

A Study on Gold Price through Vector Error Correction Model

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ABSTRACT

Historically gold has played a vital role in the economics of many nations. Even though it is not the primary currency of investment it is still the most attractive investment option available. India has a special affinity towards gold as a sign of cultural values and secure investment. It is one of the major gold consuming nation across the globe. The gold reserve in India has been increasing year on year and reached to 607 tonnes in the year 2019, this increase in demand is also one of the contributor to determining the international gold prices. In this backdrop, the paper develops a vector error correction model to forecast the gold prices apart from explaining the influence of various determinants influencing the gold price. The key determinants such as oil price, inflation and stock exchange index with 7 years data will be considered for the research. The outcome of the research will be useful to gold investor and policy making decision.

Keywords: GOLD PRICE, OIL PRICE, STOCK INDEX, INR/USD, VECM.

INTRODUCTION

Today across the globe, the financial institutions are integrated and variables such as gold price, crude oil price, US Dollar rate and stock indices invites a special attention of financial analyst and investor. Gold is the popular yellow metal for investment in India and its exemplary performance has proved its wisdom. Investor gets benefited in long term safety net with regard to gold. The determinants which influences gold price are INR/USD, Sensex and crude oil. The surge in gold price in India is due to heavy demand in the country, reason being it acts as security, no credit risk, liquidity even at crisis period, it can be hold for building diversified portfolio. World Economic History reveal that countries have increased their gold reserve and used gold in exchange for loan to cover balance of payment debts.

Numerous literature shows different findings on the relationship amongst these variables. According to the study of Jones & Kaul (1996) a raise in oil price influences stock market returns Bauru and Mc Dermott (2010) in his study showed that yellow metal has a cointegration relationship with stock market index. Lizard and Mollick (2010) done research considering OPEC countries and the result shows that there is a positive relation between crude oil prices and home currency of OPEC countries. Rebored (2013) in his research on "Is a Gold a Safe Heavy or a Hedger of Us Dollar?" Indicate the exchange has a negative relationship with gold price indicating there is a strong rupee is associated which is the same in case of the study of "Forecasting The Price Of The Gold": An error correction approach Kaushik Gangopadhyay , Abhishek Jangir, Sensarma (2014). Sahu etal (2014) research states that there is positive long run connection with the stock market Indices and crude oil .Samanta & Zeduh (2012) research shows the relationship between crude oil and US Dollor has a combination of positive to negative since 1973. Though different literature indicate varied opinion it fails to answer many question as which factor leads the change in gold price.

The study is an attempt to examine gold price in India considering monthly data for a period of 10 years from January -2008 to December- 2018 with 132 observation. The variables for the study considered as oil price exchange and BSE Sensex as independent variable and gold being a dependent variable. Data are secondary in nature collected from various sources such as gold price from RBI, INR /USD from RBI BSE Sensex from BSE website and oil price and from index mundi .The time series are non-stationary in nature, study found that there exist one cointegration relationship between the variables, Vector error correction model (VECM) model is used.

OBJECTIVE OF THE STUDY

- To analyse cointegration relationship among gold price, BSE- Sensex, INR/USD and oil price.
- To study causality among variable through Vector Error Correction model.

METHODOLOGY

The study starts with descriptive test and unit root test. Eview package 10 is used for econometric analysis. The stationarity test for all our time series of Gold, Exchange, and Oil price CPI and Sensex. There are several specification of unit root test such as random walk, random walk with drift, random walk with linear trend and drift. The unit root test for each variable is carried out with augmented Dickey fuller test for base level and first difference level. The research concentrates on studying the cointegration among the variables, we consider Johansen’s cointegration test. To study the causality among the variables Vector Error Correction Model are used.

UNIT ROOT TEST

Unit Root Test: A unit root is a random fluctuation in a given time series which is unpredictable in nature. Also called as “a random walk”, unit roots within a time series create uncertainties and cannot be relied upon. We use unit root testing to test for stationarity. A time series is said to be stationary if it does not have a unit root. The time series data which has a constant mean and minimum variance does not have unit root .The time series distribution shape is affected due to the presence of unit roots.

The ADF test or the Augmented Dickey fuller test is one of the popular test used for testing unit root for stationarity. The ADF test can work with more complicated models as compared to that of the Dickey-Fuller test. It is also much more powerful, and is capable of taking in a greater number of series data and can also be used with serial correlation.

Null hypothesis Ho: Variables are not stationary or got unit root.

Alternative H1: Variables are stationary.

JOHANSEN’S COINTEGRATION TEST

The original test of cointegration was provided by Engle and Granger (1987). Johansen’s in the year 1988 provided cointegration test. Co integration test determine whether a set of endogenous variables share a long run relationship.

Co-integration tests are used to analyse non-stationary time series data. Using the cointegration tests, long run relationships can be established in systems and models with unit roots present in them. Any two sets of time series data can be co-integrated if they can be converted from nonstationary to stationary data.

Johansen test allows testing of multiple sets of data. Today, this test is more preferred than Engle–Granger or Phillips–Ouliaris. The need to choose a dependent variable is removed in this test.

Null hypothesis Ho: There is no cointegration relationship between variables.

Alternative H1: There is cointegration relationship between variables

VECTOR ERROR CORRECTION MODEL (VECM)

Vector Auto regression (VAR): A tool used for establishing ganger causality, it is used for testing the existence of causal relationship between variables. VAR Framework is used to check for stationarity. It is used for variables which are stationary and not integrated, suppose the variables are not stationary, stationary is achieved by first difference.

The vector error correction model VECM is used when variables are non-stationary and cointegrated. The cointegrated variables carry a long run equilibrium relationship and they have disequilibrium in short run. The vector error correction model (VECM) is used to bring back the disequilibrium to equilibrium by speed of correction .The VECM test are used to check both long and short run causality.

EMPIRICAL ANALYSIS

Table 1: Descriptive statistics

	Gold	Exchange	Oil price	Sensex
Mean	2532.765	56.60834	4309.235	22467.36
Median	2793.000	59.36400	4027.500	19363.50
Maximum	3322.000	73.96000	6927.000	38645.00

Minimum	1181.000	39.28000	2004.000	8892.000
Standard Deviation	609.6395	9.230794	1258.905	7096.313
Skewness	0.960667	-0.154607	0.21926	0.345565
Kurtosis	2.494958	1.606995	1.964388	2.291229
Jarque-Bera	21.70626	11.19841	6.9882238	5.390102
Probability	0.000019	0.003701	0.030467	0.067539
Sum	334325.0	7472.301	568819.0	2965691
Sum square Dev	418686928	11162.19	2.08E+08	6.60E+09
Observation	132	132	132	132

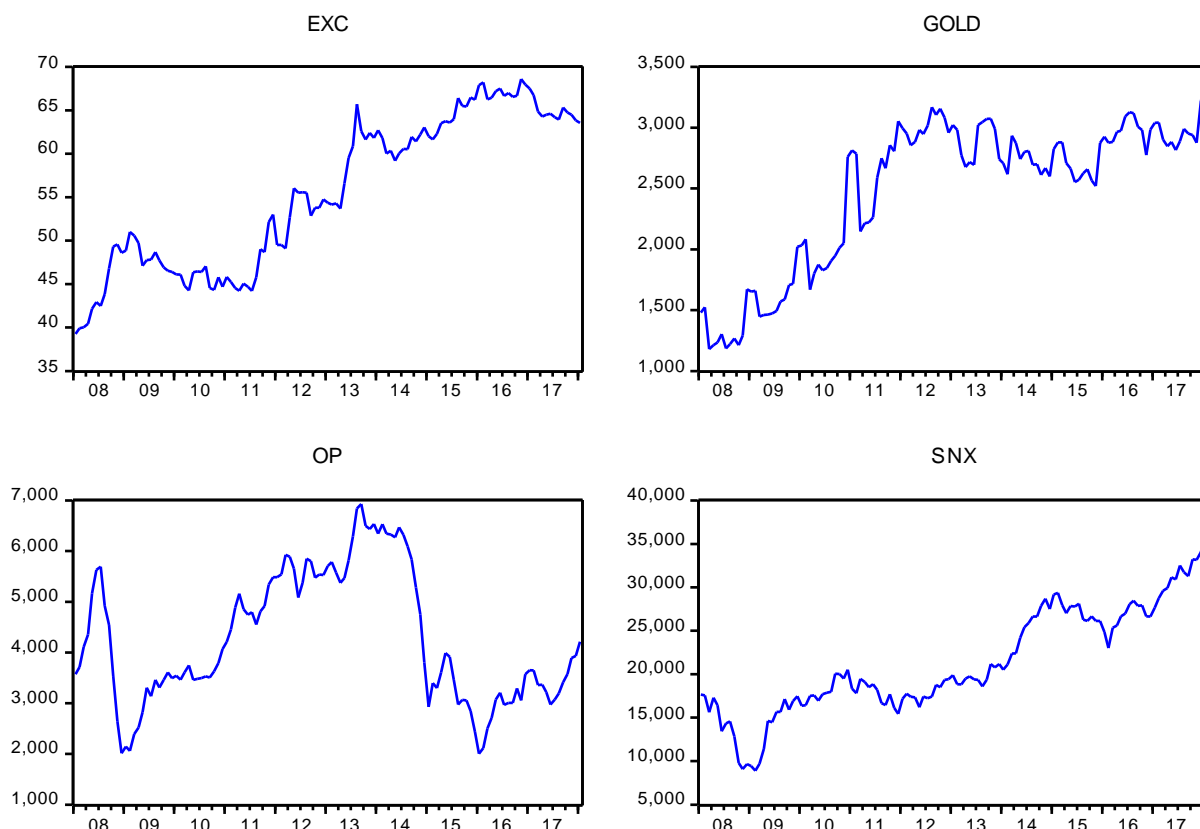


TABLE-2: UNIT ROOT TEST

Variables	Intercept	Trend and intercept	NONE	Verdict
Gold	-2.798290 (0.0615)	-2.10994 (0.5347)	0.928400 (0.9052)	Accept
(Gold)	-2.256731 (0.1878)	-2.900625 (0.1661)	-2.061619 (0.0381)	Reject
Exchange	-1.191239 (0.6769)	-2.500061 (0.3277)	1.570149 (0.9712)	Accept
(Exchange)	-6.534277 (0.0000)	-6.941352 (0.0000)	-4.57668 (0.0000)	Reject
Sensex	-0.563769 (0.8735)	-4.710228 (0.0011)	0.982396 (0.9133)	Accept
(Sensex)	-10.33595 (0.0000)	10.34258 (0.0000)	10.30218 (0.0000)	Reject
Oil Price	-2.60853 (0.0954)	-2.593418 (0.2841)	-0.156781 (0.6277)	Accept
(Oil Price)	-7.288192	-7.264565	-7.319187	Reject

	(0.0000)	(0.0000)	(0.0000)	
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Table 2: The unit root test for each of the variable is carried out using Augmented Dickey –Fuller (ADF) test at both the level (base level and first difference level) using Akaike Info criterion with maximum lag of 12 .All the log series are found to be non –stationary on level intercept, trend & intercept and none at base level and stationary at first difference level I (1).

TABLE 3: JOHANSEN COINTEGRATION TEST

Rank	Eigen value	Trace test statistics	Test p value
r=0(none)	0.189591	52.67725	0.0165
r<=1(at most 1)	0.134987	25.55941	0.1424
r<=2(at most 2)	0.035813	6.853029	0.5948
r<=3(at most 3)	0.016517	2.148431	0.1427

Table 3: It can be observed from the table3 that there is co integration relationship. The trace test suggest that the rank of 0 is rejected at 5% level of significance. However the other ranks cannot be rejected at 5% level of significance. Therefore the null hypothesis of no cointegration is rejected against the alternative hypothesis. This is the indication that variables have one integration among them at 5% level of significance (Mackinnon –Haug –Michelis (19990 p value).It can be concluded there exist a long term relationship between the variables.

TABLE 4: VECTOR ERROR CORRECTION MODEL

Variable	Cointegration vector	Adjustment vector
Gold	1.0000(0.000)	-0.043271
Exchange	-1.319130 (0.42874)	0.224202
Sensex	-0.127395 (0.21665)	0.110207
Oil Price	-0.730855 (0.146230)	-0.087699

Standard error are in parentheses, the observation considered after adjustment 130.

Log likelihood 832.9043, AIC -12.38314, Mean dependent 0.005466, Sum squared residual 0.57112,R Squared 0.024943, Adjusted R squared -0.014374

Gold=-0.021566-0.04327gold+0.224204 exchange+0.110207 sensex-0.087699 oil price +0.004271

Table 4: since the variables have a cointegration relationship VECM can be employed .The vector error correction model invokes nx1 vector stationary time series. The error correction term is an outcome of integrating vector and adjustment factor. The ECT is the integrating equation and a long run model .The short term coefficient is the adjustment coefficient. The previous period deviation from the long run equilibrium is correct in the current period as adjustment speed of 4.3%. A percentage change in exchange is associated with positive 0.224202 increase in gold on an average ceteris paribus in short run. There exist a percentage change in oil price decrease of -0.0876998 on gold on an average ceteris paribus in short run.

CONCLUSION

The paper concentrates on causal relationship between gold, Sensex, USN/INR and oil price. The result of augmented dickey fuller test concludes that the series are stationary and integrated of order one. From the study we can also see that there exist one cointegration relationship and a long run relationship between variables. The gold price shows a long term relationship with stock market, exchange and oil price. The gold are negatively correlated with oil price indicating a gold hedge.

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