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RESEARCH ARTICLE

AN EMPIRICAL STUDY ON RELATIONSHIP BETWEEN FUTURE AND SPOT PRICE

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ABSTRACT

Gold is a chemical element with symbol Au (from Latin: aurum) and atomic number 79. In its purest form, it is a bright, slightly reddish yellow, dense, soft, malleable and ductile metal. This metal has been a valuable and highly sought-after precious metal for coinage, jewellery, and other arts since long before the beginning of recorded history. The world consumption of new gold produced is about 50% in jewellery, 40% in investments, and 10% in industry. The primary purpose of the study is to examine the relationship between the Gold futures prices and Gold spot prices traded in India. The data has been collected from National Commodity & Derivatives Exchange Limited (NCDEX) for the period from May 2015 to Jan. 2016. The results from unit root test (ADF) indicate stationarity at 1st difference. Hence, Johansen's cointegration test is examined to know the relationship between Gold futures prices and spot prices. The causalitytest reveals no contradictory findings If two or more time-series are cointegrated, then there must be Granger causality between them - either one-way or in both directions. It is concluded that there is long- term relationship between Gold futures prices and spot prices price traded in India on testifying Unit Root Test, Cointegration Test and Pair-wise Granger Causality Test. This study enables to determine which market is possessing better information. Spot prices of Gold are caused by the effects of Future prices. The study is immensely helpful for the investors and portfolio managers to develop effective trading and hedging strategies in the Indian gold market.

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INTRODUCTION

Gold isa chemicalelement with symbol **Au** (from Latin: *aurum*) and atomic number 79. In its purest form, it is a bright, slightly reddish yellow, dense, soft, malleable and ductile metal. It is one of the least reactive chemical elements, and is solid under standard conditions. This metal has been a valuable and highly sought-after precious metal for coinage, jewellery, and other arts since long before the beginning of recorded history. Gold is also used in infrared shielding, colored-glass production, gold leafing, and tooth restoration. Certain gold salts are still used as anti-inflammatories in medicine. The world consumption of new gold produced is about 50% in jewellery, 40% in investments, and 10% in industry. A total of 183,600 tonnes of gold is in existence above ground, as of 2014. This is equivalent to 9513 m^3 of gold.

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Investment

Gold prices (US$ per troy ounce) are in nominal US$ and inflation adjusted US$. Many holders of gold store it in form of bullion coins or bars as a hedge against inflation or other economic disruptions. However, economist Martin Feldstein does not believe gold serves as a hedge against inflation or currency depreciation. Modern bullion coins for investment or collector purposes do not require good mechanical wear properties; they are typically fine gold at 24k. India has a rich tradition of gold consumption and production. It is cherished both as an adornment and investment. Indian households own circa 22000 tonnes of gold and around 600 tonnes of gold is used in jewellery production each year.

Review of Literature

Ehrich (1969) studied the cash – futures price relationship for live beef cattle markets during 1948 to 1966. The results suggested that there were long run price relationships between the spot and futures prices of the sample market and it was also found that the cash markets lead the future markets. Wahab

et al. (1994) tested the co integration between gold and silver prices with daily spot and future prices. They used daily cash price and daily futures price and establish that there is no integration between gold and silver in both markets. Since gold is used as the primary commodities in the commodity trading centre, there are very few researches that have focused on the long –run relationship between the silver spot and future prices metals especially gold and explained the relationship. It is believed that there exists the long –run relationship between spot and future prices rather than a short –run which can be verified by inspecting whether the spot and future prices are co integrated. There exist the immense literatures highlighting the long –run relationship between spot and future prices of commodities among others, (Matin & Garcia 1981, Hokkio & Rush, 1989, Wahab & Lashgari 1993, Giot 2003, Garica & Leuthold, 2004, Hernanadez & Torero, 2010)

Objectives: The purpose of the study is to

To examine the relationship between future and spot prices of Gold

Data Source and Methodology

The empirical investigation was carried out based on daily data ranging from May 2015 2009 to Jan.2016 which covers 160 observations. Future and Spot prices of Gold commodity was chosen for its study. The empirical investigation considers closing prices of Gold. Data for all variables were collected from the official websites of National Commodity & Derivatives Exchange Limited (NCDEX). Descriptive and inferential statistics and e views 7 are used for (1) unit root test (2) pairwise granger causality test (3) cointegration test and (4) Regression Model.

Hypothesis Testing

The hypotheses of this research are given below:

H01: There is a normal distribution
H02: There is unit root of Future and Spot prices of Gold.
H03: There is no cointegration between Future and Spot prices of Gold.
H04: FUTURE prices do not Granger Cause SPOT prices.
H05: SPOT price does not Granger Cause FUTURE prices.

Descriptive Statistics

It describes then patterns and general trends of a dataset. It enables a reader to quickly understand and interpret the set of data that has been collected. This study uses measures of central tendency (Mean), measures of Variability (standard deviation, range, minimum and maximum), skewness and kurtosis. JarqueBera test statistic measures the difference of the skewness and kurtosis of the data series from the normal distribution. Jarque-Berastatistic tests the null hypothesis that data follow normal distribution.

Linear Regression Model

Linear regression analysis is used to learn more about the relationship between one independent and dependent variable. The linear regression equation can be represented as

Yt = at + beta1*t + Ut.……2

Where Yt is the dependent variable, Xt is the independent variable, at is the constant (or intercept), β1 is the slope of the regression line which represent the strength and direction of the relationship between the independent and dependent variables and ut is random error term. The value of R-square, the coefficient of determination, is commonly used to evaluate the model fit of a regression equation. It explains the percentage of variance explained by the independent variable.

Unit Root Test

The foundation of time series analysis is stationarity. A stationary process is a stochastic process whose joint probability distribution does not change when shifted in time or space. If the variable is not stationary, we can obtain a high regression although there is no meaningful relation between variables i.e. spurious regression between totally unrelated variables. Therefore before estimating regression,Augmented Dickey Fuller Test (Hamilton, 1994) was conducted to check the stationarity of the data. If the caluculated absolute ADF test statistics is more than the critical values from fuller's table, then the series are stationary or integrated of order zero i.e. unit root do not exists. The test for a unit root is conducted on the coefficient of yt-1 in the regression.Where Yt is the variable in period t, T denotes a time trend, is the difference operator, et is pure white noise error term disturbance with mean zero and variance deviation 2, k represents the no. of lags of the differences in the ADF equation and Yt 1 = (Yt-1 – Yt-2). ADF test is also employed to check the presence of unit root in the variables. The time series model specification of unit root is given below.

$$IMP_t = b_0 + b_1 t + IMP_{t-1} + u_t \quad \ldots\ldots\ldots\ldots (1)$$

$$EXR_t = b_0 + b_1 t + EXR_{t-1} + u_t \quad \ldots\ldots\ldots\ldots..(2)$$

The above models are non-stationary as root ( ) ≤ 1.

$$IMP = b_0 + b_1 t + IMP_{t-1} + u_{t-1} \text{ where } \leq 1 \quad \ldots\ldots\ldots\ldots.. (3)$$

Co integration

Cointegration test is conducted after ADF test showing stationarity variables. The cointegration test is to be done to check whether there is a long term relationship existing between variables through Johansen Co-integration Test. The test results of Johansen cointegration indicate long term relationship through Trace statistic and Max-Eigen Statistics.

Granger Causality Test

Ordinarily regressions reflect "mere" Correlations, but Granger, who won a Nobel Prize in Economics, argued that there is an interpretation of a set of tests as revealing something about causality. The Standard Granger causality test (granger 1988) is a statistical hypothesis test for determining whether one time series is useful in forecasting another. Granger (Nobel Prize in Economics) causality technique measures the information given by one variable in explaining the latest value

of another variable. In addition, it also says that variable Y is granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case it means that the lagged values of variables X are statistically significant in explaining variable Y. Causality is the relationship between two variables, the first being cause and the second being effect. There are two types of causality relationship between these variable, bidirectional causality and unidirectional causality. The relationship between these two variables should be either unidirectional or bidirectional. If F-statistic $\geq$ 3.84, then Alternate hypothesis is accepted. If F- statistic < 3.84 then H_o- Null hypothesis is accepted. The test is based on the following regressions.

$$\mathbb{E}[\lambda(t+1) \in \forall | \Im(t)] \neq \mathbb{E}[\lambda(t+1) \in \forall | \Im^{-\chi}(t)]$$

$$Y_t = \beta_0 + \sum^{m}_{k=1} \beta_k Y_{1-k} + \sum^{n}_{l-1} \alpha_l X_{t-l} + u_t$$

RESULTS AND DISCUSSION

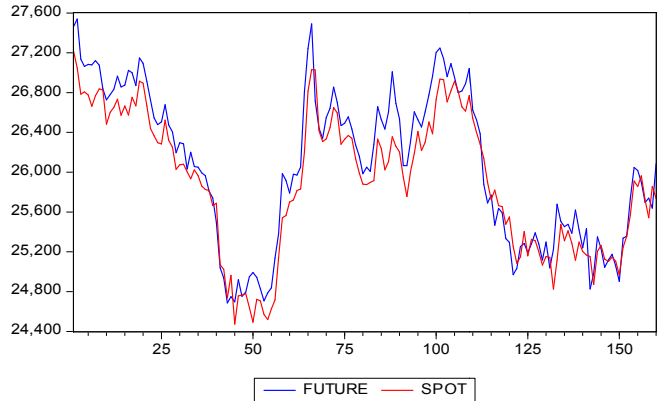

Chart I. Trend of Future and spot prices

Interpretation

On visual inspection of Chart-1 depicts the movement of future and spot prices have similar. The blue line shows future prices and the red line indicates spot prices.

The graphs show the trends in the volatility of future and spot price is moderate. From a single glance it is clear that the future and spot price share price have highly positive relationship (0.961719) in between.

Interpretation

The Table 1 shows the description statistic of the future and spot prices from May 2015 to Jan. 2016. The table gives mean, median, minimum, standard deviation, skewness and kurtosis. According to the table, the mean for gold future price is 26054.6 and gold spot price is 25896.85and the median for the same is 26054.5and 25942respectively. For the gold future the maximum value is 27539and the minimum value is 24686. For the gold spot the maximum value during the period is 27214and the minimum value is 24473. Standard deviation is the variation from the mean which is higher in gold futures than that of gold spot. It shows the level of risk in gold Futures. A negative skewness indicates that the tail on the right side is shorter than that of left side and the bulk of the values lie to the right of the mean. These have been found both in the Gold future and spot prices. If the kurtosis exceeds 3, the distribution is leptokurtic relative to the normal. If the kurtosis is less than 3, the distribution is platykurtic relative to the normal. In the above cases, Kurtosis is platykurtic because it does not exceed the 3. (Kurtosis < 3, platykurtic distribution).By using gold future price probability values0.007984and gold spot price of 0.018138of Jarque- berastastistics, null hypothesis of normality is rejected for future and spot prices at 5percent level of significance.

Interpretation

It is evident from table 2 that 87.55% of gold spot prices is determined by gold future price. T-Statistic Prob. of 0.00 indicates it is significant at 5% level of significance. R squared is 0.943094 which means 94.30% of the variation in Spot prices is explained by external factors. The null hypothesis of insignificant impact of gold future price in explaining gold spot price is rejected at fiveper cent level of significance.

Table 1. Descriptive Statistics

Descriptive Statistics	Gold FUTURE	Gold SPOT
Mean	26054.6	25896.85
Median	26054.5	25942
Maximum	27539	27214
Minimum	24686	24473
Std. Dev.	767.1655	691.6822
Skewness	-0.10269	-0.21711
Kurtosis	1.813873	1.992833
Jarque-Bera	9.66053	8.019513
Probability	0.007984	0.018138
Sum	4168736	4143496
Sum Sq. Dev.	93578312	76069468
Observations	160	160

Table 2. Regression Analysis of Gold Future and Spot Prices

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3084.007	446.006	6.914721	0
FUTURE	0.875578	0.017111	51.17121	0
R-squared	0.943094	Mean dependent var		25896.85
Adjusted R-squared	0.942734	S.D. dependent var		691.6822
S.E. of regression	165.5224	Akaike info criterion		13.06851
Sum squared resid	4328833	Schwarz criterion		13.10695
Log likelihood	-1043.48	Hannan-Quinn criter.		13.08412
F-statistic	2618.493	Durbin-Watson stat		1.179681
Prob(F-statistic)	0			

Source: Output of E-views

Table 3. Test statistic for unit root/Stationary

Augmented Dickey-Fuller test statistic					
Variables	Test Critical Values				
	1% level	5% level	10% level	t-Statistic- Calculated Value	Prob.*
Gold Spot prices	3.47199	2.87973	2.57655	12.03	0
Gold Future prices	-3.472	-2.8797	-2.5765	-10.866	0
* Prob. at 5% level of significance					

Source: Output of E-views

Table 4. Johansen Co integration Test

Johansen's Cointegration Test Results							
Variables	Cointegrating Equations	Trace Test			Maximal Eigenvalue Test		
		Statistics	Critical Values	Prob.	Statistics	Critical Values	Prob.
Spot and Future Prices of Gold	None	83.10009	15.49471	0	58.21138	14.2646	0
	Atmost 1	24.88871	3.841466	0	24.88871	3.841466	0
Trace test indicates 2 cointegratingeqn(s) at the 0.05 level							
* denotes rejection of the hypothesis at the 0.05 level							
**MacKinnon-Haug-Michelis (1999) p-values							

Source: Output of E-views

Table 5. Pair-wise Granger Causality Tests

Null Hypothesis:	Obs.	F-Statistic	Prob.	Causality	Direction
Future does not Granger Cause Spot	154	26.4243	0	Yes	Unidirectional
Spot does not Granger Cause Future		1.79086	0.12	No	

Source: Output of E-views

It is free from spurious regression since Durbin-Watson stat of 1.179681 is greater than that of R-squared of 0.943094.

Interpretation

It is disclosed from table 3 that all the absolute test statistics values are more than those of critical value. Therefore, the null hypotheses of non-stationary are rejected. It is also clear from the P value that all the P values are 0 which are less than 5 per cent. Therefore, the null hypothesis of unit root is rejected in the series. Therefore the alternative hypothesis of stationarity is accepted for all the series namely Gold Future and Spot prices at first difference.

Interpretation

The table 5 shows the cointegrated or non- cointegrated status of gold future and spot prices. The test results of Johansen cointegration represent the gold future and spot are cointegrated priced over long term. There are two statistic results namely Cointegration Rank Trace statistic and Maximum Eigenvalue statistic Tests. Trace test indicates cointegration at the 0.05 level since their statistic values are more than those of critical values and their prob. values are 0.00 and 0.00 at none and at most 1 respectively. Hence, it accepts null hypothesis of number of co integration at none and at most one. Max-eigenvalue test also indicates cointegration at the 0.05 level since their statistic values are also more than those of critical values and their prob. Values are 0.00 and 0.00 and hence, it accepts alternative hypothesis of number of cointegration. Based on the cointegration tests, we conclude there is long term relationship between gold future and spot prices.

Interpretation

Alternative hypothesis is accepted since its prob. is 0.0000 which is less than 0.05. Hence, Gold futures prices cause Gold spot prices. Whereas for null hypothesis 2, Null hypothesis is accepted which means Gold spot does not cause Gold future prices. Therefore, this proves cause and effect relationship is unidirectional and not bidirectional. Therefore, it appears that Granger causality runs one way from Gold future prices to Gold spot prices and not other way

Conclusion

It is concluded that there is long- term relationship between Gold futures prices and spot prices price traded in India on testifying Unit Root Test, Cointegration Test and Pair-wise Granger Causality Test. This study enables to determine which market is possessing better information. . Spot price of Gold is caused by the effects of Future prices. The study is immensely helpful for the investors and portfolio managers to develop effective trading and hedging strategies in the Indian gold market.

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