity (ARCH Model, 1982)
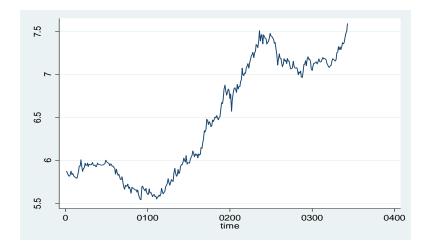- Generalized Autoregressive Conditional Heteroskedasticity (GARCH Model, 1986)

The statistical packages SPSS 20 and Stata 14 has been used to conduct the analysis

## VII. SIGNIFICANCE OF THE STUDY

This paper looks forward to provide innovative empirical findings on volatility in Indian stock market and also its spillover effects on gold prices. This paper will cater to the students, faculties and academicians to understand the concept of volatility and spillover effect pertaining to the specific area under study. This paper will also open up new dimensions in the field of research to the researchers to pursue further research. Towards the prospective investors, this paper should gain paramount importance. It will provide them with understandings in regard to taking decisions on investment in both gold and stock market. This paper also highlights the reasons behind the volatility and its spillover effects.
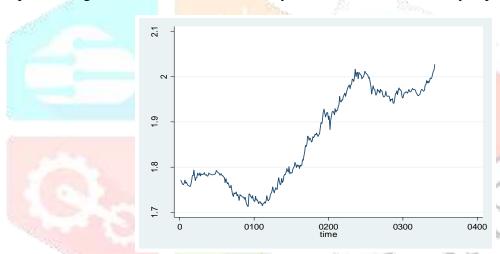
## VIII. DATA ANALYSIS AND INTERPRETATION
## VIII. I Graphical Representation



(Fig 1: time series graph of Gold Prices showing volatility obtained from Stata 14)

The above graph of Gold Prices during the study period shows volatility in their behavior which can be identified from the frequent changes in their movement. Visually it can be said that volatility is present throughout.



(Fig 2: time series graph of import showing volatility obtained from Stata 14)
The above graph of BSE SENSEX during the study period shows volatility in their behavior which can be identified from the frequent changes in their movement. Visually it can be said that volatility is present throughout.

## VIII. II Descriptive Statistics

| Descriptive Statistics | | | | | |
|---|---|---|---|---|---|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| Gold Prices | 343 | 255.80 | 1985.90 | 787.3656 | 489.4229 |
| BSE SENSEX | 343 | 2122.30 | 41253.74 | 13642.1031 | 11336.9621 |
| Valid N (listwise) | 343 | | | | |

(Table 1: Descriptive Statistics of the different variables computed from results generated from SPSS 20)

The above table shows that the mean price of gold was 787.3656 USD. Price of gold rose to 1985.90 USD, which is highest during the study period and came down to 255.80 USD, which is lowest during the study period. Similarly, BSE SENSEX rose to 41253.74 points and came down to 2122.30 points. The mean point of BSE SENSEX was 13642.1031.

## VIII. III Research Specifications

1. The ARCH (1) Model (Robert F. Engle, 1982) is as follows:

$y_t = \beta + e_t$ (Mean Equation)

Where, $y_t$ is the random variable, $\beta$ is the mean and $e_t$ is the error term.

The mean equation explains the performance of the mean of the time series data. It is a linear regression function including a constant and an advisory variable.

$\hat{e}_t^2 = y_0 + y_1\hat{e}_t^2 + v_t$ (Auxiliary regression equation)

The auxiliary regression equation explains the volatility considering one lagged term.

2. The GARCH (1,1) Model (Tim Bollerslev, 1986) is as follows:

$h_t = \delta + \alpha_1 e_{t-1}^2 + \beta_1 h_{t-1}$

Where, $h_t$ is the random variable, $\beta_1$ is the estimated coefficient on the lagged variable.

The GARCH (1,1) model explains the variation in volatility considering one lagged term.

## VIII. IV Empirical Data Analysis And Findings

| ARCH Family Regression | | | | | | |
|---|---|---|---|---|---|---|
| Sample: | 1992 Jan -2020 July | | | | No.of obs = 343 | |
| Distribution: | Gaussian | | | | Wald Chi2 (1) = 479 | |
| Log Likelihood = | 1058.978 | | | | Prob > chi2 = 0.0000 | |
| | | | | | | |
| | | | OPG | | | |
| Gold Prices | Coef. | Std. Err. | z | p>IzI | 95% Conf. | Interval |
| | | | | | | |
| | | Mean Model | | | | |
| Gold Prices | | | | | | |
| BSE SENSEX | 6.5275 | 0.003 | 2189.24 | 0 | 6.5216 | 6.5333 |
| _Cons | -5.6912 | 0.0057 | -1001.1 | 0 | -5.7023 | -5.68 |
| | | | | | | |
| | | ARCH (1) and GARCH (1,1) | | | | |
| ARCH | | | | | | |
| ARCH L1 | 0.8923 | 0.2067 | 4.32 | 0 | 0.4871 | 1.2974 |
| | | | | | | |
| GARCH | | | | | | |
| GARCH L1 | 0.1756 | 0.0931 | 1.89 | 0.059 | -0.0069 | 0.3581 |
| _Cons | 0 | 0 | 2.85 | 0.004 | 0 | 0 |

(Table 2: ARCH and GARCH model computed from results generated from Stata 14)

In the above table, mean model shows that the p value is significant at 1 percent level with a positive coefficient of 6.5275 indicating a change in BSE SENSEX by 1 percent will lead to a positive change in gold price by 6.5275 percent. There is ARCH effect as the model is significant at 1 percent level with 1 lag confirming the volatility in BSE SENSEX caused by an external shock one month before. The coefficient of the model is 0.8923 (positive)

stating that 1 percent BSE SENSEX volatility is leading to spillover volatility effect in gold price by 0.8923 percent. Though the GARCH model is significant at 6 percent, but still it explains the variation in volatility of gold prices by 0.1756 percent. It states that 1 percent previous months BSE SENSEX volatility is leading to spillover volatility effect in gold price by 0.1756 percent.

## IX. LIMITATIONS OF THE STUDY

➢ The study is limited to post liberalization period
➢ Our study is based on 343 month's data. A larger sample could have provided a better result
➢ We have assumed the customer's attitude. It could not be measured.
➢ There are other macro economic variables that affect gold prices. We have not considered them in this work.
➢ Structural breaks have not been tested in this study

## X. FURTHER SCOPE OF RESEARCH

➢ Research work can be conducted considering a comparative study between pre and post liberalization period
➢ The study can be conducted using daily data
➢ Different other statistical tools can be applied
➢ A primary survey can be conducted to study the investors sentiments regarding gold and stock market as investment opportunity

## XI. CONCLUDING REMARKS

While concluding this study, we can say that in India due to any external shock created one month back (n-1) is affecting the BSE SENSEX of the present month (n) which has a spillover effect on gold prices due to a significant p value of ARCH model. Hence, Indian stock market is suffering from volatility due to any national or international shock as predicted by ARCH model. Further, a significant p value of GARCH model indicates that volatility of BSE SENSEX of previous month (n-1) is having an influence in the present month (n) BSE SENSEX which is leading to a spillover effect on Gold Prices. This means that any good news at national and/or international level is increasing BSE SENSEX or we can say that is creating a positive volatility in BSE SENSEX and any bad news at national and/or international level is decreasing BSE SENSEX or we can say that is creating a negative volatility in BSE SENSEX. As a result of which, due to any increase in BSE SENSEX or BSE SENSEX volatility there is a positive spillover effect on Gold prices and due to any decrease in BSE SENSEX or BSE SENSEX volatility there is a negative spillover effect on Gold Prices. The possible reasons behind such phenomenon is that the Investors always looks forward to invest in either gold or stock on the basis of the economic scenario or total risk associated with each investment. Gold always provides a long term security when compared to stocks as stocks are susceptible to economic conditions. Also, if the investors do not expect short term return, they can choose to invest in gold. It is also noted that gold provides a greater return than any other investment avenue across a long run time horizon. During any financial crisis in the nation, stocks may perform poor but gold shall provide the same level of return. Even during inflation, the value of money can be stored by investing in gold. Even, gold has some cultural symbol in India. It signifies status and good luck. Hence, all these factors might make the investors to prefer gold as a better investment avenue than stock leading to a higher demand for gold even when stock market is performing well. This increase in demand leads to increase in the price of gold. The opposite can also happen. When stock market underperforms, prices of gold may reduce as a result of reduction in demand for gold. This happens when the investors' looks forward for short term return which induces them to opt for stock when compared to gold in spite of knowing that stock market is not performing well. Some investors might select to invest in stock because of fewer amounts of idle funds. We can also say that during our study period, certain events at national and international level like SEBI provided with statutory power in January, 1992, Harshad Mehta security scam, GDR issued by Reliance and replacement of Capital Issue Control Act, 1947 in May, 1992, participation by foreign institutional investors in Indian securities market in September, 1992, inception of NSE and inauguration of OTCEI in November, 1992, ban of badla trading in 1993, screen based trading in 1994, BOLT replaces open outcry system, NSCCL setup in 1995, SEBI gives recognition to integrated stock exchanges founded by 16 regional stock exchanges in 1998, Infosys Technologies is the first to list on NASDAQ through a public offering of American depository Receipts, SENSEX closed above 5,000 mark at 5,031.78 in 1999, Ketan Parekh scam in 2001, Subprime crisis in 2008 and the recent occurrence of global pandemic, COVID- 19 can be the reasons leading to volatility in Indian stock market.

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