Impact of Inflation in India, China and USA on the Gold Prices

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ABSTRACT

The paper studies Impact of Inflation on Gold Prices Fluctuations in India, China and USA. Applying co-integration and vector error correction models (VECM), Vector Auto Regression (VAR) and Granger Causality to data for 1996-2015 and found that there is a co-integration between the India Inflation and Gold Prices and in USA and China found that there is a Short term relationship between Inflation and Gold Prices.

Keywords: Gold Prices, Inflation, Co-integration, VAR, VECM, Granger Causality, Co-integration.

INTRODUCTION

The literature on the relationship between Gold Prices and Inflation is very limited because the concept is newly occurred but recent studies shows that the Inflation is negatively Correlated with the Gold prices in Malaysia (Mahdavi& Zhou (1997), Tufail (2013),SitiNurulhuda Ibrahim (2014) but in India the Gold prices are positively correlated with the Inflation. In India study the role of Gold Prices and commodity pricesin predicting Inflation and concluded that there is Co-integration between commodity prices and the Inflation. However, the relationship between the Inflation and Gold prices is not found to be significant concluded that Gold Prices are positively and significantly related to Inflation in Pakistan. so the study has been conducted to examine the Impact of Inflation in India, China and USA on the Gold Prices.

LITERATURE REVIEW

Ibrahim, 2014 this paper analyzed factors that affecting the Prices of Gold inMalaysia covering data for 10 years period which are from 2003 until 2012. The researcher used variables that affect the Prices of Gold which are Crude Oil Prices, CPI rates and Exchange rates. The empirical results have found there is negatively significant relationship between CPI rates and Exchange rates on Gold Prices, while a Crude Oil price is positively significant.

Bishnoi, 2014 this paper analyses the critical factors affecting the price of Goldusing ordinary least square, white-test and weighted least squares taken yearly data from 1994 to 2013. The results show that Gold Prices, US dollar to Indian Rupee Exchange rate, and Crude Oil Prices are positively correlated albeit a negative relationship clearly emerges with the Rate of CPI, long run interest rates in the US and their Real GDP.

Dubey, 2014present study is based on the Gold price trends and what factors determine the Gold price in India. The paper specially focuses on increase in Gold Prices in India in the years 2004 to 2013. According to empirical findings, highly positive correlation is found between Gold Prices and CPI rate of our country.

Jaiswal, 2015this paper deals with various aspects attached to the paper basically uses the data available through journals, reports, articles etc. and concludes that Investing in Gold is potentially a way to maintain purchasing power. The purchasing power of Gold rises and falls as the real price of Gold rises and falls.

Shahbaza,2014 in their study Investigates whether a Gold investment is a hedge against CPI in case of Pakistan. In doing so, they have used time series data on Gold Prices; economic growth and CPI are used for the period of quarterly 1997 to 2011. The study has applied the ARDL bounds test-ing approach to co-integration for the long run, and innovative accounting approach (IAA) to examine the direction of causality in variables.

Pierdzioch,2015 they have use a real-time boosting approach to study the time-varying out-of sample informational content of various predictor variables (CPI rate, exchange-rate fluctuations, stock market returns and interest rates)

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for forecasting Gold-price fluctuations. While the predictor variables have predictive power, the economic value added of forecasts does not suffice to leverage the performance of a simple trading rule above the performance of a buy-and-hold strategy.

Scope of the Study

Growing variability in Gold prices in the recent years, validate the need to examine such fluctuation from January 1996 to December 2015. The data for 20 years has been taken for consideration and the three markets are considered i.e. India, China and USA for studying the Impact of inflation on Gold prices. In reality Gold price did not solely affected by single factor. In the study, the relationship between the Inflation (Consumer Price Index as a proxy for Inflation) and Gold prices were being investigated.

RESEARCH METHODOLOGY

The Period of the Study is from January 1996 to December 2015 Sample size Contains three countries India, China and USA. The study undertook the secondary data for analysis. The Monthly values of CPI rate(CPI),World Gold Council (Gold Prices)Statistical Tools and Techniques used are

Unit Root Analysis (Augmented Dickey Fuller), (Phillip Perron)

The ADF Unit root is based on null Hypothesis Ho:-Yt is Not I(0). If the calculated ADF Statistic is less than the critical value, then the null Hypothesis is rejected; otherwise accepted. ADF and Phillip Perronis used to see the stationarity between Gold Prices and Exchange rate of Rupee.

$$\Delta Yt = \alpha 0 + \alpha 1 Yt - 1 + \sum Y j \Delta Yt - j + Et$$

Vector Auto Regression

VAR Model is used to predict and analyze interrelated time series and dynamic effects that the random perturbations have on the variables system. There is no need to specify whether some variables are endogenous or exogenous. It shows the response of Exchange Rate and Gold Prices. It focuses more on the increase or decrease in trend. It is also used to detect the causal relationships among the variables.

Johansen Co-integration Test

The trace statistic can be specified as: Trace

$$= -T \sum \log(1 - \lambda i)$$

Johansen Co-integration Test has been applied to check whether the long run Equilibrium relation exists between the Oil Prices and Gold Prices. It is based on two test statistic, i.e. Trace Test Statistic and the Maximum Eigen value test statistic.

Granger Causality Test

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. So study helps to determine whether Exchange Rate helps to determine Gold Prices. A time series Exchange Rate is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of Exchange Rate (and with lagged values of Gold Prices also included), that those Exchange Rate values provide statistically significant information about future values of Gold Prices.

$$\hat{t} = \sum_{i-1}^{m} B 1 Yt - 1 + \sum_{i-1}^{m} ai Xt - i$$

$$X_{t=} \alpha 0 + \sum_{i-1}^{m} \alpha i Xt - 1 + \sum_{i=1}^{m} \Lambda i Y t - 1$$

Table-I:Descriptive Statistics of Gold Prices and Inflation from 1996-2015

Particular	Gold Prices China	Gold prices India	Gold Prices USA	CPI USA	CPI India	CPI China
Mean	2.2856	2.2858	2.2858	1.954378	1.8729	1.9625
Standard Deviation	0.2827	0.2827	0.2825	0.0591	0.1669	0.0554
Skewness	0.2283	0.2293	0.2283	-0.1436	0.3523	0.5136
Kurtosis	1.4776	1.4802	1.4783	1.6532	1.9600	1.7371
Jarque-bera	25.2601	25.2003	25.2400	18.96387	15.780	26.5013
Probability	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000

Source: Secondary Source

The above Table I highlights the Descriptive Statistics of CPI and Gold Prices. The Data is Converted to logs because of uniformity, It gives information about Mean, Standard Deviation, Skewness and Kurtosis values of the India, China, USA for the period of January 1996 to December 2015.The dependent variable that is Gold Prices India has a Highest standard deviation i.e. 0.28 and kurtosis value of 1.480270.which points out that Gold Prices of India moves around 0.02.. CPI which is taken as proxy of CPI rate shows a Highest standard deviation for India i.e. 0.16, Kurtosis shows that India CPI is distributed normally i.e.1.96 which is closer to 3 among other variables.

Table-2: Unit Root Analysis of Gold Prices and Inflation Rate

Unit Root				
Null Hypothesis	Prob.		Prob.	
Gold price USA has a Unit Root	-13.01	0.000	-13.01	0.0000
Gold price India has a Unit Root	-13.02	0.0000	-13. 03	0.0000
Gold price China has a Unit Root	-12.99	0.0000	-12.99	0.0000
CPI of USA has a Unit Root	-9.76	0.0000	-7.42	0.0000
CPI of India has a Unit Root	-11.54	0.0000	-10.69	0.0000
CPI of China has a Unit Root	-15.16	0.0000	-11.32	0.0000

Source: Authors' Compilation

Time series data is usually non stationary it will lead to spurious regression. To carry out the co-integration Analysis the first step to check the Stationary So for that Unit Root test i.e. Augmented Dickey-Fuller test(ADF) and Phillip Perron test(PP test) is conducted and found that data is non-stationary at level so the data is converted to the first differenced. Table 2shows that the data is significant at 1% level (i.e. p value<1%) and become stationary at First differenced so this data can be used to find the Johansen (1998) and Johansen and Juselius (1990) Co-integration for long term relationship.

Inflation and Gold Prices

To find the long term relationship by Co-integration first we have to decide the Lag length criteria by running a Normal VAR so from the VAR the length which is decided as per the Schwarz information criterion (SIC) is order (1) for India CPI and Gold Prices and order order (2) for USA CPI and China CPI and Gold Prices. Co-integration tells about there is Long Term Relationship or not for Examining the relationship between the variables Co-integration model has developed by taking the Lag length criteria as per SIC. Johansen Co-integration determines that there the variables are co-integrated or not.so it shows if one variable increases then what will be the effect on other variable. (Tufail, 2013) Co-integration is used to determine the long-run relationship between two or more variables that are individually non-stationary but have a stationary linear combination.

Table-3: Johansen Co-integration between Inflation and Gold Prices

Null Hypothesis Trace rank Test	Alternative Hypothesis	Eigenvalue	Trace Statistic	Critical values (0.05%)	P-values*
		India CPI and Gold Prices			
H_0: r = 0	H_1: r = 0	0.074034	19.02701	15.49471	0.014*
H_0: r = 1	H_1: r = 1	0.003023	0.720471	3.841466	0.396
		USA CPI and Gold Prices			
H_0: r = 0	H_1: r = 0	0.012124	3.372675	15.49471	0.9475
H_0: r = 1	H_1: r = 1	0.002031	0.481747	3.841466	0.4876
		China CPI and Gold Prices			
H_0: r = 0	H_1: r = 0	0.023799	7.292834	15.49471	0.5438
H_0: r = 1	H_1: r = 1	0.006663	1.584346	3.841466	0.2081
Max-Eigen Statistic	Alternative Hypothesis	Eigenvalue	Max-Eigen Statistic	Critical values (0.05%)	P-values*
		India CPI and Gold Prices			
H0: r = 0	H: r > 0	0.074034	18.30654	14.2646	0.0109*
H_0: r ≤1	H_1: r > 1	0.003023	0.720471	3.841466	0.396
		USA CPI and Gold Prices			
H_0: r = 0	H_1: r > 0	0.012124	2.890928	14.2646	0.9537
H_0: r ≤1	H_1: r > 1	0.002031	0.481747	3.841466	0.4876
		China CPI and Gold Prices			
H_0: r = 0	H_1: r > 0	0.023799	5.708488	14.2646	0.6509
H_0: r ≤1	H_1: r > 1	0.006663	1.584346	3.841466	0.2081

* Indicates significance at 10%

Source: Authors' compilation

Table 3 shows that Johansen Co-integration proposes two tests-the trace test (trace) and maximum eigenvalue test (max)-which are used to determine the existence and number of co-integrating vectors. Test shows that critical Value is less than the Trace statistics then we can say that there is a co-integrated equation between the variables i.e. there is a Co-integration equation between India CPI and Gold prices (or p value <0.05).When we find at least one Co-integration then we use VECM Model to known the long term relationship between the variables. The table also shows the critical value is more than the trace value then we can say that there is no co-integrating variables in the equation.. Test shows that there is no Co-integration equation between USA CPI and Gold prices (i.e. p value >0.05). Shows the same thing i.e. China CPI and Gold prices are not Co-integrated because the critical value is higher than the Trace Statistics or (p value >0.05). When we find at least no Co-integration then we use VAR Model to known the Short term relationship between the variables.

Table-4: Vector Error Correction Model of India Inflation and Gold Prices

India CPI and Gold Prices		
Independent	Dep. India CPI	Dep. Gold Price India
	-0.002244	-0.000950
	(0.00052)	(0.00873)
CPI India(-1)	[-4.32392]	[-0.10876]
	0.250708	-1.773361*
	(0.06340)	(1.06669)
D(CPI India(-1))	[3.95425]	[-1.66249]
	0.003222	0.158440**
	(0.00383)	(0.06443)
D(Gold Price India(-1))	[0.84133]	[2.45897]
	0.355111	1.607291
	(0.05296)	(0.89094)
Costant	[6.70582]	[1.80405]

* Significance at 10% ** significance at 5%

Source: Authors' Compilation

Table-5: Vector Auto Regression between Inflation and Gold Prices

Particular	USA CPI and Gold Prices		China CPI and Gold Prices		
Independent	Dep. USA	Dep. Gold	Independent	Dep. China	
	CPI	Price USA		CPI	
	1.498830	-1.901673		1.232208	3.273***
	(0.05787)	(2.09954)		(0.06388)	(1.12836)
CPI USA(-1)	[25.8979]	[-0.90576]	CPI China(-1)	[19.2898]	[2.90133]
	-0.502751	2.050970		-0.246934	-3.391***
	(0.05768)	(2.09238)		(0.06336)	(1.11924)
CPI USA(-2)	[-8.71663]	[0.98021]	CPI China (-2)	[-3.897]	[-3.030]
	0.001238	1.1693***		0.003347	1.1361***
	(0.00182)	(0.06594)	Gold Prices China (-	(0.00362)	(0.06397)
Gold Price USA (-1)	[0.68099]	[17.7347]	1)	[0.92408]	[17.7601]
	-0.001013	- 0.183***		-0.001897	-0.1323**
	(0.00182)	(0.06585)	Gold Prices China (-	(0.00372)	(0.06574)
Gold Price USA(-2)	[-0.55809]	[-2.78165]	2)	[-0.50969]	[-2.01283]
	0.378814	-9.221145		1.132266	10.22110
	(0.27417)	(9.94630)		(0.70630)	(12.4761)
Constant	[1.38166]	[-0.92709]	Constant	[1.60309]	[0.81926]

* Indicates significance at 10% ** significance at 5% ***significance at 1%

Source: Authors' Compilation

Table-4 shows the Vector Error Correction Model for India CPI and Gold Prices,after getting Co-integration between the variables we go for the VECM Model. The coefficient of CPI For Lag(1) is negative and significant at 10% level i.e. if India CPI goes up then in one Month India Gold prices will goes down and CPI has the long run relationship with the Gold Prices and it will reach to equilibrium at 0.095%. Table 5shows the Vector Auto Regression (VAR) results when there is no Co-integration between the China and USA CPI and Gold prices then we go for VAR model. As results show that Gold price as a dependent variable and as the USA CPI Decreases then in 1 month Gold prices will go up so there is inverse short term relationship between the variables. For china as the CPI increases, then 1 month Gold price will also increase simultaneously so there is a proportionate relationship between the variables. So India CPI and Gold prices have a long term relationship and as the CPI increases then the Gold price will decreases and China CPI and Gold Prices have a short term relationship between the variables and also USA CPI and Gold prices have the short term relationship.

CONCLUSION

In thispaperit has beenanalyzed the impact of Inflation on Gold Prices. We use the time series data from January1996 toDecember 2015 and apply Co integration ,Vectorerror correction Model and Vactor auto Regrassion. In studywefoundthat in India the Gold Prices and Inflation are co-integrated and affect eachother and they have Negativesignificant long termrelationship. In USA the relationshipbetween the Gold Prices and Inflation insignifiacant short-term Relationship and the variables are not cointegrated.so Inflation affect Gold prices in short-run. In China Gold prices and Inflation has a significantshot-runrelationship and the variables are not co-integrated. The Inflation affect the Gold Prices are for short period.

If the Inflation Increases the Gold Prices will reduce in long term so investors will advise that if the Inflation increases then not to invest in Gold for longer period in India USA the Inflation affect the Gold Prices in Short run and it is

insignificant so Gold can help the investor to Hedge against the Inflation in USA. In China Inflation has a negative significant short term relationship so investor is advice to invest in Gold for long term to hedge against the inflation.

REFERENCES

1. Allese, k. (2008). Understanding the development and influences of the price of gold. International university audentes.
2. Bhunia A. (2014). Investigating the impact of gold price and exchange rates on sensex: an evidence of India. European journal of accounting,finance and business , 2 (1).
3. Bhunia, A. (2013). Co-integration and causal relationship among crude price, domestic gold price and financial variables an evidence of bse and nse. Journal of contemporary issues in business research , 1-10.
4. Bishnoi R., (2014). An empirical analysis of factors affecting gold prices. IJHPD 3 (2).
5. China, N. B. (2015).Retrived from www.nationalberauof statisticsof china.com
6. Ibrahim S.N. (2014). The determinants of gold prices in Malaysia. Journal of advanced management science, 38-41.
7. IMF. (2015). World economy and financial survey. IMF .
8. K. S. Sujit (2011). Study on dynamic relationship among gold price, oil price, exchange rate and stock market returns. International journal of applied business and economic research, 145-165.
9. Omag, A. (2012). An observation of the relationship between gold prices and selected financial variables in turkey. Muhasebevefinansmandergisi , 195-204.
10. OPEC. (2016). OPEC monthly oil market report. Organization of the petroleum exporting countries.
11. Prakash,P. (2014). An empirical analysis on the relationship between gold and silver with special reference to the national level commodity exchanges, India. International journal on recent and innovation trends in computing and communication , 2 (8), 2224- 2233.
12. Sheetal Dubey, a. H. (2014). An analysis of determinants that influence the gold price movements in India. International journal of research in commerce, economics &management , 4 (3).
13. Sindhu. (2014). A study on impact of select factors on the price of gold. Journal of business and management , 84-93.
14. Sood V. (2013). An econometric analysis of gold price: a paradigm change in Indian capital markets in dynamic business environment. Altiusshodh journal of management & commerce (2348 - 8891)
15. Tufail, B. (2013). An analysis of the relationship between inflation and gold prices: evidence from Pakistan. The Lahore journal of economics, 1-35.
16. World Gold Council reports (2015)