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Gold as a Hedge Against Purchasing Power Risk

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Abstract

India and China are the world's top two consumers of gold while USA, Turkey and Germany are amongst next top three gold consumers. Gold is the most popular investment avenue because of its ability to provide liquidity. The average monthly price however has grown by 1588% over the whole period 1979-June 2017. In this paper, we intend to investigate gold as an investment to hedge against inflation risk or purchasing power risk. The sample period to study the relationship between gold and inflation is 2011-2017 (March). To analyse long run equilibrium between gold and inflation (CPI-consumer price index), Johansen's cointegration approach has been used. The short and long run causality between gold and inflation has been studied using VECM and Wald test. The results of cointegration indicate that gold and CPI series are cointegrated and bear long run equilibrium. VECM and Wald test results indicate that there is only long run causality between CPI and gold prices. However, in short run these variables do not show any causality. Thus, we conclude that gold investment can be used as guard against purchasing power risk.

Keywords: Gold, Purchasing Power Risk, Cointegration, Inflation, Investment

Introduction

Inflation is a necessary ailment for investors and governments all over the globe. According to Fisher's effect, inflation rate is inversely related to real rate of interest on an investment. Higher the inflation rate, the lower will be the real rate of interest. In other words, higher inflation rate in an economy decreases the chances of getting high real return or interest rate on investment. The risk of getting lower real return than expected is called purchasing power risk or Inflation risk. Purchasing power risk corrodes the buying or purchasing power of money and the value of the real return on an investment. Thus, investors, portfolio managers and governments intend to manage and hedge against purchasing power risk. World Gold Council Report (2017) indicates that for a 1% increase in inflation, gold demand increases by 2.6%. This reflects that gold may be used as hedging tool against purchasing power risk.

Gold and Indian Culture have been sharing an age old association. It is used for various cultural reasons and as a store of value. Gold is the most popular investment avenue because of its ability to provide liquidity. In present digital era, we have another avenue like paper gold for making gold investment viz. exchange traded funds (ETFs), sovereign gold bonds, gold

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mutual funds and e-gold. Financial advisors across the globe are today relaying a lot on gold as an investment product. The major reason behind this is that the value of gold has been increasing and has reached an all-time high in the recent past.

India and China are the world's top two consumers of gold while USA, Turkey and Germany are amongst next top three gold consumers (World Gold Council Report 2015). India is second largest gold jewellery market in the world (World Gold Council Report 2017). Where about 20% of the total population is covered under health insurance, gold holdings play the role of insurance for the poor in India. Indian people buy gold more for gifts, personal use, status enhancement, or on the festivals like Dhanteras or Akshaya Tritiya, than during marriages (ICE 360º survey, 2016).

Gold has become universal phenomenon across consumers of all income levels. It is not only rich but also poor's choice for investment. That's the prime reason gold attracts only 3% GST (ICE 360º survey, 2016). India's middle class comprises of one of the world's largest population of an average 225 million people. This number is expected to reach 500 million's mark by the year 2025 as per NCAER estimates. World Gold Council Report (2017) indicates that income level is the prime deciding factor in gold consumption. It reports that 1% jump in income results in 1% increase in the gold demand. Also, for a 1% increase in inflation, gold demand increases by 2.6%. This shows that gold may be used as hedging tool against inflation. The purpose of this paper is to analytically investigate gold as an investment to hedge against inflation.

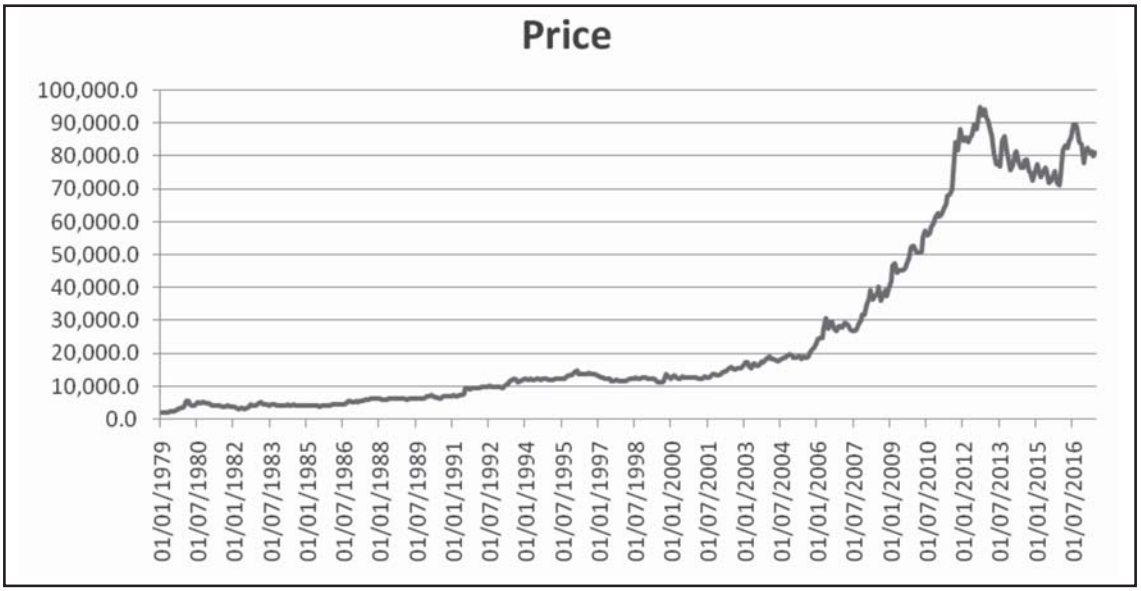

Figure 1: Gold Price Movement

Literature Review

There are a few studies on the relationship between gold and inflation. Some of the important studies have been mentioned here. Table 1 shows objectives, research methodology and major findings of these studies.

Table 1: Literature Review Summary

Year	Author 's	Objectives	Data & Research Methodology	Major Findings
2004	Ghosh et al.	Gold as an inflation hedge	Cointegration regression technique Sample period: 1976–1999	They results confirm theoretical model hypothesis that gold serves as an effective hedge against inflation.
2006	Worthington & Pahlavani	To analyse Cointegration relation with allowance for endogenous structural breaks	Cointegration analysis wi th endogenous structural breaks, Zivot and Andrews test.	They find a structural break in gold and inflation series in 1970s. Gold and inflation are strongly cointegrated.
2007	Nadeshda &Thomas	Gold in the investment portfolio	Risk and Return analysis using graphical analysis, correlation analysis Study period: 2000-2006.	They find a great increase in gold prices since 2000. They suggest that Deutsche Börse's Xetra-Gold minimizes the transaction costs. Moreover, it better than gold pool accounts as it is free of credit risk and better than gold futures as it does not have negative roll returns.
2011	Ivanov	The influence of ETFs on the price discovery of gold, silver and oil	Intra-daily data ETF and futures prices of Gold. ETF used in this study is the SPDR Gold Trust and iShares Silver Trust . Unit Root Test, Zero Mean Model JohansenCointe gration test Sample period March 01, 2009– August 31, 2009	They report that indeed there is a shift in the price discovery processes for gold and silver in that the ETF market dominates the information shares of both spot and futures markets while the oil market has price discovery occurring stillpredominantly in the futures market.

2012	Martin, Mulyadi and Anwar	Gold versus stock investment: Aneconometric analysis	probit econometric model sample period: 1997 to 2011.	Gold investment is better than stocks.
2012	Singhvi	Gold risk return analysis d uring recession	Descriptive Secondary data from BSE & NSE (1990 to 2009) Market Capitalization-Weighted	They find that gold has high risk but compensates that by high returns
2012	Mukul, Kumar & Ray	To compare Gold ETF Performance of Monthly Returns	Sample period: January 2010 to August 2011.	They infer that gold ETF has given better return than a diversified equity fund and investors should have a certain portion of their investment in gold.
2014	Jones & Sackley	To study the effect of economic policy uncertainty on gold prices.	Stepwise regression of multiple lags for each variable.	Results suggest that in addition to gold being a hedge against inflation, higher uncertainty in economic policy lead to Increase in gold prices.
2015	Hemevathy & Gurusamy	To analyze impact of demographic variables on the preference for different forms of gold for Indian working women	Primary data collected through a structured questionnaire Non-Parametric Pearson's chi square One way ANOVA.	They identify some important factor s like age, marital status, education, income, role in the Family. They conclude that women having higher disposable income generate more investment demand than consumption demand.
2015	Marwaha & Sangeeta	To study variables influencing preferences of individual investors for Gold (Safer Investment) Vis-A-Vis Stocks (Risky Investment)	Primary data collected through an interview, Weighted Average Scores method, Paired Sample T-test	Inflation Resistance is found as the most important variable and Stability of Income is found as the least influencing variable for investors towards investing in gold.

2011	Ibrahim& Baharom	To explore t he role of gold in financial investment in Malaysia.	Descriptive analysis, Baur and Lucey regression model and EGARCH model Sample period: August 2001 to March 2010	They find that gold investment results in diversification. Also, they report that there is a change in investment function of gold due to existing uncertainty in global financial market that has diminished gold' s role as a diversification asset.
2016	ICE 360º Survey	To study gold as an investment in India	Survey of 61000 households in India	The survey reports that 9 out of 10 rich, 8 out of 10 poor and 87% of the households hold gold.

Research Gap and Research Problem

From literature review, it has been observed that gold has been used as a hedging tool in many facets of investment. It is considered as a safe investment avenue because of its several benefits. It helps to hedge against inflation, political and currency risk (Aggarwal et al. 1992, Capie et al. 2005, Levin and Wright, 2006, Worthington and Pahlavani, 2006), hedge against stock returns (Baur and Lucey, 2010), hedge against economic policy uncertainty (Jones and Sackley, 2014), to diversify portfolio (Sherman, 1986 and Chua et al. 1990) and its forecast ability and other investment benefits (Smith, 2002 and Lucey et al. 2004). Gold's durability and worldwide acceptance further places it above other investment avenues.

The most imperative and common purpose of making investment in gold is to guard against inflation or purchasing power risk and to provide liquidity (Ghosh et al. 2004 and Worthington and Pahlavani, 2006). Despite of its well known benefits, there is a dearth of research on gold's effectiveness as a hedging tool against purchasing power risk in India - world's second largest gold consumer economy. To contain devastating impact of gold imports on trade balance, Government of India introduced the sovereign gold bond, gold monetisation scheme and gold coin in year 2015.This motivates us to study the relationship between gold and inflation, and further, investigate gold as a hedge against purchasing power risk.

Objectives of the study

This study intends to investigate gold as an investment to hedge against purchasing power risk by

i. analysing long run equilibrium between gold and inflation

ii. examining long run and short run causality between gold and inflation

Data and Research Methodology

Data

The sample period of this study is from 1979-2017 (June) for descriptive statistics analysis of gold returns. However, the sample period to study the relationship between gold and inflation is 2011-2017 (March). Due to non-availability of consumer price index (CPI) for April – June 2017,

we have restricted study up to March 2017. Monthly data on gold and CPI inflation is collected from the websites of World Gold Council and Reserve Bank of India (RBI) respectively.

Research Methodology

Unit Root Test

Augmented Dickey Fuller (ADF) test has been used to test unit roots. The select price series are expected to be non-stationary while their return series are expected to be stationary. The test has been conducted in all three form; constant, trend and intercept, and none. We test the null hypothesis of non-stationary of series. If the null hypothesis is rejected then the series is said to stationary otherwise it is non-stationary.

Johansen's Cointegration test

Short–run and long-run relationship study has been used to investigate gold investment as inflation hedge by a number of researchers (Moore, 1990; Laurent 1994; Chappell and Dowd, 1997; Mahdavi and Zhou, 1997).The most common approach to study long-run relationship found in literature is cointegration (Ghosh et al. 2004, Worthington and Pahlavani, 2006) and Johansen's cointegration test has been used widely in literature to study cointegration or long run equilibrium relationship between two non-stationary variables (Ivanov, 2011).Thus in this study we use Johansen's cointegration approach to test the long-run relationship between gold and inflation.

Two variables are said to be cointegrated if there combination is a stationary variable. For *Johansen's cointegration* test, a VAR model with k lags containing the given two variables is represented as follows:

$$\Delta Y_t = \mu + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \, \Delta Y_{t-1} + \varepsilon_t \qquad \ldots . \quad (3)$$

WhereYtis the vector to be tested for cointegration, λ_{trace} is trace statistics and λ_{max} is max eigen value statistics

Vector Error Correction Model (VECM) and Wald Test

Wetest the relationship between the two markets for causality and error correction using Vector Error Correction Model (VECM) shown in equation (4) and (5).

$$\Delta P_{c,t} = a_c + \alpha_c P_{c,t-1} + \beta_g P_{g,t-1} + \sum_{i=1}^{k} a_{c,i} \Delta P_{c,t-i} + \sum_{j=1}^{k} a_{g,j} \Delta P_{g,t-j} + \varepsilon_{c,t} \quad (4)$$

$$\Delta P_{g,t} = a_g + \alpha_g P_{g,t-1} + \beta_c P_{c,t-1} + \sum_{i=1}^{k} a_{g,i} \Delta P_{g,t-i} + \sum_{j=1}^{k} a_{c,j} \Delta P_{c,t-j} + \varepsilon_{g,t} \quad (5)$$

Where subscripts c and *g* refer to CPI and Gold futures markets respectively.The error correction term,$\alpha_m P_{m,t-1} + \beta_n P_{n,t-1}$ or $\alpha_n P_{n,t-1} + \beta_m P_{m,t-1}$ represents the speed of adjustment

towards long run equilibrium. Here, both long term and short term causality has been studied using VECM. If these αs and αs are significant then there is a long term causality between the two markets. However, the short run coefficients α_{ci}, α_{gi}, α_{cj} and α_{gj} measure short term causality. Further, short term causality has been analyzed by using Wald test.

Empirical Findings

Statistics Summary

In Table 2, we have shown descriptive statistics of monthly gold prices and returns from 1979-June 2017. The whole period has been divided into four sub-periods 1979-1988, 1989-98, 1999-2009 and 2009-June 2017. The average monthly return has fallen from 1.02% in 1979-1988 period to 0.65% increased in 2009-June 2017. Similarly the volatility has also decreased from 6.47% to 3.71 % over the same period. The returns throughout have been positively skewed and leptokurtic in nature. This shows that gold returns are not normally distributed. Jarquebera probability further shows that the gold returns distribution is non-normal. The average monthly price however has grown by 1588% over the whole period 1979-June 2017.

Table 2: Statistics Summary over 1979-2017*

	Prices (Rs/Troy ounce)				Returns			
Period → / Descriptives	1979-88	1989-98	1999-2008	2009-2017*	1979-88	1989-98	1999-2008	2009-2017*
Mean	4348.070	10422.43	20130.57	73394.29	1.024822	0.597741	0.992293	0.653390
Std. Dev.	1045.968	2543.533	8204.742	14058.62	6.470933	3.246531	4.156579	3.711205
Skewness	- 0.048366	- 0.528199	0.954828	- 0.731663	1.530180	1.621844	0.173844	0.601763
Kurtosis	2.864165	1.910771	2.773447	2.403908	10.15820	11.96570	4.210286	3.987050
J B Prob.	0.932841	0.003164	0.000097	0.004965	0.000000	0.000000	0.019621	0.004965

*till June 2017

Unit Root Test

Augmented Dickey Fuller (ADF) test results report that the logarithmic series of gold price and CPI are non-stationary at levels (see Table 3). However, their return series are found to be stationary. The null hypothesis of non- stationary is rejected for return series. So we can proceed to apply Johansen's cointegration test on log series of gold prices and CPI.

Table 3: ADF Test Results for Crude Oil Spot and Future Price Series on Levels

Price	Model Form	Critical Values @ 5%	Test Statistics	*p*-value
Ln (CPI)	Trend and Intercept	-3.470851	-1.806193	0.6920
	None	-1.945199	3.398708	0.9998
ln (Gold)	Trend and Intercept	-3.470032	-2.826142	0.1928
	None	-1.945139	0.783452	0.8803
Return on ln (CPI)	Trend and Intercept	-3.476275	-6.527908	0.0000*
	None	-1.945199	-3.666091	0.0004*
Return on ln (Gold)	Trend and Intercept	-3.470851	-7.370349	0.0000*
	None	-1.945199	-7.266281	0.0000*

*represents significant results

Table 4: Johansen Cointegration Test Results

Hypothesised No of CE(s)	Eigen Value	λ_{trace} Statistics	Prob. For Trace Test	λ_{max} Statistics	Prob for Max Eigen value Test
r=0 (None)	0.15454	15.55033 (15.4947)	0.0491	12.42295 (14.26460)	0.0958
r≤1 (at most 1)	0.04138	3.127383 (3.8414)	0.0770	3.127383 (3.84147)	0.0770

Note: The critical values have been shown in parentheses.

Johansen Cointegration Test

In Table 4, the trace test values indicate that the null hypothesis of r = 0 is rejected while null hypothesis r≤1 is accepted at 5% significance level. It means the results suggest that there is one cointegrating relationship between the two variables. However, the λ_{max} probability value suggests contradictory results. In this case, the null hypothesis of r = 0 cannot be rejected. In case of conflict between the results of trace and max eigen statistics, we should prefer trace statistics (Johansen and Juselius, 1990). Thus we can conclude that gold and CPI series are cointegrated and bear long run equilibrium. Similar results were reported by Worthington and Pahlavani (2006). It means gold investment can be used as guard against inflation risk.

Vector Error Correction Model (VECM) and Wald Test

In Table 5, we have shown parameter estimates of VECM and Wald Test results to test for long run and short run causality. VECM model given in equation (1) has been presented in a different form as equation (2). In equation (1), C(1) represents the speed of adjustment towards long run equilibrium. It should be negative in sign and significant. C(1) is found to be -0.066938 with p = 0.0015. So we can say that there is long run causality from CPI to gold. In Table 5, it has been shown separately for a, á and â. It is evident from the results that the error correction term in equation (1) is significant. All these coefficients namely a, á and â are significant. This indicates that CPI has influence on gold in the long run. In other words, there is long run causality running from CPI to gold. Further, short term causality has been analyzed by using Wald test. The null hypothesis $b_1 = b_2 = 0$of no short term causality from CPI to gold prices cannot be rejected. It shows that there is no short term causality running from CPI to gold prices. Thus we conclude that there is only long run causality between CPI and gold prices. However, in short run these variables don't show any causality. It further supports the findings of Johansen's Cointegration test that gold investment can be used as hedge against purchasing power risk. The similar results were reported by Ghosh et al. (2004).

$$\Delta LGP_t = a + \alpha LGP_{t-1} + \beta LCP_{t-1} + \sum_{i=1}^{k} a_i \Delta LGP_{t-i} + \sum_{j=1}^{k} b_j \Delta LCP_{t-j} + \varepsilon_t \quad (1)$$

D(LGP) = C(1)*(LCP(-1) + 2.009650822*LGP(-1) - 27.421843167) + C(2)*D(LCP(-1)) + C(3)*D(LCP(-2)) + C(4)*D(LGP(-1)) + C(5)*D(LGP(-2)) + C(6) (2)

Table 5: Parameter estimates of VECM of Gold Prices and Wald Test

Parameter	Coefficient	Prob.
A	1.83556*	0.0015
A	-0.13451*	0.0015
B	-0.06693*	0.0015
a_1	0.159396	0.1639
a_2	-0.107063	0.3468
b_1	0.087095	0.9145
b_2	0.215993	0.7784
Wald Test for Short Term Causality		
Null Hypothesis	Chi-square	Prob.
$b_1 = b_2 = 0$	0.172936	0.9172

**denote significance of parameters at 5% level of significance.*

Implications of the Study

The findings of this research have got direct implications for retail investors, portfolio managers, treasury and fund managers, government, commercial traders etc. In emerging economy like India, the retail investors may invest in gold through different options like bullions, gold ETFs, gold bonds etc that would help to hedge against purchasing power risk. Similarly, portfolio managers may include gold in their portfolio to guard against inflation and immune real returns of their portfolio.

Concluding Remarks

Purchasing power risk corrodes the buying or purchasing power of money and the value of the real return on an investment. Investors, portfolio managers and governments intend to manage and hedge against purchasing power risk. In this paper, we intend to investigate gold as an investment to hedge against inflation risk or purchasing power risk. Gold and Indian Culture have been sharing an age old association. It is used for various cultural reasons and as a store of value. Gold is the most popular investment avenue because of its ability to provide liquidity.

The sample period to study the relationship between gold and inflation is 2011-2017 (March). To analyse long run equilibrium between gold and inflation (CPI-consumer price index), Johansen's cointegration approach has been used. The short and long run causality between gold and inflation has been studied using VECM and Wald test. The results of cointegration indicate that gold and CPI series are cointegrated and bear long run equilibrium. VECM and Wald test results indicate that there is only long run causality between CPI and gold prices. However, in short run these variables don't show any causality. Thus, we conclude that gold investment can be used as guard against purchasing power risk. The findings of this research have got direct implications for retail investors, portfolio managers, treasury and fund managers, government, commercial traders etc.

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