Causal Relation Between Gold and Stock Returns In India: A Study

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ABSTRACT  
The main focus of this study is based on making comparative analysis on stocks (Nifty) and gold as, it creates a scope for the investors to understand how the Nifty returns and the Gold returns are impacted for their investment option to their portfolio. This study is for making better and safe investment option to the investors for any type of conditions. To analyse this we have used the data of Gold prices & Nifty Index from 2005 to 2014 financial year. The analysis found that data is stationary condition and have a long run relationship between them, but according to causality relationship model it is suggested that the data have bidirectional impact on each other.  
Key Words: Gold Vs Stock, Unit Root Test, Johansen Cointegration test
Numerous studies seems to be vanishing price from 2002 to 2007 dollar and the gold prices, the gold prices have a considerable impact due to the crude oil prices. Rates are positively co-related with the inflation rate. Repo rates and the gold prices are interdependent in nature, gold prices and inflation rate are factors like exchange rate of US dollar with Indian rupee, Crude oil prices, repo rate and stock market indices. A integration test it specify that there is no co-integration relationship between the gold price and two stock market indices 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.

PREVIOUS STUDIES
Numerous studies were made for comparing and analyzing the returns of the yellow metal i.e. Gold and the stocks which are performing at a constant stable value in the market. Analysts says the position of gold can be still more attractive in the terms of medium due to uncertainty of global economies and the uncertainty in price changing pattern in the global market may change the returns on the commodity market. Investors can include their precious metals to their portfolios carefully by buying in small quantities from time to time. Following are the Indian authors proposed their viewpoints through different articles and journals are mentioned to make a research gap.

Gayatri and Dr. Dhanabhakym (2014) studied the relationship between the gold and the nifty using the observations for ten years during 2003 and 2013 and found that the price of gold and the nifty stocks were changing significantly and there is a need to validate the relationship. Using the techniques of time series analysis like co-integration and causal relationship between the variables the results show that there is unidirectional causality relationship between the variables. It is also concluded that gold is the best secured investment method for reducing their risk in investment because some time due to any destruction like war, inflation and economic crisis, the prices of the gold will not fall and they will affect the returns the investor. Dilip Kumar (2014) mentioned that gold-stock portfolio provides better diversification benefits than the stock portfolios. Gold can be considered as a valuable asset class that can improve the performance of a well-diversified portfolio of stocks which was under risky conditions and also acts as protector against various market and external economic factors.

Sarbapriya Ray (2013) examined that the causal relation between stock price and gold price in India over a period from 1990-91 to 2010-11 and stated that Gold & stock market moves in the opposite direction. Predominantly, when gold prices are going in negative direction, people will get back their investment from gold and they invest the same amount in stock market where it rises due to heavy investment in stocks. If the economy is going in a downstream and stock markets are going down, shareholders tend to disinvest their funds in stock market and invest in gold and they come out of the storm. As the gold price increases, Indian investors likely to invest less in stocks, it leads to the fall of stock prices. Somnath Mukhuti and Amalendu Bhunia (2013) examined the impact of the domestic gold price on stock price indices in India for the period for the period from 2nd Jan, 1991 to 10th Aug, 2012 by using statistics like unit root test and Granger causality test. In India the domestic gold prices are eternally escalating inconsequence of its intense domestic demand on the context of protection, liquidity along with the spreader portfolio. Based on World Gold Council, BSE and NSE database they find that no causality exists between gold price & Sensex, nifty &Sensex and gold price. Bidirectional causality exists between Sensex & gold price, Sensex & nifty and gold price & nifty. In addition, Somnath Mukhuti and Amalendu Bhunia (2013) also opined that at the time of rupee depreciation, bank failures, national crisis, and in the case of negative real interest rate, gold is consider as the liquid asset, which is safe haven for investors and they like to invest their money in such precious yellow metal because there is very less chance for getting better returns in stock investment than gold due to the volatile economic and financial position. However, with the help of Bivariant co-integration test it specify that there is no co-integration relationship between the gold price and the stock market indices. And the multivariate co-integration test result show that the presence of the steady co-integration relationship between gold price and two stock market indices in India. Shruti Bangad (2013) analyzed various factors that affecting Gold price. Major factors that are affecting gold price are factors like exchange rate of US dollar with Indian rupee, Crude oil prices, repo rate and inflation rate. Repo rates and the gold prices are interdependent in nature, gold prices and inflation rates are positively correlated and dependent in nature, there is an inverse relation between the US dollar and the gold prices, the gold prices have a considerable impact due to the crude oil prices.

Narang S P & Raman Preet Singh (2012) found positive correlation between stock returns and gold price from 2002 to 2007, but during U.S facing economic crisis in 2008 and 2011 this correlation seems to be vanishing. Using correlation and Johansen's co-integration test, it is found that there is no
relation between gold prices and stock returns i.e. Sensex return in the long run period. The results of Granger causality test reveals that returns of Sensex index does not lead to increase in gold price and rise in gold price does not lead to increase in Sensex. Aclan OMAG (2012) revealed that commodities similar to gold be significant in the study of economic environment because their prices are subjective by an assortment of factors together with the changes in demand and supply, switch over charge and additional economic variables. Rabi N. Mishra and Jagan Mohan analyzed the effectiveness of gold price in different sectors. He mentioned that the gold prices will not be affected by any type of collapses and the gold prices fall will not affect the stock market. And it also found that presently, domestic and international gold prices are closely interlinked and they have a similar echo of gold prices. It was also found that in post 2003 the demand for gold has raised by china and India have lead to interlink between the domestic & international gold market with similar echo. Amalendu Bhunia and Amit Das (2012) studied that country’s stock markets has been becoming more responsive to both internal (domestic) and external factors, and one of the major reason is gold price. They examined the gold price volatility and the relationship between stock market and gold returns in India. With concern to stock market returns based on NSE and domestic gold prices, from April 2001 to March 2011, gold prices have an impact on the stock market returns and stock market returns also had an impact on gold prices in India during the period of study. They accomplished that during the period global financial crisis and after that also there is a co movement between gold prices and stock market. Indian investors are taking into consideration gold not only as jewelry but also a significant form of investment similar to investment in equities and bonds. Bryan Harris (2012) found that for the duration of a feeble global economy and unsure financial markets, several investors thought that profit of hold gold in their portfolios. Gold is time and again cited portfolio benefits take in safe haven during down times, a muscular long phrase returns and defend against inflation. As evaluated to other assets Gold has more volatile in nature and doesn’t make positive cash flows, dropping its possible as a portfolio stabilizer. Martin Surya Mulyadi and Yunita Anwar (2012) stated that it is significant to have a diversified portfolio in investment to different kinds of instruments. Gold is to a certain extent safe for the investors and it could be categorized as safe haven and Gold is a good portfolio for diversifying and a hedgerow against stocks as well as a safe haven in risky stock market conditions. Gold return tends to increase when stock investor in loss. While gold returns are increasing, it shows the indirect impact on the stock return. Prashanta Athma and Suchitra K (2011) stated gold is regarded mainly as an effective hedge against inflation, safe and sound form of investment and an effective portfolio diversifier. There are various gold investment options available to the investors to reap rich returns. Like, Demat form of gold investment options viz. Gold Futures, Gold ETFs, Gold Savings Fund and E-gold are better than the physical form of gold. It is very important to analyze the various investment options that are available to the investors. An investor can make investment in any Demat form of gold investment options as there is no significant differences in the return of the various demat form of gold investment options. Anil Suresh (2011) mentioned that gold is one of the main integral investments of Indian society and it is also called as the foundation of wealth & savings in India. Consumers will always have high price expectations; a further risen gold jewelers and the investment demand anticipated. This trend continued over a long run as local investors are buying gold, which is driven by wealth accumulation motive. Moreover, gold is known for the most popular investment pattern in the country. A report from the world gold council says India is the tenth largest country in gold reserves. World gold council (2010) demonstrated that gold investable marketplace is bigger than the market place of all self-governing debt markets, and moreover distinct to independent debt market, gold is not have any credit risk, which allows the gold market to acquire large investment without any unenthusiastic magnification. At the same time as debt market raise; the escalating in credit risk dilutes the value of presented stockpile of the debt. Whereas gold no longer act a bureaucrat role in global financial and monetary systems, it ruins lone of the maximum eminence liquid assets in the marketplace. Hinashahzadi and Muhammad Naveed chohan (2010) have examined the various factors which are affecting the stock markets. Like security circumstances, feeble economic situations and unstable political factors. Investors are showing interest in gold instead of stocks because they no fear about future price fluctuations which repeatedly seen in the stock markets. Results show that there
is no longtime relationship among the variables gold prices and Karachi stock exchange returns. Shankari (2010) mentioned that gold has an inflation edge. If inflation of a country increases, investors are buying gold to make balance their portfolio. It is also identified that there is an indirect relationship between the components (crude/gold/nifty) especially about the direct relationship between crude v/s gold and also suggests if one gets profit from one instrument, try to switch to another instruments for more profits after careful analysis of that particular product and the factors which effects. Richard Michaud, Robert Michaud and Katharine Pulvermacher (2006) examined that gold as strategic investment for U.S. institutional investors. Gold is the factor which is mostly suspected to geopolitical factors. At the times of relative stability of the gold price a small positive allocation may be useful. At the periods of abnormally positive economic activity, gold returns will reflect the multiplier effect which is associated with the cultural issues. At periods of monetary or fiscal mismanagement different kinds of crisis or the fundamental changes in the dominant currency will take place. In order to reduce his type of risk gold is considered as the best asset class for hedging risk. Dirk G. Baurand Brian and M. Lucey (2006) investigated that whether gold is windbreak against stocks, bonds. Gold is retreat in extreme conditions. They studied the constant and time varying relationship between gold, stocks and bonds for analyzing the component which is a hedge and a safe haven. They mainly analyze the role of gold in financial market. Results revealed that there is a lot of confusion among investors whether to hold or purchase the gold after an extreme negative shock occurred.

The previous studies revealed whether there is any bidirectional or unidirectional and any long term relationship between gold and stocks. Nonetheless the results show mixed results with respect to relationship between gold and stocks returns under different time periods. Therefore, this study is needed to understand the long term relationship between the Gold returns and Stocks returns (Nifty) for creating a better investment options, through which they can consider that which is having a higher returns with low risk on investment of those commodities than the stocks which are having a risk on fluctuation of the market and the economy of the country.

OBJECTIVES OF STUDY
The objectives of the study are:
1. To compare the returns of Gold and Nifty.
2. To study the long run relation among Gold and Stock market (Nifty) on the basis of Returns.
3. To study whether there any causality relation between Gold returns and Nifty returns in log run.

RESEARCH METHODOLOGY
This study aims at investigating the casual relation between Gold Returns and Nifty Returns for period 2005 to 2014.
Secondary data: Daily prices of Gold and Nifty have been taken, the gold data in ounce and the converted it in to 10 grams.
By using this formula:
Gold 10 gm price = (ounce price /28.35)*10.
For both Gold price and Nifty were converted into daily return \([(p_1 - p_0)/p_0]\). The data used in this research is daily prices (weakly 5days) of the Gold and Nifty from 2005 to 2014. Total sample size is 2483.

Graph 1: Gold Price movement

The graph 1 shows gold price movement from last 10 years (2005-14).

Graph 2: Nifty price movement (Graph shows Nifty price movement from last 10 years.)

Tests Used:

Augmented Dickey-Fuller (ADF): This test will be used in order to examine the stationary of the time series of the study.

Decision rule:
If \( t^* > ADF \) critical value, ==\&gt; not reject null hypothesis, i.e., unit root exists.
If \( t^* < ADF \) critical value, ==\&gt; reject null hypothesis, i.e., unit root does not exist.

Under the unit root test, the null hypothesis is

- \( H_0: \) Gold returns/Nifty returns have unit root
- \( H_1: \) Gold returns /Nifty returns don’t have unit root

Johansen’s co-integration: This test will be applied to check whether the long run equilibrium exists between variables. Co-integration test hypothesis is

- \( H_0: \) Gold returns/Nifty returns does not have long run relationship
- \( H_1: \) Gold returns/Nifty returns have long run relationship

Lag length criteria: This test is used to find proper lag length for accurate result. The minimum the lag length better the model.

Granger causality: This test determines the whether one time series is useful in forecasting another and used to find relationship between the two variables is in bidirectional or in unidirectional. Granger causality test hypothesis is
H0: Nifty Returns doesn’t cause Gold Returns in long run  
H1: Nifty Returns cause Gold Returns in long run  
H0: Gold Returns does not causes Nifty Returns in long run  
H1: Gold Returns causes Nifty returns in long run  

DATA ANALYSIS AND INTERPRETATION  

Augmented Dickey-Fuller (ADF) Unit Root Test Results:  
As a 1st step to examine the Stationarity and unit root of the time series data, ADF is conducted with Gold Returns with null hypothesis that Gold Returns has unit root.

<table>
<thead>
<tr>
<th>Null Hypothesis: GR has a unit root</th>
<th>Exogenous: Constant   Lag Length: 0 (Automatic - based on SIC, max lag=1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey -Fuller test statistic</td>
<td>-47.92216</td>
</tr>
</tbody>
</table>

Test critical values:  
1% level -3.432791  
5% level -2.862504  
10% level -2.567328  

Augmented Dickey-Fuller Test Equation  
Dependent Variable: D(GR)  
Method: Least Squares  
Sample (adjusted): 1/04/2005 12/31/2014  
Included observations: 2482 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR(-1)</td>
<td>-0.961545</td>
<td>0.020065</td>
<td>-47.92216</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.060382</td>
<td>0.023787</td>
<td>2.538467</td>
<td>0.0112</td>
</tr>
</tbody>
</table>

R-squared 0.480795  
Adjusted R-squared 0.480586  
S.E. of regression 1.183390  
Sum squared resid 3473.022  
Log likelihood -3938.732  
F-statistic 2296.534  
Prob(F-statistic) 0.000000

From the above table the results of the ADF unit root test which implies that, the ADF test statistic value (-47.92216) is less than the test critical value at (1%) -3.436, (5%) -2.863, (10%) -2.568 significant levels, with the probability value less than 5%. Thus the null hypothesis H = 0 is rejected. It means the Gold returns doesn’t have unit root and the GR series are stationary at 1%, 5% and 10% significant level.
Table- 2. Unit Root Test of Nifty returns

Null Hypothesis: NR has a unit root  
Exogenous: Constant   Lag Length: 0 (Automatic - based on SIC, max lag=1)

<table>
<thead>
<tr>
<th></th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>-46.88888</td>
<td>0.0001</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.432791</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-2.862504</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.567328</td>
<td></td>
</tr>
</tbody>
</table>


Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NR)  
Method: Least Squares  
Date: 02/26/15   Time: 17:19  
Sample (adjusted): 1/04/2005 12/31/2014  
Included observations: 2482 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR(-1)</td>
<td>-0.939589</td>
<td>0.020039</td>
<td>46.88888</td>
<td>0.0000</td>
</tr>
<tr>
<td>C</td>
<td>0.063328</td>
<td>0.031528</td>
<td>2.008593</td>
<td>0.0447</td>
</tr>
</tbody>
</table>

R-squared 0.469923  Mean dependent var 0.000872  
Adjusted R-squared 0.469709  S.D. dependent var 2.155057  
S.E. of regression 1.569335  Akaike info criterion 3.739986  
Sum squared resid 6107.774  Schwarz criterion 3.744674  
Log likelihood -4639.323  Hannan-Quinn criter. 3.741689  
F-statistic 2198.567  Durbin-Watson stat 1.997374  
Prob(F-statistic) 0.000000

Here the results of the ADF unit root test which implies that, the ADF test statistic value (-46.88888) is less than the test critical value at (1%) -3.436, (5%) -2.863, (10%) -2.568 significant levels, with the probability value less than 5%. Thus, the null hypothesis H = 0 is rejected. It means the Nifty returns doesn’t have unit root and the NR series is stationary at 1%, 5% and 10% significant level.

Johansen Co-integration test:
After the ADF Unit Root Test, as a second step to determine whether is there cointegration and as well as is there any log run relationship between Gold Returns and Nifty Returns Johansen Cointegration is applied. The results of the Johansen Cointegration test are tabulated below:

Table 3: Johansen Cointegration test

Included observations: 2478 after adjustments  
Trend assumption: Linear deterministic trend  
Series: GR NR  
Lags interval (in first differences): 1 to 4  
Unrestricted Co-integration Rank Test (Trace)
Trace test indicates 2 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

<table>
<thead>
<tr>
<th>Hypothesized</th>
<th>Max-Eigen</th>
<th>0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of CE(s)</td>
<td>Eigenvalue</td>
<td>Statistic</td>
</tr>
<tr>
<td>None *</td>
<td>0.178763</td>
<td>488.0276</td>
</tr>
<tr>
<td>At most 1 *</td>
<td>0.145783</td>
<td>390.4583</td>
</tr>
</tbody>
</table>

Max-eigenvalue test indicates 2 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co-integrating Coefficients (normalized by \(b^*S11*b=I\)):

<table>
<thead>
<tr>
<th></th>
<th>GR</th>
<th>NR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalized</td>
<td>-0.205500</td>
<td>1.845154</td>
</tr>
<tr>
<td>co-integrating coefficients (standard error in parentheses)</td>
<td>1.379941</td>
<td>0.196764</td>
</tr>
</tbody>
</table>

Adjustment coefficients (standard error in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>D(GR)</th>
<th>D(NR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted</td>
<td>-0.012331</td>
<td>0.148573</td>
</tr>
<tr>
<td>Adjustment Coefficients (alpha):</td>
<td>(0.00526)</td>
<td>(0.00648)</td>
</tr>
</tbody>
</table>

Unrestricted Adjustment Coefficients (alpha):

<table>
<thead>
<tr>
<th></th>
<th>D(GR)</th>
<th>D(NR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Co-integrating Equation(s):</td>
<td>-0.060006</td>
<td>0.064871</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-483318</td>
<td>-0.086719</td>
</tr>
</tbody>
</table>

1 Co-integrating Equation(s):

Log likelihood: -8738.423

From the above table the Trace Statistics and the Max-Eigen statistic test the critical value is less than the trace statistics and the p-value is also less than the level of significant 0.05. Hence, the Trace Statistics and the Max-Eigen Statistic test reject the null hypothesis and accept the alternative hypothesis. Also tell us that there is a long run relationship between the variables Gold Returns and the Nifty Returns.
Lag Order Selection Criteria:

**Table 4:** Lag Order Selection Criteria

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-8550.389</td>
<td>18.83477</td>
<td>3.450432</td>
<td>6.914254</td>
<td>6.928348</td>
<td>6.919373*</td>
</tr>
<tr>
<td>3</td>
<td>-8544.308</td>
<td>5.312796</td>
<td>3.455787</td>
<td>6.915804</td>
<td>6.948691</td>
<td>6.927750</td>
</tr>
<tr>
<td>4</td>
<td>-8542.298</td>
<td>4.00587</td>
<td>3.461349</td>
<td>6.917412</td>
<td>6.959696</td>
<td>6.932771</td>
</tr>
<tr>
<td>5</td>
<td>-8533.515</td>
<td>17.48704</td>
<td>3.447998</td>
<td>6.913548</td>
<td>6.965228</td>
<td>6.932320</td>
</tr>
<tr>
<td>7</td>
<td>-8517.766</td>
<td>4.621657</td>
<td>3.426473</td>
<td>6.907285</td>
<td>6.977758</td>
<td>6.932883</td>
</tr>
</tbody>
</table>

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The above table shows the summary of VAR lag order selection criteria. The first left hand column shows the lag length that has been selected using the different selection criteria’s like LR, FPE, AIC, SC and HQ. Before selecting the lag length, one must understand the criteria which will give the accurate result by selecting the criteria. If we select the lag length which is minimum or which is maximum, then the test will not give accurate result and leads to the behavior of the variables in a wrong way. In this, the minimum lag order length selection is “0” lag order, but zero lag cannot be selected for doing an analysis. So the lag length should be from 1 lag.

Granger Causality Relationship:

Granger causality test examines the relationship of lag lead between the variables by taking F-statistics test findings at the 0.05 level of significance. This test is a statistical proposition for determining the one time series is helpful in forecasting another. The result of the Granger causality test is tabulated in below table.
Form the above table results reveal that the returns of the Nifty doesn’t cause Gold returns because the probability is greater than the (5%) level of significance, in this null hypothesis is accepted and the alternative hypothesis is rejected i.e., Nifty Returns doesn’t cause Gold Returns in long run. The Gold returns and the Nifty returns have relationship between each other since the probability (0.0439) is less than 5% of level of significance. So as the thumb rule represents, the null hypothesis is rejected and the alternative hypothesis is accepted i.e., Gold Returns causes Nifty returns in long run. Hence the results show that there is a unidirectional relationship between Gold Returns and Nifty Returns.

CONCLUSION
This study aims at exploring co-integration and casual relationship between Gold returns and nifty returns. The most important conclusion of empirical test results is that the selected time series 2005-2014 of daily returns of gold and nifty is stationary and hence provide the sign of long run co-integration relationship between them. ADF Unit root test shows that the gold returns and nifty returns are stationary. Johansen’s co-integration test shows that there is a co-integration relationship between gold returns and nifty returns in the time period 20052014. Also there is a unidirectional relationship between the variables i.e. when the returns from gold changes then there is a change in Nifty stock market returns.

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