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   STATEMENT OF THE PROBLEM

   OBJECTIVES

   HYPOTHESES

   RESEARCH METHODOLOGY

   RESULTS & DISCUSSION

   FINDINGS

   RECOMMENDATIONS/SUGGESTIONS

   CONCLUSIONS

   SCOPE FOR FURTHER RESEARCH

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CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

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AN EMPIRICAL INVESTIGATION INTO CAUSAL RELATIONSHIP BETWEEN SPOT AND FUTURE PRICES OF CRUDE OIL

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ABSTRACT
The study investigates the dynamic relationship between the spot and futures prices of crude oil commodity. The objectives of the study are examined by employing ADF test to check the stationarity, Johansen's co-integration test for examining the long term relationship, OLS method to examine the significance of coefficients and Granger Causality test to know the cause and effect relationship between spot and the future prices of lead crude oil. The daily closing data is taken from 1st January 2006 to 31st December 2010 for the analysis. The findings of the study proved that the series derived from the futures prices and cash market prices for crude oil were not stationary in the level form, but there is evidence of stationarity in the first difference form. Empirical results found the existence of threshold co-integration and a bidirectional causality relationship between spot and futures markets from the Granger-Causality tests. It was revealed that futures leads the spot as well as spot causes future prices in case of commodity selected, i.e. crude oil in our case.

KEYWORDS
Spot prices, future prices, crude oil, Johansen's Co-Integration, Granger Causality.

INTRODUCTION
The dynamic relationships between spot and futures have been extensively examined and analyzed by academics and practitioners over the past three decades. The theoretical relationship between cash and futures prices can be explained by the cost of carry model. According to this view, futures prices depend on the cash prices of the asset from the present to the delivery date of the futures contracts. According to the cost of the carry model, stock and futures have been co-integrated (Wahab and Lashgari (1993), Ghosh (1993), Brenner & Kroner (1995)). More than a hundred commodities are today available for trading in the commodity futures market and more than fifty of them are actively traded. These include Bullion, Metals, Agricultural Commodities and Energy products. Crude oil is among one of the most actively traded commodity. In general, it is said that the forward and futures contracts are efficient risk management tools which insulate buyers and sellers from unexpected changes in future price movements (Black, 1976). These contracts enable them to lock in the prices of the products well in advance. Moreover, futures prices give necessary indications to producers and consumers about the likely future ready price and demand and supply conditions of the commodity traded. The cash market or ready delivery market on the other hand is a time-tested market system which is used in all forms of business to transfer title of goods. Futures and cash prices present an interesting case for application of causality-type relationships (Peck, 1985). One might expect, a priori, that a predictive relationship may exist between these two market prices. If one considers the futures prices at time t for delivery at time t + k as the expectation held at time t of the cash price in period t + k, then the relationship between futures price and cash price is defined by the order of integration of cash price (Bessler and Covey, 1991). As a result of this, it is interesting to investigate the causal relationship between both price series, in order to ascertain which series provides an indication of the other in the future, that is, if futures prices lead cash prices or vice-versa. If this is so, then cash market participants can use futures position as a risk minimization tool. Hence, this paper attempts to investigate the statistical relationship that exists between the price movements in the cash market and futures market with reference to selected crude oil commodity.

LITERATURE REVIEW
Many empirical studies have adopted the vector auto regression model (VAR) or cointegration method proposed by Engle and Granger (1987) and Johanson (1988) to investigate the dynamic relationships between spot and futures. Empirical research has produced mixed results, (a) futures prices tend to influence spot prices (b) spot prices tend to lead futures prices (c) a bidirectional feedback relationship exists between spot and futures prices. The various studies conducted on the similar lines are:

Oellermann et al. (1985) investigated lead lag relation between change in futures and spot price for live beef cattle between 1966 and 1982. The futures price led spot price during nearly every sub period analyzed. Based on Granger causality test for various sub samples of their data, they concluded that change in live cattle futures price led change in live cattle spot price. They also found that the spot market responded to change in futures price within one trading day. The authors concluded that futures market was the centre of price discovery for live cattle. They suggest that a likely explanation for the results is that the futures market serves as a focal point for information assimilation.

Harris (1989) examined the relationship between S&P 500 index and futures during the October 1987 stock market crash using five-minute data. A correlation technique and weighted least squires (WLS) model was employed for examining the objective of the study. The analysis revealed that the S&P 500 cash index displayed more autocorrelation that the futures and the futures market lead the spot market.

Pizzi et al. (1998) analyzed S&P 500 futures and cash stock exchange markets. Some one minute's data belonging to three and six months' time deposit equity contracts of S&P 500 index were examined. In this study, Unit root test, the two phase methods of Engle-Granger were used for the analyses. Engle-Granger analysis results revealed that for both three months' and six months' contracts cash prices and futures prices follow each other and futures and cash prices are co-integrated. The results of the method revealed that for both the three month and six-month contracts futures prices lead cash prices within 20 minutes. On the other hand, cash market transactions influence the three-month futures contracts in three minutes and they influence the six-month futures transactions in four minutes. The correlation between these markets is bidirectional and both markets influence each other.

Mooosa (2002) found out weather the crude oil future market perform the function of price discovery and risk transfer. The study used the daily data of spot and one-month future prices of WTI crude oil covering from 2 January 1985 to July 1996. He found that sixty percent of the price discovery function is performed in future market. The result also showed a fairly elastic supply of arbitrage service.

Asche and Guttormsen (2002) investigated the correlation between futures oil prices and cash prices. The data was composed of the price information belonging to April 1981 to September 2001 and they used Engle-Granger method and ECM methods for the analysis. The results of the analysis revealed that there is a long term relationship between futures and cash oil prices and the futures prices lead over cash prices.

Zapata, Fortenbery and Armstrong (2005) examined the relationship between 11 future prices traded in New York and the World cash prices for exported sugar by considering the observation from January 1990 to January 1995. They found that the future market for sugar leads the cash market in price discovery. However, they also found unidirectional causality from future price to spot but not vice versa. The finding of co-integration between futures and cash prices suggests that sugar future contract is a useful vehicle for reducing overall market price risk faced by cash market participants selling at the world price. Further, it was found through impulse response function that a one unit shock in the future price innovation generates a quick (one month) and positive response in futures and cash prices, but not vice versa.

Praveen and Sudhakar (2006) studied the price discovery mechanism in India's rapidly growing commodity futures market. Granger Causality test was used for the study that focuses on the Indian stock and commodity market. A comparison was drawn for price discovery between the grown stock market and the growing commodity market. Their study highlighted as to how the futures market influenced the spot market and facilitates better price discovery in the spot market. The spot and/or futures market dominated the price discovery, but it appeared that a better price discovery occurred when there was a mature futures market for the commodity.

Maslyuk and Smyth (2008) investigated the stationarity of the crude oil spot and futures prices based on a unit root with structural breaks using weekly data from January 1991–December 2004. In the light of the empirical evidence the authors report that forecasting future movements in crude oil prices based on past prices is impractible for this timeframe owing to the fact that oil spot markets and oil futures markets are efficient in the weak form with having a random walk behaviour.

Bekiros and Diks (2008) investigated the linear and nonlinear causal linkages between daily spot and futures prices for maturities of one, two, three and four months of West Texas Intermediate (WTI) crude oil. The data cover two periods October 1991–October 1999 and November 1999– October 2007, with the latter being significantly more turbulent. Apart from the conventional linear Granger test, they applied a new nonparametric test for nonlinear causality by Diks and Panchenko after controlling for co-integration. They investigated the hypothesis of nonlinear non-causality after controlling for conditional heteroskedasticity in the data using a GARCH-BEKK model. Whilst the linear causal relationships disappear after VECM co-integration filtering, nonlinear causal linkages in some cases persist even after GARCH filtering in both periods. This indicated that spot and futures returns may exhibit asymmetric GARCH effects and/or statistically significant higher order conditional moments. Moreover, the results imply that if nonlinear effects are accounted for, neither market leads or lags the other consistently, videlicet the pattern of leads and lags changes over time.

Kaufmann and Ullman (2009) used a dataset of daily prices for crude oils traded in spot and future markets with their starting date, disregarding the prices of refined petroleum products in their study. The results of their empirical tests indicate that the connections between spot and futures markets are feeble. They also find that alterations in market fundamentals and speculation give rise to the increase in oil prices.

Chinn and Coibion (2010) examined the relationship between spot and futures prices for a broad range of commodities, including energy, precious and base metals, and agricultural commodities. They examined whether futures prices are (1) an unbiased and/or (2) accurate predictor of subsequent spot prices. While energy futures prices are generally unbiased predictors of future spot prices, there is much stronger evidence against the null for other commodity markets. This difference appears to be driven in part by the depth of each market. It was found that over the last five years, it is much harder to reject the null of futures prices being unbiased predictors of future spot prices than in earlier periods for almost all commodities. In addition, futures prices do approximately as well as a random walk in forecasting future spot prices, and vastly outperform a reduced form empirical model.

Debasish (Feb 2011) examined the long-term relationship between spot prices and futures prices. The study has used daily prices (closing, opening, high and low) in both spot market and futures market for the 40 sample individual stocks drawn from six leading sectors namely, Automobiles, Banking, Cement, Gas, Oil & Refineries, Information Technology and Pharmaceutical. The period of study was from 1st January 1997 to 31st May 2009. The study begins by testing the stationarity of the spot price series and futures price series using two econometric methods namely, Philips Perron (PP) test and Augmented Dickey-Fuller (ADF) test. The long term relationship between spot prices and futures prices was statistically tested using Johansen's test of Co-integration employing likelihood Ratio (L.R.). It was found that both spot prices and futures prices for the selected companies are not stationary in the level form, but there is evidence of stationarity in the first difference form. The study finds a single long-term relationship for each of the selected companies across the six sectors. Among the selected companies in each sector, those evidencing strongest relation in respective sector were Tata Motors, Punjab National Bank, Gujrat Ambuja Cements, Bongaigaon Refineries, I-Flex and GLAXO Pharma.

Jackline and Deo (Jun 2011) observed the relationship between the futures market and spot market for the lean hogs and pork bellies markets during the sample period January 2001 through May 2010 and quantifies the price discovery function of commodity futures prices in relation to spot prices of the sample markets. The econometric tools like Unit root tests and Pair-wise Granger Causality tests were employed in the study. The Augmented Dickey Fuller tests and Phillips-Perron tests employed in the study proved that both the selected markets were stationary series and the Granger Causality test proved bi-causality relationships among these markets. It was concluded that the profitable arbitrage does not exist in both of these markets and they are said to be in perfect equilibrium.

Lee and Zeng (Sept 2011) revisits the relationship between spot and futures oil prices of West Texas Intermediate covering 1986 to 2009 with an innovative approach named quantile co-integration. In this empirical analysis, except for market efficiency, long-run co-integrating relationships and causalities between spot and futures oil prices had significant differentials among futures maturities and the performances of spot oil markets. Furthermore, the response of spot prices to shocks in 1-month futures oil prices is much steeper in high spot prices than in low spot prices.

OBJECTIVE OF THE STUDY

The specific objectives of this present study are as follows:

1. To examine the long term relationship between spot and future market prices in oil commodity.
2. To examine the cause and effect relationship between spot and future prices in oil commodity.

HYPOTHESES

The following hypotheses are formulated:

1. H_0: There is no long term relationship between spot and future prices in oil commodity.
2. H_0: There is no significant cause and effect relationship between spot and future prices in oil commodity.

DATA COLLECTION

Secondary data has been used for the analysis. The data consist of time series of daily spot and futures prices for maturities of one month of West Texas Intermediate (WTI), also known as Texas Light Sweet, which is a type of crude oil used as a benchmark in oil pricing and the underlying commodity of New York Mercantile Exchange's (NYMEX) oil futures contracts. The NYMEX futures price for crude oil represents, on a per-barrel basis, the market-determined value of a futures contract to either buy or sell 1,000 barrels of WTI at a specified time. The NYMEX market provides important price information to buyers and sellers of crude oil around the world. Daily data from 1st January 2006 to 31st December 2010 is used for all variables. Data of spot and future oil price are obtained from the EIA (Energy Information Administration) website.

RESEARCH METHODOLOGY

To check the hypothesis, following tests were used to examine the causality between spot prices and future prices of crude oil:

- ADF-Augmented Dickey Fuller test to check the stationarity of the data series.
- Johansen Co-integration test to check long term equilibrium relationship between the spot and future prices.
- Granger Causality test to check the causality

STATIONARITY

The prior step to apply any model is to analyse whether the prices are stationary or not. If the mean and variance of a series remain constant no matter at what point we measure them, then the series is stationary, i.e. they are time invariant. A series of prices that grow without bound in time is not stationary, and, in this case, the mean is not constant. Even if a price series has a constant mean, if fluctuations around that mean become increasingly larger with time, the series is again not stationary. If a time series is not stationary it is called as non stationary time series. Stationary time series is important because if it is non stationary, its behaviour can be studied only for the time period under consideration. Each set 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 non stationary time series may be of little practical value. To test the stationarity of the data, we used ADF (Augmented Dickey Fuller) test. The ADF test is applied to the model:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta \Delta y_{t-1} \pm - - - - + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

Where α is a constant, β the coefficient on a time trend and p the lag order of the autoregressive process. The hypothesis taken for spot prices of crude oil is:

H_0=Spot rate series of crude oil is not stationary (has unit root)

The hypothesis taken for future prices of crude oil is:

H_0=Future rate series of crude oil is not stationary (has unit root)

JOHANSEN CO-INTEGRATION

The co-integration is tested by using Johansen co-integration test. The aim of this test is to determine whether a long-term relationship exists between the variables or not. Johansen's methodology takes its starting point in the vector auto regression (VAR) of order p given by

$$y_t = \mu + A_1 y_{t-1} + \cdots \ldots \ldots + A_p y_{p-t} + \varepsilon_t$$

Where y_t is an n×1 vector of variables that are integrated of order one – commonly denoted

I(1) and ε_t is an n×1 vector of innovations.

The hypothesis taken is:

H_0=There is no long term relationship between Spot and future prices of crude oil

OLS METHOD

Ordinary least squares (OLS) is a method for estimating the unknown parameters in a linear regression model. This method minimizes the sum of squared vertical distances between the observed responses in the dataset and the responses predicted by the linear approximation. The OLS estimator is consistent when the regressors are exogenous and there is no multi collinearity, and optimal in the class of linear unbiased estimators when the errors are homoscedastic and serially uncorrelated. Under these conditions, the method of OLS provides minimum-variance mean-unbiased estimation when the errors have finite variances. Under the additional assumption that the errors benormally distributed, OLS is the maximum likelihood estimator.

Suppose the data consists of n observations { yi, xi }ni=1. Each observation includes a scalar response y_i and a vector of predictors (or regressors) x_i. In a linear regression model the response variable is a linear function of the regressors:

$$y_i = x_i'\beta + \varepsilon_i,$$

where β is a p×1 vector of unknown parameters; ε_i's are unobserved scalar random variables (errors) which account for the discrepancy between the actually observed responses y_i and the "predicted outcomes" $x'_i\beta$; and ′ denotes matrix transpose, so that x′ β is the dot product between the vectors x and β. This model can also be written in matrix notation as

$$y = X\beta + \varepsilon,$$

where y and ε are n×1 vectors, and X is an n×p matrix of regressors, which is also sometimes called the design matrix.

As a rule, the constant term is always included in the set of regressors X, say, by taking x_{i1} = 1 for all i = 1, …, n. The coefficient $\beta_1$corresponding to this regressor is called the intercept.

GRANGER CAUSALITY TEST

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. A time series X is said to Granger-cause Y if it can be shown that the X values provide statistically significant information about future values of Y. In the Granger-sense, X is a cause of Y if it is useful in forecasting Y. In this framework "useful" means that X is able to increase the accuracy of the prediction of Y with respect to a forecast, considering only past values of Y.

Let y and x be stationary time series. To test the null hypothesis that x does not Granger-cause y, one first finds the proper lagged values of y to include in a univariate autoregression of y:

$$y_t = a_0 + a_1 y_{t-1} + a_2 y_{t-2} + \cdots \ldots \ldots + a_m y_{t-m} + \text{residual}_t$$

Where y_{t-j} is retained in the regression if and only if it has a significant t-statistic; m is the greatest lag length for which the lagged dependent variable is significant.

The hypothesis taken is:

$H_{0=}$Future prices of crude oil does not cause spot prices of Crude oil

$H_{0=}$Spot prices of crude oil does not cause future prices of Crude oil

ANALYSIS AND FINDINGS

STATIONARITY

As said, the ADF test is applied and the results can be seen in table 1 for spot price series and table 2 for future price series. The hypothesis taken for spot prices of crude oil is:

H_0=Spot rate series of crude oil is not stationary (has unit root)

TABLE 1: AUGMENTED DICKEY-FULLER TEST FOR SPOT PRICES

		t- Statistic	Prob.
At Level I(0) Trend			
Augmented Dickey-Fuller Statistic		-1.793211	0.3842
Test critical values	1% level	-3.435340	
	5% level	-2.863631	
	10% level	-2.567933	
At Level I(0) Trend and Intercept			
Augmented Dickey-Fuller Statistic		-1.825783	0.6918
Test critical values	1% level	-3.965363	
	5% level	-3.413390	
	10% level	-3.128731	
At Level I (1) Trend			
Augmented Dickey-Fuller Statistic		-35.47300	0.0000
Test critical values	1% level	-3.435344	
	5% level	-2.863633	
	10% level	-2.567934	

It can be seen from the table 1 that the spot rate series is not stationary in its level form, but there is evidence of stationarity in the first difference form. The p value at first difference level is less that .05 and thus the null hypothesis is rejected. The series is made stationary at first level of difference.

The hypothesis taken for future prices of crude oil is

H_0=Future rate series of crude is not stationary (has unit root)

TABLE 2: AUGMENTED DICKEY-FULLER TEST FOR FUTURE PRICES

		t- Statistic	Prob.
At Level I(0) Intercept			
Augmented Dickey-Fuller Statistic		-1.809744	0.3760
Test critical values	1% level	-3.435340	
	5% level	-2.863631	
	10% level	-2.567933	
At Level I(0) Trend and Intercept			
Augmented Dickey-Fuller Statistic		-1.841035	0.6842
Test critical values	1% level	-3.965363	
	5% level	-3.413390	
	10% level	-3.128731	
At Level I (1) Intercept			
Augmented Dickey-Fuller Statistic		-37.08157	0.0000
Test critical values	1% level	-3.435344	
	5% level	-2.863633	
	10% level	-2.567934	

Table 2 represents the ADF result for future price series. It shows that the series is not stationary in its level form, but there is evidence of stationarity in the first difference form. The p value at first difference level is less that .05 and thus the null hypothesis is rejected. The series is made stationary at first level of difference.

JOHANSEN CO-INTEGRATION TEST

The hypothesis taken is:

H_0=There is no long term relationship between Spot and future prices of crude oil

TABLE 3: JOHANSEN CO-INTEGRATION TEST

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.204538	289.5118	15.49471	0.0001
At most 1	0.002221	2.785461	3.841466	0.0951
Trace test indicates 1 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Co-integration Rank Test (Maximum Eigen value)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.204538	286.7264	14.26460	0.0001
At most 1	0.002221	2.785461	3.841466	0.0951
Max-Eigen value test indicates 1 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

From table 3, it can be seen that there is one co-integrating equation at 0.05 level according to both Trace Statistic as well as Max Eigen Value. This implies that there is long term association between the spot and future prices of crude oil commodity.

OLS METHOD

The paper employs OLS Method to determine significance of coefficients

H_0 : The coefficients are not significant

TABLE 4: OLS METHOD

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.642794	0.029362	-21.89233	0.0000
C(2)	0.175662	0.028182	6.233025	0.0000
C(3)	0.022845	0.012573	1.817077	0.0693
C(4)	0.246844	0.031018	7.958119	0.0000
C(5)	-0.187181	0.028257	-6.624352	0.0000
C(6)	0.000224	0.000339	0.660035	0.5093
C(7)	-0.097735	0.066157	-1.477323	0.1397
C(8)	0.164027	0.063500	2.583110	0.0098
C(9)	0.074454	0.028328	2.628246	0.0086
C(10)	-0.150188	0.069889	-2.148955	0.0317
C(11)	-0.210820	0.063667	-3.311297	0.0009
C(12)	0.000331	0.000765	0.433173	0.6649
Determinant residual covariance		1.02E-07		
Equation: D(SPOT) = C(1)*(SPOT(-1) - 1.00896531416*FUT(-1) + 0.0409150021515) + C(2)*D(SPOT(-1)) + C(3)*D(SPOT(-2)) + C(4) *D(FUT(-1)) + C(5)*D(FUT(-2)) + C(6)				
Observations: 1255				
R-squared	0.807537	Mean dependent var		0.000299
Adjusted R-squared	0.806767	S.D. dependent var		0.027342
S.E. of regression	0.012019	Sum squared resid		0.180422
Durbin-Watson stat	2.018321			
Equation: D(FUT) = C(7)*(SPOT(-1) - 1.00896531416*FUT(-1) + 0.0409150021515) + C(8)*D(SPOT(-1)) + C(9)*D(SPOT(-2)) + C(10) *D(FUT(-1)) + C(11)*D(FUT(-2)) + C(12)				
Observations: 1255				
R-squared	0.015336	Mean dependent var		0.000296
Adjusted R-squared	0.011394	S.D. dependent var		0.027236
S.E. of regression	0.027081	Sum squared resid		0.915968
Durbin-Watson stat	2.008551			

From table 4, its clearly visible that coefficients C(1),C(2),C(4),C(5),C(8),C(9),C(10)and C(11) are significant as p-values are less than 0.05. Hence we reject null hypothesis and these coefficients are significant.

GRANGER CAUSALITY TEST USING WALD STATISTICS

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another.

H0: Lagged values of coefficients in each equation are zero

TABLE 5: GRANGER CAUSALITY TEST USING WALD STATISTICS

DEPENDANT VARIABLE		
	D(SPOT) p-value	D(FUT) p-value
D(SPOT)	0.0000 C(2)=C(3)=0	0.0000 C(4)=C(5)=0
D(FUT)	0.0024 C(8)=C(9)=0	0.0037 C(10)=C(11)=0

In the above table, we observe that there runs causality running from independent to dependant variable.

The Hypothesis taken are:

H_0=Future prices of crude oil does not cause spot prices of Crude oil

H_0=Spot prices of crude oil does not cause future prices of Crude oil

TABLE 6: GRANGER CAUSALITY TEST (CHI SQUARE TEST)

Dependent variable: D(SPOT)			
Excluded	Chi-sq	df	Prob.
D(FUT)	223.1089	2	0.0000
All	223.1089	2	0.0000
Dependent variable: D(FUT)			
Excluded	Chi-sq	df	Prob.
D(SPOT)	12.09766	2	0.0024
All	12.09766	2	0.0024

We can observe from the table 5 that p values are significant at 5%. Hence, we reject null hypothesis. There is a bi-directional causality between spot prices and future prices of crude oil. i.e Spot prices causes future prices and Future prices do have an impact on spot prices of crude oil.

CONCLUSION

This paper discusses the interdependence between spot and futures market for crude oil. We examined whether there is any statistically significant evidence that the trading activity in futures markets of commercial and non-commercial traders had a systematic influence on the price of crude oil. The result implies that there is long term association between the spot and future prices of crude oil commodity. Analysis also reveal that there is a bi-directional causality between spot prices and future prices of crude oil i.e Spot prices causes future prices and future prices do have an impact on spot prices of crude oil. The results are of interest both for a contribution to an extensive financial literature on the interplay between spot and futures markets and for potential investors and speculators strategies. The significant rise in longer-dated futures prices reflects the perception of continued tightness in the physical market, and is facilitated by increased investor interest. The organized exchanges such as NYMEX allow for the competitive interaction of thousands of independent traders, including both commercial as well as financial institutions. These interactions, in turn, give rise to publicly reported futures prices that reflect the market's best estimate today of what future supply and demand conditions and, hence, prices will be. Futures market brings together valuable information about the market's expectations about future supply and demand conditions in the physical market – conditions that will ultimately determine the price for oil. As a result of our findings and interpretations and thus in view of above arguments, it can be concluded that there is a **bi-directional causality** between the spot prices and future prices of crude oil.

REFERENCES

1. Asche F., Guttormsen A.G., "Led Lag Relationship Between Futures and Spot Prices", Working Paper No. 2/02, Institute for Research in Economics and Business Administration, Bergen January 2002, (http://bora.nhh.no/bitstream/2330/ 898/1/A02-02.pdf, E:05.10.2007)
2. Bekiros, S. D., and Diks, C.G., "The Relationship between Crude Oil Spot and Futures Prices: Cointegration, Linear and Nonlinear Causality" Energy Economics (2008), 2673–2685, journal homepage: www.elsevi e r.com/locate/eneco
3. Bessler DA, Covey T. (1991), "Cointegration - Some Results on U.S. Cattle Prices", Journal of Futures Market, 11, pp 461-474
4. Black, F., (1976), "The Pricing of Commodity Contracts", Journal of Financial Economics, 3, pp 167-179
5. Bopp, A. E., and Sitzer, S., (1987), "Are petroleum futures prices good predictors of cash value?", The Journal of Futures Markets, 7, pp 705–719
6. Brenner, R. J. and Kroner, K. F.. (1995) "Arbitrage, Cointegration and Testing the Unbiasedness Hypothesis in Financial Markets", Journal of Financial and Quantitative Analysis, Vol. 30, pp. 23-42
7. Brooks, C., (1996), "Testing for nonlinearities in daily pound exchange rates", Applied Financial Economics, 6, pp 307-317
8. Chien-Chiang Lee and Jhih-Hong Zeng, (Sept 2011), "Revisiting the relationship between spot and futures oil prices: Evidence from quantile cointegrating regression", Energy Economics, Vol. 33, Issue 5 , pp 924–935
9. Choudhury, A R., (1991), "Futures market efficiency: Evidence from cointegration tests", The Journal of Futures Markets, 11, pp 577–589
10. Debasish, S.S., (Feb 2011), "Analysis of Long-Term Relationship between Spot and Futures prices Using Johansen's Test of Cointegration", Information Management and Business Review Vol. 2, No. 2, pp 65-80
11. Engle, R.F. and Granger, C.W.J., (1987), "Cointegration, and error correction: representation, estimation and testing", Econometrical, 55, pp 251–76
12. Ghosh, A., (1993) "Hedging with Stock Index Futures: Estimation and Forecasting with Error Correction Model", Journal of Futures Markets, 13, pp 743-752
13. Harris, C. (1989), "The October 1987 S&P 500 Stock-Futures Basis", The Journal of Finance, Vol. XLIV, No.1, pp 77-99
14. Jackline, S., and Deo, M., (Jul 2011), "Lead - lag relationship between the futures and spot Prices", Journal of Economics and International Finance, Vol. 3(7), pp 424-427, Available online at http://www.academicjournals.org/JEIF
15. Johansen, S., (1988), "Statistical analysis of cointegration vectors", Journal of Economic and Dynamics and Control, 12, pp 231–54
16. Kaufmann, R.K., and Ullman, B., (2009), "Oil prices, speculation and fundamentals: interpreting causal relations among spot and futures prices", Energy Economics, 31, pp 550-558
17. Kawaller, I.G., Koch, P.D., and Koch, T.W., (1988), "The relationship between the S&P 500 index and the S&P 500 index futures prices Federal Reserve Bank of Atlanta", Economic Review, 73 (3), pp 2–10
18. Krehbiel, T., and Adkins, L.C., (1993), "Cointegration tests of the unbiased expectations hypothesis in metals markets", The Journal of Futures Markets, 13, pp 753–763
19. Maslyuk, S., Smyth, R., (2008), "Unit root properties of crude oil spot and futures prices", Energy Policy. 36, pp 2591-2600
20. Moosa, I.A., (2002), 'Price discovery and risk transfer in the crude oil futures markets: some structural time series evidence', Benna Monte del Paschi de Sienna Spa, Vol.31, Blackwell Publishers
21. Oellermann, C.M., Brorsen, B.W., and Farris, P.L. (1985), "Price discovery for feeder cattle", Journal of Futures Market, 9, pp 113-121
22. Peck, A.E., (1985), "The Economic Role of Traditional Commodity Futures Markets. In: Futures Markets: Their Economic Roles, A.E. Peck, ed., American Enterprise Institute for Public Policy Research: Washington.
23. Pizzi, M.A., Economopoulos A.J., and O'neill, H.M., (1998), "An Examination of the Relationship Between Stock Cash and Futures Markets: A Cointegration Approach", The Journal of Futures Markets, Vol. 18, No.3, pp 297-305
24. Praveen, D. G. and Sudhakar, A., (2006), "Price Discovery and Causality in the Indian Derivatives Market", ICFAI Journal of Derivatives Markets, 3(1), pp 22-29
25. Sadorsky, P., (2000), "The empirical relationship between energy futures prices and exchange rates", Energy Economics, 22 (2), pp 253-266
26. Wahab, M. and Lashgari, M., (1993), "Price Dynamics and Error Correction in Stock Index and Stock Index Futures Markets: A Co-integration Approach", The Journal of Futures Markets, 13, pp 711-742
27. Zapata, H., Fortenbery, T.R. and Armstrong, D., (2005)', 'Price discovery in the world sugar futures and cash markets: implications for the Dominican Republic', Staff Working Paper No.469, March, Agricultural and Applied Economics

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