

## How Gold Prices Correspond to Stock Index: A Comparative Analysis of Karachi Stock Exchange and Bombay Stock Exchange

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**Abstract:** The purpose of this study is to examine the long-run relationship between gold prices and Karachi Stock Exchange (KSE) and Bombay Stock Exchange (BSE). The statistical techniques used for this study includes Unit Root Augmented Dickey Fuller test, Phillips-Perron, Johnson Co-integration and Granger's Causality tests to measure the long-run relationship between gold prices, KSE and BSE using monthly data from 1st July 2005 to 30th June 2011. Findings of the co-integration test indicated that no long-run relationship exist between monthly average gold prices and KSE stock index; whereas, a significant long-run relationship is proved between BSE stock index and average gold prices. Results of Granger causality test demonstrated that no causal relationship exists among average gold prices, KSE and BSE stock indices.

**Key words:** Gold prices • Karachi Stock Exchange (KSE) • Bombay Stock Exchange (BSE) • Co-Integration

### INTRODUCTION

Gold is considered as one of the most precious elements from ancient times. In initial age, it was used as currency alternative but now-a-days it is used as business investment, jewelry manufacturing, risk diversifier, security collateral and inflation predictor [1]. People invest in gold to hedge against inflation, to offset stock market declines and counteract against declining dollar; whereas, financial institutions are generally used it for security coverage for their specialized funded and non-funded products, hence is often considered a secure investment and solid security with easily marketability.

A report from World Gold Council (Liquidity of the global gold market) illustrated that gold is the scarcest yellow precious metal and in practical it is irreplaceable element due to its unique properties. Half of the gold resources are used for jewelry; whereas, its second use is in investment. Third favorable usage of gold is in financial sector holdings. Participants of financial markets use gold as store of wealth, investment and as a source of prime collateral against financial deals.

For the last 10 years, a rising trend is seen to buy and stock gold reserves by central banks globally. Central banks of Russia, China, Philippines and India has bought ample amount of gold in last couple of decades. Advanced, developing and Asian countries keep gold reserves 1/3, 5% and less than 2.5% respectively. Using statistics of the reserves of Asian countries in the form of gold, the demand of gold is expected to increase by 900 tones worldwide.

Gulati and Modi [2] explained that initially prices of gold were maintained by national monetary authority but after March 1968, with the end of official attempts of controlling prices, Two Tier Gold Prices System was introduced in which transactions between national monetary authorities were underwritten at \$ 35 per ounce; whereas, private markets were declared free to set gold parity. In August 1971, this system also abandoned and no one made attempts to keep gold prices in limits.

The purpose of our research is to investigate the relationship between gold prices and Karachi and Bombay Stock Exchanges in perspective of supply and demand of gold and its impact on value of stocks' index. A report from world gold council (The 10 years gold bull market)

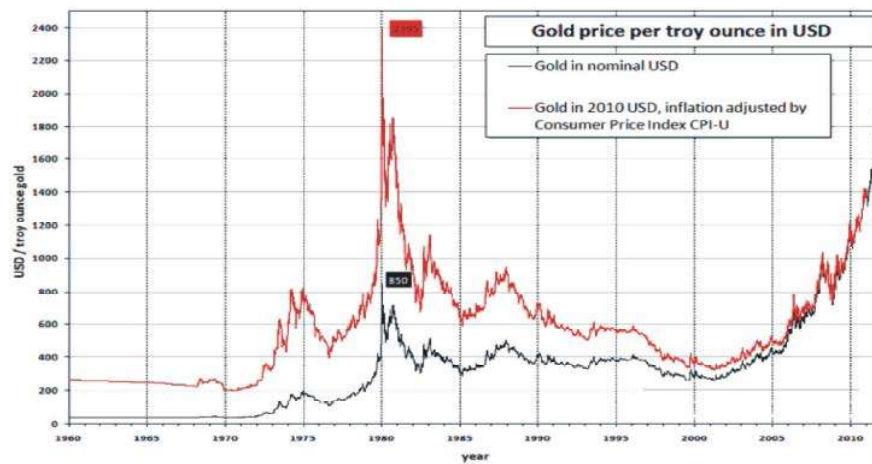


Fig. 1: Gold Prices per troy ounce in USD (1960-2010)

states that demand of gold is linked to financial crisis which is depicted by sharp increase in investment of gold during 2008. But the gold prices do not reflect demand of gold as it is increasing since 2001 and a high momentum is witnessed in the year of 2011-12 in both gold and silver rates.

**Introduction to KSE and BSE:** Karachi Stock Exchange was founded on September 18, 1947 with initial capital of Rs. 37 million. It has four indices i.e. KSE 100, KSE 30, KSE all share index and KMI 30. There are 651 companies listed in KSE which used Electronic Trading System (ETS) for stocks trading. According to Gulf news (2008), KSE was declared as the "Best Performing Stock Exchange of the World for 2002". KSE started its computerized operation in 1997 by using KATS (Karachi Automated Trading System). Currently 1000 KATS workstations are working in KSE which are equipped with latest technology and having internet trading facilities.

Vaidyanathan [3] explains that *Bombay Stock Exchange (BSE)* is one of the oldest stock exchanges and has ISO 9001-2000 certifications. India's foremost stock market benchmark index is BSE index and SENSEX. In 1875, BSE was established as "The Native Share and Stock Brokers' Association" and for the last 137 years, BSE has successfully facilitated the growth of Indian corporate sector by providing a platform where they efficiently raise their business capital. According to Ramkumar *et al.*; Ray [4, 5] BSE is one of the top 10 global exchanges with respect to its listed companies and market capitalization (as of Dec 31, 2009). Globally, India has

highest saving rates, approximately around 30% of total income out of which 10% is invested in gold. According to a survey report (heart of gold revival, 2010), from the first six months of 2010, in India, the net retail investment in gold has risen by 264% to 93 tons (year on year basis). RBI is holding 358 tons of gold in 1998, but over the years it increased by 56% as of 2009 and its consumption of gold reached to 558 tons.

**Literature Review:** Using statistics from January 2008- January 2009, [6] applied regression equation model to investigate the relationship between macro economic factors like change in exchange rate, foreign exchange reserves, inflation rate, gold prices and stocks value of BSE. Empirical results of the study revealed a strong relationship of exchange rate and gold prices with BSE while the effects of inflation rate and foreign exchange on BSE were proved limited. Herbst [7] 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. Historical data from 1930 to 1976 shows that gold has negative beta; and due to its significant characteristics, when we include it in investment portfolio, it helps to eliminate systematic risk. It would be short sightedness for investors to exclude gold from investing options without checking their relation to stock market returns. Findings of Dempster and Artigas [8] proved that investment

strategies are highly correlated between gold and stock market along with profitability in the periods of inflation and deflation.

Gulati and Modi [2] investigated that during 1972 to 1982; the gold prices were determined by the demand of gold for investment purposes or by the speculative investment in gold which in turn is characterized by economic activities due to inflationary expectations and exchange rate fluctuations. Their study also proved that gold prices are highly correlated with the investment demand for gold while increase in interest rate reduces the demand for gold as it is non interest asset.

Levin and Wright [9] examined the relationship between Gold prices and the US dollar prices. Applying co-integration technique on data from January 1976 to August 2005, long-term determinants of gold prices were established and a long-term relationship between prices of gold and the level of U.S. dollar prices was found. Study results 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. Findings of their study also explored positive relationship between gold price movement and US inflation, US inflation volatility and credit risk.

Baur and Mc Dermott [10] conducted a descriptive and econometric analysis of data from 1979 to 2009. Results of the study indicated that gold is mostly used as hedge and considered as safe haven for major European and US stock markets but said result are not witnessed in Australia, Canada, Japan and emerging markets such as BRIS countries. Gold investors used it to protect the wealth in 'negative market conditions' like financial depression which currently being faced since July 2007 to date. This phenomenon created higher demand of gold and an overall increase of 75 % is observed in the gold prices globally. Moving forward on this notion, Baur and Lucey [11] studied relationship of gold prices with negative market conditions and found curvilinear relationship. They suggested that negative market conditions put significant impact on gold investors. Mc Cown and Zimmerman [12] found relationship between quality of gold and inflation hedging; and characterized gold as Zero beta asset i.e. without market risk.

Moore[13] examined relationship between gold prices and the value of stock markets. The results on empirical basis for the period of 1970 to 1988 explored a negative relationship between gold prices and the value of stock markets which demonstrated that an increase in gold prices tends to decline in the value of stock markets. These findings were also confirmed by [14] who investigated the effects of seven macroeconomic variables (consumer price index, money market interest rate, gold price, industrial production index, oil price, foreign exchange rate and money supply) on the Turkish Capital Markets. Findings of his study stated that Turkish investors used gold is an alternative investment tools; whereas, in event of rising in gold prices, Turkish investors are inclined to less investment in stocks, resultantly stock prices diminished; hence, study explored negative relationship between gold prices and stock returns.

Hassan *et al.* [15] investigated relationship between KSE and equity markets of developed and emerging countries. For this purpose, they obtained data of weekly closing values of stock market indices of nine popular countries for the period of 2000- 2006. These countries included the USA, the UK, France, Germany, Japan, Canada, Italy, Australia and Pakistan. Using Descriptive statistics, Correlation matrix, Co integration tests and Granger causality technique, authors intended to apprehend the dynamic inter-linkages between Karachi stocks exchange and the equity markets of these countries for the period 2000 to 2006. Results of their analysis provided valuable evidences and illustrated that Stock markets of the USA, the UK, Japan and Italy are showing normal negative returns during study period. At the same risk level, significant negative returns are witnessed in German stocks markets; whereas, Karachi stock exchange depicted maximum stocks returns. Study findings of [22-27], also supported significant long-term relationship between macroeconomic factors and stock market returns.

Issam and Murinde<sup>16</sup> also observed the relationship between the exchange rate and equity prices in India, Pakistan, Korea and Philippines during 1985-1994 by employing co-integration analysis. Muhammad *et al.* [17] explored the relationship between exchange rates and equity prices in Pakistan, India, Sri Lanka and Bangladesh for the period 1994-2000. Findings of above studies proved that causal relationship among monetary variables and Equity Returns do not exist.

**Data Description and Methodology:** To investigate the existence of long-run equilibrium relationship among time-series variables, different statistical tests are used. To analyze the lead lag relationship in the sample, Granger causality test is used which is proposed by C.J granger in 1969; whereas, hypotheses will be accepted based on F-test results at significance level of 0.05 which provide the evidence of explained relationship between predictors and endogenous variables. This study is comprised with the period from 2005:1 to 2011:6. To analyze the impact of gold prices on KSE and BSE stocks index, monthly data is used which is gathered from reliable and official sources of KSE and BSE statistics.

To ensure the accuracy of KSE statistics, daily-basis data is derived which transformed into average monthly data; whereas, for execution of statistical analysis, data is further transformed into average market returns. To obtain accurate findings to test research hypotheses, various statistical tests are used including 1: Descriptive Statistics, 2: Unit Root Analysis (Augmented Dickey Fuller), (Phillip Perron), 3: Vector Auto Regression 4: Johansen Co-integration Test and 5: 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 KSE and BSE index. Co-integration approach entails the actual series.

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-term relationship among the observation factors.

A lag length is chosen from Vector Auto Regression (VAR) to run Johansen Co-Integration test. On the basis of Schwarz information criterion; the minimum negative value of Schwarz is used. In 1969, Granger-causality test is offered by C. J. Granger which examines the lag lead relationship at 0.05 level of significance with taking F-test findings. These findings provide the evidence of leading relationship among the under observation variables.

**Empirical Results:** Table 1 explains descriptive statistics which used to calculate the Mean, Median, Standard deviation, variance, Skewness, maximum and minimum of the study variables. Findings of descriptive analysis indicated that mean values of gold prices, KSE and BSE are depicted 0.0165, 0.0019 and 0.0132 respectively.

Table 2 explained the results that time series are not at stationary 'at level' but all are at stationary position at '1st difference'. The time series of all three variables are not stationary form 'at level' but all are at stationary status at '1st difference'. Augmented Dickey Fuller test exposed that the error which has constant variances are statistically independent. This assessment permitted the error variance to be less dependent and heterogeneously distributed. Phillips Perrons test is an alternative test of Unit Root Analysis which is also used to measure the stationary position.

Through Schwarz criterion, the length of lag in Vector Auto Regression (VAR) is determined which used to minimize the negative value of Schwarz. The results for lag lengths are exhibited in Table 3. This gives the lag length of 7 for our analysis.

To analyze the co-integration vectors among Gold prices, KSE and BSE; Johansen Co-integration method (Trace Statistics and Max Eigen) is used. This expounds the long-run relationship among dependent variables i.e. KSE, BSE and independent variable i.e. Gold prices. Findings of Co-integration Trace Statistics are given in Table 4 which shows that gold prices have long-term relationship with BSE but such relationship does not exist with KSE.

Trace test indicated that no Co-integration is found at the 0.05 level. Max-Eigenvalue test is practiced to confirm the results that are generated by Co-integration Analysis. The results are shown in Table 4.1 as given below. Statistics of Max-Eigenvalue indicated 1 co-integrating eqn(s) at the 0.05 level. \* which denoted rejection of the hypothesis at the 0.05 level.

Results of Granger causality test are shown in Table 5 which displays that Average Gold prices do not lead with KSE, hence, null hypothesis do not accepts at 0.05 level which explained that there no causal relationship is found between gold prices and KSE; whereas, Gold Price are significantly leads with BSE stock index.

Table 1: Descriptive Statistics

	R_OF_GP	R_OF_BSE	R_OF_KSE
Mean	0.016527	0.013242	0.001938
Median	0.021310	0.023125	0.000794
Std. Dev.	0.054191	0.088146	0.080207
Skewness	-0.567122	-0.695663	-1.203287
Probability	0.007708	0.000094	0.000000
Maximum	0.127117	0.272251	0.200129
Minimum	-0.184158	-0.300657	-0.353418

Table 2: Unit Root Analysis (Augmented Dickey Fuller and Phillips Perrons)

	Augmented Dickey Fuller (level)	Augmented Dickey Fuller (1 <sup>st</sup> difference)	Phillips Perrons (level)	Phillips Perrons (1 <sup>st</sup> difference)
Gold prices	0.083899	-10.05351	0.892265	-10.63024
KSE	-1.305831	-7.149850	-1.441582	-7.185503
BSE	-1.651356	-7.846288	-1.714778	-7.844731
<i>Critical values</i>				
1%	-3.524233	-3.525618	-3.524233	-3.525618
5%	-2.902358	-2.902953	-2.902358	-2.902953
10%	-2.588587	-2.588902	-2.588587	-2.588902

Table 3: Vector Auto Regression

Estimate VAR at Lag 1-1	
Akaike information criterion	-7.213680
Schwarz criterion	-6.834236
Estimate VAR at Lag 1-2	
Akaike information criterion	-7.178067
Schwarz criterion	-6.508823
Estimate VAR at Lag 1-3	
Akaike information criterion	-7.512894
Schwarz criterion	-6.549253
Estimate VAR at Lag 1-4	
Akaike information criterion	-7.448225
Schwarz criterion	-6.185469
Estimate VAR at Lag 1-5	
Akaike information criterion	-7.306047
Schwarz criterion	-5.739336
Estimate VAR at Lag 1-6	
Akaike information criterion	-7.152812
Schwarz criterion	-5.277178
Estimate VAR at Lag 1-7	
Akaike information criterion	-6.995874
Schwarz criterion	-4.806220

Table 4: Co-integration Analysis (Trace Statistics)

Hypothesize No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None	0.29627	29.73278	29.79707	0.0409
At most 1	0.064595	4.787513	15.49471	0.8310
At most 2	0.000654	0.046446	3.841466	0.8293

Table 4.1: Co-integration Analysis (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigen values	Trace Statistic	0.05 Critical Value	Prob.**
BSE None *	0.296257	24.94527	21.13162	0.0138
KSE At most 1	0.064595	4.741067	14.26460	0.7741
GP At most 2	0.000654	0.046446	3.841466	0.8293

Table 5: Granger Causality Analysis

Null Hypothesis:	Obs	F-Statistic	Prob.
R_OF_BSE does not			
Granger Cause R_OF_GP	72	0.02356	0.8785
R_OF_GP does not			
Granger Cause R_OF_BSE	1.05691	0.04075	
R_OF_KSE does not			
Granger Cause R_OF_GP	72	0.46213	0.4989
R_OF_GP does not			
Granger Cause R_OF_KSE	0.14126	0.7082	
R_OF_KSE does not			
Granger Cause R_OF_BSE	72	2.44428	0.1225
R_OF_BSE does not			
Granger Cause R_OF_KSE	0.15553	0.6945	

**Conclusion and Practical Implication:** Keeping current supercilious volatility in gold prices, the main objective of this study was to find the corresponding relationship between gold prices and broad-spectrum stock values of KSE and BSE. Findings of this study indicated that there is no long-run relationship exists between monthly average gold prices and KSE 100 Index; however, BSE has long-term relation with average gold prices. 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 gold prices and KSE and BSE stock indices. Findings revealed no presence of long-term relationship between Gold prices and KSE, but long-term relationship is witnessed with BSE stock index. In this model, we used minimum negative value of Schwarz information criterion which provided Lag length 7. Finally, Granger causality test explored no causal relationship among average gold prices, BSE and KSE-100 index. Findings of this study provide significant insights for academic researchers and for local and international business investors specifically who are interested to invest in sub-continent capital markets for prudent decision making.

**Future Research Direction:** Our empirical findings suggest a rich agenda for future research. This study is limited to find the long-term relationship between gold prices and KSE and BSE stock indices; however, future research can explore the relationship of gold prices at large scale; may be included to other Asian, European or American countries or a comparative study among different regional stock markets. Short-term relationship by expanding other microeconomic factors and their relationship with gold prices may also be examined.

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