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ESTIMATING LONG-RUN COINTEGRATION BETWEEN GOLD PRICES AND ITS DETERMINANTS

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ABSTRACT

The objective of this paper is to analyse the determinants of gold prices in Pakistan and to deduce long run co-integration between them, if any. The impact of silver prices, foreign exchange rates, and global oil prices have been measured on the gold prices in Pakistan. The study utilizes annual time series data of these variables from 1975 to 2019. To test the long-run relationship among variables, econometric techniques such as the Unit Root Test using Augmented Dickey-Fuller (ADF) test, Johansen Cointegration, Vector Error Correction Model (VECM), and Granger causality were performed. The empirical results reveal that foreign exchange rates and silver prices are significant determinants of gold prices in local market. Also, the local gold prices cause the domestic silver prices. Oil prices in international market weakly cause the gold prices in domestic market. The results also indicate the presence of a long-run cointegration among gold prices, silver prices, foreign exchange rate and oil prices.

JEL Codes: C58, E44, G15

Introduction

Gold has been seen as an emblem of power, wealth and opulence. Since time immemorial, the yellow metal has been seen as an important asset. Banks, industries, households, and investors hold gold reserves to achieve different objectives. The demand for gold is characterized by two constituents; the consumer demand and the investment demand. First, there is the consumer demand for gold. Gold is used for industrial, healthcare and technological purposes. It is a highly liquid commodity and is heavily used in the production of jewellery and ornamental objects (Ciner, 2011). The ancient Romans also discovered that gold has healing powers and it helped prevent infections. As (Kauffman, 1985) writes in "The Role of Gold in Alchemy. Part III", in the early twentieth century, the 'oil of gold' was prepared by an alchemist, Archibald Cockren. Many people believed in the healing powers of this 'oil of gold' and consumed small amounts to cure their ailments. The 'oil of gold' was greatly revered amongst ancient alchemists and it was widely believed that this oil possessed glorious powers of healing all illnesses and even had the strength to give physical immortality, if consumed in suggested doses.

The distinctive properties of the yellow metal, such as malleability and ductility, support the usage of gold in routine dental practices. Gold does not oxidize in air or water, and when it is paired with palladium – another precious metal – it becomes a sturdy preference in dental prosthetics (Oleszek-Listopad et al., 2015). Because of its high electrical conductivity and greater corrosion resistance, gold is also extensively consumed in electronics (Goodman, 2002).

The second demand for gold comes from the perspective of holding it as an asset and hedging. Central banks, individuals and asset managers demand gold to hedge themselves against inflation and economic uncertainty. Central banks hold gold to diversify their

portfolios and to use its high liquidity characteristic to counter crises. The bullion is seen as a shelter in times of uncertain economic and political environment. All these diverse uses of gold has given more prominence to its demand during different stages of an economic cycle.

The past few decades have witnessed a volatile movement in value of gold. This greatly disturbs the myth: gold always rises in value. From $422 an ounce in 2005 to $1225 per ounce in 2015, price of gold has taken a flight of a staggering 190% in that decade. But it has taken dips in between as well. The most pronounced fall in the price of gold happened during 2013 and 2014. The yearly average in London fell from $1606 to $1295 per ounce.

The principal purpose of this investigation is to identify the chief determinants of the fluctuating gold prices. The association between gold prices in Pakistan and five independent variables is studied for the period of 1973 to 2015. The independent variables include gold price in the international market, interest rate, silver prices, stock market performance, and foreign exchange rate of PKR to USD.

The remainder of the paper is structured in the following manner. Section 2 gives the literature review, Section 3 outlines the methodology used, Section 4 gives a thorough detail of the outcomes obtained, and Section 5 concludes the analysis.

2. Literature Review

There is a lot of literature showing the relationship of gold prices with different variables. There are several studies that use daily time series data. A study conducted by (Erdoğdu, 2017) on the USA market finds that interest rates have no impact on the prices of gold, but exchange rates contribute significantly to changes in prices of gold. This study analyses data over 13 years using exponential GARCH model. To determine the influence of interest rates, exchange rate and gold prices on inflation rate, (Aleemi & Tariq, 2016) use

Johansen Cointegration over a period of 1975 to 2013. They find that a rise in interest rates and gold prices cause inflation to rise.

Examining the macroeconomic determinants of global gold price, (Baur, 2013) observes that the demand for yellow metal is guided by a couple of determinants; the first being conventional factors which include inflation, and the other are contemporary factors which include demand of gold by the central banks. A similar study by (Ghosh et al., 2004) uses monthly data from 1976 to 1999 and applying cointegration techniques, find out that in the longer run, gold is an impressive guard against inflation.

(Toraman et al., 2011) have explained that gold has strong negative correlation with exchange rate, whereas gold has a positive correlation with crude oil. Data from 1992 to 2010 has been used and MGARCH model has been applied to come to these conclusions.

In a study conducted on Indian economy between 2002 and 2012, (Baber et al., 2013) find the existence of positive interrelationship among gold prices and interest rates. The research also looks into the effect of international business environment, consumer buying behaviour, and political environment on gold prices.

A study conducted on similar variables in context of Malaysian economy by (Ibrahim et al., 2014) find that gold prices are negatively impacted by the inflation rate and exchange rates, whereas a positive correlation exists between gold prices and international oil prices. (Ranjusha et al., 2017) examined the relationship between gold price and value of exchange rate in India. The study used the annual data of gold and exchange rate from 1970 to 2015 and used Johansen cointegration test, Vector Error Correction Model and Granger causality to check the long run relationship among these variables. The analysis reveal the occurrence of a long-run cointegration among the said variables. It also found out there was no Granger causality in gold prices and exchange rates.

Many researches have examined the prominence of gold as a shelter from inflation. (Tufail & Batool, 2013) uses data of fifty years, from 1960 to 2010, to analyse the association of gold prices and inflation. The study finds that increasing gold prices are an indication of rising inflation. Another study by (Javid & Zafar, 2020) using GARCH model supports the notion that in Pakistan, gold is definitely an effective hedge against inflation. (Nadeem et al., 2014) analyse time series data ranging from 2000 to 2012 to show the impact of inflation, international gold prices, stock prices, exchange rate, and international oil prices on domestic gold prices. It was noted that inflation and international oil prices have a positive impression on local gold prices, whereas exchange rate and stock prices impacted gold prices negatively.

(Kamran et al., 2014) use multiple regression model to identify the influence of inflation, interest rates, exchange rates, domestic savings, silver prices and stock market performance on gold prices. The study uses yearly data from 1980 to 2008 to find that gold prices are closely correlated to silver prices. The importance of psychological behaviour in gold prices is assessed by (Aggarwal & Lucey, 2007) where the study captures the effect of intra-day price fluctuation.

To evaluate the association of gold and silver in the long run, (Baur & Tran, 2014) find out that during certain periods of extreme price changes, long-run relationship exists between both these metals. (Khan et al., 2016) analyse monthly movements of stock prices and gold rates in Pakistan from Oct 1993 to May 2014. Using Johansen co-integration test and Vector Autoregressive model (VAR), they conclude there does not exist any long term association among gold prices and Karachi Stock Exchange (KSE-100) index. In another study by (Gokmenoglu & Fazlollahi, 2015), it is found that stock prices are heavily affected by gold prices and oil prices. This research used daily data of prices and indexes from January 2013 to the end of November 2014.

2.1 Modelling for Price Determination

A dynamic model is developed by (Koutsoyiannis, 1983) to determine the price of a speculative financial commodity in the short run, in which the data for gold prices was tested. The main conclusion of this study revealed that participants in the yellow metal market, as opposed to the common belief, behaved in a rational manner. It was also found out that gold price is heavily dependent on both quantitative and qualitative variables. Quantitative measures include interest rates, the price of silver and the stock prices, whereas, qualitative measures such as political and economic instability were discussed. In our model, we have incorporated interest rates, foreign exchange rates, domestic silver prices, domestic stock market performance, and gold prices in the international market.

Interest rates and gold prices usually have a negative relationship. This is because when interest rates go up, investors find it lucrative to invest in stocks and other interest-bearing instruments. On the contrary, when interest rates go down, the demand for gold goes up, and so does its price. But this is not true for all economies. Because gold is primarily traded in US Dollars, changes in interest rates in the US have profound effects on gold prices.

Gold is an asset whose value varies over time. Since global gold prices are quoted in terms of US Dollars, when the value of USD rises, gold becomes expensive in local currencies. Gold translating into an expensive commodity result in reduced demand. This drives up gold price in local country. Therefore, when the foreign exchange rates go up, the gold price also goes up. This has been affirmed by (Ranjusha et al., 2017) who found that in Indian market, a long-run and positive association among gold prices and exchange rates exist.

Silver is considered to be the closest substitute of Gold. Being a substitute there exists a negative relationship between both metals. In an analysis of gold and silver price

movements, (Escribano & Granger, 1998)found that long run cointegration could exist during some periods – notably the bubble and the post-bubble period.

Stock prices and gold prices usually move in an opposite direction. This is because gold is considered a secure investment, but many studies have found no long run relation between gold and stock indexes (Khan et al., 2016; Raza Bilal et al., 2013).

3. Data and Methodology

3.1. Data

The data utilized in this research is collected from published resources of the State Bank of Pakistan, Handbook of Statistics, Economic Surveys of Pakistan, and website of Pakistan Stock Exchange Limited. The study covers annual data of prices and indexes from 1973 to 2015.

3.2. Methodology

3.2.1. Model Specification

Conforming to stated theories and the extensive review of literature, the econometric model in this study regards annual data of global gold price, interest rates, foreign exchange rates, price of silver and stock market performance as explanatory variables, and domestic gold price as the response variable, over the period 1973 to 2015. The model is specified as:

$$GP = f(GPD, INT, FOREX, SP, SMP) \quad (1)$$

Where, GP is Gold Price in Pakistani market, measured in Pakistani Rupee (PKR) per 10 grams. GPD is the international gold price at spot rate, measured in US Dollars (USD) per troy ounce. INT is the interest rate in Pakistan calculated on the basis of weighted average rate of return on deposits. FOREX represents the exchange rate of USD to PKR at the end of

the year. SP represents the silver price in domestic market, measured in Pakistani Rupee per 10 grams. SMP signifies the performance of stock market based on aggregate market capitalization in Pakistan.

3.2.2. Unit Root & Co-integration Test

When a regression is run on non-stationary series, the model turns out to be over-fitted. In a time series data this happens because time factor is implicitly involved. Economic variables usually depict a trend. A series which is making trend with time is said to be a non-stationary series. A regression run on non-stationary series will give spurious results.

For a series to be stationary, three characteristics should be satisfied: it should have a constant mean, a constant variance, and the covariance should be time invariant. For a variable to be stationary and non-deterministic, it has to be differenced '*d-times*' to be called integrated of order '*d*' or *I(d)* (see (Hendry, 1986)). Therefore, to determine a long-run relationship, or co-integration, it is essential to establish the order of integration, *I(d)*.

In order to test the existence of unit roots and to establish the order of integration, we have employed a test developed by (Dickey & Fuller, 1979, 1981) known as the Augmented Dickey-Fuller (ADF) test:

$$\Delta Y_t = \alpha + \varphi t + \gamma Y_{t-1} + \sum_{i=1}^{m} \psi_i \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

Where *Y* is the variable under consideration, α is the constant term, φ is the constant on a time trend, *m* represents the lagged difference terms. ΔY_{t-i} is used to estimate the ARMA arrangement of the residuals. The error or the residual term, ε_t, is presumed to be homoscedastic. Under the null hypothesis, Y_t is I(1), which suggests that $\varphi=1$.

Co-integration is performed to explore the long-run relationship between variables. Series are considered co-integrated when their linear combination is stationary. The assumption of co-integration test is “all variables (dependent and independent) are stationary at first difference” or these variables are I(1), and the residual of the estimated model is stationary at level, or at I(0).

3.2.3. Error Correction Mechanism

The error correction model helps to identify short-run association and long-run adjustment in the model. The ECM approximates the speed of convergence, that is, the rate it takes for a response variable to restore to equilibrium after a shock in the explanatory variable(s) (Pesaran et al., 2001). If the series are co-integrated and error correction term (ECT) is stationary at I(0), then the connection between two series, Y_t and X_t, can be expressed as:

$$\Delta Y_t = \alpha + \beta_1 \Delta X_t - \gamma ECT_{t-1} + \varepsilon_t \quad (3)$$

This incorporates both the long term and short term details. β captures the short-run effect of a difference in X_t over a difference in Y_t. ECT_{t-1} is the first lag of the residual of the estimated model, and γ is the long-run adjustment effect, which shows the extent of the disequilibrium being corrected.

4. Empirical Analysis

This part reports the empirical outcomes of the variables utilized within the model. Eviews 9 has been used to estimate the outcomes.

4.1. Statistical Model

The model specification used in equation (1) leads us to formulate the following model. The ensuing model is used to have a better economic interpretation.

$$GP_t = \beta_0 + \beta_1 GPD_t + \beta_2 INT_t + \beta_3 FOREX_t + \beta_4 \ln(SP_t) + \beta_5 \ln(SMP_t) + \varepsilon_t \quad (4)$$

In the analysis of the model, Silver Prices (SP) and Stock Market Performance (SMP) are expressed in natural logarithm (i.e. lnSP and lnSMP). The descriptive statistics for these variables are given in Table 1. Table 2 displays the correlation matrix of the variables under study.

Table 1: Descriptive Statistics

	GP	GPD	INT	FOREX	LNSP	LNSMP
Mean	9677.093	508.9535	5.431860	41.72440	4.267374	11.93135
Median	3990.000	384.0000	6.000000	30.83190	3.970292	12.46568
Maximum	50744.00	1674.000	10.66000	106.9710	6.842683	15.81983
Minimum	278.0000	77.00000	0.950000	9.907800	1.791759	8.173604
Std. Dev.	14128.16	394.1239	2.025537	30.94144	1.228614	2.490626
Skewness	1.898422	1.662935	-0.046919	0.667494	0.443300	-0.017608
Kurtosis	5.207681	4.823286	3.294814	2.197572	2.802455	1.622051
Jarque-Bera	34.56104	25.77452	0.171500	4.346735	1.478278	3.404137
Probability	0.000000	0.000003	0.917824	0.113794	0.477525	0.182306
Observations	43	43	43	43	43	43

The correlation matrix in Table 2 exhibits strong positive correlation between global gold prices (GPD) and domestic gold prices (GP). Similarly, an inverse weak correlation between interest rates (INT) and gold prices (GP) can be observed.

Table 2: Correlation Matrix

	GP	GPD	INT	FOREX	LNSP	LNSMP
GP	1	0.966	-0.349	0.877	0.871	0.727
GPD	0.966	1	-0.239	0.813	0.885	0.690
INT	-0.349	-0.239	1	-0.545	-0.368	-0.511
FOREX	0.877	0.813	-0.545	1	0.938	0.934
LNSP	0.871	0.885	-0.368	0.938	1	0.906
LNSMP	0.727	0.690	-0.511	0.934	0.906	1

4.2. Unit Root Tests

Before proceeding to the formal methods of testing stationarity, it is essential to first look at the graphical representation of the variables under study.

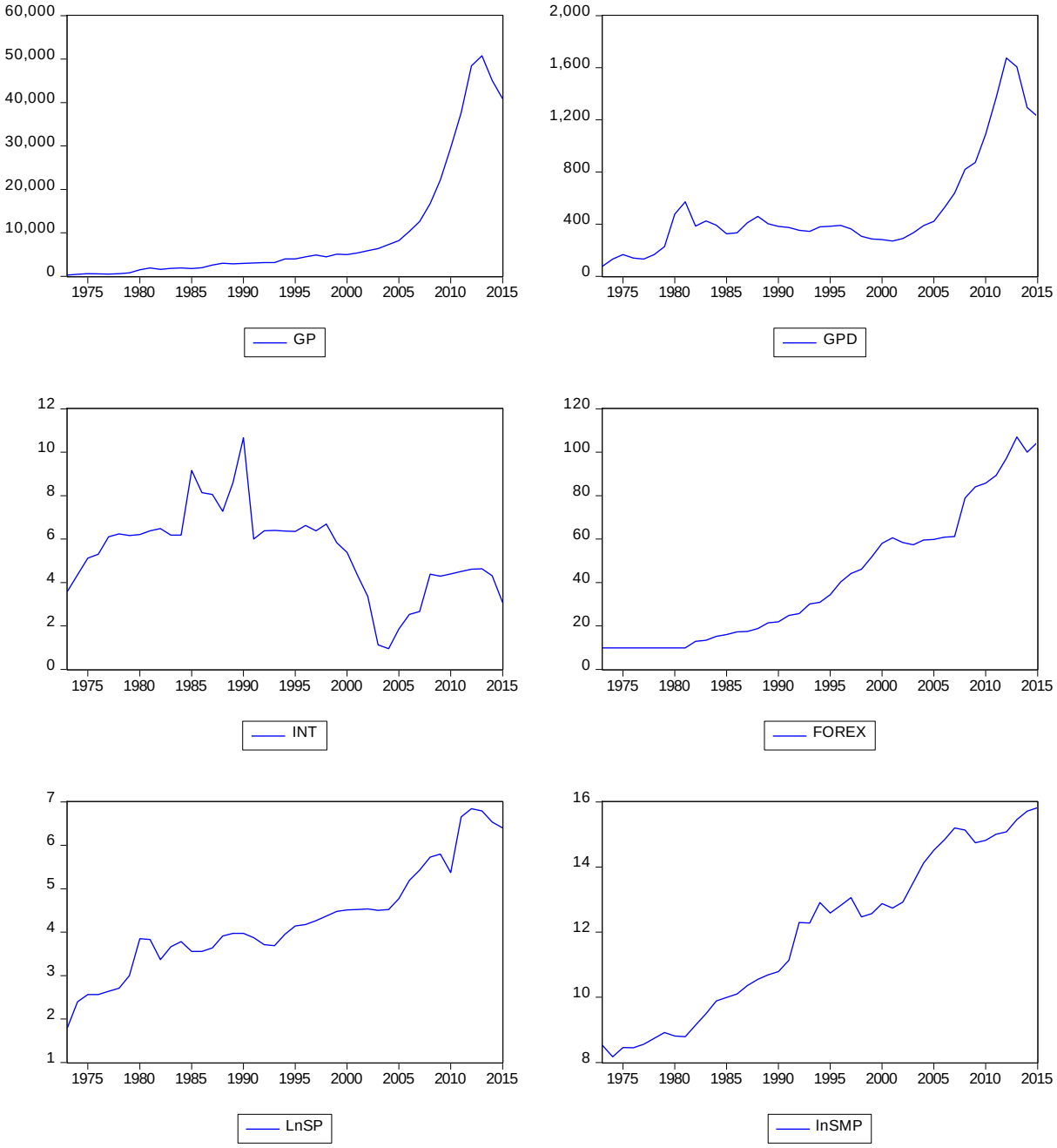

Fig. 1. Time series visualization of the variables

The time sequence of GP, GPD, FOREX, LnSP, LnSMP show an increasing trend, suggesting that the mean is not constant and the series may be non-stationary. To check stationarity we applied Augmented Dickey-Fuller test at level data and at first difference data, using Constant (C) and Constant & Trend (C&T). By using equation (2) we try to investigate the unit root of each series and test the hypothesis:

H_0: [variable] has a unit root.

The outcomes are presented in Table 3. The results show that all variables depict non-stationarity at I(0). However, all variables become stationary at. I(1). Since all variables are stationary at first difference (or I(1)), and the residual of the model (ECT) is stationary at I(0), we reject the null hypothesis and conclude that co-integration is present, and the variables have a long-run relationship.

Table 3: ADF Test Statistics

ADF TEST STATISTICS				
Variables	I(0)		I(1)	
	C	C&T	C	C&T
GP	0.9918 (0.9957)	-3.3634 (0.0706)	-3.5124(0.012)**	-4.0741 (0.0139)**
GPD	-1.2516 (0.6427)	-2.1820 (0.4865)	-4.3976 (0.0011)*	-4.5374 (0.0042)*
INT	-1.8055 (0.3728)	-2.6781 (0.2504)	-7.0081 (0.0000)*	-7.0580 (0.0000)*
FOREX	3.2587 (1.0000)	-0.6907 (0.9662)	-0.6351 (0.8495)	-5.6664 (0.0002)*
LNSP	-1.1614 (0.6821)	-2.6393 (0.2659)	-6.5733 (0.0000)*	-6.4872 (0.0000)*
LNSMP	-0.0095 (0.9523)	-2.8519 (0.1879)	-6.4099 (0.0000)*	-6.3037 (0.0000)*
ECT	-4.0440 (0.0030)*	-3.9899 (0.0167)*	-	-

Note: *, **, *** represent the level of significance at 1%, 5% and 10%, respectively.
In parenthesis are the prob values for this particular sample size
Source: Author's estimation

Ordinary Least Squares (OLS) method can be applied on level data when we have found out that all variables are I(1). The results obtained from the regression are summarized in Table 4. The model's R-squared shows that 98.27% of variation in gold prices in Pakistan (GP) is explained by the variation in all explanatory variables combined.

Table 4: Regression results using OLS

Variable	Coefficient	t-Stat
C	10884.12	3.1902
GPD	31.65158	14.6188*
INT	184.1871	0.8762
FOREX	343.7636	8.0683*
LNSP	-5690.08	-4.8463*
LNSMP	-702.21	-1.5383
R-squared	0.982687	
Adjusted R-squared	0.980347	
F-statistic	420.0209	
Prob(F-statistic)	0.0000	

Source: Author's estimates
Note: *, **, *** represent the level of significance at 1%, 5% and 10%, respectively.

4.3. Johansen Co-integration

Johansen co-integration test (Johansen, 1988) is conducted to assess if three or more time series are co-integrated. It uses maximum likelihood estimates (MLE) approach to determine co-integrating relationship. Johansen co-integration uses two types of statistics; Trace statistics and Maximum Eigenvalue statistics. The following results were obtained:

Table 4: Johansen Co-integration Test Statistics

Hypothesized Number of CE(s)	Trace statistic	5% critical values	Prob value	Max-Eigen value statistic	5% critical values	Prob value
None*	121.4073	95.75366	0.0003	55.53735	40.07757	0.0004

Source: Author's estimates

The results exhibit that null (no cointegration) is rejected at the 0.05 level, and that co-integration occurs in only one equation. The following is the only co-integrating equation (absolute t-values are in parenthesis):

$$GP_{t-1} = 14007.41 + \underset{(25.8649)}{31.24305}\ GPD_{t-1} + \underset{(7.0527)}{842.4286}\ INT_{t-1} + \underset{(20.2974)}{500.4932}\ FOREX_{t-1} - \underset{(12.3757)}{8410.989}\ LNSP_{t-1} - \underset{(3.44066)}{817.7381}\ LNSMP_{t-1} \quad (5)$$

In the long term, GPD, INT and FOREX have positive effect, while SP and SMP have negative impact on GP, on average, ceteris paribus. Coefficients are statistically significant at 1% level of significance. In the long-run, if Gold price in international market (GPD) increases by one dollar per ounce, Gold price in Pakistan (GP) increases by 31.243 rupees per 10 grams, on average, ceteris paribus. If interest rate in Pakistan (INT) increases by one percent, GP increases by 31.243 rupees per 10 grams, on average, ceteris paribus. If Foreign exchange rate of USD to PKR, (FOREX), increases by one dollar per Pakistani rupee, the GP increases by 500.49 rupees per 10 grams, on average, ceteris paribus. Gold prices and Silver prices have negative relationship. If Silver price (SP) increases by one rupee per 10 grams, GP decreases by 84.10 rupees per 10 grams, on average, ceteris paribus. If market capitalization (SMP) increases by one million rupees, GP declines by 8.1773 rupees per 10 grams, on average, ceteris paribus. All coefficients are statistically significant at 1% level.

4.3. Long-run Relationships

By applying Vector Error Correction Model (VECM), we get the following co-integrating equation and long-run model.

$$ECT_{t-1} = [\psi_i\, GP_{t-1} - \eta_j\, GPD_{t-1} - \xi_m\, INT_{t-1} - \delta_n\, FOREX_{t-1} + \lambda_q\, LNSP_{t-1} + \zeta_r\, LNSMP_{t-1}] \quad (6)$$

$$ECT_{t-1} = [1.000\, GP_{t-1} - 31.2430\, GPD_{t-1} - 842.428\, INT_{t-1} - 500.493\, FOREX_{t-1} + 8410.989\, LNSP_{t-1} + 817.738\, LNSMP_{t-1} - 14007.41] \quad (7)$$

4.4. Short-run Relationships

To test for short-run dynamics, the following model was estimated for the period of 1973 to 2015.

$$\Delta GP_{t-1} = \Phi\, ECT_{t-1} + \sum_{i=1}^{k-1} \psi i\, \Delta GP_{t-1} - \sum_{j=1}^{k-1} \eta j\, \Delta GPD_{t-1} + \sum_{m=1}^{k-1} \xi m\, \Delta INT_{t-1} - \sum_{n=1}^{k-1} \delta n\, \Delta FOREX_{t-1} + \sum_{q=1}^{k-1} \lambda q\, \Delta LNSP_{t-1} + \sum_{r=1}^{k-1} \zeta r\, \Delta LNSMP_{t-1} + \alpha \quad (8)$$

$$\Delta GP_{t-1} = -0.51220\, ECT_{t-1} + 0.6679\, \Delta GP_{t-1} - 1.4923\, \Delta GPD_{t-1} + 40.1903 \Delta INT_{t-1} - 241.2813\, \Delta FOREX_{t-1} + 3301.508\, \Delta LNSP_{t-1} + 278.066\, \Delta LNSMP_{t-1} + 397.87 \quad (9)$$

Where α is constant and Φ is the coefficient of the Error Correction Term (ECT).

The preceding period's variation from long-run equilibrium is rectified in the prevailing period at an adjustment speed of 51.22%. As the range of the value of Φ is $-1 < \Phi < 0$, the recovery will follow a monotonic movement.

To test the assumption of homoscedasticity in the model, (White, 1980) Heteroscedasticity test is implemented on the residuals of the fitted model. White's test includes cross terms, which means it tests for both heteroscedasticity and specification bias. The results obtained from the test are presented in Table 5. The null hypothesis is not rejected, and therefore, we can deduce that the residuals of the model are homoscedastic.

Table 5: White's Heteroscedasticity Test including cross terms

Chi-sq	df	p-value
784.9616	735	0.0982

In the end Granger Causality test is carried out to explore the direction of any potential relationship between variables. Two series are said to be Granger-caused if one series provides statistically significant information about another series. Table 6 shows the pairwise Granger causality. As theory suggests, global gold prices (GPD) cause changes in the local gold prices (GP), and not the other way round. This is attested by the Granger causality results. Similarly, there is a unidirectional causality when foreign exchange rates (FOREX) Granger-cause gold prices in the local market (GP). Although low interest rates cause greater spending by households and businesses, leading stock prices to rise, but in case of Pakistan, this has not been proved by the Granger causality test. Rather, the opposite has been proved by the test, that stock market performance (SMP) Granger-causes interest rates (INT) in the country. The only bidirectional causality is observed in foreign exchange rates (FOREX) and silver prices (lnSP) in Pakistan.

Table 6: Pairwise Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision on Causality
GPD does not Granger Cause GP	42	2.89227	0.0970***	Unidirectional
GP does not Granger Cause GPD		0.02977	0.8639	causality
INT does not Granger Cause GP	42	1.58810	0.2151	No causality
GP does not Granger Cause INT		1.36344	0.2500	
FOREX does not Granger Cause GP	42	4.13600	0.0488**	Unidirectional
GP does not Granger Cause FOREX		0.07347	0.7878	Causality
LNSP does not Granger Cause GP	42	3.96252	0.0536***	Unidirectional
GP does not Granger Cause LNSP		1.34381	0.2534	causality
LNSMP does not Granger Cause GP	42	3.57516	0.0661***	Unidirectional
GP does not Granger Cause LNSMP		0.00457	0.9465	causality
INT does not Granger Cause GPD	42	2.74837	0.1054	No causality
GPD does not Granger Cause INT		0.36893	0.5471	
FOREX does not Granger Cause GPD	42	1.70612	0.1991	No causality
GPD does not Granger Cause FOREX		0.31257	0.5793	
LNSP does not Granger Cause GPD	42	0.88481	0.3527	No causality
GPD does not Granger Cause LNSP		0.38853	0.5367	
LNSMP does not Granger Cause GPD	42	1.85752	0.1807	No causality
GPD does not Granger Cause LNSMP		0.03542	0.8517	
FOREX does not Granger Cause INT	42	5.51574	0.0240**	Unidirectional
INT does not Granger Cause FOREX		0.18957	0.6657	causality
LNSP does not Granger Cause INT	42	2.30019	0.1374	Unidirectional
INT does not Granger Cause LNSP		2.89332	0.0969***	causality
LNSMP does not Granger Cause INT	42	3.30688	0.0767***	No causality
INT does not Granger Cause LNSMP		0.37961	0.5414	
LNSP does not Granger Cause FOREX	42	4.74666	0.0355**	Bidirectional
FOREX does not Granger Cause LNSP		6.28574	0.0164**	causality
LNSMP does not Granger Cause FOREX	42	7.14662	0.0109**	Unidirectional
FOREX does not Granger Cause LNSMP		0.01224	0.9125	Causality
LNSMP does not Granger Cause LNSP	42	5.94467	0.0194**	Unidirectional
LNSP does not Granger Cause LNSMP		0.54363	0.4653	causality

Note: *, **, *** represent for significant level at 1%, 5% and 10%, respectively

5. Conclusion

The factors affecting gold prices in Pakistan are discussed in this research. We have employed multiple regression model to evaluate the effect of international gold prices, interest rates, foreign exchange rates, silver prices and domestic stock market performance on the gold prices. The R-squared of the model comes out to be 0.9827. This shows that 98.27% of the deviation in gold prices (GP) is explained by the variation in the explanatory variables combined. The international gold price, foreign exchange rates, and interest rates have a positive relationship with local gold prices, whereas, silver being a close substitute, has a negative relationship. The results also coincide with that of (Erdoğdu, 2017) that interest rates have no substantial impression on gold price determination whereas foreign exchange rates greatly affect the gold prices. The negative impact of stock market performance (SMP) on domestic gold prices (GP) are aligned with the findings of (Nadeem et al., 2014).

Using annual gold price data (1973-2015) and co-integration regression approach, an experimental investigation affirms a long-run association between gold prices and explanatory variables. These results also imply that local gold prices (GP) converge to its long term position by a rate of 51.22% of yearly adjustment due to global gold prices, silver prices, foreign exchange rates, interest rates and stock market performance. The study also affirms that global gold prices Granger-cause the gold prices in local market. Therefore, past values of global gold prices (GPD) can be used to forecast future values of gold prices in Pakistan (GP).

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