Crude Oil Pricing: Fantasies in Stock Futures Pricing in India

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Present paper had cross-sectional analysis of Crude Spot, Crude Futures and Stock Futures using GARCH (1, 1) Model and explored Karl Pearson Correlation among the variables individually and collectively with respect to volatility clustering, Regression and Granger Causality Test to mange challenges in uncertain environment. It unearthed facts that Crude Futures is independent variable and has no bonding of stock futures returns and spot market prices but crude when studied as dependent variable; there was least impact. It unfolded fact that stock futures discovered their prices from crude futures for period 1st June, 2009 to 31st March, 2014.

KeyWords: Crude Spot, Crude Futures, Stock Futures, GARCH, Granger Causality.

1. Introduction

Oil is a heterogeneous commodity. Crude oil has varied characteristics, quality, and market penetration which determine its price mechanism globally through values of underlying assets. Crude oil is considered to be the world's most influential physical commodity that plays a prominent role in all economies by way of trade mobilization and production of utility based commodities. Thus, oil price fluctuations affect the world economy in different and significant ways (Bapna, et. al., 2013). Rise in crude oil prices increases the cost of production of goods, services, transportation and heating. The change in crude oil prices can create both direct and indirect pressure on the worlds' economy and its volatility drive many companies away and it affects the stock market also. India satisfies its major crude oil requirements by importing it from oil producing nations.
Therefore, any upward and downward movements in prices are closely tracked in the domestic market place which is influenced by international factors. Continuous instability in crude oil prices has an impact on the other industrial segments also. Higher crude oil price results into the higher price of energy, which negatively affects other trading practices (Sood, et. al., 1012). The investors react differently towards the rapidly changing oil prices for their interest as the different industries also get affected by such changes. It is observed that, in the short run, price of crude oil is influenced by many factors like, socio, economic and political events, status of financial markets, whereas in a medium to long run, it is influenced by the fundamentals of demand and supply resulting into self-price correction mechanism. There are numerous other factors which influence the price movement of crude oil internationally also. The behaviour of oil prices has received special attention in the current environment of rapid rises and marked increase in oil price volatility. It is widely believed that high oil prices can slow economic growth, cause inflationary pressures and create global imbalances. Volatile oil prices can also increase uncertainty and discourage much-needed investment in the oil sector. High oil prices and tight market conditions have also raised fears about oil scarcity and concerns about energy security in many oil-importing countries (Fattouh, 2007).

India fulfills its major crude oil requirements by imports. Though it is large ones, like other oil importing countries, it is price-taker in the international oil market; countries usually exercise discretion in passing on international price shocks to domestic prices, sometimes immediately and sometimes with lag. Crude oil price determination mechanism is still not left open fully to the market forces as it is a developing country. The administered price system has traditionally offered a mechanism to cushion the international price changes and achieve domestic policy objectives on inflation, growth and equity (Park and Ratti, 2008). The administered price system for oil is supported by subsidies in budgets. Present international situations do not support subsidy based system. The pass-through policy, presently on the reform agenda, thus, has important implications for the way international oil price changes impact the macro economy (Hammoudeh, et. al., 2004; Hammoudeh and Huimin, 2005). Seasoning and maturity of Indian economy needs to understand crude oil price determination independently, thus, a relationship based understanding of the variables is the need of the hour. This paper is an attempt to present a two way study causal relationship, volatility and impact of crude futures, crude spot and nifty stock futures.

How would one go in explaining relationship between crude oil and stock futures? Seasoning and maturity of Indian capital market needs to understand crude oil price determination independently, thus, a volatility analysis is used in understanding the causal effect among crude futures and stock futures. Knowing whether stock futures are effective on crude oil returns or not makes investors and financial analysts hopeful to compile an algorithm and obtain a fair price and a reasonable return from investment in crude oil so as to create a better hedge. It is tried in the present study to evaluate the relationship, impact causal relationship and volatility analysis of stock futures on crude oil futures return using various methods and models.

2. Literature Review

The study suggests that gold is an integral part of the international reserve portfolio of several countries including the oil

producing countries, the research argued that if some shock leads to expectations of official gold purchases, the expected future price of gold will rise. When oil price rises, oil exporter's revenues from oil tends to rise, This also argued that, this may have implications for the price of gold, provided that gold consists of a significant share of the asset portfolio of oil exporters (relative to other nations) and oil exporters purchase gold in proportion to their wealth. This will lead to a rise in demand for gold and a rise in price of gold. Hence, an oil price rise leads to a rise in gold prices (Melvin and Sultan, 1990). Empirical results show that, from 1970 to1988, gold prices and stock/ bond markets had negative correlation that is when gold prices were rising, the stock/ bond were declining (Moore,1990).

Changes in exchange rate affect international trades; thereby, affect the stock market of the country. When domestic exchange rate appreciates, the domestic currencies importers need to exchange for the same amount of foreign currencies will decrease and hence the costs of imports decrease. With the same selling price for the merchandises, the profits increase and stock prices go up; On the contrary, when domestic exchange rate depreciates, the domestic currencies exporters will receive for the same amount of foreign currencies will decrease. With the same selling price for the merchandises, profits decrease and the stock prices go down. It can be seen that changes in the exchange rate, through changes in costs and revenues, will have direct impact on profits and, thus, impact on stock prices. Therefore, it is necessary to explore the impact of exchange rate fluctuations on stock indices in various countries (Golub, 1983; Krugman, 1983; Bloomberg and Harris, 1995).

The study was conducted using crude oil, stock returns, interest rate and industrial production implying negative returns caused by all these factors on crude oil. The study based on US economy which shows that, oil price volatility shocks have asymmetric effects on the economy. On analysing the impulse response functions, it was concluded that oil price movements are important in explaining movements in stock returns. The oil price movements explain a larger fraction of the forecast error variance in real stock returns than do interest rates that results in positive shocks to oil prices depress real stock returns while shocks to real stock returns have positive impacts on interest rates and industrial production (Sardosky, 1999). The study focused on volatility of the price of a barrel Brent crude oil, over the period ranging from 1982 to 2002 representing that, there were no asymmetric leverage effects of crude oil. The paper also unfolds the nature of dependence of the conditional variance on past volatility in oil prices. Time-varying conditional variances are estimated using univariate (G)ARCH models. The result was the same that there is no conditional heteroscedaticity or conditionality of crude oil pricing (Kuper, 2002).

Oil prices can affect stock prices in several ways. When oil price changes and volatility exceeds a threshold they possess as significant explanatory power for the outcome of economic variables such as industrial production and stock market returns. Further, it was also examined how unexpected oil price shocks affect the dynamics of US Stock Market returns showing unexpected jumps. The unexpected oil price shocks as jump shocks originating from the crude oil market and its impact on the distribution of US Stock Market returns using an asymmetric GARCH-jump model was very high (Huang, et al, 2005). The price of gold and stock, among others, can help to form expectations of higher inflation over time. In the short run, only gold price impacts the interest rate in Japan. Overall findings could benefit both the Japanese monetary authority and investors who hold the Japanese Yen in their portfolios. The study also infers that when a common stochastic shock hits the system, all the variables move together but the four variables: oil price, gold price, stock price and exchange rate move first and then the interest rate follows (Liao and Chen, 2005).

Rising oil prices are often seen as inflationary by policy makers and central banks respond to inflationary pressures by raising interest rates which affects the discount rate. When oil prices rise, economic always falls into a recession and stock market declines; hence oil price is a critical leading indicator of the economy health and change in the stock market (Basher and Sadorsky, 2006). India is one of the largest consumers of crude oil, importing nearly 70% of its requirement, due to which, the oil price shocks are more vulnerable and the price hike is observed. Oil prices have been gradually rising from mid 2001 and there has been a phenomenal acceleration in the recent months. The reasons for the increase in the oil prices can be observed both from the demand side and the supply side. On the demand side, the most prominent reason for the recent snowballing in the price of oil is the corresponding world economic growth (Pescatori and Mowry, 2008). While China and USA have shown the largest increase in the consumption of oil over the past years, countries like India and Japan have also parallel raised their consumption of oil. The other cited supply side factors affecting the oil price hike is the low stock of fuel in the US due to the devastating effects of natural disasters like Katrina and Rita, oil supply bottlenecks, low inventories and very low output capacity (Boyer and Filion, 2007; Henriques and Sadorsky, 2008).

Oil price has a crucial role in explaining the stock market performance in oil-importing countries. The impact was less for oil-exporting countries. For most European countries, an increase of oil price volatility significantly depressed the real stock market returns. For the United States, shocks of oil price appear to explain more of fluctuations in real stock returns compared to those of interest rates (Park and Ratti, 2008; Kilian, 2009).The study concludes that the interest rates may also affect oil prices through a connection with inflation. Unexpected inflation erodes the real value of investments like stocks and bonds. Central banks can respond to inflationary pressures by raising interest rates. International investors looking for better investments in inflationary times may prefer to invest in real assets like oil, which drives the price of oil up and puts further pressure on inflation. Recycled petrodollars from oil rich countries can help to reduce the impact of increases in interest rates (Akram, 2009). The researchers tested a mediator variable between Crude Oil Company and stock exchange in England, France and Japan by E-GARCH model. They discovered two implied events in series behaviours' a low median and high variance as well as high median and low variance relation. The study concludes that, economic crisis followed low median and high variance regimes against crude oil pricing mechanism (Alouei and Jamazi, 2009).

The study measured a dynamic relation between stock exchange and crude oil prices in Russia by two variables E-GARCH model and concluded that there exists a negative relation between Russia stock exchange and crude oil prices (Behran and Nikolovann, 2010). The relationship between oil price and Vietnam Stock Market exists for a very reason. There is a long-run relationship, among oil price, the nominal exchange rate of Vietnamese Dong vis-à-vis the US Dollar (VND/USD exchange rate) and Vietnam's stock prices. It was also concluded that both oil price and the VND/USD exchange rate have significantly positive effect on Vietnam's stock prices (Narayan and Narayan, 2010). Oil prices respond not just only to economic fundamentals like, oil supply and real economic activ1ity, but also to movements in emerging stock prices and the Treasury Bills and Euro Dollar Futures (TED) Spread. Stock markets are often seen as leading economic indicators. Rapidly rising stock prices in emerging markets signals the expectation of higher economic growth ahead. If emerging market stock prices get trapped in a bubble, however, oil prices will overshoot in relation to economic fundamentals (Basher, et. al., 2010).
There exist co-integrations among fluctuations in oil price, gold price and exchange rates of the Dollar vs. various currencies, and the stock markets in Germany, Japan, Taiwan and China. This indicates that there exist long-term stable relationships among these variables. Whereas, there is no co-integration relationship among these variables and the US Stock Market indices which indicates that there is no long-term stable relationship among the oil price, gold price and exchange rate and the US Stock Market index. In addition, results of the causal relation empirically showed that in Taiwan, oil price, stock price and gold price have two-way feedback relations (Wang, et. al., 2010). The researcher used co-integration and VECM analysis found that, overall BRICs have strong, stable, bidirectional and long-term relationship with the BRENT price index. The results also illustrated an absence of short-term linkages of crude oil importing countries with BRENT except Russia where it can influence the short term oil prices. The study also showed the volatility spill over effects and found that equity markets are highly interconnected with crude oil market where shocks and spill over were found to be significant and bidirectional in nature (Khan, 2010).

In case of inflation, industry, interest rates and stock prices of gold mining companies least squares method verified Just Inflation Regression Model. Regarding Granger Causality Test, causal links between gold and oil price levels was identified and Johansen Co-integration Test revealed long-term relationship between examined variables and Vector Error Correction Model confirmed, that after market fluctuations, both time series return to long-term equilibrium (Simakova, 2011). The relationship between oil prices and emerging market stock prices and oil prices and exchange rates were studied. A relatively little is known about the relationship between oil prices, exchange rates and emerging stock markets. The researchers proposed and estimated a structural vector auto- regression and investigated that the dynamic relationship between these variables exists in long run. The model supports the facts that, positive shocks to oil prices tend to depress emerging market stock prices and US dollar exchange rates in the short run (Basher et. al., 2011).

The researchers used a single variant GARCH model to test S&P 500 index and WTI crude oil prices relation and concluded that there exist significant volatilities in crude oil prices which would have negative impact on S&P500 return but their results has not been approved in low price volatilities (Lee and Chiou, 2011). The study conferred that the oil price shocks have two different negative effects on firm profitability. First, it has a direct negative effect as it increases the production costs of firms and secondly, it has an indirect negative effect because investors foresee the decline in profit margins of firms and make decisions that affect the stock market indexes. The study recommended that policies should be improved for enhancing energy efficiency; promote energy conservation and use of alternative fuels (i.e. coal, natural gas and renewable energy). The research finally infers that, oil-importing countries should enhance dialogue with oil-exporting countries in order to increase multilateral cooperation and to minimise shocks that have an adverse effect on the national economy (Masih et. al., 2011).

An increase in the price of oil culminates in an appreciation of the Nigerian exchange rate against the US Dollar. An asymmetric effect was established with regards magnitude of positive and negative oil price shocks on exchange rate volatility. The results, for the GARCH models, indicated that a 100% increase in oil price returns leads to a 1.073% appreciation of the Naira with respect to the US Dollar, while for the EGARCH, the magnitude of response is slightly higher at about 1.140% (Adeniyi, et. al., 2012). The study focused on measuring the volatility of crude oil and gold prices using GARCH model then the relation of gold, crude oil prices and their volatilities with stock markets of selected member of OPEC was examined by panel data model. The results showed that, crude oil price had significant positive effect on stock index of studied countries; also gold price had noticeable significant negative effect on stock indices of selected country meanwhile crude oil and gold volatilities' had respectively low positive effects and noticeable significant positive effects on stock markets of studied countries. The study concludes that although crude oil price volatility had inevitable impact on most of the macroeconomic factors, because of small scale of capital market for selected countries and lag of its impact on corporations profitability and their stock prices, stock index in those countries had a minor repercussion to Global crude oil prices . Hence stock index reaction to gold price and its volatility was rigorous and stock indices volatility is more predictable by Global gold price index (Hamed and Ehsan, 2012).

The paper investigated the co-movements of World Gold price, World Oil price, US Stock price (measured by Dow-Jones Industrial Index) and real exchange rate for US dollar over a period of time using daily data for over twenty years. It was examined that the existence of co-integration, common trend, Granger causality and volatility spillover for these macro variables. The study concludes the existence of co-movements among them however, not all of them are moving simultaneously. The study also inferred that, stock price and gold price are more likely to move on their own while oil price and exchange rates likely to be influenced by other variables (Samanta and Ali, 2012).

3. Objectives

The research objectives are as follows:

Note: Nifty Stock Futures used in study are (ACC AMBUJA ASIANPAINTS AXISBANK BAJAJAUTOS BHARTI BHEL BOB BPCL CAIRN CIPLA DLF DRREDDY GAIL GOLD_FUTURES GOLD_SPOT GRASIM HCLTECH HDFC HDFCBK HEROMOTO HINDALCO HINDLEVER ICICIBK IDFC INFY ITC JINDAL JPASSO KOTAKBK LNT LUPIN MARUTI MNM NTPC ONGC PNB POWERGRID RANBAXY RELIANCE SBIIN SSLT SUNPHARMA TATAMOTORS TATAPOWER TATASTEEL TCS ULTRACHEM)

- To study the relationship between returns of Crude Futures, Nifty Stock Futures and Crude Spot.
- To study the impact of returns of Crude Futures on Nifty Stock Futures and Crude Spot.
- To study the impact of returns of Crude Spot and Nifty Stock Futures on Crude Futures.
- To study the Causal relationship between returns of Crude Futures, Nifty Stock Futures and Crude Spot.
- To study the volatility caused by Nifty Stock Futures and Crude Spot on Crude Futures.
- To study returns of Crude Futures, Nifty Stock Futures and Crude Spot are serially correlated.
- To study returns of Crude Futures, Nifty Stock Futures and Crude Spot are normally distributed.
- To study the ARCH effect caused by Crude Futures, Nifty Stock Futures and Crude Spot.

4. Hypotheses

The research hypotheses are as follows:

H_{01}: There is no significant relationship between returns of Crude Futures, Nifty Stock Futures and Crude Spot.
H_{02}: There is no significant impact of returns of Crude Futures on Nifty Stock Futures and Crude Spot.
H_{03}: There is no significant impact of returns of Crude Spot and Nifty Stock Futures on Crude Spot.
H_{04}: Crude Futures does not granger cause Nifty Stock Futures and Crude Spot.
H_{05}: There is no volatility caused by Nifty Stock Futures and Crude Spot on Crude Futures.
H_{06}: There is no serial correlation in the returns of Crude Futures, Nifty Stock Futures and Crude Spot.
H_{07}: The residuals of Crude Futures, Nifty Stock Futures and Crude Spot are normally distributed.
H_{08}: There is no ARCH effect in the returns of Crude Futures, Nifty Stock Futures and Crude Spot.

5. Research Methodology

Data

The study is based on secondary data obtained from various sources as databases of MCX, and NSE. The study considers daily data comprising the closing prices of Nifty Stock Futures (*ACC AMBUJA ASIANPAINTS AXISBANK BAJAJAUTOS BHARTI BHEL BOB BPCL CAIRN CIPLA DLF DRREDDY GAIL GOLD_FUTURES GOLD_SPOT GRASIM HCLTECH HDFC HDFCBK HEROMOTO HINDALCO HINDLEVER ICICIBK IDFC INFY ITC JINDAL JPASSO KOTAKBK LNT LUPIN MARUTI MNM NTPC ONGC PNB POWERGRID RANBAXY RELIANCE SBIIN SSLT SUNPHARMA TATAMOTORS TATAPOWER TATASTEEL TCS ULTRACHEM) Crude* Spot and Crude Futures for finding their returns. For this hetroscedastic data were converted into homoscedastic data. The period spans from April 1st, 2009 to March 31st, 2014 for all Nifty Stock Futures, Crude spot and Crude Futures. There are total 1156 observations under the study period.

Tools Used

In the course of analysis of the study, statistical tools comprising econometric tools like, Correlation Analysis, Granger Causality Test, Regression Analysis, GARCH (1, 1) Model, Serial Correlation, Jarque-Bera Test and ARCH (LM) Test have been applied. Eviews 7.0 Package Program has been used for arranging the data and implementation of econometric analysis.

6. Results & Interpretation

Correlation

(Table 1a) shows results of Correlation as follows:

	LOG(CRUDE_FUTURES)
LOG(ACC)	0.354235939
LOG(AMBUJA)	0.302038895
LOG(ASIANPAINTS)	0.318964209
LOG(AXISBANK)	0.001591061
LOG(BAJAJAUTOS)	-0.027761545
LOG(BHARTI)	-0.045181494
LOG(BHEL)	-0.301235122
LOG(BOB)	0.098398859
LOG(BPCL)	-0.107599818

LOG(CAIRN)	0.06579119
LOG(CIPLA)	0.075747013
LOG(DLF)	-0.196535371
LOG(DRREDDY)	0.11961071
LOG(GAIL)	-0.181559072
LOG(CRUDE_FUTURES)	1
LOG(CRUDE_SPOT)	0.105519583
LOG(GRASIM)	0.21410181
LOG(HCLTECH)	0.083413121
LOG(HDFC)	-0.302448615
LOG(HDFCBK)	-0.37892878
LOG(HEROMOTO)	0.0540314
LOG(HINDALCO)	-0.180929322
LOG(HINDLEVER)	0.286414444
LOG(ICICIBK)	0.034909648
LOG(IDFC)	-0.081224068
LOG(INFY)	-0.132787449
LOG(ITC)	0.066634614
LOG(JINDAL)	-0.159303791
LOG(JPASSO)	-0.209334957
LOG(KOTAKBK)	-0.148209075
LOG(LNT)	-0.055732694
LOG(LUPIN)	-0.301158051
LOG(MARUTI)	-0.152706407
LOG(MNM)	0.070777703
LOG(NTPC)	-0.223878603
LOG(ONGC)	-0.388975398
LOG(PNB)	-0.049800216
LOG(POWERGRID)	0.215096966
LOG(RANBAXY)	0.074076917
LOG(RELIANCE)	-0.258195218
LOG(SBIIN)	-0.055516461
LOG(SSLT)	-0.339853942
LOG(SUNPHARMA)	-0.249494291
LOG(TATAMOTORS)	-0.345278658
LOG(TATAPOWER)	-0.314664877
LOG(TATASTEEL)	-0.243778412
LOG(TCS)	0.145743264
LOG(ULTRACHEM)	0.249210558

On applying Karl Pearson Coefficient of Correlation at 5% level of significance, as shown in Table 1 above, there is a Low degree of negative correlation between returns of Crude Futures and Nifty Stock Futures (*BAJAJAUTOS, BHARTI, BHEL, BPCL, DLF GAIL, HDFC, HDFCBK, HINDALCO IDFC INFY JINDAL, JPASSO, KOTAKBK, LNT, LUPIN, MARUTI, NTPC, ONGC, PNB, RELIANCE, SBIIN, SSLT, SUNPHARMA, TATAMOTORS, TATAPOWER and TATASTEEL*) individually. There is a low positive correlation between returns of Crude Futures and Nifty Stock Futures (BOB, CAIRN, CIPLA, DRREDDY, GRASIM HCL TECH, HEROMOTO, ICICIBANK, ITC, MNM, POWERGRID, RANBAXY, TCS and ULTRACHEM) and Crude Spot. There is a moderate positive correlation between returns of Crude Futures and Nifty Stock Futures (ACC, AMBUJA, ASIANPAINTS and HINDLEVER) Thus, the null hypothesis that, there exist no significant relationship between returns of Crude Futures, Nifty Stock Futures and Crude Spot was rejected. So, there exist significant

relationship between returns of Crude Futures, Nifty Stock Futures and Crude Spot.

Regression

Table 2a (Be Read with Table 2b) shows results of Regression as follows:

Dependent Variable: LOG(CRUDE_FUTURES)				
Method: Least Squares				
Date: 10/07/14 Time: 12:35				
Sample: 4/01/2009 3/31/2014				
Included observations: 1155				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.92469	8.456929	3.656729	0.0003
LOG(CRUDE_SPOT)	-0.437817	0.487894	-0.89736	0.3697
LOG(ACC)	-0.297424	0.927083	-0.32082	0.7484
LOG(AMBUJA)	0.992638	0.692259	1.433911	0.1519
LOG(ASIANPAINTS)	0.052751	0.108664	0.48545	0.6275
LOG(AXISBANK)	-0.353728	0.672773	-0.52578	0.5991
LOG(BAJAJAUTOS)	-0.244571	0.401418	-0.60927	0.5425
LOG(BHARTI)	-0.364959	0.248714	-1.46739	0.1426
LOG(BHEL)	-0.072249	0.199949	-0.36134	0.7179
LOG(BOB)	-1.320179	0.675505	-1.95436	0.0509
LOG(BPCL)	0.11657	0.263399	0.442561	0.6582
LOG(CAIRN)	-0.198164	0.665824	-0.29762	0.766
LOG(CIPLA)	-0.029655	0.671044	-0.04419	0.9648
LOG(DLF)	0.295113	0.446111	0.661522	0.5084
LOG(DRREDDY)	-0.562504	0.586542	-0.95902	0.3378
LOG(GAIL)	-1.830687	0.68204	-2.68413	0.0074
LOG(GRASIM)	-0.081379	0.548962	-0.14824	0.8822
LOG(HCLTECH)	0.766238	0.453993	1.687774	0.0917
LOG(HDFC)	-0.035809	0.220651	-0.16229	0.8711
LOG(HDFCBK)	-0.07596	0.130758	-0.58092	0.5614
LOG(HEROMOTO)	0.661737	0.52572	1.258726	0.2084
LOG(HINDALCO)	0.024204	0.539359	0.044876	0.9642
LOG(HINDLEVER)	1.05E+00	0.53003	1.981111	0.0478
LOG(ICICIBK)	0.612412	0.856045	0.715397	0.4745
LOG(IDFC)	0.837639	0.588285	1.423866	0.1548
LOG(INFY)	-0.139876	0.562722	-0.24857	0.8037
LOG(ITC)	0.098109	0.392328	0.250069	0.8026
LOG(JINDAL)	-0.02539	0.150769	-0.1684	0.8663
LOG(JPASSO)	-0.159341	0.377345	-0.42227	0.6729
LOG(KOTAKBK)	-0.226741	0.450576	-0.50323	0.6149

Dependent Variable: LOG(ACC)				
Method: Least Squares				
Date: 10/07/14 Time: 12:41				
Sample: 4/01/2009 3/31/2014				
Included observations: 1155				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(AMBUJA)	0.377701	0.019383	19.48633	0
LOG(ASIANPAINTS)	-0.01196	0.003505	-3.413501	0.0007
LOG(AXISBANK)	-0.05116	0.021758	-2.351258	0.0189
LOG(BAJAJAUTOS)	-0.04351	0.01295	-3.359917	0.0008
LOG(BHARTI)	-0.01623	0.008056	-2.014506	0.0442
LOG(BHEL)	-0.01102	0.006474	-1.702865	0.0889
LOG(BOB)	-0.05932	0.021864	-2.713041	0.0068
LOG(BPCL)	0.060278	0.008345	7.223024	0
LOG(CAIRN)	0.059796	0.021511	2.77985	0.0055
LOG(CIPLA)	-0.05421	0.021693	-2.499062	0.0126
LOG(DLF)	-0.04178	0.01441	-2.899309	0.0038
LOG(DRREDDY)	0.005198	0.019022	0.273267	0.7847
LOG(GAIL)	0.014215	0.022178	0.640963	0.5217
LOG(GRASIM)	0.11574	0.017453	6.631451	0
LOG(HCLTECH)	-0.06754	0.014596	-4.627218	0
LOG(HDFC)	0.014749	0.007139	2.065808	0.0391
LOG(HDFCBK)	-0.00068	0.00424	-0.160913	0.8722
LOG(HEROMOTO)	0.065912	0.01694	3.890999	0.0001
LOG(HINDALCO)	0.104839	0.017199	6.095754	0
LOG(HINDLEVER)	-0.0243	0.017198	-1.412702	0.158
LOG(ICICIBK)	-0.12838	0.027488	-4.670302	0
LOG(IDFC)	0.144334	0.018589	7.764447	0
LOG(INFY)	0.04689	0.018188	2.57804	0.0101
LOG(ITC)	-0.02601	0.012695	-2.048757	0.0407
LOG(JINDAL)	0.007879	0.004882	1.613985	0.1068
LOG(JPASSO)	-0.01051	0.01223	-0.859693	0.3901
LOG(KOTAKBK)	-0.06426	1.45E-02	-4.44E+00	0
LOG(LNT)	0.071381	0.015704	4.545512	0
LOG(LUPIN)	0.011519	0.006946	1.6584	0.0975
LOG(MARUTI)	-0.00808	0.016316	-0.495189	0.6206

LOG(LNT)	0.319295	0.488818	0.653198	0.5138
LOG(LUPIN)	-0.031383	0.214513	-0.1463	0.8837
LOG(MARUTI)	-1.641028	0.500923	-3.27601	0.0011
LOG(MNM)	4.90E-01	0.252964	1.938922	0.0528
LOG(NTPC)	0.17161	0.656744	0.261304	0.7939
LOG(ONGC)	-0.413137	0.13659	-3.02464	0.0025
LOG(PNB)	1.970401	0.721448	2.731176	0.0064
LOG(POWERGRID)	-0.249327	0.914021	-0.27278	0.7851
LOG(RANBAXY)	0.105227	0.356859	0.29487	0.7681
LOG(RELIANCE)	-0.173821	0.378469	-0.45928	0.6461
LOG(SBIIN)	-0.440914	0.692781	-0.63644	0.5246
LOG(SSLT)	-0.029443	0.503831	-0.05844	0.9534
LOG(SUNPHARMA)	0.009973	0.13116	0.076038	0.9394
LOG(TATAMOTORS)	0.05974	0.177213	0.337108	0.7361
LOG(TATAPOWER)	0.135231	0.165622	0.816502	0.4144
LOG(TATASTEEL)	-0.37048	0.537155	-0.68971	0.4905
LOG(TCS)	-0.546942	0.332512	-1.64488	0.1003
LOG(ULTRACHEM)	-0.397674	0.66362	-0.59925	0.5491
R-squared	0.329342	Mean dependent var	13.31286	
Adjusted R-squared	0.300868	S.D. dependent var	0.850539	
S.E. of regression	0.711171	Akaike info criterion	2.196862	
Sum squared resid	559.8809	Schwarz criterion	2.40681	
Log likelihood	-1220.688	Hannan-Quinn criter.	2.276097	
F-statistic	11.56633	Durbin-Watson stat	2.16313	
Prob(F-statistic)	0			

LOG(MNM)	0.079165	0.007862	10.06881	0
LOG(NTPC)	-0.07266	0.021179	-3.430536	0.0006
LOG(ONGC)	-0.01744	0.004415	-3.948915	0.0001
LOG(PNB)	0.200068	0.022683	8.8201	0
LOG(POWERGRID)	0.41297	0.026907	15.34808	0
LOG(RANBAXY)	-0.02716	0.01154	-2.353493	0.0188
LOG(RELIANCE)	-0.00305	0.01227	-0.248749	0.8036
LOG(SBIIN)	-0.11158	0.022211	-5.023621	0
LOG(SSLT)	-0.04657	0.016273	-2.861659	0.0043
LOG(SUNPHARMA)	-0.0325	0.004138	-7.853647	0
LOG(TATAMOTORS)	0.012018	0.005734	2.096045	0.0363
LOG(TATAPOWER)	-0.01802	0.005343	-3.372258	0.0008
LOG(TATASTEEL)	-0.04417	0.017367	-2.543624	0.0111
LOG(TCS)	-0.02295	0.010771	-2.130402	0.0334
LOG(ULTRACHEM)	0.263653	0.020004	13.17972	0
LOG(CRUDE_SPOT)	0.042795	0.01577	2.71369	0.0068
C	0.90336	0.274469	3.291306	0.001
LOG(CRUDE_FUTURES)	-0.00031	0.000974	-0.320817	0.7484
R-squared	0.986363	Mean dependent var	6.941659	
Adjusted R-squared	0.985784	S.D. dependent var	0.193362	
S.E. of regression	0.023055	Akaike info criterion	-4.661215	
Sum squared resid	0.588397	Schwarz criterion	-4.451268	
Log likelihood	2739.852	Hannan-Quinn criter.	-4.58198	
F-statistic	1703.579	Durbin-Watson stat	0.400088	
Prob(F-statistic)	0			

As shown in Table 2a above, the regression model of returns of Crude Futures as dependent variable on Nifty Stock Futures and Crude Spot as independent variable has yielded an R-squared value of 0.329342 collectively, indicating that, 32.93% of the variation in independent variables was causing changes in returns of Crude Futures. The subsequent F-statistics (Goodness of Fit or Good Fit) was 11.56633 and the corresponding P Value was 0, pointing out that it was significant at 95% level of significant, as P Value is less than 0.05. Further, the regression test proves that the independent variables out of forty six variables only five affect the dependent variable significantly because their P Values (GAIL, HINDLEVER, MARUTI, ONGC and PNB) are less than 0.05 i.e. 0.0074, 0.0001 0.0011, 0.0024 and 0.0065 respectively at 95% level of significance. So, the null hypothesis that returns of Crude Futures as dependent variable on Nifty Stock Futures and Crude Spot have no significant impact on returns of Crude Futures was rejected. Hence, it is inferred that the studied variables have significant impact on the returns of crude futures.

The regression test in Table 2b above shows that the returns of Nifty Stock Futures and Crude Spot as dependent variable and returns of Crude Futures as independent variable has yielded an R-squared value of 0.986363 collectively, indicating that,

98.63% of the variation in independent variables was causing changes in returns of gold. The subsequent F-statistics (Goodness of Fit or Good Fit) was 1703.579 and the corresponding P Value was 0.00, pointing out that it was significant at 95% level of significant, as P Value is less than 0.05. Further, the regression test proves that the Gold Spot dependent variables out of forty six variables thirty five variables namely Nifty Stock Futures (*AMBUJA, ASIANPAINTS, AXISBANK, BAJAJAUTOS, BHARTI, BOB, BPCL, CAIRN, CIPLA, DLF, GRASIM, HCLTECH, HDFC, HEROMOTO, HINDALCO, ICICIBK, IDFC, INFY, ITC, KOTAKBK, LNT, MNM, NTPC, ONGC, PNB, POWERGRID, RANBAXY, SBIIN, SSLT, SUNPHARMA, TATAMOTORS, TATAPOWER, TATASTEEL, TCS and ULTRACHEM)* and Crude Spot affect the dependent variable significantly because their P Values are less than 0.05 at 95% level of significance. So, the null hypothesis that returns of Nifty Stock Futures and Crude Spot as dependent variable and Crude Futures as independent variable have no significant impact on returns of crude futures was rejected. Hence, it is inferred that the studied variables have significant impact on the returns of crude futures.

Granger Causality

Table 3 shows results of Granger Causality as follows:

Pairwise Granger Causality Tests				
Date: 10/08/14 Time: 21:30				
Sample: 4/01/2009 3/31/2014				
Lags: 2				
Null Hypothesis:	Obs	F-Statistic	Prob.	Direction
CRUDE_FUTURES does not Granger Cause ACC	1151	1.02558	0.3928	Unidirection
ACC does not Granger Cause CRUDE_FUTURES		5.75446	0.0001	
CRUDE_FUTURES does not Granger Cause AMBUJA	1151	0.95994	0.4109	Unidirection
AMBUJA does not Granger Cause CRUDE_FUTURES		5.50391	0.0009	
CRUDE_FUTURES does not Granger Cause ASIANPAINTS	1151	0.95895	0.4114	Bidirection
ASIANPAINTS does not Granger Cause CRUDE_FUTURES		20.7926	4.00E-13	
CRUDE_FUTURES does not Granger Cause AXISBANK	1151	0.89575	0.4427	Bidirection
AXISBANK does not Granger Cause CRUDE_FUTURES		1.43985	0.2296	
CRUDE_FUTURES does not Granger Cause BAJAJAUTOS	1151	1.73428	0.1582	Bidirection
BAJAJAUTOS does not Granger Cause CRUDE_FUTURES		1.35E+00	0.2579	
CRUDE_FUTURES does not Granger Cause BHARTI	1151	0.1927	0.9014	Bidirection
BHARTI does not Granger Cause CRUDE_FUTURES		0.6182	0.6033	
CRUDE_FUTURES does not Granger Cause BHEL	1151	0.51438	0.6724	Unidirection
BHEL does not Granger Cause CRUDE_FUTURES		4.97504	0.002	
CRUDE_FUTURES does not Granger Cause BOB	1151	0.3426	0.7945	Bidirection
BOB does not Granger Cause CRUDE_FUTURES		2.12944	0.0948	
CRUDE_FUTURES does not Granger Cause BPCL	1151	2.70411	0.0442	Bidirection
BPCL does not Granger Cause CRUDE_FUTURES		1.06607	0.3625	
CRUDE_FUTURES does not Granger Cause CAIRN	1151	0.52175	0.6674	Bidirection
CAIRN does not Granger Cause CRUDE_FUTURES		2.46911	0.0605	
CRUDE_FUTURES does not Granger Cause CIPLA	1151	0.69155	0.5573	Bidirection
CIPLA does not Granger Cause CRUDE_FUTURES		0.29575	0.8285	
CRUDE_SPOT does not Granger Cause CRUDE_FUTURES	1151	0.35225	0.7875	Bidirection
CRUDE_FUTURES does not Granger Cause CRUDE_SPOT		0.50212	0.6809	
DLF does not Granger Cause CRUDE_FUTURES	1151	1.69973	0.1653	Bidirection
CRUDE_FUTURES does not Granger Cause DLF		0.67756	0.5658	
DRREDDY does not Granger Cause CRUDE_FUTURES	1151	0.31234	0.8165	Bidirection
CRUDE_FUTURES does not Granger Cause DRREDDY		0.27587	0.8428	
GAIL does not Granger Cause CRUDE_FUTURES	1151	1.40947	0.2384	Bidirection
CRUDE_FUTURES does not Granger Cause GAIL		0.88872	0.4463	

GRASIM does not Granger Cause CRUDE_FUTURES	1151	1.96475	0.1175	Bidirection
CRUDE_FUTURES does not Granger Cause GRASIM		0.73226	0.5328	
HCLTECH does not Granger Cause CRUDE_FUTURES	1151	0.25717	0.8563	Bidirection
CRUDE_FUTURES does not Granger Cause HCLTECH		1.67406	0.1708	
HDFC does not Granger Cause CRUDE_FUTURES	1151	9.39753	4.00E-06	Unidirection
CRUDE_FUTURES does not Granger Cause HDFC		3.25874	0.0209	
HDFCBK does not Granger Cause CRUDE_FUTURES	1151	4.11462	0.0065	Unidirection
CRUDE_FUTURES does not Granger Cause HDFCBK		1.78243	0.1487	
HEROMOTO does not Granger Cause CRUDE_FUTURES	1151	0.96893	0.4066	Bidirection
CRUDE_FUTURES does not Granger Cause HEROMOTO		0.6404	0.5891	
HINDALCO does not Granger Cause CRUDE_FUTURES	1151	0.64659	0.5852	Bidirection
CRUDE_FUTURES does not Granger Cause HINDALCO		1.5577	0.198	
HINDLEVER does not Granger Cause CRUDE_FUTURES	1151	3.0641	0.0272	Unidirection
CRUDE_FUTURES does not Granger Cause HINDLEVER		0.90675	0.4371	
ICICIBK does not Granger Cause CRUDE_FUTURES	1151	2.40384	0.066	Bidirection
CRUDE_FUTURES does not Granger Cause ICICIBK		0.2455	0.8646	
IDFC does not Granger Cause CRUDE_FUTURES	1151	0.48349	0.6938	Bidirection
CRUDE_FUTURES does not Granger Cause IDFC		1.47858	0.2187	
INFY does not Granger Cause CRUDE_FUTURES	1151	1.5145	0.2091	Unidirection
CRUDE_FUTURES does not Granger Cause INFY		2.71709	0.0435	
ITC does not Granger Cause CRUDE_FUTURES	1151	0.0545	0.9832	Unidirection
CRUDE_FUTURES does not Granger Cause ITC		3.40994	0.017	
JINDAL does not Granger Cause CRUDE_FUTURES	1151	1.18747	0.3133	Bidirection
CRUDE_FUTURES does not Granger Cause JINDAL		0.18817	0.9045	
JPASSO does not Granger Cause CRUDE_FUTURES	1151	3.02619	0.0287	Unidirection
CRUDE_FUTURES does not Granger Cause JPASSO		0.44251	0.7226	
KOTAKBK does not Granger Cause CRUDE_FUTURES	1151	1.84538	0.1371	Bidirection
CRUDE_FUTURES does not Granger Cause KOTAKBK		0.28821	0.8339	
LNT does not Granger Cause CRUDE_FUTURES	1151	0.29689	0.8277	Bidirection
CRUDE_FUTURES does not Granger Cause LNT		0.48379	0.6936	
LUPIN does not Granger Cause CRUDE_FUTURES	1151	8.21727	2.00E-05	Bidirection
CRUDE_FUTURES does not Granger Cause LUPIN		1.02175	0.3821	
MARUTI does not Granger Cause CRUDE_FUTURES	1151	1.83179	0.1396	Bidirection
CRUDE_FUTURES does not Granger Cause MARUTI		1.40933	0.2385	
MNM does not Granger Cause CRUDE_FUTURES	1151	0.24818	0.8627	Bidirection
CRUDE_FUTURES does not Granger Cause MNM		0.79607	0.4961	
NTPC does not Granger Cause CRUDE_FUTURES	1151	2.02997	0.108	Bidirection
CRUDE_FUTURES does not Granger Cause NTPC		0.21059	0.8891	
ONGC does not Granger Cause CRUDE_FUTURES	1151	6.66506	0.0002	Unidirection
CRUDE_FUTURES does not Granger Cause ONGC		2.38734	0.0675	
PNB does not Granger Cause CRUDE_FUTURES	1151	0.22086	0.8819	Bidirection
CRUDE_FUTURES does not Granger Cause PNB		1.42043	0.2352	
POWERGRID does not Granger Cause CRUDE_FUTURES	1151	3.19923	0.0227	Unidirection
CRUDE_FUTURES does not Granger Cause POWERGRID		1.91328	0.1256	
RANBAXY does not Granger Cause CRUDE_FUTURES	1151	1.6549	0.175	Bidirection
CRUDE_FUTURES does not Granger Cause RANBAXY		0.78601	0.5018	
RELIANCE does not Granger Cause CRUDE_FUTURES	1151	4.56024	0.0035	Unidirection

CRUDE_FUTURES does not Granger Cause RELIANCE		0.20902	0.8902	
SBIIN does not Granger Cause CRUDE_FUTURES	1151	0.39091	0.7596	Bidirection
CRUDE_FUTURES does not Granger Cause SBIIN		0.56018	0.6414	
SSLT does not Granger Cause CRUDE_FUTURES	1151	3.52613	0.0145	Unidirection
CRUDE_FUTURES does not Granger Cause SSLT		2.16356	0.0906	
SUNPHARMA does not Granger Cause CRUDE_FUTURES	1151	3.25357	0.0211	Unidirection
CRUDE_FUTURES does not Granger Cause SUNPHARMA		0.94402	0.4186	
TATAMOTORS does not Granger Cause CRUDE_FUTURES	1151	2.30986	0.0748	Bidirection
CRUDE_FUTURES does not Granger Cause TATAMOTORS		1.84329	0.1375	
TATAPOWER does not Granger Cause CRUDE_FUTURES	1151	4.50221	0.0038	Unidirection
CRUDE_FUTURES does not Granger Cause TATAPOWER		1.79242	0.1468	
TATASTEEL does not Granger Cause CRUDE_FUTURES	1151	1.23782	0.2946	Unidirection
CRUDE_FUTURES does not Granger Cause TATASTEEL		2.67481	0.046	
TCS does not Granger Cause CRUDE_FUTURES	1151	0.40444	0.7498	Bidirection
CRUDE_FUTURES does not Granger Cause TCS		0.73539	0.531	
ULTRACHEM does not Granger Cause CRUDE_FUTURES	1151	2.80231	0.0388	Unidirection
CRUDE_FUTURES does not Granger Cause ULTRACHEM		2.01697	0.1098	

On applying Granger Causality Test at 5% level of significance, as shown in Table 3 above, there is a Bi directional relationship between returns of: Nifty Stock Futures (*ASIANPAINTS, AXISBANK, BAJAJAUTOS, BHARTI, BOB, BPCL, CAIRN, CIPLA, DLF, DRREDDY, GAIL, GRASIM, HCLTECH, HEROMOTO, HINDALCO, ICICIBK, IDFC, JINDAL, KOTAKBK, LNT, LUPIN, MARUTI, MNM, NTPC, PNB, RANBAXY, SBIIN, TATAMOTORS and TCS)* and Crude Spot and Crude Futures individually. There is a Uni directional relationship between returns of: Nifty Stock Futures *(ACC, AMBUJA, BHEL, HDFC, HDFCBANK, HINDLEVER, INFY, ITC, JPASSO, ONGC, POWERGRID, RIL SSLT, SUNPHARMA, TATAPOWER, TATASTEEL AND ULTRATECH)* and Crude Futures individually. Thus, the null hypothesis that, the returns of Crude Futures does not granger cause Nifty Stock Futures and Crude Spot was rejected. So, there exist significant bidirectional and unidirectional relationship between returns of Crude Futures, Nifty Stock Futures and Crude Spot.

GARCH (1, 1) Model

Table 4a (Be Read with Table 4b) shows results of GARCH (1, 1) Model as follows:

Dependent Variable: LOG(CRUDE_FUTURES)				
Method: ML - ARCH (Marquardt) - Normal distribution				
Date: 10/07/14 Time: 12:37				
Sample: 4/01/2009 3/31/2014				
Included observations: 1155				
Convergence not achieved after 500 iterations				
Presample variance: backcast (parameter = 0.7)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	56.5148	3.01273	18.75867	0
LOG(CRUDE_SPOT)	-1.2263	0.175752	-6.977446	0
LOG(ACC)	-1.35304	0.335924	-4.027819	0.0001
LOG(AMBUJA)	1.602709	0.263932	6.072422	0
LOG(ASIANPAINTS)	-0.05107	0.04305	-1.186406	0.2355
LOG(AXISBANK)	-0.61324	0.223289	-2.746389	0.006
LOG(BAJAJAUTOS)	-5.47E-01	1.84E-01	-2.977607	0.0029
LOG(BHARTI)	-0.50564	0.090365	-5.595532	0

Dependent Variable: LOG(ACC)				
Method: ML - ARCH (Marquardt) - Normal distribution				
Date: 10/07/14 Time: 12:42				
Sample: 4/01/2009 3/31/2014				
Included observations: 1155				
Convergence achieved after 375 iterations				
Presample variance: backcast (parameter = 0.7)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(AMBUJA)	0.415021	0.01154	35.9649	0
LOG(ASIANPAINTS)	0.028524	0.002398	11.89699	0
LOG(AXISBANK)	-0.0459	0.012975	-3.53724	0.0004
LOG(BAJAJAUTOS)	-0.05027	0.008095	-6.20939	0
LOG(BHARTI)	-0.00032	0.005108	-0.06338	0.9495
LOG(BHEL)	-0.02275	0.003409	-6.67332	0
LOG(BOB)	-0.02416	0.013637	-1.77126	0.0765
LOG(BPCL)	0.009572	0.005329	1.796108	0.0725

LOG(BHEL)	-0.04535	0.092022	-0.492841	0.6221
LOG(BOB)	-2.51408	0.231983	-10.83732	0
LOG(BPCL)	-0.14242	0.093508	-1.523051	0.1277
LOG(CAIRN)	-0.3909	0.217908	-1.793877	0.0728
LOG(CIPLA)	0.087844	0.249988	0.351394	0.7253
LOG(DLF)	0.238772	0.168733	1.415084	0.157
LOG(DRREDDY)	-0.44982	0.234529	-1.917989	0.0551
LOG(GAIL)	-2.24773	0.235793	-9.532609	0
LOG(GRASIM)	-0.7198	0.229852	-3.131583	0.0017
LOG(HCLTECH)	0.889549	0.195614	4.547473	0
LOG(HDFC)	-0.50673	0.226187	-2.240336	0.0251
LOG(HDFCBK)	-0.29174	0.05437	-5.365922	0
LOG(HEROMOTO)	0.862585	0.194511	4.434643	0
LOG(HINDALCO)	1.594217	0.177401	8.986499	0
LOG(HINDLEVER)	0.612678	0.220184	2.782576	0.0054
LOG(ICICIBK)	-0.34657	0.303007	-1.143763	0.2527
LOG(IDFC)	2.003392	0.209004	9.585431	0
LOG(INFY)	0.355817	0.187782	1.894835	0.0581
LOG(ITC)	0.769808	0.283795	2.712544	0.0067
LOG(JINDAL)	0.125145	0.048157	2.598694	0.0094
LOG(JPASSO)	0.546567	0.128301	4.260032	0
LOG(KOTAKBK)	-0.13744	0.236924	-0.580107	0.5618
LOG(LNT)	0.358085	0.192872	1.856591	0.0634
LOG(LUPIN)	0.062488	0.192506	0.324604	0.7455
LOG(MARUTI)	-2.14E+00	1.69E-01	-12.64473	0
LOG(MNM)	1.210127	0.100393	12.05384	0
LOG(NTPC)	-1.18656	0.236027	-5.027241	0
LOG(ONGC)	-0.84488	0.068019	-12.42125	0
LOG(PNB)	2.760185	0.266715	10.34881	0
LOG(POWERGRID)	-0.32926	0.329803	-0.998347	0.3181
LOG(RANBAXY)	-0.05854	0.12665	-0.462185	0.6439
LOG(RELIANCE)	-8.33E-02	0.128185	-0.649518	0.516
LOG(SBIIN)	-1.14168	0.264151	-4.322066	0
LOG(SSLT)	-0.15752	0.170596	-0.92336	0.3558
LOG(SUNPHARMA)	0.101115	0.064601	1.565213	0.1175
LOG(TATAMOTORS)	0.116651	0.065179	1.789712	0.0735
LOG(TATAPOWER)	0.089787	0.074315	1.208186	0.227
LOG(TATASTEEL)	-0.84226	0.174821	-4.817836	0

LOG(CAIRN)	0.082832	0.013245	6.253654	0
LOG(CIPLA)	-0.06937	0.012848	-5.39891	0
LOG(DLF)	-0.03469	0.009362	-3.70509	0.0002
LOG(DRREDDY)	0.081315	0.01246	6.525835	0
LOG(GAIL)	0.062461	0.013401	4.661057	0
LOG(GRASIM)	0.121866	0.01051	11.59557	0
LOG(HCLTECH)	-0.05175	0.008712	-5.9399	0
LOG(HDFC)	-0.00019	0.007157	-0.02676	0.9787
LOG(HDFCBK)	-0.0028	0.002379	-1.17648	0.2394
LOG(HEROMOTO)	0.056066	0.010127	5.536232	0
LOG(HINDALCO)	0.037827	0.011662	3.243633	0.0012
LOG(HINDLEVER)	-0.06058	0.010805	-5.60649	0
LOG(ICICIBK)	-0.10223	0.015167	-6.73984	0
LOG(IDFC)	0.009971	0.011735	0.84964	0.3955
LOG(INFY)	0.048012	0.011761	4.082273	0
LOG(ITC)	-0.01117	0.007175	-1.55723	0.1194
LOG(JINDAL)	0.010697	0.003165	3.379448	0.0007
LOG(JPASSO)	0.02656	0.006989	3.8003	0.0001
LOG(KOTAKBK)	-0.0184	0.009521	-1.93283	0.0533
LOG(LNT)	0.071942	0.009714	7.405714	0
LOG(LUPIN)	-0.00017	6.67E-03	-2.51E-02	0.98
LOG(MARUTI)	-0.01987	0.009404	-2.11341	0.0346
LOG(MNM)	0.083623	0.004766	17.54623	0
LOG(NTPC)	-0.04029	0.012121	-3.32421	0.0009
LOG(ONGC)	0.003255	0.002475	1.314828	0.1886
LOG(PNB)	0.07164	0.014574	4.915529	0
LOG(POWERGRID)	0.282993	0.01686	16.78488	0
LOG(RANBAXY)	-0.04413	0.007564	-5.83483	0
LOG(RELIANCE)	-0.01212	0.007244	-1.67319	0.0943
LOG(SBIIN)	-0.04863	0.014244	-3.41409	0.0006
LOG(SSLT)	0.016695	0.00999	1.671084	0.0947
LOG(SUNPHARMA)	-0.03459	0.002485	-13.9152	0
LOG(TATAMOTORS)	0.007086	0.003392	2.089302	0.0367
LOG(TATAPOWER)	-0.01443	0.002781	-5.1885	0
LOG(TATASTEEL)	0.0237	0.011714	2.023241	0.043
LOG(TCS)	-0.03387	0.007631	-4.43848	0
LOG(ULTRACHEM)	0.222685	0.011542	19.29376	0
LOG(CRUDE_SPOT)	-0.01804	0.009298	-1.94061	0.0523

LOG(TCS)	-0.83486	0.129026	-6.470521	0
LOG(ULTRACHEM)	0.526258	0.245824	2.140791	0.0323
Variance Equation				
C	0.010661	0.003216	3.314843	0.0009
RESID(-1)^2	1.020103	0.099336	10.26925	0
GARCH(-1)	0.356005	0.039503	9.012104	0
R-squared	0.211458	Mean dependent var	13.31286	
Adjusted R-squared	0.177979	S.D. dependent var	0.850539	
S.E. of regression	0.771145	Akaike info criterion	1.497389	
Sum squared resid	658.293	Schwarz criterion	1.720457	
Log likelihood	-813.742	Hannan-Quinn criter.	1.581575	
Durbin-Watson stat	1.861312			

C	1.182053	0.168313	7.022922	0
LOG(CRUDE_FUTURES)	0.000379	0.000531	0.714481	0.4749
Variance Equation				
C	5.56E-05	8.26E-06	6.733078	0
RESID(-1)^2	0.867934	0.094125	9.221063	0
GARCH(-1)	0.1278	0.04103	3.1148	0.0018
R-squared	0.979637	Mean dependent var	6.941659	
Adjusted R-squared	0.978772	S.D. dependent var	0.193362	
S.E. of regression	0.028172	Akaike info criterion	-5.189904	
Sum squared resid	0.878607	Schwarz criterion	-4.966835	
Log likelihood	3048.17	Hannan-Quinn criter.	-5.105718	
Durbin-Watson stat	0.240731			

Table 5a (Be Read with Table 5b) shows results of (Student's t Distribution) as follows:

Dependent Variable: LOG(CRUDE_FUTURES)				
Method: ML - ARCH (Marquardt) - Student's t distribution				
Date: 10/07/14 Time: 12:37				
Sample: 4/01/2009 3/31/2014				
Included observations: 1155				
Convergence not achieved after 500 iterations				
Presample variance: backcast (parameter = 0.7)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	25.5162	2.290666	11.13921	0
LOG(CRUDE_SPOT)	-0.03705	0.13627	-0.27186	0.7857
LOG(ACC)	-0.78406	0.248535	-3.15474	0.0016
LOG(AMBUJA)	0.541502	0.189392	2.859153	0.0042
LOG(ASIANPAINTS)	0.106791	0.029389	3.633653	0.0003
LOG(AXISBANK)	0.109631	0.182581	0.600452	0.5482
LOG(BAJAJAUTOS)	2.26E-02	1.15E-01	0.195888	0.8447
LOG(BHARTI)	-0.50945	0.066733	-7.63416	0
LOG(BHEL)	-0.08605	0.058866	-1.46173	0.1438
LOG(BOB)	-0.83692	0.181302	-4.61616	0
LOG(BPCL)	-0.10195	0.074482	-1.36872	0.1711
LOG(CAIRN)	-0.08355	0.186124	-0.4489	0.6535
LOG(CIPLA)	-0.29479	0.184113	-1.60112	0.1093
LOG(DLF)	0.261845	0.127193	2.058636	0.0395
LOG(DRREDDY)	0.06417	0.163345	0.39285	0.6944
LOG(GAIL)	-0.4131	0.189095	-2.18459	0.0289
LOG(GRASIM)	0.102609	0.173599	0.591067	0.5545
LOG(HCLTECH)	-0.17619	0.128731	-1.36867	0.1711
LOG(HDFC)	-0.02325	0.085553	-0.27174	0.7858
LOG(HDFCBK)	-0.03498	0.033813	-1.0346	0.3009
LOG(HEROMOTO)	0.453191	0.147816	3.065901	0.0022

Dependent Variable: LOG(ACC)				
Method: ML - ARCH (Marquardt) - Student's t distribution				
Date: 10/07/14 Time: 12:42				
Sample: 4/01/2009 3/31/2014				
Included observations: 1155				
Convergence achieved after 276 iterations				
Presample variance: backcast (parameter = 0.7)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(AMBUJA)	0.410036	0.011246	36.45948	0
LOG(ASIANPAINTS)	0.029556	0.00278	10.63121	0
LOG(AXISBANK)	-0.06963	0.01263	-5.51279	0
LOG(BAJAJAUTOS)	-0.05694	0.008095	-7.03458	0
LOG(BHARTI)	0.00045	0.005109	0.088092	0.9298
LOG(BHEL)	-0.02891	0.003347	-8.63674	0
LOG(BOB)	-0.00203	0.013534	-0.14982	0.8809
LOG(BPCL)	0.005257	0.005426	0.968802	0.3326
LOG(CAIRN)	0.089186	0.01329	6.710948	0
LOG(CIPLA)	-0.05949	0.01316	-4.52063	0
LOG(DLF)	-0.03285	0.009448	-3.4768	0.0005
LOG(DRREDDY)	0.082479	0.012359	6.673447	0
LOG(GAIL)	0.041921	0.013746	3.049729	0.0023
LOG(GRASIM)	0.118592	0.00989	11.99054	0
LOG(HCLTECH)	-0.05674	0.008418	-6.73987	0
LOG(HDFC)	-0.00296	0.006059	-0.48817	0.6254
LOG(HDFCBK)	-0.00644	0.002265	-2.84542	0.0044
LOG(HEROMOTO)	0.051423	0.010166	5.058475	0
LOG(HINDALCO)	0.052698	0.011338	4.647876	0
LOG(HINDLEVER)	-0.06888	0.010472	-6.57751	0
LOG(ICICIBK)	-0.08374	0.015466	-5.41416	0

LOG(HINDALCO)	0.340558	0.147907	2.302521	0.0213
LOG(HINDLEVER)	0.700928	0.154193	4.545785	0
LOG(ICICIBK)	0.409043	0.231064	1.770259	0.0767
LOG(IDFC)	0.937538	0.158945	5.898525	0
LOG(INFY)	0.046476	0.15211	0.305541	0.76
LOG(ITC)	-0.0744	0.151497	-0.49111	0.6233
LOG(JINDAL)	0.01708	0.042564	0.401277	0.6882
LOG(JPASSO)	-0.31165	0.101844	-3.0601	0.0022
LOG(KOTAKBK)	-0.05212	0.134958	-0.38623	0.6993
LOG(LNT)	0.497282	0.126585	3.928429	0.0001
LOG(LUPIN)	-0.06757	0.078449	-0.8613	0.3891
LOG(MARUTI)	-1.08E+00	1.29E-01	-8.37765	0
LOG(MNM)	-0.02471	0.074244	-0.33284	0.7393
LOG(NTPC)	-0.26816	0.175447	-1.52845	0.1264
LOG(ONGC)	-0.3145	0.045802	-6.86639	0
LOG(PNB)	0.46811	0.200234	2.33782	0.0194
LOG(POWERGRID)	0.255067	0.255688	0.997572	0.3185
LOG(RANBAXY)	0.150137	0.09388	1.599245	0.1098
LOG(RELIANCE)	-0.11585	0.104093	-1.11291	0.2657
LOG(SBIIN)	-0.08402	0.190723	-0.44054	0.6595
LOG(SSLT)	-3.59E-01	0.138796	-2.58437	0.0098
LOG(SUNPHARMA)	0.067011	0.044438	1.50798	0.1316
LOG(TATAMOTORS)	-0.02088	0.047684	-0.43797	0.6614
LOG(TATAPOWER)	0.071425	0.04677	1.527147	0.1267
LOG(TATASTEEL)	-0.25293	0.142792	-1.77132	0.0765
LOG(TCS)	-0.3011	0.095568	-3.15064	0.0016
LOG(ULTRACHEM)	-0.48623	0.188273	-2.58255	0.0098
Variance Equation				
C	101.5019	563680.2	0.00018	0.9999
RESID(-1)^2	48.79159	270916.6	0.00018	0.9999
GARCH(-1)	0.961899	0.016847	57.09748	0
T-DIST. DOF	2.000016	0.089109	22.44465	0
R-squared	0.21898	Mean dependent var	13.31286	
Adjusted R-squared	0.18582	S.D. dependent var	0.850539	
S.E. of regression	0.767458	Akaike info criterion	0.556915	
Sum squared resid	652.0138	Schwarz criterion	0.784358	
Log likelihood	-269.618	Hannan-Quinn criter.	0.642752	
Durbin-Watson stat	1.863951			

LOG(IDFC)	0.020971	0.012213	1.717115	0.086
LOG(INFY)	0.041077	0.011931	3.442938	0.0006
LOG(ITC)	-0.01905	0.007888	-2.41442	0.0158
LOG(JINDAL)	0.017088	0.003101	5.510055	0
LOG(JPASSO)	0.011574	0.006799	1.702362	0.0887
LOG(KOTAKBK)	-0.02314	0.008841	-2.61701	0.0089
LOG(LNT)	0.072435	0.010072	7.192029	0
LOG(LUPIN)	0.005422	5.40E-03	1.00E+00	0.315
LOG(MARUTI)	0.02111	0.009564	2.2071	0.0273
LOG(MNM)	0.078243	0.005038	15.53044	0
LOG(NTPC)	0.015889	0.01472	1.079418	0.2804
LOG(ONGC)	-0.00223	0.002567	-0.86785	0.3855
LOG(PNB)	0.053793	0.014035	3.832834	0.0001
LOG(POWERGRID)	0.247531	0.017376	14.24573	0
LOG(RANBAXY)	-0.04174	0.007315	-5.70623	0
LOG(RELIANCE)	-0.01324	0.007338	-1.80455	0.0711
LOG(SBIIN)	-0.0491	0.014113	-3.47925	0.0005
LOG(SSLT)	0.031559	0.009859	3.201122	0.0014
LOG(SUNPHARMA)	-0.03162	0.002519	-12.553	0
LOG(TATAMOTORS)	0.00794	0.002519	3.152233	0.0016
LOG(TATAPOWER)	-0.01701	0.002397	-7.09535	0
LOG(TATASTEEL)	0.005108	0.011477	0.4451	0.6562
LOG(TCS)	-0.03979	0.00715	-5.56455	0
LOG(ULTRACHEM)	0.210933	0.01146	18.40564	0
LOG(CRUDE_SPOT)	-0.02217	0.00934	-2.37316	0.0176
C	1.338335	0.160014	8.363864	0
LOG(CRUDE_FUTURES)	0.000468	0.000569	0.822687	0.4107
Variance Equation				
C	4.81E-05	8.07E-06	5.963111	0
RESID(-1)^2	0.831016	0.096911	8.575068	0
GARCH(-1)	0.175551	0.049058	3.578444	0.0003
T-DIST. DOF	17075.6	9208314	0.001854	0.9985
R-squared	0.97912	Mean dependent var	6.941659	
Adjusted R-squared	0.978233	S.D. dependent var	0.193362	
S.E. of regression	0.028528	Akaike info criterion	-5.195398	
Sum squared resid	0.900918	Schwarz criterion	-4.967955	
Log likelihood	3052.342	Hannan-Quinn criter.	-5.109561	
Durbin-Watson stat	0.233542			

Table 6a (Be Read with Table 6b) shows results of (Student's t Distribution) as follows:

Dependent Variable: LOG(CRUDE_FUTURES)
Method: ML - ARCH (Marquardt) - Generalized error distribution (GED)
Date: 10/07/14 Time: 12:38
Sample: 4/01/2009 3/31/2014
Included observations: 1155

Dependent Variable: LOG(ACC)
Method: ML - ARCH (Marquardt) - Generalized error distribution (GED)
Date: 10/07/14 Time: 12:43
Sample: 4/01/2009 3/31/2014
Included observations: 1155

Convergence achieved after 76 iterations				
Presample variance: backcast (parameter = 0.7)				
GED parameter fixed at 1.5				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	27.86306	2.505691	11.11991	0
LOG(CRUDE_SPOT)	-0.76674	0.136281	-5.62619	0
LOG(ACC)	-1.46026	0.24568	-5.943761	0
LOG(AMBUJA)	1.207014	0.215346	5.605003	0
LOG(ASIANPAINTS)	0.070958	0.033385	2.125407	0.0336
LOG(AXISBANK)	-6.11E-01	1.73E-01	-3.533458	0.0004
LOG(BAJAJAUTOS)	-3.71E-01	1.48E-01	-2.504026	0.0123
LOG(BHARTI)	0.007944	0.071983	0.110365	0.9121
LOG(BHEL)	-0.07718	0.070624	-1.092797	0.2745
LOG(BOB)	-1.33323	0.178623	-7.463936	0
LOG(BPCL)	-0.01593	0.073861	-0.215704	0.8292
LOG(CAIRN)	0.485714	0.17236	2.818018	0.0048
LOG(CIPLA)	-0.83657	0.196365	-4.260264	0
LOG(DLF)	0.439636	0.127418	3.450336	0.0006
LOG(DRREDDY)	0.190576	0.17902	1.064554	0.2871
LOG(GAIL)	-1.94111	0.199187	-9.745143	0
LOG(GRASIM)	0.26629	0.174462	1.526355	0.1269
LOG(HCLTECH)	0.080084	0.144527	0.554114	0.5795
LOG(HDFC)	-0.11624	0.17212	-0.67533	0.4995
LOG(HDFCBK)	-0.1472	0.038742	-3.79954	0.0001
LOG(HEROMOTO)	0.785652	0.162662	4.829974	0
LOG(HINDALCO)	0.182354	0.149406	1.220525	0.2223
LOG(HINDLEVER)	0.34276	0.156956	2.183798	0.029
LOG(ICICIBK)	0.075557	0.240537	0.314116	0.7534
LOG(IDFC)	0.864802	0.153612	5.629786	0
LOG(INFY)	-0.3225	0.154526	-2.087031	0.0369
LOG(ITC)	0.861865	0.204843	4.21E+00	0
LOG(JINDAL)	0.10535	0.038021	2.770854	0.0056
LOG(JPASSO)	-0.23935	0.117182	-2.042566	0.0411
LOG(KOTAKBK)	-0.41955	0.200266	-2.09496	0.0362
LOG(LNT)	0.208395	0.13686	1.522686	0.1278
LOG(LUPIN)	0.078559	0.146307	0.536943	0.5913
LOG(MARUTI)	-5.68E-01	1.34E-01	-4.238968	0
LOG(MNM)	0.88924	0.080252	11.08056	0
LOG(NTPC)	-0.33213	0.188691	-1.760155	0.0784
LOG(ONGC)	-0.52883	0.04768	-11.09136	0
LOG(PNB)	1.872612	0.194328	9.636359	0

Convergence achieved after 329 iterations				
Presample variance: backcast (parameter = 0.7)				
GED parameter fixed at 1.5				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(AMBUJA)	0.414366	0.010037	41.28401	0
LOG(ASIANPAINTS)	0.037559	0.002029	18.51461	0
LOG(AXISBANK)	-0.06466	0.011368	-5.68817	0
LOG(BAJAJAUTOS)	-0.04478	0.006893	-6.49615	0
LOG(BHARTI)	0.001382	0.004196	0.329435	0.7418
LOG(BHEL)	-0.02	0.002839	-7.04552	0
LOG(BOB)	-0.02718	0.01165	-2.33263	0.0197
LOG(BPCL)	0.008185	0.004555	1.796771	0.0724
LOG(CAIRN)	0.082669	0.012557	6.583746	0
LOG(CIPLA)	-0.08161	0.010899	-7.48785	0
LOG(DLF)	-0.04227	0.00834	-5.06775	0
LOG(DRREDDY)	0.082672	0.010675	7.74449	0
LOG(GAIL)	0.056135	0.012001	4.677357	0
LOG(GRASIM)	0.108054	0.009758	11.07326	0
LOG(HCLTECH)	-0.06166	0.007636	-8.07553	0
LOG(HDFC)	-0.0008	0.004323	-0.18602	0.8524
LOG(HDFCBK)	-0.00295	0.002183	-1.35341	0.1759
LOG(HEROMOTO)	0.064507	0.008611	7.491515	0
LOG(HINDALCO)	0.044321	0.010278	4.312439	0
LOG(HINDLEVER)	-0.04988	0.009141	-5.45716	0
LOG(ICICIBK)	-0.04418	0.014341	-3.08036	0.0021
LOG(IDFC)	0.040785	0.010566	3.86015	0.0001
LOG(INFY)	0.052604	0.010038	5.240477	0
LOG(ITC)	-0.00784	0.00591	-1.32631	0.1847
LOG(JINDAL)	0.016177	0.002861	5.653832	0
LOG(JPASSO)	0.017877	0.006074	2.943339	0.0032
LOG(KOTAKBK)	-0.01106	0.00805	-1.37392	0.1695
LOG(LNT)	0.028538	0.007704	3.704204	0.0002
LOG(LUPIN)	-2.95E-04	3.99E-03	-0.07378	0.9412
LOG(MARUTI)	0.007208	0.009003	0.800653	0.4233
LOG(MNM)	0.075674	0.004751	15.92773	0
LOG(NTPC)	0.012059	0.013158	0.916438	0.3594
LOG(ONGC)	-0.00144	0.002428	-0.59244	0.5536
LOG(PNB)	0.05168	0.012813	4.033363	0.0001
LOG(POWERGRID)	0.237691	0.015989	14.86575	0
LOG(RANBAXY)	-0.02635	0.006398	-4.11798	0
LOG(RELIANCE)	-0.0156	0.006675	-2.33645	0.0195

LOG(POWERGRID)	0.311568	0.250945	1.241582	0.2144	LOG(SBIIN)	-0.0655	0.012604	-5.19687	0
LOG(RANBAXY)	0.5927	0.096862	6.119023	0	LOG(SSLT)	-0.00038	0.009004	-0.04261	0.966
LOG(RELIANCE)	-1.51E-01	0.111238	-1.361241	0.1734	LOG(SUNPHARMA)	-0.03299	0.002379	-13.8693	0
LOG(SBIIN)	-0.25197	0.204971	-1.229284	0.219	LOG(TATAMOTORS)	0.005018	0.002902	1.729431	0.0837
LOG(SSLT)	0.004488	0.125224	0.035839	0.9714	LOG(TATAPOWER)	-0.01251	0.002245	-5.5711	0
LOG(SUNPHARMA)	-0.04855	0.054767	-0.886568	0.3753	LOG(TATASTEEL)	0.037009	0.010257	3.60821	0.0003
LOG(TATAMOTORS)	0.165129	0.046172	3.57641	0.0003	LOG(TCS)	-0.04623	0.006516	-7.09536	0
LOG(TATAPOWER)	0.068669	0.054475	1.260553	0.2075	LOG(ULTRACHEM)	0.212338	0.010733	19.78349	0
LOG(TATASTEEL)	-0.77022	0.132223	-5.825151	0	LOG(CRUDE_SPOT)	-0.00558	0.008118	-0.68708	0.492
LOG(TCS)	-0.18037	0.095816	-1.882422	0.0598	C	1.102148	0.146	7.548981	0
LOG(ULTRACHEM)	-0.08637	0.21858	-0.395128	0.6927	LOG(CRUDE_FUTURES)	0.000343	0.000468	0.733143	0.4635
Variance Equation					Variance Equation				
C	0.018339	0.003163	5.798162	0	C	5.70E-05	8.31E-06	6.864655	0
RESID(-1)^2	1.850158	0.148706	12.44172	0	RESID(-1)^2	1.161846	0.138088	8.413794	0
GARCH(-1)	0.092206	0.021408	4.307108	0	GARCH(-1)	0.036621	0.03587	1.020939	0.3073
R-squared	0.281852	Mean dependent var	13.31286		R-squared	0.978718	Mean dependent var	6.941659	
Adjusted R-squared	0.251362	S.D. dependent var	0.850539		Adjusted R-squared	0.977815	S.D. dependent var	0.193362	
S.E. of regression	0.73592	Akaike info criterion	1.238092		S.E. of regression	0.028801	Akaike info criterion	-5.173922	
Sum squared resid	599.5264	Schwarz criterion	1.461161		Sum squared resid	0.918228	Schwarz criterion	-4.950853	
Log likelihood	-663.998	Hannan-Quinn criter.	1.322278		Log likelihood	3038.94	Hannan-Quinn criter.	-5.089736	
Durbin-Watson stat	2.030954				Durbin-Watson stat	0.22812			

As per Table 4a, the GARCH (1, 1) Model confers that Normal GAUSSIAN Test, Students t Distribution Test and GED With Fix Parameter show that the P Values of (Crude futures i.e., ARCH (α), and Crude Spot and Nifty Stock Futures i.e., GARCH (β)), is greater than 0.05 in all the three tests.

As per Table 4a, 5a and 6a the GARCH (1, 1) Model confers that Normal GAUSSIAN Test, and GED With Fix Parameter show that the P Values of Nifty Stock Futures and Crude Spot i.e., ARCH (α), and Crude Futures i.e., GARCH (β)), is less than 0.05 and in Students t Distribution Test the value is greater than 0.05 hence it is inferred that there is a ARCH effect.

Where as in Table 4b, 5b and 6b GARCH(1,1) Model confers that Normal GAUSSIAN Test, Student t Distribution Test and GED with Fix Parameter Test and Variance Equation Results, Nifty Stock Futures and Crude Spot i.e. GARCH (-1), and Gold Futures, i.e., ARCH (α) have P Values greater than 0.05; Hence, the null hypothesis that the volatility in the returns of Nifty Stock Futures and Crude Spot and Crude Futures does not affect the volatility of crude is rejected in from the outcome of Table 4b, 5b and 6b. It means that the volatility of independent variables does not affect crude price volatility but it is the other way round that crude futures volatility affect Nifty Stock Futures and Crude Spot.

Serial Correlation Test

Table 7a (Be Read with Table 7b) shows results of Serial Correlation Test as follows:

Date: 10/07/14 Time: 12:39				Date: 10/07/14 Time: 12:43			
Sample: 4/01/2009 3/31/2014				Sample: 4/01/2009 3/31/2014			
Included observations: 1155				Included observations: 1155			
AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob

0.075	0.075	6.4679	0.011	0.512	0.512	303.65	0
0.016	0.011	6.7805	0.034	0.379	0.159	470.48	0
-0.004	-0.006	6.7991	0.079	0.298	0.074	573.48	0
-0.003	-0.002	6.8065	0.146	0.27	0.082	657.95	0
0.133	0.134	27.418	0	0.225	0.031	716.79	0
0.112	0.094	41.929	0	0.186	0.014	757.11	0
0	-0.019	41.929	0	0.166	0.025	789.36	0
-0.042	-0.044	43.952	0	0.116	-0.028	805.08	0
-0.012	-0.003	44.123	0	0.101	0.006	816.93	0
0.089	0.079	53.39	0	0.067	-0.022	822.16	0
0.064	0.028	58.187	0	0.008	-0.068	822.24	0
0.023	0.004	58.794	0	-0.027	-0.046	823.1	0
-0.068	-0.062	64.21	0	-0.02	0.008	823.56	0
-0.064	-0.045	68.976	0	-0.032	-0.016	824.78	0
0.011	0.003	69.123	0	-0.03	0.007	825.83	0
0.099	0.075	80.551	0	-0.025	0.012	826.54	0
0.048	0.025	83.217	0	-0.025	0.002	827.3	0
0.002	0.011	83.22	0	-0.037	-0.012	828.95	0
-0.011	0.017	83.355	0	-0.037	-0.002	830.54	0
-0.048	-0.045	86.035	0	-0.066	-0.046	835.63	0
0.003	-0.025	86.046	0	-0.045	0.019	838.01	0
0.033	0.004	87.368	0	-0.058	-0.026	841.95	0
0.028	0.031	88.309	0	-0.079	-0.048	849.34	0
-0.024	-0.011	88.98	0	-0.095	-0.037	859.99	0
-0.021	-0.003	89.483	0	-0.035	0.065	861.46	0
0.012	0.01	89.662	0	0.008	0.059	861.54	0
0.067	0.048	94.907	0	0.006	0.011	861.59	0
0.037	0.01	96.565	0	0.016	0.021	861.91	0
0.023	0.025	97.182	0	0.017	0.007	862.26	0
-0.044	-0.024	99.528	0	0.024	0.007	862.93	0
0.041	0.057	101.54	0	0.031	0.009	864.1	0
0.02	-0.006	102	0	0.029	-0.011	865.07	0
0.004	-0.032	102.02	0	0.03	0.002	866.16	0
0.009	-0.009	102.13	0	0.004	-0.044	866.18	0
-0.008	0.004	102.2	0	0.036	0.025	867.77	0
0	0.011	102.2	0	0.016	-0.026	868.09	0

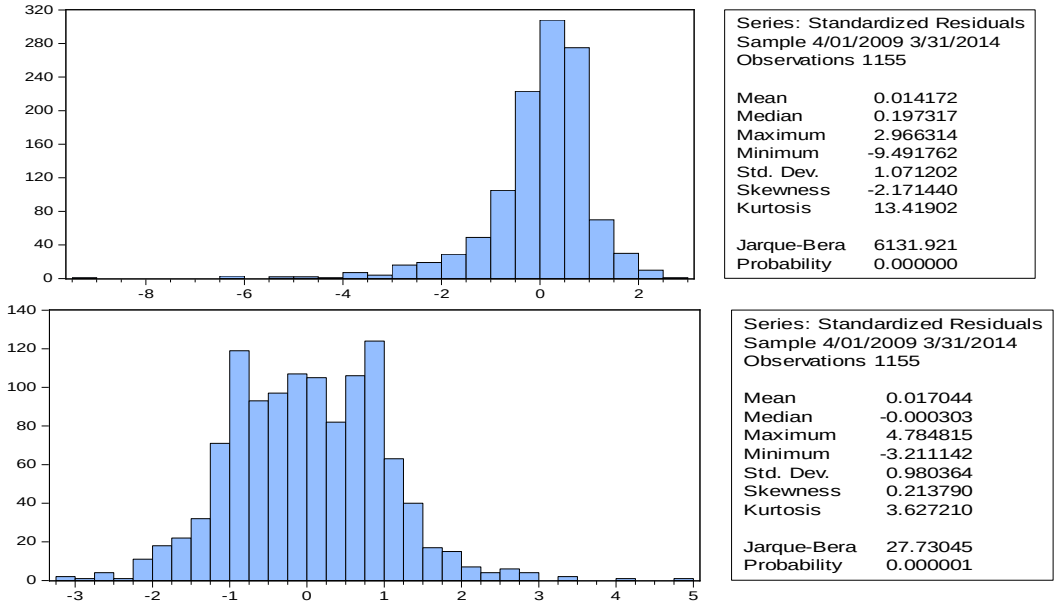
The Serial Correlation in Table 7a and 7b indicates that the P Values of all the variables are smaller than 0.05 and hence the null hypothesis is rejected that there is serial correlation. Similarly Table Value of the Q-statistics in Table 7a and 7b are 6.4679 and 303.65 respectively and the calculated values of Q-statistics are gradually increasing and after wards because there is a trend of consistent rise in the values from lag 1 hence it is justified that there is no serial correlations among the variables. Moreover, in all the cases the P Values are smaller than 0.05 so, on the basis of Q- statistics it can be conferred that there is no serial correlation and hence the null hypothesis is accepted that, there is no serial correlation in the returns of Crude Futures, Nifty Stock Futures and Crude Spot.

Jarque-Bera Statistics

Table 8a & 8b shows results of Jarque-Bera Statistics as follows:

The Jarque-Bera Test is a popular test of normality that incorporates both Skewness and Kurtosis. As per Table 8a and 8b, it appears that crude price returns are not normally distributed which is shown in the charts above. The empirical distribution has a large dispersion; the Mean/Standard Deviation Ratios are very low. The distribution is right skewed, implying that

upward jumps are more frequent than downward jumps, and has fat tails; meaning that large jumps tend to occur more frequently than in the normal Bell Shape Curve. The corresponding P Values are less than 0.05 in both the testes of Jarque-Bera Statistics Test. The Kurtosis values are greater than 3; they are 13.41902 and 3.627210 respectively in all cases indicating that the null hypothesis of residuals of Nifty Stock Futures and Crude Spot and Crude Futures are normally distributed is rejected. This concludes that the Kurtosis Values are not normally distributed.



ARCH Effect

Table 9a & 9b shows the results of ARCH Effect as follows:

Heteroskedasticity Test: ARCH				
F-statistic	1.56523	Prob. F(1,1152)		0.2112
Obs*R-squared	1.565819	Prob. Chi-Square(1)		0.2108
Test Equation:				
Dependent Variable: WGT_RESID^2				
Method: Least Squares				
Date: 10/07/14 Time: 12:40				
Sample (adjusted): 4/02/2009 3/31/2014				
Included observations: 1154 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.189805	0.123174	9.659518	0
WGT_RESID^2(-1)	-0.03684	0.029442	-1.25109	0.2112
R-squared	0.001357	Mean dependent var	1.147563	
Adjusted R-squared	0.00049	S.D. dependent var	4.025015	
S.E. of regression	4.024029	Akaike info criterion	5.624176	
Sum squared resid	18654.12	Schwarz criterion	5.63293	
Log likelihood	-3243.15	Hannan-Quinn criter.	5.62748	
F-statistic	1.56523	Durbin-Watson stat	2.001231	
Prob(F-statistic)	0.211155			

Heteroskedasticity Test: ARCH				
F-statistic	1.660174	Prob. F(1,1152)		0.1978
Obs*R-squared	1.660663	Prob. Chi-Square(1)		0.1975
Test Equation:				
Dependent Variable: WGT_RESID^2				
Method: Least Squares				
Date: 10/07/14 Time: 12:44				
Sample (adjusted): 4/02/2009 3/31/2014				
Included observations: 1154 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.996729	0.053989	18.46166	0
WGT_RESID^2(-1)	-0.03794	0.029442	-1.28848	0.1978
R-squared	0.001439	Mean dependent var	0.96028	
Adjusted R-squared	0.000572	S.D. dependent var	1.562566	
S.E. of regression	1.562119	Akaike info criterion	3.731695	
Sum squared resid	2811.129	Schwarz criterion	3.740449	
Log likelihood	-2151.19	Hannan-Quinn criter.	3.734999	
F-statistic	1.660174	Durbin-Watson stat	1.998682	
Prob(F-statistic)	0.197839			

The ARCH (lm) Test in Table 9a is based on two statistical tests F-Statistic and R-squared and their associated probabilities. The Tabulated Value of F-statistics is 1and the Calculated Value under this study is 1.56523 which are greater than 1; The corresponding Probability Values are 0.2112 which are greater than 0.05; hence, the null hypothesis that there is no ARCH effect in the returns of Crude Futures, Nifty Stock Futures and Crude Spot is accepted. So it is concluded that there is no ARCH effect.

The ARCH (lm) Test in Table 7b is based on two statistical tests F-Statistic and R-squared and their associated probabilities. The Tabulated Value of F-statistics is 1and the Calculated Value under this study is 1.660174 which are greater than 1. The corresponding Probability Values are 0.1978 which are more than 0.05; hence, the null hypothesis that there is no ARCH effect in the returns of Gold Futures, Nifty Stock Futures and Crude Spot is accepted. So it is concluded that there is no ARCH effect in both the cases and there is GARCH effect.

7. Conclusion

The study unfolds the relationship among Crude Futures, Nifty Stock Futures and Crude Spot. It concludes that, Nifty Stock Futures and Crude Spot has low correlation with Crude Futures. Crude future is a better hedge for crude spot and has no direct contribution in price formation of Nifty Stock Futures. Hence the relationship is low. The independent impact of Nifty Stock Futures and Crude Spot on Crude futures is low and Crude Future as independent and Nifty Stock Futures and Crude Spot as dependent had a very high impact. This is because crude prices are controlled by oil producing countries and as india is no producing it the impact is low and independent in nature. The crude Futures have mixed cause and effect relationship with Nifty Stock Futures and Crude Spot it is because crude is ruling and others are followers and they modify their prices according to the price determination of Crude in the economy. Volatility measures the uncertainty in the oil prices caused due to underlying variables. The higher the volatility, the greater is the uncertainty faced by the market. This volatility is shown by GARCH model and conferred that the volatility is caused by crude futures in Nifty Stock Futures and Crude Spot. There is GARCH effect and the returns compliment each other tremendously.

8. Implications and Suggestions

The empirical studies for a specific economy may show different results for this relation. The reason for these differences can be explained by time period used for data, econometric models used and varying futures prices of the stocks. The study further implies that the volatility can be explained on other parameters and investment basket or portfolio can be ascertained. On applying regression models further on the specific impact can be judged and decisions can be made whom to hedge and when. Further presence of volatility implies that in long run how these variables can behave and used to determine the optimum portfolio mix strategy.

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