An Analysis of Volatility of Macro Economic Variables on Gold Price

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Abstract

Volatility in gold price occurs due to several factors that include Sensex which is a free float market-weighted stock market index of financially sound companies listed on Bombay Stock Exchange (BSE). Gold prices are the result of a complex interplay of a host of factors. Therefore, it is not an easy to make a correct appraisal of its movement, and the task becomes all the more difficult when other macro economics variables depict a lot of volatility. Sensex and dollar price also influence the gold price in India in one or another way. The researcher tried to study the relationship among these three variables in given period of time with help of some significant statistical test i.e. Correlation, Augmented Dickey Fuller (ADF), Unit root tests, Co-integration test & Granger Causality test.

Keywords: Gold, Volatility, USD, Sensex, Variables, Unit root, Granger Causality test.

Introduction

Gold is one color that is universally loved. Gold is used in India as a form of tackling inflation and holding an item with an intrinsic value because of its rarity is a good way to counter the fluctuations in flat currency. As a traditional form of savings in India, gold instills a feeling of comfort and security for a person's wealth. This has been termed the "exposure effect" by psychologists. "Change is the only constant in this world". This is an extremely popular saying which holds true till this day. No matter how hard we strive to keep things stable, the universe will always find a way around it. Nothing in this world stays the same for long, especially commodities, as what is valuable today might be junk tomorrow. Gold has managed to hold on to its position as an important metal for centuries, but even the mighty golden treasure is not immune to change.

14 September 2012 was a golden day, for the gold as it broke all previous records to touch Rs. 32,900 for 10 grams in the spot market while April 2013 futures hit a new high in India. Festive and wedding season demand besides global cues and investor expectations lead to touch new highs in gold prices but fluctuating gold rates is a common trend across the globe, changing on an almost daily basis. It is not rare to see extremes when it comes to gold rates, extremes which evoke a range of emotions, ranging from happiness and joy to sorrow and despair. Gold rates have been on a roller coaster ride in the last few years, reaching great highs below falling to extreme depths. It is common for us to wonder why gold rates fluctuate, for gold has been

around for centuries and survived the test of time. Shouldn't it be immune to fluctuations and other lowly considerations? Well, it's not, gold is just like any other commodity today and there is no guarantee when it comes to its prices.

Review of Literature

Kumar & Dadhich (2014) attempted to uncover the relationship between Sensex and value of rupee/dollar with help of statistical tools. The study shows that correlation between the Sensex and value of rupee/dollar has a perfect negative. More will the volatility of rupee/dollar more will the unpredictability of Sensex. Herbst investigated long run relationship between gold price and the U.S stock prices. Findings of his study revealed that gold prices and stock prices have cyclic relationship which found in linear outline instead of phases. Most of the researchers are agreed on the fact that gold acts as investment manager and used as a hedging tool against inflation. Mishra et al. (2012) found that both domestic and global gold prices are closely interrelated. They also examined the nature of changes in the factors affecting international gold prices during the last two decades wherein they found that short-run volatility in international gold prices used to be traditional factors such as international commodity prices, US dollar exchange rate and equity prices. Levin and Wright (2006) examined the relationship between Gold prices and the US dollar prices. Applying co-integration technique on data from January 1976 to August 2005, study revealed that the level of U.S $ prices and prices of gold moves together in a statistically significant way that 1% increase in a U.S $ price level leads to 1% increase in gold prices; whereas, in case of any uneven shock, this long-term relationship is deviated which resulted in weakening of relationship.

Objectives of the study

a. To examine and explain the trends of gold prices in India.

b. To determine long run relationship between macro economic factors and gold price in India.

c. To determine whether there exist any cause and effect relationship between Sensex and dollar on gold price in India.

Hypotheses

-H0: There is no significant relationship between gold price and Sensex & dollar price in India.

-H1: There is significant relationship between gold price and Sensex & dollar price in India.

Data Description and Methodology

To study the existence of long-term equilibrium relationship among time-series models, different statistical tests are used. To analyze the lag and lead relationship in the sample, Granger causality test is used which is propounded by C.J granger in 1969; whereas, hypotheses will be accepted based on F-test results at significance level of 0.05 that provide the evidence of explained relationship between predictors and endogenous variables. The data was collected during the period of Jan 2011 to Dec. 2015 on monthly basis. To analyze the impact of Sensex and dollar price on gold price, monthly data were gathered from reliable and official websites. To obtain accurate findings to test research hypotheses, various statistical tests are used including descriptive statistics, Unit Root Test (Augmented Dickey Fuller), Johansen Co-integration Test and Granger Causality Test.

Descriptive statistics are used to evaluate the mean, standard deviation, median, skewness and probability of the variables that are under consideration in the research. Alongside the variance of data, these values show the distribution of error terms. Co-integration method is used to detention the actual depiction of the co-movements of gold prices along with the Sensex and dollar price.

ADF assumes that the variance is constant and the error terms are independent. Statistically, to confirm the series of factors in a stationary form, Unit Root Test (Augmented Dickey Fuller) is used. In this study, ADF model is applied to investigate the presence of single unit root. To run Johansen-juselius (1990) test; co-integration test is applied which estimates the long-run relationship among the time series.

6.Data Analysis and Interpretation

Table 1 Descriptive Statistics

Particular	Sensex	Gold	Dollar
Mean	21470.37	27270.12	56.85267
Median	19488.28	27399.00	59.36000
Maximum	29533.42	31330.00	66.76000
Minimum	15534.67	19737.00	44.21000
Std. Dev	4195.604	2721.306	6.780704
Skewness	0.569683	-0.935448	-0.437397
Kurtosis	1.821413	3.698624	1.992654
Jarque-Bera	6.718060	9.970820	4.450026
Probability	0.034769	0.006837	0.108066
Sum	1288222	1636207.	3411.160
Sum Sq. Dev	.04E+09	4.37E+08	2712.699
Observations	60	60	60

Table 2 Correlation Matrix

S.N.	Sensex	Gold	Dollar
Sensex	1.000000	-0.189480	0.715176
Gold	-0.189480	1.000000	0.324320
Dollar	0.715176	0.324320	1.000000

The correlation statistics given in the Table 2 above points out gold price has negative relationship with Sensex whereas moderate positive relationship with dollar price. Before applying Granger Causality test to establish whether there is any underlying impact of different global factors on gold price in India or vice versa it is imperative that a data series are stationary so as to draw some meaningful conclusions. Thus, for the purpose of checking stationary, the Augmented Dickey Fuller (ADF) test has performed. ADF test discloses that errors have constant variance and are statistically independent. ADF test has been performed at two different levels i.e. at level data & at 1st difference setting a Null Hypothesis that the variable series is non stationary.

Table 3 Unit Root Analysis (Augmented Dickey Fuller Test)

Critical Values of ADF Test **at Level**							
Variables	Lag	ADF- Static	Prob.	1%	5%	10%	D/W
USD	0	-1.028583	0.7375	-3.546099	-2.911730	-2.593551	1.983250
Gold	1	-2.799044	0.0645	-3.546099	-2.911730	-2.593551	2.148290
Sensex	0	-0.490912	0.8852	-3.546099	-2.911730	-2.593551	2.003674

Source: Output of E-views 8

Table 4 Unit Root Analysis (Augmented Dickey Fuller Test)

Critical Values of ADF Test at **1st Difference**							
Variables	Lag	ADF- Static	Prob.	1%	5%	10%	D/W
USD	0	-7.561454	0.0000	-3.548208	-2.912631	-2.594027	2.006791
Gold	0	-8.284769	0.0000	-3.548208	-2.912631	-2.594027	2.004180
Sensex	0	-8.429989	0.0000	-3.548208	-2.912631	-2.594027	2.084020

The results show that all the variables are integrated of order of one & stationary upon differencing (see Table 3). When test was applied on level data, it was found that p-values of all variables are more than our assumed level of significance i.e. 0.05. Thus, are not significant. Therefore ADF Unit root test was applied at 1st level differencing (see Table 4). The results so obtained show that p-values of all the variables close to zero. Hence it indicates the absence of unit root in the present data series & the data were found fully stationary.

Table 5 (a): Results of Johansen's Co-integration Test
[Unrestricted Co-integration Rank Test] (Trace)

Hypothesized Trace 0.05 No. of CE(s)	Eigen value	Trace Statistics	Critical Value 0.05	Prob.**
None	0.231127	22.01435	29.79707	0.2977
At most 1	0.094303	6.770221	15.49471	0.6045
At most 2	0.017522	1.025276	3.841466	0.3113

Table 5 (b): Results of Johansen's Co-integration Test
[Unrestricted Co-integration Rank Test] (Max-Eigen value)

Hypothesized Trace 0.05 No. of CE(s)	Eigen value	Max-Eigen Statistics	Critical Value 0.05	Prob.**
None	0.231127	15.24413	21.13162	0.2722
At most 1	0.094303	5.744945	14.26460	0.6462
At most 2	0.017522	1.025276	3.84166	0.3113

To test long run co-integration between all variable, the Johansen's Co-integration test and maximum Eigen value test (table 5) have been conducted. The Trace test indicates the existence of three co-integrating equations at 5% level of significance and the same is also not confirmed by the maximum Eigen value test. Thus, the test confirms non-existence of long-run or equilibrium relationship between them.

Table 6 Pair wise Granger Causality Test

Null Hypothesis	Ob.	F- Stat	p-value	Decision	Nature of Causality
GOLD does not Granger Cause DOLLAR	57	2.12766	0.1294	Accepted	No Causality
DOLLAR does not Granger Cause GOLD		0.12231	0.8851	Accepted	No Causality
SENSEX does not Granger Cause DOLLAR	57	0.52188	0.5965	Accepted	No Causality
DOLLAR does not Granger Cause SENSEX		9.29842	0.0004	Rejected	Uni-directional causality
SENSEX does not Granger Cause GOLD	57	0.35584	0.7023	Accepted	No Causality
GOLD does not Granger Cause SENSEX		5.46064	0.0070	Rejected	Uni-directional causality

Source: Output of E-views 8

Table 6 depicted the results of Granger causality test which explained that there is no causal relationship is found between gold prices and dollar i.e. gold doesn't granger cause and vice-versa. Same no casual relationship found between Sensex and dollar price but there is uni-directional causality between dollar and Sensex. Eventually casual relationship is not significant between Sensex and gold price at p-value 0.05 percent. Thus, the trend of few variables are absolutely independent in nature and do not cause any causal relationship among them.

Conclusion

Findings of this study indicated that there is no long-run relationship exists between monthly average gold price and dollar and vice-versa. Moreover, Sensex also does not Granger cause dollar price in long run but dollar has long-term uni-directional relationship with average Sensex. Furthermore, in long run Sensex depicts no relationship with gold but gold price shows significant relationship with Sensex that has also been observed in previous research. To shape the data in the stationary time series, Unit Root (Augmented Dickey Fuller) test is used. In addition to monthly data analysis, this study used Co-Integration test to examine the long-term relationship among average variables. On the basis of the above overall analysis, it can be concluded that some of macroeconomic variables are relatively significant and likely to influence the gold prices in long run. The evidence of this study is consistent with other similar studies. However, the results from this empirical research should not be a conclusive indicator for gold price volatility.

Future Research

This study is limited to find the long-term relationship between gold prices, dollar and Sensex however, future research can explore the relationship of gold prices at large scale; may be included to other macro-economic variables i.e. gross domestic product, foreign direct investment, consumer price index etc. Short-term relationship by expanding other microeconomic factors and their relationship with gold prices may also be examined.

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