Price Discovery in Precious Metals Market: A Study of Gold

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Abstract

Gold is the oldest known precious metal on this earth and for a long time it has been used as a standard currency. The present study has been undertaken with an attempt to analyze whether Indian futures market is playing its role of price discovery in case of gold or not. For the purpose of study, data for spot and futures prices for a period of four and a half years starting from June 2005 to December 2009 has been collected from the website of Multi Commodity Exchange of India Limited, India's largest commodity exchange in terms of value of trading on commodity exchanges in India. Data has been tested for statioanrity and was found non stationary. It was then transformed to make it stationary. On the basis of Johansen's cointegration test, series of spot and futures prices were found cointgrated. Granger Causality test was applied on stationary data. The results of the study show that futures market in India is performing its role of price discovery in case of Gold.

Keywords:
Price Discovery, Commodity Market, Granger Causality, Cointegration.

JEL Classification: G13.

1. Introduction

Indian Commodity Futures Market has undergone many changes over time. From time to time a ban has been imposed on the future trading of commodities on the assumption that future trading leads to inflationary trends and then due to some other reasons the ban was lifted. In the periods of imposing and lifting of ban the commodity futures market has not been recognized by the Indian investors to the required extent. Although the picture has changed after the establishment of National level commodity exchanges in India since 2002-03 and there is a tremendous growth in the volume of trading on these exchanges. The same is clear from Table 1*

It is also clear from the same table that MCX is the largest commodity exchange in India on the basis of volume traded. It captures about 75% of the total volume traded in India. Value of trading of different segments on MCX has been shown with the help of Table 2.

Table 2* also shows that out of the five segments of commodities traded on MCX i.e. precious metal products, non-precious metal products, agricultural products, energy products and environmental products, the highest trading value has been captured by the precious metal segment. That is why the present study is based on precious metals market and the commodity studied is Gold.

* Table 1 & Table 2 displayed on next page.

Table 1. Trading Value on Indian Commodity Exchanges (Rs in Crores)

Year	*MCX*	*NCDEX*	*NMCE*	*Regional Exchanges*	*Total*
2003-04	2,456.23(1.90)	1,490.25(1.15)	23,840.87(18.43)	101,576.3(78.52)	129,363.65(100%)
2004-05	165,146.92(28.88)	266,338.28(46.58)	13,988.20(2.45)	126,286.2(22.09)	571,759.6(100%)
2005-06	961,632.61(44.62)	1,066,686.42(49.50)	18,385.34(0.85)	108,417.7(5.03)	2,155,122.07(100%)
2006-07	2,293,723.93(62.38)	1,167,279.39(31.75)	112,798.51(3.07)	103,124.8(2.80)	3,676,926.63(100%)
2007-08	3,125,959.12(76.88)	775,590.65(19.08)	25,414.75(0.63)	139,025(3.42)	4,065,989.52(100%)
2008-09	4,588,093.97(87.41)	535,706.96(10.21)	61,456.61(1.17)	63,698.6(1.21)	5,248,956.14(100%)
2009-10	6,393,302.16(83.81)	917,584.71(12.03)	227,901.49(2.99)	89,540.33(1.17)	7,628,328.69(100%)
TOTAL	17,530,314.94(74.67)	4,730,676.66(20.15)	483,785.77(2.06)	731,668.93(3.12)	23,476,446.3(100%)

Source: www.fmc.gov.in

MCX- Multi Commodity Exchange of India Limited

NCDEX- National Commodity & Derivatives Exchange Limited

NMCE- National Multi Commodity Exchange of India Limited

Figures in parentheses are the percentage share of different commodity exchanges in the total volume traded in Indian commodity exchanges.

Table 2. Segment Wise Trading On MCX (Rs. in Lakhs)

Segment/ Year	*Precious Metal Products*	*Non-Precious Metal Products*	*Agricultural Products*	*Energy Products*	*Environmental Products*
2003	13,681.3	-	209.2	-	-
2004	8,649,916.4	17,606.7	675,696.4	-	-
2005	38,050,457.4	427,982.9	9,943,685.2	13935330.6	-
2006	145,309,128.5	23,466,386.5	16,958,988.1	16831979.4	-
2007	132,210,618.5	85,482,086.6	10,588,403.3	44700990.8	-
2008	268,086,441.8	65,823,697.7	5,416,681.5	89002194.1	136301.1
2009	310,951,039.3	129,176,087.0	6,644,950.6	148880331.0	13184.8
2010	270,259,188.9	160,439,002.0	4,813,000.5	115972266.0	-
Total	1,173,530,472.0	464,832,850.0	55041614.7	429323092.0	149485.9

Source: www.mcxindia.com

Figures have been rounded off to one decimal place.

Objective of the Study

Multi Commodity Exchange of India Limited (including MCX-SX, a stock exchange promoted by MCX and Financial Technologies (India) Limited) has been ranked 8th by Futures Industry Association (in the June-July 2010 Volume of 'The Magazine of The Futures Industry') out of the top 30 Derivative Exchanges with an increase of 310.1% in Jan to March 2010 over the same period in 2009. But the same magazine states that volume of gold futures and gold mini futures has fallen by 31.2% and 39.5% respectively in Jan to March 2010 over Jan to March 2009. The present study has been carried out with an attempt to find out whether MCX is doing well or not in its major function of price discovery in case of gold. As the two major economic functions of a commodity futures market are price risk management and price discovery. The present research paper studies the price discovery with in market by analyzing the gold spot and futures prices at MCX.

Review of Literature

Many studies have been conducted on the price discovery aspect of future trading and the mixed results have been reached. Some studies concluded that there is unidirectional causality from futures prices to spot prices or from spot prices to futures prices, some studies concluded that there is bi-directional causality from spot prices to futures prices and from futures prices to spot prices yet some other studies reached the conclusion that there no relationship between spot prices and futures prices. Review of some of the studies is:

Cabrera Juan, Wang Tao, & yang Jian (2009) in their study on Euro and Japanese Yen exchange rates in three foreign exchange markets by using intraday data reached the conclusion that the spot market consistently lead the price discovery process for both currencies during the study period undertaken by them.

Ferretti, Figuerola, Isabel, & Gonzalo, Jesus (2006) in their study on LME traded metals aluminum, copper, nickel, lead and zinc by applying econometric techniques on the data, concluded that in case of aluminum, copper, nickel and zinc, futures price is the most efficient in reflecting the balance of supply and demand whereas in case of lead spot price is the main contributor.

Pradhan Kailash Chandra, & Bhat Sham K. (2009), studied price discovery in Nifty Futures Maket by applying Vector Error Correction Model on daily closing values of the S&P CNX Nifty index futures and spot Nifty index from June 12, 2000 to November 28, 2007 for near month futures contracts concluded that spot market leads the futures market and spot market serves as a primary market for price discovery.

Gupta Kapil and Singh Balwinder (2007) by applying Granger Causality and Vector Auto regression(VAR) on daily closing values of Nifty futures from 12th June 2000 to 30th June 2006 of near month index and stock futures reached the conclusion that futures market leads cash market.

Herbst Anthony F., McCormack Joseph P. & West Elizabeth N. studied spot and future series of Value Line Index and S&P500 Index and reached the conclusion that index future prices tend to lead those of their cash indices for both the Value Line & S&P 500.

Karande Kiran (2006) in his study on Castorseed futures market in India reached the conclusion that the futures and spot market at both Mumbai and Ahmadabad (with in market) as well as the futures market at Mumbai and Ahmadabad (across market) are mostly co integrated and there is causality information flow from futures to spot market at Mumbai and Ahmadabad (with in market).

Kavussanos Manolis G., Visvikis D., & Alexakis Panayotis (2008) studied the lead lag relationship in daily returns between price movements of the FTSE/ATHEX-20 and FTSE/ATHEX Mid-40 stock index futures and the underlying cash indices in the relatively new futures market of Greece and concluded that futures lead the cash index returns, by responding more rapidly to economic events than stock prices.

Koontz, Garcia and Hudson (1990) with the objective of determining the extent to which the spatial nature of the price discovery process has changed in the US Cattle Slaughter market studied weekly prices for fed cattle from January 1973 to December 1984 and found that cash markets have decreased their reliance on the futures market as an overall price discovery mechanism.

Yang Jian., Bessler, David A.,& Leatham David J.(2000), examined the price discovery of future markets in USA for corn, oat, soybean, three major types of wheat, cotton and pork bellies (storable commodities), hog, live cattle and feeder cattle (non-storable commodities) by applying co integration technique on the data for a period of six years and six months reached the conclusion that asset storability does not affect the existence of a long-run relationship between cash and future prices.

Nath Golaka C and Lingareddy T (2008) studied the impact of future trading on agricultural commodities prices during 2005 to 2007 and on the basis of Linear Regression and Granger Causality Test reached the conclusion that the increase in spot prices was significant during the period of future trading in case of urad whereas it was not significant in case of gram.

Min H. Jae and Najand Mohammad (1999) analyzed 10-minute intraday data from 3 May 1996 through 16 October 1996 for the Korea Composite Stock Price Index- (KOSPI) 200 index and its nearby futures contracts. They reached the result that in case of return series; futures market strongly leads cash market by as long as 30 minutes.

Oellermann Charles M., Brorsen Wade B., & Farris Paul L. (1989) conducted Granger Causality Tests to investigate lead lag relationship among cash and futures prices of feeder cattle, cash prices for feeder cattle and futures prices of live cattle, futures prices for feeder cattle and live cattle and cash prices for feeder cattle and live cattle for the periods 1979-1982 and 1983-1986 and reached the conclusion that futures markets contribute significantly towards the discovery of feeder cattle prices.

While analyzing the crude oil spot and futures prices Quan Jing (1992) in his study "Two Step Testing Procedure for Price Discovery Role of Futures prices" found that crude oil spot price generally leads the futures price in incorporating new information and that the crude oil spot market always dominates the futures markets. Thus the crude oil futures price does not play a very important role in the price discovery process.

Sahi, Gurpreet S. and Raizada, Gaurav (2006) by studying the three months wheat futures at NCDEX and testing the data for five horizons, one week, two weeks, one month, two months and three months prior to the maturity of each contract examined the performance of role of futures market i.e. price discovery reached the conclusion that futures market is not performing its main role of allowing for price discovery.

Methodology

The essence of price discovery is to establish a competitive reference (futures) price from which the spot price can be derived and hinges on whether new information is reflected first in changed futures price or changed spot price. Evidence of price changes in one market generating price changes in the other market so as to bring about a long run equilibrium relationship is given in equation 1:

$$F_t - \beta_0 - \beta_1 S_t = e_t \qquad (1)$$

Where S_t and F_t are contemporaneous cash and futures prices at time, t; β_0 and β_1 are parameters: and e_t is the deviation from parity.

If a time series is nonstationary, we can study its behavior only for the time period under consideration. Each series of time series data will therefore be for a particular episode. As a consequence, it is not possible to generalize it to other time periods. Therefore for the purpose of forecasting, such (nonstationary) time series may be of little practical value. As the data for the purpose of present study is time series data it must be tested for stationarity before applying any test on it. Stationarity can be checked in many ways- by graphically presenting the data, by applying Autocorrelation Function (ACF) and Correlogram, and by applying Unit Root Tests. In the present study stationarity has been tested by graphically analyzing the data and by applying Unit Root Test. Many unit root tests are available for the purpose of testing the stationarity. In the present study The Augmented Dickey-Fuller (ADF) test has been applied for the same. The Augmented Dickey-Fuller (ADF) test consists of estimating the following regression.

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-1} + \varepsilon_t \qquad (2)$$

If on the basis of the test time series is found to be non stationary it is transformed by differencing and made stationary.

Transforming Non Stationary Time Series: A non stationary time series is transformed to stationary time series by taking its first difference. The new series of differenced data will be:

$$\Delta X_t = X_t - X_{t-1} \qquad (3)$$

Co integration: The regression of a non stationary time series on another non stationary time series may produce a spurious regression. If two time series are not stationary in level but they are I (1) i.e. these contain a unit root and these both are stationary after first differencing. And if their linear pair is stationary i.e. residual got from the regression equation of these series is stationary i.e. I (0), then the two series are termed as co integrated. Economically speaking, two variables will be co integrated if they have a long run or equilibrium relationship between them.

Causality Test: Causality relationship is tested for the purpose of price discovery. After making the series stationary causality test may be applied to the stationary data. Granger Causality Test analyses that out of the two variables which variable causes the other variable. The test is based on the following two regression equations:

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-1} + u_{1t} \qquad (4)$$

$$X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + u_{2t} \qquad (5)$$

In the above equations it is assumed that the disturbances u_{1t} and u_{2t} are uncorrelated. Equation (4) postulates that current Y is related to past values of itself as well as that of X, and equation (5) postulates a similar behavior for X. There may be following four possible cases:

Unidirectional causality from X to Y is indicated if the estimated coefficients on the lagged X in (4) are statistically different from zero as a group (i.e., $\sum\alpha i \neq 0$) and the set of estimated coefficients on the lagged Y in (5) is not statistically different from zero (i.e. , $\sum\delta_j = 0$)

Unidirectional causality from Y to X exists if the set of lagged X coefficients in (4) is not statistically different from zero (i.e. $\sum\alpha i=0$) and the set of the lagged Y coefficients in (5) is statistically different from zero (i.e.$\sum\delta j\neq 0$)

Feedback, or bilateral causality, is suggested when the sets of X and Y coefficients are statistically significant different from zero in both the regressions.

Independence is suggested when the sets of X and Y coefficients are not statistically significant in both the cases.

Lag length: Lag Length in the present study has been determined on the basis of Schwartz Criterion. The Schwartz criterion uses a function of the residual sum of squares together with a penalty for large number of parameters. Specifically, the Schwartz information criterion minimizes the expression: T * log (RSS) + K * (log T), where T is the number of observations, RSS is the sum of the squared residuals and K is the number of regressors.

Data

The present study is based on the spot and future prices of gold for a period of four and a half years starting from June 2005 and up to December 2009. Both the price series have been collected form the website of Multi Commodity Exchange of India Limited (www.mcxindia.com). Six futures contract expiring in February, April, June, August, October and December are available for trading on this commodity exchange. Closing value of future prices for the near month contract has been taken into account. A series of 1352 spot and future prices has been analyzed with the help of EViews 6.

Table 3. Basic Statistics for Data

	*FUTURE_ PRICECLOSE_RS_*	*SPOT_PRICE__ RS__*
Mean	10823.94	10812.97
Median	9776.500	9749.000
Maximum	18121.00	18188.00
Minimum	5946.000	5970.000
Std. Dev.	2929.462	2930.641
Skewness	0.405357	0.416053
Kurtosis	2.226621	2.217281
Jarque-Bera	70.71934	73.51778
Probability	0.000000	0.000000
Sum	14633966	14619132
Observations	1352	1352

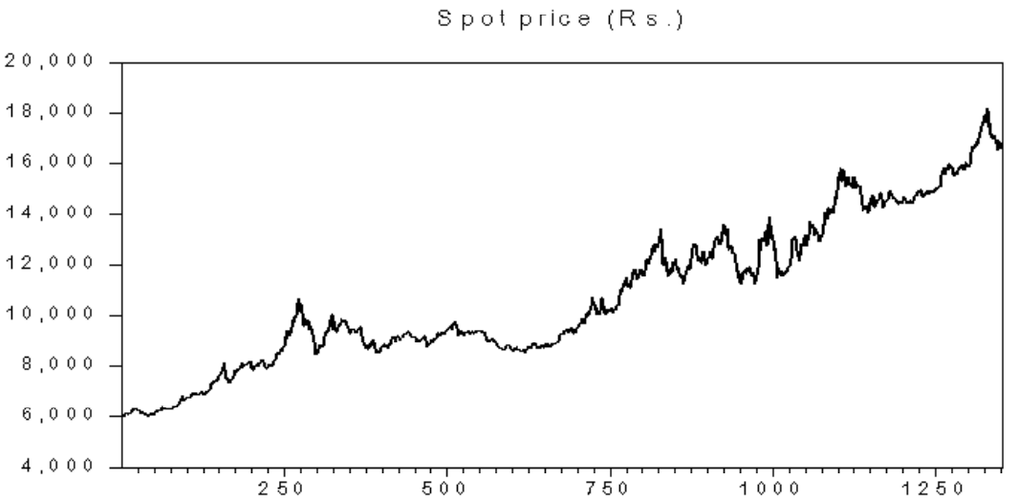
On the basis of above statistics it can be said that both the series of data have almost similar features.

Results

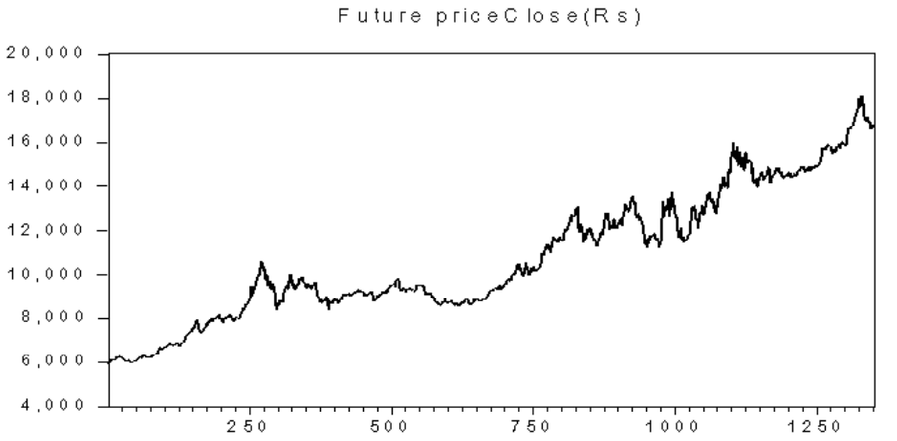
Price discovery is studied in three ways- 1. Price discovery within market i.e. price discovery in a futures market and its corresponding spot market, 2. Price discovery across markets- by designating one of the futures market as futures market and the other futures market of the same commodity as spot market (where more than one future markets are available for the same commodity), and 3. Price discovery over time- by dividing the whole period in two parts on the basis of volume traded and studying whether the price discovery role of futures market has changed over time. As the data for the purpose of the study is time series data first of all the data has been analyzed for statioanrity with the help of graphical analysis and by applying Unit Root Test.

Graphical Presentation of Data

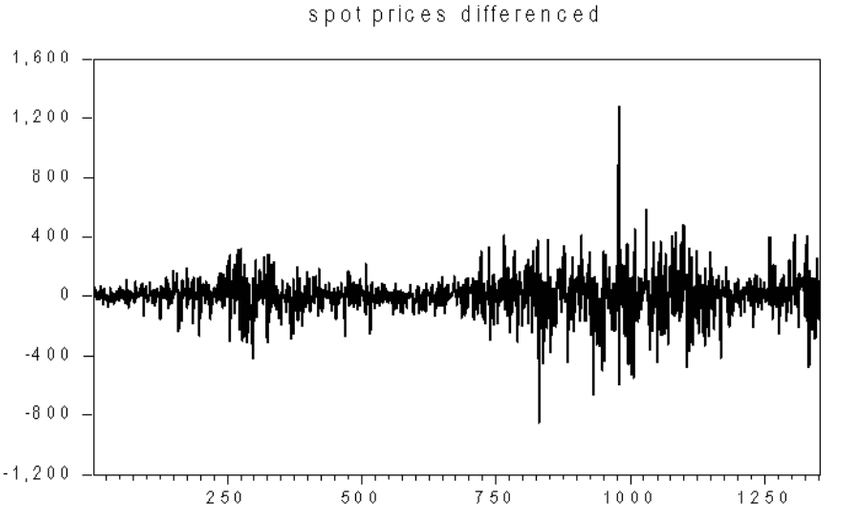
Data for Spot Prices, Futures Prices, and First difference of Spot Prices and First Difference of Futures Prices has been presented graphically to test whether the data is stationary or not:



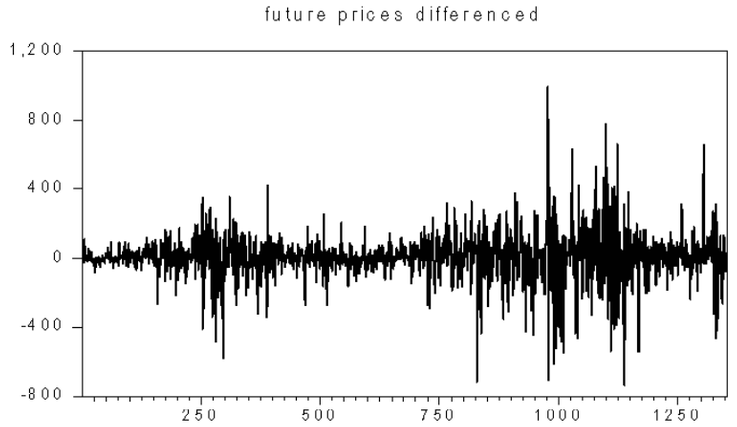
Source of Data: www.mcxindia.com



Source of Data: www.mcxindia.com



Source of data: Differenced series of spot prices data collected from www.mcxindia.com



Source of data: Differenced series of futures prices data collected from www.mcxindia.com

The above graphs show that data for spot price and futures price is not stationary in the level form but it is stationary after first difference.

On the basis of Augmented Dickey-Fuller (ADF) test the results for spot and futures prices are shown in Table 4 and Table 5

Table 4. Results of augmented Dickey-Fuller Test for Spot Prices of Gold

Null Hypothesis: SPOT_PRICE__RS__ has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic based on SIC, MAXLAG=23)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.462365	0.8958
Test critical values:	1% level	-3.434980	
	5% level	-2.863472	
	10% level	-2.567848	
*MacKinnon (1996) one-sided p-values.			

From the results shown in the above table it is clear that the null hypothesis of spot prices having a unit root can not be rejected. So it can be concluded that spot prices in the level form are not stationary i.e. they have a unit root.

Table 5. Results of augmented Dickey-Fuller Test for Futures Prices of Gold

Null Hypothesis: FUTURE_PRICECLOSE_RS_ has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic based on SIC, MAXLAG=23)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.527370	0.8833
Test critical values:	1% level	-3.434980	
	5% level	-2.863472	
	10% level	-2.567848	
*MacKinnon (1996) one-sided p-values.			

It is clear from the above table that Futures prices have also a unit root i.e. these are also not stationary in the level form.

The same test has been applied to the first difference form of the two series and the results have been tabulated below.

Table 6. Results of augmented Dickey-Fuller Test for First difference of Spot Prices of Gold

Null Hypothesis: D(SPOT_PRICE__RS__) has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic based on SIC, MAXLAG=23)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-36.07749	0.0000
Test critical values:	1% level	-3.434984	
	5% level	-2.863474	
	10% level	-2.567849	
*MacKinnon (1996) one-sided p-values.			

The above table makes it clear that first difference of spot prices doesn't have unit root i.e. this series is stationary.

Table 7. Results of augmented Dickey-Fuller Test for First difference of Futures Prices of Gold

Null Hypothesis: D(FUTURE_PRICECLOSE_RS_) has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic based on SIC, MAXLAG=23)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-37.57315	0.0000
Test critical values:	1% level	-3.434984	
	5% level	-2.863474	
	10% level	-2.567849	
*MacKinnon (1996) one-sided p-values.			

On the basis of the results of the above table it can be said that first difference of futures prices is also stationary. Thus the null hypothesis of unit root can be rejected for this series.

Level form of both the series is non stationary whereas first difference of both the series is stationary. Thus both the series are I (1) and these may be co integrated. To test whether these series are co integrated or not Johansen Cointegration Test has been applied on the series of spot prices and futures prices of the gold and the results have been shown in Table 8.

Table 8. Results of Johansen Cointegration Test

Sample (adjusted): 6 1352				
Included observations: 1347 after adjustments				
Trend assumption: Linear deterministic trend				
Series: FUTURE_PRICECLOSE_RS_ SPOT_PRICE__RS__				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.075469	105.8838	15.49471	0.0001
At most 1	0.000139	0.186818	3.841466	0.6656
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

On the basis of Johansen cointegration test it can be concluded that the spot and futures prices of gold are cointegrated and now because these two series are co integrated there must be some long term causal relationship between these two series of data. To test this long run causal relationship Granger causality Test has been applied. This test has been applied on the differenced series of spot and futures prices because only after first differencing these series are stationary. The results have been shown in Table 9.

Table 9. Results of Granger Causality Test on the first difference of Spot and Futures Prices of Gold

Pairwise Granger Causality Tests			
Sample: 1 1352			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
SPOT_PRICES_DIFFERENCED does not Granger Cause FUTURE_PRICES_DIFFERENCE	1349	2.24702	0.1061
FUTURE_PRICES_DIFFERENCE does not Granger Cause SPOT_PRICES_DIFFERENCED	556.437	9E-177	

Results of Granger Causality test show that there is unidirectional causality from difference in futures prices to difference in spot prices and difference in spot prices does not Granger cause difference in futures price i.e. difference in futures prices leads difference in spot prices. In this way it can be said that in India futures market of gold is performing its role of price discovery and it is an efficient price discovery vehicle.

Discussion

Earlier Chaihetphon Piyamas and Pavabutr Pantisa (2008) also conducted a research on the Price Discovery in Indian gold futures market. Data analyzed by them ranges from 2003 to 2007, data for futures prices was collected from the website of Multi Commodity Exchange of India Limited. The techniques used for analysis were vector error correction models (VECMs). The results of that study show that futures price leads spot price indicating that price discovery occurs in the futures market. The present study "Price Discovery in Precious Metals Market-A Study of Gold" has also been conducted on the price discovery aspect of futures prices of gold on Multi commodity Exchange of India limited. The period of study in the present case is from June 2005 to November 2009 and the technique applied is Granger Causality Test. The results of the present study confirm the results of the study undertaken by Chaihetphon Piyamas and Pavabutr Pantisa. In the study by Chaihetphon Piyamas and Pavabutr Pantisa role of standard gold future contract and mini contracts of gold were studied but in the present study only standard gold futures contract has been studied.

Conclusion

Gold is the oldest known precious metal on this earth and for a long time it has been used as a standard currency. In India even today it is believed to be a safe investment. Multi Commodity Exchange of India Limited is India's largest commodity exchange on the basis of volume traded on commodity exchanges in India. Precious metal segment captures the highest trade on this exchange. On the basis of the analysis and the discussion made above it can be concluded that the results of Unit Root Test show that the two series of spot and futures prices of gold on Multi Commodity Exchange of India Limited are non stationary in the level form. Both of these series are stationary after first differencing. Johansen Cointegration Test shows that these series of gold prices are co integrated, and the results of Granger Causality Test show that there is uni-directional causality from difference in futures prices to difference in spot prices i.e. future prices lead spot prices but spot prices do not lead futures price. Thus it can be said that MCX is doing well in its main role of price discovery in case of gold prices and futures market is an efficient price discovery vehicle.

References

1. Bose, S. (May 2008). Commodity Futures Market in India: A Study of Trends in the Notional Multi-Commodity Indices. Money & Finance, 3, p.126. Electronic copy available at: http://www.ssrn.com/abstract=1262742

2. Cabrera, J., Wang, T. & Yang, J. (2009). Do futures lead price discovery in electronic foreign exchange markets?. The Journal of Futures Markets, 29, 137-156.
3. Chaihetphon, P., & Pavabutr, P. (2008). Price Discovery in Indian Gold Futures Market. Journal of Economics and Finance, Nov., 1-13.
4. Figuerola-Ferretti, I. , & Gonzalo, J. (2006). Price Discovery in Commodity Markets: The Case of Metals. Electronic copy available at: http://ssrn.com/abstract=891030
5. Golaka, N. C., & Lingareddy T. (2008). Impact of Futures Trading on Commodity Prices. Economic and Political Weekly, 43, 3, 18-23.
6. Gujarati D. N., & Sangeetha. (2007). Basic Econometrics (4th ed.). New Delhi: Tata McGraw-Hill Publishing Company Limited.
7. Gupta, K., & Singh, B. (2007). An Examination of Price Discovery and Hedging Efficiency of Indian zEquity Futures Market. 10th Indian Institute of Capital Markets Conference Paper. Electronic copy available at: http://www.ssrn.com/abstract=962002
8. Gurpreet, S., & Raizada, G.(2006). Commodity Futures Market Efficiency in India and Effect on Inflation. Electronic copy available at: http://ssrn.com/abstract=949161
9. Herbst ,F. A., McCormack , J. P. & West , N. E. (1987). Investigation of a Lead-Lag Relationship between Spot Stock Indices and their Futures contracts. The Journal of Futures Markets, 7, 373-381.
10. Karande, K. (2006). A Study of Castorseed Futures Market in India. Unpublished doctoral dissertation, Indira Gandhi Institute of development Research, Mumbai (India). Electronic copy available at: http://www.ssrn.com/abstract=983342.
11. Kavussanos, G. M., Visvikis, I. D., & Alexakis, P. D. (2008). The Lead-Lag Relationship Between Cash and Stock Index Futures in a New Market. European Financial
12. Koontz, S. R., Garcia, P., & Hudson , M. A. (1990). Dominant-Satellite Relationships between Live Cattle Cash and Futures Markets. The Journal of Futures Markets, 10, 123-136.
13. Min, J. H., & Najand, M. (1999). A Further Investigation of the Lead –Lag Relationship between the Spot Market and Stock Index Futures: Early Evidence from Korea. The Journal of Futures Markets, 19, 217-232.
14. Oellermann, M. C., Brorsen, W. B., & Farris, P. L. (1989). Price Discovery for Feeder Cattle. The Journal of Futures Markets, 9, 113-121.
15. Pizzi, M. A. , Economopoulos, A. J., & O'neill, H. M. (1998). An Examination of the Relationship between Stock Index Cash and Futures Markets: A Cointegration Approach. The Journal of Futures Market 18, 297-305. P.298
16. Pradhan,K. C., & Bhat , K. S. (2009). An Empirical Analysis of Price Discovery, Causality and Forecasting in the Nifty Futures Markets. International Research Journal of Finance and Economics, 26, 83-92.
17. Quan J. (1992). Two-Step Testing Procedure for Price Discovery Role of Futures Prices. The Journal of Futures markets, 12, 139-149.
18. Jian, Y. ,Bessler, A .D., & Leatham, J. D. (2001). Asset Storability and Price Discovery in Commodity Futures Markets: A New Look. The Journal of Futures Markets, 21, 279-300.
19. www.futuresindustry.org accessed on 12th September 2010.
20. www.mcxindia.com accessed on 10th September 2010.