Crude Oil and Indian Capital Market: An Empirical Analysis

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Abstract

Derivatives instruments are those financial assets that are linked to a specific financial instrument, indicator and commodity and through which specific financial risk can be traded in their own right. The value of a financial derivative asset is derived from the price of an underlying asset, such as an asset or index. The present global economy is heavily depending on varied non renewable fossil fuel reserves which are key drivers of 21st century economy. The fuel prices are volatile in recent years that hamper the growth of developing and developed countries. Ever increasing high prices of crude oil directly affect the masses due to increment in the transportation cost influencing the basic necessities and food prices. High oil costs adversely hit economies at macro-level and have been triggering and alarming factors in economic cycles. Oil demand will inevitably prolong to grow even if it is now held back for a few years by the stagnating world-economy. Equity derivatives trading in an organized stock exchange like National Stock Exchange (NSE) was commenced on 12th June, 2000 based on S&P CNX Nifty. Hedging, investing, trading, securities regulators and stock exchanges along with domestic and foreign institutional investor's carries common interest i.e. fairly priced futures contracts.

Achieving and sustaining fair valued equity futures depends heavily on the existence of volatility in which commodities and futures are paired off against one another by professional arbitrageurs seeking to exploit any mispricing. This paper is an attempt to measure crude oil price uncertainty caused by endogenous conditional factors and variables as S&P CNX Nifty and S&P CNX Nifty companies' futures. The measure of volatility will be done on the basis of daily returns of S&P CNX Nifty and S&P CNX Nifty companies' futures and crude oil. Conditional standard deviations will be derived from uni-variate GARCH models. Data will be employed to model the volatility and volatility spill-over across emerging Indian capital markets from July 5th, 2007 to September 27th, 2012 using volatility clustering assuming that the present volatility shocks may be influenced by the expectation of volatility of future period.

Keywords:

Indian Capital Markets; Crude Oil; S&P CNX Nifty; S&P CNX Nifty companies' futures.

Introduction

Petroleum products are hydrocarbon-rich mixture of crude oil and gases. It not only runs factories, cars, heats some homes but drives economies. It has provided Americans with an unprecedented standard of living since its

discovery in America in 1859. Oil is a heterogeneous commodity. There are over 160 different types of crude oil products internationally traded in commodity exchanges world over. 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. 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. Many times it had been recorded that prices of essential products like, crude also acts as a prime driver for such volatility in price of various commodities (Sharma, et al, 2012).

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. 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).

The topics of oil and capital market are the spotlight during last few years. Futures of crude oil were started in India in the year February, 9th 2005. Since then futures and capital market indices along with crude oil trading in futures created some price tidal waves. It seems that, the trend keeps expanding on their ways. Oil belongs to one of the basic energy sources, besides, as the best defensive assets against inflation, oil becomes a popular investment choice as gold is (Liao and Chen, 2005). The oil market has observed a considerable increase in prices over the last decade. Over the period 2005-2012, for instance, the annual average growth rate in crude oil has drastically increased. It is observed that the price of crude oil has also risen sharply, at an annual average rate of 52 per cent.

A derivative is any financial instrument, whose payoffs depend in a direct way on the value of an underlying variable or asset at a time in the future. There are only four derivatives instruments available in the Indian markets, namely, index futures, index options, stock futures and stock options. The future contract is an agreement to buy or sell an asset at a certain time in the future for a certain price. Equities, bonds, hybrid securities and currencies are the financial products that are traded on organized exchanges in which a clearing house interposes itself between buyer and seller and guarantees all transactions. Futures trading are to enter into contracts to buy or sell financial instruments, dealing in commodities or other financial instruments, for forward delivery or settlement, on standardized terms. Stock futures on individual securities were introduced in November 2001 by NSE. The volumes in derivatives markets especially on the Futures and Options segment of the NSE witnessed a tremendous increase and now the turnover is much higher than the turnover in the cash markets (Singh, 2001).

This provokes the question: does the oil market leads the capital market? If it does the same, then it implies that oil prices can be a predictor of futures and stocks prices in the capital market. This may further indicate that there is joint market inefficiency. The study is an attempt to draw a link between the crude oil, S&P CNX Nifty and S&P CNX Nifty companies' futures in Indian capital market. This paper explores three broad methods to study using the above variables. The first is a volatility investigation of the basic correlations using the historical data of crude oil, S&P CNX Nifty and S&P CNX Nifty companies' futures. Second is to determine the combined stationary characteristics and impact of returns of S&P CNX Nifty and S&P CNX Nifty companies' futures on crude oil returns using regression and unit root models. The third is to look at the volatility caused by these variables towards the volatility in the price discovery of crude oil using econometrics' GARCH (1, 1) Model, Serial Correlation, Jarque- Bera and ARCH lm Tests.

Literature Review

A 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 was 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 discovered that oil price movements are important in explaining movements in stock returns. The oil price movements are able to explain a larger fraction of the forecast error variance in real stock returns than interest rates do; that results in positive shocks to oil prices to depress real stock returns while shocks to real stock returns have positive impacts on interest rates and industrial production (Sardosky, 1999). A 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 study 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 in crude oil pricing (Kuper, 2002).

The researchers tested a mediator variable between crude oil companies and stock exchanges 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). Another study measured a dynamic relation between stock exchange and crude oil prices in Russia by two variable's E-GARCH model and concluded that there exists a negative relation between Russia Stock Exchange Indices and crude oil prices (Behran and Nikolov, 2010). The researcher used co-integration and vector error correction method analysis and 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).

The relationship between oil prices and emerging market stock prices and oil prices and exchange rates were studied as relatively little was 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&P 500 return but their results has not been approved in low price volatilities (Lee and Chiou, 2011).

A 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 indices. 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).

Another 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 concluded 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 reacted on to gold price and its volatility was rigorous and stock indices volatility was more predictable by global gold price index (Hamed and Ehsan, 2012).

A research paper investigated the co-movements of world gold price, world oil prices, 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 spill over for these macro variables. The study concluded the existence of co-movements among them, however, not all of them were moving simultaneously. The study also inferred that, stock price and gold price were more likely to move on their own while oil price and exchange rates likely to be influenced by other variables (Samanta and Ali, 2012).

The literature review opens up scope for the present study in Indian context as it was investigated that the volatility caused on the price of crude oil by other economic variables, relatively is little known, especially about the relationship between crude oil prices, S&P CNX Nifty and S&P CNX Nifty companies' futures. This paper proposes to investigate the volatility caused by these variables.

Objectives

- To study the relationship between returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures.
- To study whether crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures returns are stationary.
- To study the impact of returns of S&P CNX NIFTY companies' futures and S&P CNX Nifty on crude oil returns.
- To study the volatility caused by of S&P CNX NIFTY companies' futures and S&P CNX Nifty in crude oil returns.
- To study whether returns of crude oil, S&P CNX Nifty and of S&P CNX NIFTY companies' futures are serially correlated.
- To study whether returns of crude oil, S&P CNX Nifty and of S&P CNX NIFTY companies' futures prices are normally distributed.
- To study the ARCH effect caused by returns of S&P CNX NIFTY and S&P CNX Nifty companies' futures on returns of crude oil.

Research Methodology

Hypotheses

To test the above objectives following null hypothesis were made:

H_{01}: There is no significant relationship between returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures.

H_{02}: returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures are non-stationary.

H_{03}: There is no significant impact of returns of S&P CNX Nifty and S&P CNX NIFTY companies' futures on returns of crude oil.

H_{04}: There is no volatility caused by returns of S&P CNX Nifty and S&P CNX NIFTY companies' futures on returns of crude oil.

H_{05}: There is no serial correlation in the returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures.

H_{06}: The residuals of returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures are normally distributed.

H_{07}: There is no ARCH effect in the returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures.

Scope of the Study

1. The analysis is being carried on from July 5th, 2007 to September 27th, 2012.
2. S&P CNX Nifty futures companies of 50 companies Siemens, DLF, SESA-GOA, and SUN PHARMA companies started their future trading in between the studied period. Thus data for these companies were not available for said period. Hence present study includes analysis on 46 companies.
3. The analysis is also subjected to the contemporary environment affecting crude oil pricing and capital market.

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 crude oil price, value of S&P CNX Nifty and S&P CNX NIFTY companies' futures prices, for finding their returns. For this, hetroscedastic data were converted into homoscedastic data. There are total 1264 observations under the study period.

Tools Used

Statistical tools comprising econometric tools like, Correlation Analysis, Regression Analysis, Unit Root, 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.

Analysis and Inerpretation

Table 1: Correlation of Returns of S&P CNX Nifty, S&PCNX Nifty Companies' Futures with Crude Oil Returns

On applying Karl Pearson Coefficient of Correlation at 5% level of significance as shown in Table 1 above shows that, there is a high positive correlation between returns of: crude oil and Bank of Baroda, Cairn India, CIPLA, Dr Reddy's, Hero Moto Corp, HLL and Infosys futures individually. There is a moderate degree of positive correlation between returns of: crude oil and ACC, Ambuja, AXIS Bank, BPCL, HCL, Maruti, PNB, Ranbaxy, TCS and Ultra Tech futures individually. There is a low positive correlation between returns of: crude oil and Bajaj, GAIL, HINDALCO, ICICI, IDFC ITC, M&M, Power Grid, S&P CNX Nifty, and SBIN futures individually. There is a negative correlation between returns of: crude oil and Bharti, BHEL, Coal India, Grasim, HDFC Bank, HDFC Company, JINDAL, JP Associates, Kotak, L&T, Lupin, NTPC, ONGC, RIL, RILINFRA, Tata Motors, Tata Powers, Tata Steel, and WIPRO futures. Thus, the null hypothesis that, there exists no significant relationship between returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures was rejected. On the basis of correlation results it may be interpreted that there is a significant relationship between crude oil prices and values of S&P CNX Nifty and S&P CNX NIFTY. The relationship is either, very high (with seven companies), moderate (with ten companies), low (with ten companies), even very high negative (with seven companies), moderate negative (with six companies) and low negative (with six companies). So, there exists significant relationship between returns of crude oil, S&P CNX Nifty and S&P CNX Nifty companies' futures.

Table 2: Unit Root

Augmented Dickey-Fuller Unit Root Test was conducted at 95% level of significance. Lag lengths and model were chosen according to the Schwarz Information Criterion (SIC). The critical values are based on MacKinnon (1999); an asterisk indicates significance at 5 percent level. Results of the Unit Root Test was applied for determining whether variables are stationary or not which were found at the level I (0), which is shown in Table 2. It was observed that at constant i.e., level, trend and intercept and none the value of p* are greater in case of crude oil, S&P CNX NIFTY, ACC, Ambuja, AXIS, Bajaj, Bharti, BHEL, BOB, BPCL, Cairn, CIPLA, Coal, Dr Reddy, GAIL, Grasim, HCL, HDFC Bank, HDFC company, Hero Moto Corp, HINDALCO, HLL, ICICI, IDFC, Infosys, ITC, JP, KOTAK Bank, LUPIN, M&M, Maruti, NTPC, ONGC, PNB, Ranbaxy, Reliance, Reliance Infra, SBI, Tata Motors, Tata Powers, Tata Steels, Ultra Tech and Wipro futures except three companies i.e., Jindal, L &T and Power Grid; hence the hypothesis that the returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures are non-stationary is accepted. That is to say that, the data set is non stationary and got unit root in the initial phase. It is also observed that futures of Jindal, L&T, and Power Grid are having p values smaller than 0.05 but the ADF value is greater than values of significance at 1%, 5% and 10% level and all the values are negative. It is further observed that last three variables are stationary in p values but when it comes to ADF Test and negative values, they have unit root and they are not stationary. According to overall results, as all variables are integrated from the first degree I (0), it is concluded that, the null hypothesis is accepted that crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures returns are non-stationary so other tests like Granger Causality and Johensen Co-integration tests cannot be applied upon.

Table 3: Regression

As shown in Table 3, the regression model of returns of crude oil as dependent variable on the basis of S&P CNX Nifty and S&P CNX NIFTY companies' futures as independent variable has yielded an R-squared value of 0.663587, indicating that, 66.35% of the variation in independent variables was causing changes in returns of crude oil. The subsequent F statistics i.e., goodness of fit or good fit was 52.1007 and the corresponding P value was 0.00, pointing out that, it was significant at 95% level of significant, as $P < 0.05$. Further the regression test proves that the independent variables like ACC, Ambuja, Bajaj, BPCL, Dr Reddy, HCL, HDFC, Hero Moto Corp, HLL, IDFC, Lupin, NTPC, Ranbaxy, RIL Infra, Tata Steel and Wipro futures affect the dependent variable significantly because, the corresponding P value is less than 0.05. It is also

observed that, the p values of S&P CNX NIFTY, AXIS, Bharti, BHEL, BOB, Cairn, CIPLA, Coal, GAIL, Grasim, HDFC Bank, HINDALCO, ICICI, Infosys, ITC, Jindal, JP Associates, KOTAK, L&T, Maruti, M&M, ONGC, Power Grid, PNB, RIL, SBI, TATA Motors, Tata Power, TCS and Ultra Tech futures are more than 0.05 so, have low impact on crude oil individually. But, it is also inferred that the studied variables collectively have significant impact on the returns of crude oil (R-squared value of 0.663587). Thus, the null hypothesis that there is no significant impact of returns of S&P CNX Nifty and S&P CNX NIFTY companies' futures on returns of crude oil was rejected. So, there is a significant impact of returns of S&P CNX Nifty and S&P CNX NIFTY companies' futures on the returns of crude oil. The DW statistics will lie in the 0-4 range, with a value near two, indicating no first-order serial correlation. Positive serial correlation is associated with DW values below 2 and negative serial correlation with DW values above 2. The Durbin Watson statistics value is 1.706995 which concludes that there is positive serial correlation among the variables.

Table 4: GARCH (1, 1) Model

GARCH= C(3)+C(4)*RESID(-1)^2+C(5)*GARCH(-1) + C (6) * A C C F + C (7) * A M B U J A F +C(8)*AXISF+C(9)*BAJAJF+C(10)*BHARTIF +C(11)*BHELF+C(12)*BOBF+C(13)*BPCLF +C (1 4) * C A I R N F + C (1 5) * C I P L A F + C (16)*COALF+C(17)*DRREDDYF+C(18) *GAILF+ C(19)* GRASIMF + C(20)*HCLF+C(21)* HDFCBKF +C (22) * H D F C C O F + C (2 3) * H E R O F + C (2 4) * HINDALCOF+C(25)*HLLF+C(26)*ICICIF+C(27)*IDFC+C(2 8) * I N F Y F + C (2 9) * I T C F + C (3 0)*JINDALF+C(31)*JPF+C(32)*KOTAKF+C(33)*LNTF+C(3 4)*LUPINF+C(35)*MARUTIF+(36)*MNMF+C(37)*NTPCF +C(38)*ONGCF+C(39)*PGRIDF+C(40)*PNBF+C(41)*RAN BAXYF+(42)*RILF+C(43)*RILINFF+C(44)*SBIINF+C(45) *TATAMOF+C(46)*TATAPOF+C(47)*TATASTF+C(48)*TCS F+C(49)*ULTRAF+C(50)*WIPROF.

The GARCH (1, 1) Model confers that, at Normal GAUSSIAN Test, Student t Distribution and GED with fix parameters, the p value of crude oil i.e., ARCH (α), S&P CNX NIFTY i.e., GARCH (β), S&P CNX NIFTY companies' futures is less than 0.05 in all the three tests, hence the null hypothesis that the no volatility caused by returns of S&P CNX Nifty and S&P CNX NIFTY companies' futures on returns of crude oil is rejected. This is to say that it affect the returns of crude oil. The study also shows that independently these variables have low volatility meaning that the p values in almost all the cases are higher than 0.05 which means that these variables does not transmit volatility independently but combined, they transmit volatility. The overall judgement can be made that volatility in S&P CNX NIFTY and S&P CNX NIFTY companies' futures affect the volatility in the returns of crude oil.

Table 5: Serial Correlation Test

Normal GAUSSIAN, Student t Distribution and GED with fix parameter indicates that, there is no serial correlation among the variables as the p values of all the variables are greater than 0.05 and hence the null hypothesis is accepted that there is no serial correlation in the returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures. Similarly the Q statistics tabulated value is 3.87 and there is a consistent rise in value from lag 6 under Normal Gaussian, lag 9 in Student t Distribution and lag 3 in case of GED with Fix Parameters. Hence it is justified that there is no serial correlations among the variables. The p value is greater than 0.05, hence it can be said that there is no serial correlation in the returns of crude oil, S&P CNX NIFTY and S&P CNX NIFTY companies' futures.

Table 6: Jarque-Bera Statistics

The Jarque-Bera is a popular test of normality that incorporates both skewness and kurtosis. It appears that crude oil returns are not normally distributed as shown in the charts created by using Normal GAUSSIAN, Student t Distribution and GED with fix parameter. The empirical distribution has a large dispersion; the mean/standard deviation ratio is very low. The distribution is left skewed, implying that downward jumps are more frequent than upward jumps, and has fat tails meaning that large jumps tend to occur more frequently than in the normal case. The corresponding p value is $0 < 0.05$ in all 3 tested Jarque- Bera statistics tests indicting that null hypothesis that the residuals of returns of crude oil, S&P CNX Nifty and S&P CNX NIFTY companies' futures are normally distributed is rejected. It means that the residuals are not normally distributed.

Table 7: ARCH Effect

The ARCH lm test is based on the probability associated with two statistical tests F-Statistic and R-squared. The p value in both the cases, are greater than 0.05 hence the null hypothesis of these two tests is that there is no ARCH effect in the returns of crude oil, S&P CNX NIFTY and S&P CNX NIFTY companies' futures is accepted. So it is inferred that there is no ARCH effect that is to say there is a GARCH effect. It may be inferred that the volatility caused by S&P CNX Nifty and S&P CNX Nifty companies' futures affect volatility of crude oil prices.

Discussion

The existence of significant correlation-ship (either positive or negative) explains that crude oil and S&P CNX Nifty and S&P CNX Nifty companies' futures are significantly correlated. Presence of significant correlation justifies choosing of variables studied. Though there was significant correlation but data set was found to be non stationary. On non stationary data set Granger Causality and Johensen Co-integration test could not be applied upon. Regression model depicted linear equation to predict crude oil returns on the basis of S&P CNX Nifty. Under GARCH (1,1) Model it was found that the volatility caused by S&P CNX Nifty and S&P CNX Nifty companies' futures affect volatility of crude oil prices it is noteworthy that the two variables volatility is affecting volatility of crude oil that signifies importance of Indian stock market. Probably it is due to expected higher consumption of crude oil, higher demand of crude oil. Another probable reason the impact of foreign stock exchanges on Indian stock exchanges. As foreign stock exchange have foreign oil producing companies having higher profits as registered companies causing higher indexing. Further crude oil is required as a source of production and any change in prices affect the cost of production and further it is revealed through the share prices which affect index.

Conclusion

The study unfolds the relationship among crude oil, S&P CNX

Nifty and S&P CNX Nifty companies' futures. It concludes that crude oil and S&P CNX Nifty is significantly correlated. It is also conferred that there exist unit root among crude oil, S&P CNX Nifty and S&P CNX Nifty companies' futures. Persistence was shown by the existence of a unit root. The combined impact of these variables is high and S&P CNX Nifty and S&P CNX Nifty companies' futures poses impact on crude oil returns. It is also worthwhile to study the volatility of crude oil prices against S&P CNX Nifty and S&P CNX Nifty companies' futures. 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 in crude oil is caused by S&P CNX Nifty and S&P CNX Nifty companies' futures. This is due to the fact that S&P CNX Nifty companies' futures are a better hedge; S&P CNX Nifty shows an average performance of stocks of listed companies which use crude oil. There is no serial correlation and prices are independent of behavior. The downward trend was persistent and forecast-able using Jarque- Bera test. There is no ARCH effect and the returns effect and complement each other.

Implications

The study implies that there is a relationship between crude oil and stock exchanges consequently with capital market. Further it implies that not only consumption of crude oil but financial products determine crude oil prices. It also implies that crude oil also affect capital market activities.

Suggestions

The implication also suggests that while determining crude oil prices impact on capital market be considered. While regulating capital market impact on crude oil consequently impact on general price level changes should be taken under considerations. The two financial products along with crude oil should be considered in any ones portfolio. Impact of futures index may be added or replaced in further studies.

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Table 1: Correlation of Returns of S&P CNX Nifty, S&PCNX Nifty Companies' Futures with Crude Oil Returns

ACCF	0.355513	ITCF	0.249446
AMBUJAF	0.438593	JINDALF	-0.67355
AXISF	0.406806	JPF	-0.6363
BAJAJF	0.10437	KOTAKF	-0.20767
BHARTIF	-0.616409	LNTF	-0.25434
BHELF	-0.443407	LUPINF	-0.44456
BOBF	0.540666	MARUTIF	0.370034
BPCLF	0.474445	MNMF	0.136473

CAIRNF	0.638683	NTPCF	-0.33434
CIPLAF	0.649482	ONGCF	-0.53547
COALF	-0.596554	PGRIDF	0.209446
DRREDDYF	0.661427	PNBF	0.490587
GAILF	0.193644	RANBAXYF	0.315408
GRASIMF	-0.036892	RILF	-0.6446
HCLF	0.471699	RILINFF	-0.4914
HDFCBKF	-0.298287	S&P CNX NIFTY	0.256535
HDFCCOF	-0.644366	SBIINF	0.27456
HEROF	0.691206	TATAMOF	-0.15396
HINDALCOF	0.050186	TATAPOF	-0.41126
HLLF	0.689866	TATASTF	-0.16053
ICICIF	0.112123	TCSF	0.304461
IDFCF	0.022517	ULTRAF	0.416964
INFYF	0.519234	WIPROF	-0.0765

Table 2: Unit Root

Variables		ADF Value	1% level	5% level	10% level	P value*
Crude Oil f	**Level**	-2.280718	-3.435352	-2.863637	-2.567936	0.1785*
	Trend & Intercept	-5.514256	-3.965381	-3.413399	-3.128736	0
	None	-0.505294	-2.566807	-1.941076	-1.616529	0.4976*
S&P CNX Nifty	**Level**	-1.708084	-3.435319	-2.863622	-2.567928	0.4269*
	Trend & Intercept	-1.892763	-3.965334	-3.413376	-3.128722	0.6577*
	None	0.155102	-2.566796	-1.941074	-1.616531	0.731*
ACC f	**Level**	-1.002958	-3.435319	-2.863622	-2.567928	0.7541*
	Trend & Intercept	-2.391139	-3.965334	-3.413376	-3.128722	0.384*
	None	0.235786	-2.566796	-1.941074	-1.616531	0.7545*
AMBUJA f	**Level**	-1.502089	-3.435319	-2.863622	-2.567928	0.5325*
	Trend & Intercept	-3.271507	-3.965334	-3.413376	-3.128722	0.0715*
	None	-0.151149	-2.566796	-1.941074	-1.616531	0.6314*
AXIS f	**Level**	-1.871922	-3.435319	-2.863622	-2.567928	0.3458*
	Trend & Intercept	-2.026883	-3.965334	-3.413376	-3.128722	0.5855*
	None	-0.020853	-2.566796	-1.941074	-1.616531	0.6757*
BAJAJ f	**Level**	-1.81882	-3.435319	-2.863622	-2.567928	0.3715*
	Trend & Intercept	-1.904561	-3.965334	-3.413376	-3.128722	0.6515*
	None	-0.891565	-2.566796	-1.941074	-1.616531	0.3299*
BHARTI f	**Level**	-1.665776	-3.435319	-2.863622	-2.567928	0.4485*
	Trend & Intercept	-2.82921	-3.965334	-3.413376	-3.128722	0.1869*
	None	-1.436478	-2.566796	-1.941074	-1.616531	0.1409*
BHEL f	**Level**	-0.68865	-3.435319	-2.863622	-2.567928	0.8475*
	Trend & Intercept	-1.639968	-3.965334	-3.413376	-3.128722	0.7767*
	None	-0.861233	-2.566796	-1.941074	-1.616531	0.3429*
BOB f	**Level**	-1.692288	-3.435319	-2.863622	-2.567928	0.435*
	Trend & Intercept	-1.890316	-3.965334	-3.413376	-3.128722	0.6589*
	None	-0.101788	-2.566796	-1.941074	-1.616531	0.6485*
BPCL f	**Level**	-2.060487	-3.435319	-2.863622	-2.567928	0.2611*
	Trend & Intercept	-1.885301	-3.965334	-3.413376	-3.128722	0.6615*
	None	-0.544098	-2.566796	-1.941074	-1.616531	0.4814*
CAIRN f	**Level**	-2.216012	-3.435319	-2.863622	-2.567928	0.2007*
	Trend & Intercept	-3.103608	-3.965334	-3.413376	-3.128722	0.1058*
	None	0.217942	-2.566796	-1.941074	-1.616531	0.7494*
CIPLA f	**Level**	-1.229497	-3.435319	-2.863622	-2.567928	0.6636*
	Trend & Intercept	-2.788939	-3.965334	-3.413376	-3.128722	0.2016*
	None	0.564242	-2.566796	-1.941074	-1.616531	0.838*

COAL f	Level	-1.541036	-3.435319	-2.863622	-2.567928	0.5126*
	Trend & Intercept	-1.896667	-3.965334	-3.413376	-3.128722	0.6556*
	None	-1.326404	-2.566796	-1.941074	-1.616531	0.1712*
DRREDDY f	Level	-0.720108	-3.435319	-2.863622	-2.567928	0.8397*
	Trend & Intercept	-1.797674	-3.965334	-3.413376	-3.128722	0.7056*
	None	1.009914	-2.566796	-1.941074	-1.616531	0.9181*
GAIL f	Level	-2.324079	-3.435319	-2.863622	-2.567928	0.1645*
	Trend & Intercept	-2.288388	-3.965334	-3.413376	-3.128722	0.4395*
	None	-0.2469	-2.566796	-1.941074	-1.616531	0.5973*
GRASIM f	Level	-1.456008	-3.435319	-2.863622	-2.567928	0.5558*
	Trend & Intercept	-1.406834	-3.965334	-3.413376	-3.128722	0.8589*
	None	-0.08985	-2.566796	-1.941074	-1.616531	0.6526*
HCL f	Level	-0.603641	-3.435319	-2.863622	-2.567928	0.8673*
	Trend & Intercept	-2.406037	-3.965334	-3.413376	-3.128722	0.3761*
	None	0.54585	-2.566796	-1.941074	-1.616531	0.8339*
HDFCBK f	Level	-1.669843	-3.435319	-2.863622	-2.567928	0.4464*
	Trend & Intercept	-1.865026	-3.965334	-3.413376	-3.128722	0.672*
	None	-0.894589	-2.566796	-1.941074	-1.616531	0.3286*
HDFCCO f	Level	-1.737014	-3.435319	-2.863622	-2.567928	0.4123*
	Trend & Intercept	-2.630757	-3.965334	-3.413376	-3.128722	0.2665*
	None	-1.39753	-2.566796	-1.941074	-1.616531	0.1512*
HERO f	Level	-1.446839	-3.435319	-2.863622	-2.567928	0.5604*
	Trend & Intercept	-2.217147	-3.965334	-3.413376	-3.128722	0.479*
	None	0.512548	-2.566796	-1.941074	-1.616531	0.8263*
HINDALCO f	Level	-1.677703	-3.435319	-2.863622	-2.567928	0.4424*
	Trend & Intercept	-1.670738	-3.965334	-3.413376	-3.128722	0.7638*
	None	-0.756196	-2.566796	-1.941074	-1.616531	0.3888*
HLL f	Level	0.498034	-3.435319	-2.863622	-2.567928	0.9867*
	Trend & Intercept	-1.43674	-3.965334	-3.413376	-3.128722	0.8499*
	None	1.852251	-2.566796	-1.941074	-1.616531	0.9851*
ICICI f	Level	-2.126555	-3.435323	-2.863624	-2.567929	0.2343*
	Trend & Intercept	-2.257179	-3.96534	-3.413379	-3.128724	0.4567*
	None	-0.45604	-2.566797	-1.941075	-1.61653	0.5176*
IDFC f	Level	-1.997497	-3.435319	-2.863622	-2.567928	0.2881*
	Trend & Intercept	-1.996202	-3.965334	-3.413376	-3.128722	0.6023*
	None	-0.376777	-2.566796	-1.941074	-1.616531	0.5488*
INFY f	Level	-1.321859	-3.435319	-2.863622	-2.567928	0.6213*
	Trend & Intercept	-1.925201	-3.965334	-3.413376	-3.128722	0.6406*
	None	0.060626	-2.566796	-1.941074	-1.616531	0.702*
ITC f	Level	-2.942499	-3.435319	-2.863622	-2.567928	0.0409*
	Trend & Intercept	-3.122372	-3.965334	-3.413376	-3.128722	0.1014
	None	0.024818	-2.566796	-1.941074	-1.616531	0.6905*
JINDAL f	Level	-3.240373	-3.435323	-2.863624	-2.567929	0.018
	Trend & Intercept	-3.546141	-3.96534	-3.413379	-3.128724	0.035
	None	-3.001551	-2.566797	-1.941075	-1.61653	0.0026
JP f	Level	-2.7629	-3.435323	-2.863624	-2.567929	0.064*
	Trend & Intercept	-2.873885	-3.96534	-3.413379	-3.128724	0.1714*
	None	-2.380789	-2.566796	-1.941074	-1.616531	0.0168
KOTAK f	Level	-2.833908	-3.435319	-2.863622	-2.567928	0.0538*
	Trend & Intercept	-2.854622	-3.965334	-3.413376	-3.128722	0.178*
	None	-0.793792	-2.566796	-1.941074	-1.616531	0.3722*
LNT f	Level	-3.729003	-3.435319	-2.863622	-2.567928	0.0038
	Trend & Intercept	-4.466127	-3.965334	-3.413376	-3.128722	0.0017
	None	0.050617	-2.566796	-1.941074	-1.616531	0.6988*

LNT f	Level	-3.729003	-3.435319	-2.863622	-2.567928	0.0038
	Trend & Intercept	-4.466127	-3.965334	-3.413376	-3.128722	0.0017
	None	0.050617	-2.566796	-1.941074	-1.616531	0.6988*
LUPIN f	Level	-1.81244	-3.435319	-2.863622	-2.567928	0.3747*
	Trend & Intercept	-2.244884	-3.965334	-3.413376	-3.128722	0.4635*
	None	-1.21452	-2.566796	-1.941074	-1.616531	0.2063*
MNM f	Level	-2.2968	-3.435319	-2.863622	-2.567928	0.1732*
	Trend & Intercept	-2.447241	-3.965334	-3.413376	-3.128722	0.3547*
	None	-0.459102	-2.566796	-1.941074	-1.616531	0.5164*
MARUTI f	Level	-1.554415	-3.435319	-2.863622	-2.567928	0.5057*
	Trend & Intercept	-1.753945	-3.965334	-3.413376	-3.128722	0.7265*
	None	0.192706	-2.566796	-1.941074	-1.616531	0.7421*
NTPC f	Level	-3.321638	-3.435319	-2.863622	-2.567928	0.0142
	Trend & Intercept	-3.933552	-3.965334	-3.413376	-3.128722	0.0111
	None	-0.400311	-2.566796	-1.941074	-1.616531	0.5397*
ONGC f	Level	-1.212094	-3.435319	-2.863622	-2.567928	0.6713*
	Trend & Intercept	-2.068968	-3.965334	-3.413376	-3.128722	0.5621*
	None	-0.987174	-2.566796	-1.941074	-1.616531	0.2902*
PNB f	Level	-1.426867	-3.435319	-2.863622	-2.567928	0.5703*
	Trend & Intercept	-1.34975	-3.965334	-3.413376	-3.128722	0.8747*
	None	-0.014908	-2.566796	-1.941074	-1.616531	0.6776*
PGRID f	Level	-3.831929	-3.435327	-2.863626	-2.56793	0.0027
	Trend & Intercept	-4.098513	-3.965346	-3.413382	-3.128726	0.0064
	None	0.169702	-2.566797	-1.941075	-1.61653	0.7353*
RANBAXY f	Level	-1.742872	-3.435319	-2.863622	-2.567928	0.4093*
	Trend & Intercept	-2.045365	-3.965334	-3.413376	-3.128722	0.5752*
	None	-0.00732	-2.566796	-1.941074	-1.616531	0.6801*
RIL f	Level	-1.370986	-3.435319	-2.863622	-2.567928	0.5978*
	Trend & Intercept	-3.049898	-3.965334	-3.413376	-3.128722	0.1191*
	None	-0.991116	-2.566796	-1.941074	-1.616531	0.2886*
RILINF f	Level	-1.798323	-3.435319	-2.863622	-2.567928	0.3816*
	Trend & Intercept	-2.892587	-3.965334	-3.413376	-3.128722	0.1652*
	None	-0.785235	-2.566796	-1.941074	-1.616531	0.376*
SBIIN f	Level	-1.978536	-3.435323	-2.863624	-2.567929	0.2965*
	Trend & Intercept	-2.084162	-3.96534	-3.413379	-3.128724	0.5536*
	None	-0.149509	-2.566797	-1.941075	-1.61653	0.632*
TATAMO f	Level	-1.10147	-3.435319	-2.863622	-2.567928	0.7172*
	Trend & Intercept	-1.138024	-3.965334	-3.413376	-3.128722	0.9209*
	None	-0.982388	-2.566796	-1.941074	-1.616531	0.2921*
TATAPO f	Level	-0.975793	-3.435319	-2.863622	-2.567928	0.7636*
	Trend & Intercept	-1.897545	-3.965334	-3.413376	-3.128722	0.6552*
	None	-0.793639	-2.566796	-1.941074	-1.616531	0.3723*
TATAST f	Level	-1.65566	-3.435319	-2.863622	-2.567928	0.4537*
	Trend & Intercept	-1.82368	-3.965334	-3.413376	-3.128722	0.6928*
	None	-0.890004	-2.566796	-1.941074	-1.616531	0.3305*
TCS f	Level	-1.4474	-3.435319	-2.863622	-2.567928	0.5601*
	Trend & Intercept	-2.447599	-3.965334	-3.413376	-3.128722	0.3546*
	None	-0.195492	-2.566796	-1.941074	-1.616531	0.6158*
ULTRA f	Level	1.291795	-3.435319	-2.863622	-2.567928	0.9987*
	Trend & Intercept	-0.659041	-3.965334	-3.413376	-3.128722	0.9749*
	None	1.8768	-2.566796	-1.941074	-1.616531	0.9859*
WIPRO f	Level	-1.867887	-3.435323	-2.863624	-2.567929	0.3478*
	Trend & Intercept	-1.869382	-3.96534	-3.413379	-3.128724	0.6697*
	None	-0.787494	-2.566797	-1.941075	-1.61653	0.375*

Table 3: Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.36698	6.883044	3.394861	0.0007
S&P CNX NIFTY	0.743062	1.194649	0.621992	0.5341*
ACCF	-0.976593	0.321514	-3.037483	0.0024
AMBUJAF	0.591711	0.169575	3.489377	0.0005
AXISF	-0.092969	0.291939	-0.318452	0.7502*
BAJAJF	-0.17444	0.07724	-2.258413	0.0241
BHARTIF	0.099278	0.157077	0.632035	0.5275*
BHELF	0.035047	0.11564	0.303072	0.7619*
BOBF	0.074986	0.185853	0.403468	0.6867*
BPCLF	-0.26142	0.118144	-2.212729	0.0271
CAIRNF	0.329433	0.266206	1.237511	0.2161*
CIPLAF	-0.339551	0.332784	-1.020335	0.3078*
COALF	0.071371	0.119349	0.598005	0.5499*
DRREDDYF	0.423454	0.215678	1.963362	0.0498
GAILF	-0.150882	0.267253	-0.564565	0.5725*
GRASIMF	0.378312	0.279763	1.352257	0.1765*
HCLF	0.479417	0.217819	2.200992	0.0279
HDFCBKF	-0.115885	0.073782	-1.57065	0.1165*
HDFCCOF	-0.181087	0.074975	-2.415283	0.0159
HEROF	0.558467	0.236037	2.366015	0.0181
HINDALCOF	0.236905	0.222584	1.064341	0.2874*
HLLF	0.735672	0.276099	2.664521	0.0078
ICICIF	-0.658133	0.33913	-1.940654	0.0525*
IDFCF	0.687029	0.256806	2.675285	0.0076
INFYF	-0.220995	0.2447	-0.903126	0.3666*
ITCF	0.229918	0.193508	1.188159	0.235*
JINDALF	-0.095115	0.050443	-1.885604	0.0596*
JPF	-0.104345	0.157887	-0.660882	0.5088*
KOTAKF	-0.355629	0.222155	-1.600817	0.1097*
LNTF	-0.012718	0.194519	-0.06538	0.9479*
LUPINF	-0.260458	0.096377	-2.702499	0.007
MARUTIF	-0.139236	0.27728	-0.50215	0.6157*
MNMF	-0.135941	0.136458	-0.996211	0.3193*
NTPCF	0.475503	0.231277	2.055991	0.04
ONGCF	-0.068225	0.077072	-0.885213	0.3762*
PGRIDF	-0.593592	0.313722	-1.892095	0.0587*
PNBF	-0.405806	0.342682	-1.184207	0.2366*
RANBAXYF	-0.478598	0.184247	-2.597595	0.0095
RILF	0.111089	0.164708	0.674458	0.5001*
RILINFF	-0.508306	0.213998	-2.375279	0.0177
SBIINF	-0.084413	0.341434	-0.247231	0.8048*
TATAMOF	0.073135	0.082263	0.889032	0.3742*
TATAPOF	0.030803	0.089275	0.345032	0.7301*
TATASTF	0.799639	0.272466	2.934825	0.0034
TCSF	-0.341333	0.207923	-1.641636	0.1009*
ULTRAF	-0.091121	0.290842	-0.313299	0.7541*
WIPROF	-0.686123	0.180575	-3.799648	0.0002
R-squared	0.663587	Mean dependent var	17.75588	
Adjusted R-squared	0.65085	S.D. dependent var	0.684771	
S.E. of regression	0.404624	Akaike info criterion	1.064812	
Sum squared resid	198.9201	Schwarz criterion	1.256256	
Log likelihood	-624.8966	Hannan-Quinn criter.	1.136748	
F-statistic	52.1007	Durbin-Watson stat	1.706995	

Table 4: GARCH (1, 1) Model

GARCH= C(3)+C(4)*RESID(-1)^2+C(5)*GARCH(-1) + C (6) * ACCF +C(7)*AMBUJAF +C(8)*AXISF+C(9)*BAJAJF+C(10)*BHARTIF +C(11)*BHELF+C(12)*BOBF+C(13)*BPCLF +C (14)*CAIRNF+C(15)*CIPLAF +C (16)*COALF+C(17)*DRREDDYF+C(18) *GAILF+ C(19)* GRASIMF + C(20)*HCLF+C(21)* HDFCBKF +C (22) *HDFCCOF+C(23)*HEROF +C(24)* HINDALCOF+C(25)*HLLF+C(26)*ICICIF+C(27)*IDFC+C(28)*INFYF+C (29)*ITCF+ C(30)*JINDALF+C(31)*JPF+C(32)*KOTAKF+C(33)*LNTF+C(34)*LUPINF+C(35)*MARUTIF+(36)*MNMF+C(37)*NTPCF+C(38)*ONGCF+C(39)*PGRIDF+C(40)*PNBF+C(41)*RANBAXYF+(42)*RILF+C(43)*RILINF F+C(44)*SBIINF+C(45)*TATAMOF+C(46)*TATAPOF+C(47)*TATASTF+C(48)*TCSF+C(49)*ULTRAF +C(50)*WIPROF.

Normal Distribution

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	5.229127	0.936503	5.583672	0
S&P CNX NIFTY	0.960991	0.071757	13.3923	0
	Variance Equation			
C	-0.106528	2.65512	-0.040122	0.968
RESID(-1)^2	0.086209	0.037916	2.273708	0.023
GARCH(-1)	0.585042	0.108059	5.414079	0
ACCF	-0.010159	0.09947	-0.102129	0.9187
AMBUJAF	0.07383	0.067397	1.095448	0.2733
AXISF	-0.0013	0.107168	-0.012128	0.9903
BAJAJF	0.061814	0.023618	2.617272	0.0089*
BHARTIF	-0.036895	0.048808	-0.75592	0.4497
BHELF	-0.015824	0.097399	-0.162467	0.8709
BOBF	-0.016251	0.081946	-0.198314	0.8428
BPCLF	-0.019484	0.057114	-0.341148	0.733
CAIRNF	-0.122031	0.083589	-1.459884	0.1443
CIPLAF	-0.045042	0.098331	-0.458062	0.6469
COALF	-0.033922	0.035212	-0.963353	0.3354
DRREDDYF	0.051742	0.076272	0.678387	0.4975
GAILF	-0.005869	0.073012	-0.080383	0.9359
GRASIMF	-0.052992	0.066725	-0.794188	0.4271
HCLF	0.006032	0.071327	0.084566	0.9326
HDFCBKF	-0.002131	0.037845	-0.056302	0.9551
HDFCCOF	0.045964	0.018027	2.549679	0.0108
HEROF	-0.01008	0.097683	-0.103195	0.9178
HINDALCOF	-0.003648	0.081451	-0.044791	0.9643
HLLF	0.001491	0.087263	0.017087	0.9864
ICICIF	0.076505	0.112337	0.681028	0.4959
IDFCF	0.046267	0.084171	0.549676	0.5825
INFYF	-0.036107	0.094792	-0.380905	0.7033
ITCF	-0.05981	0.066176	-0.903803	0.3661
JINDALF	0.051302	0.0169	3.035601	0.0024*
JPF	0.039107	0.048072	0.813502	0.4159
KOTAKF	0.050751	0.082139	0.617869	0.5367
LNTF	0.02321	0.082911	0.279933	0.7795
LUPINF	-0.005961	0.041334	-0.144216	0.8853
MARUTIF	-0.047942	0.101992	-0.470059	0.6383
MNMF	0.048663	0.044496	1.093639	0.2741
NTPCF	-0.017237	0.088632	-0.194476	0.8458
ONGCF	-0.021767	0.027528	-0.790701	0.4291

PGRIDF	-0.007475	0.117663	-0.063527	0.9493
PNBF	-0.050784	0.125703	-0.404003	0.6862
RANBAXYF	0.078744	0.052536	1.498848	0.1339
RILF	0.010129	0.062252	0.162708	0.8707
RILINFF	-0.001026	0.085574	-0.011991	0.9904
SBIINF	-0.016064	0.104489	-0.153741	0.8778
TATAMOF	-0.023005	0.043633	-0.527228	0.598
TATAPOF	-0.035383	0.078043	-0.453375	0.6503
TATASTF	0.022074	0.078217	0.282208	0.7778
TCSF	-0.029662	0.036281	-0.817559	0.4136
ULTRAF	0.053765	0.090232	0.595854	0.5513
WIPROF	0.011985	0.045841	0.26144	0.7938
R-squared	0.049137	Mean dependent var	17.75588	
Adjusted R-squared	0.059391	S.D. dependent var	0.684771	
S.E. of regression	0.664125	Akaike info criterion	1.617923	
Sum squared resid	555.7387	Schwarz criterion	1.821586	
Log likelihood	-970.9093	Hannan-Quinn criter.	1.69445	
Durbin-Watson stat	0.612529			

Student t Distribution

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	4.938709	0.560888	8.805158	0
S&P CNX NIFTY	0.985159	0.042985	22.91885	0
Variance Equation				
C	0.234334	3.245867	0.072195	0.9424
RESID(-1)^2	0.637846	0.112701	5.659609	0
GARCH(-1)	0.238475	0.072022	3.311136	0.0009*
ACCF	-0.00429	0.169136	-0.025376	0.9798
AMBUJAF	0.052768	0.09043	0.583519	0.5595
AXISF	-0.04489	0.140589	-0.31932	0.7495
BAJAJF	0.06696	0.03298	2.030304	0.0423*
BHARTIF	0.020947	0.063549	0.329616	0.7417
BHELF	0.001568	0.150035	0.010449	0.9917
BOBF	0.008455	0.094938	0.089057	0.929
BPCLF	0.028298	0.084923	0.333215	0.739
CAIRNF	-0.0662	0.121547	-0.544672	0.586
CIPLAF	-0.02903	0.152695	-0.190113	0.8492
COALF	0.01768	0.044378	0.398406	0.6903
DRREDDYF	-0.01218	0.090989	-0.133802	0.8936
GAILF	-0.0257	0.108658	-0.236505	0.813
GRASIMF	-0.00447	0.076599	-0.058354	0.9535
HCLF	-0.02955	0.093455	-0.316199	0.7519
HDFCBKF	-0.01289	0.068036	-0.189472	0.8497
HDFCCOF	-0.00308	0.029385	-0.104808	0.9165
HEROF	-0.00393	0.126414	-0.031055	0.9752
HINDALCOF	0.009989	0.110599	0.090314	0.928
HLLF	0.005095	0.135031	0.037729	0.9699
ICICIF	0.025856	0.139083	0.1859	0.8525
IDFCF	0.002486	0.118204	0.021027	0.9832
INFYF	0.002093	0.139955	0.014955	0.9881
ITCF	-0.05118	0.092194	-0.555077	0.5788
JINDALF	0.03287	0.024636	1.334231	0.1821

JINDALF	0.03287	0.024636	1.334231	0.1821
JPF	0.016991	0.068245	0.248964	0.8034
KOTAKF	0.019566	0.092082	0.212478	0.8317
LNTF	-0.00949	0.110283	-0.08601	0.9315
LUPINF	-0.01541	0.048492	-0.317742	0.7507
MARUTIF	-0.01877	0.127266	-0.147512	0.8827
MNMF	0.059621	0.056447	1.056227	0.2909
NTPCF	0.004864	0.111478	0.043631	0.9652
ONGCF	-0.02837	0.036614	-0.774761	0.4385
PGRIDF	0.012809	0.171558	0.074664	0.9405
PNBF	-0.02639	0.16716	-0.157864	0.8746
RANBAXYF	0.060983	0.074025	0.823825	0.41
RILF	-0.02268	0.067835	-0.334387	0.7381
RILINFF	-0.01122	0.110423	-0.1016	0.9191
SBIINF	-0.01861	0.151011	-0.12322	0.9019
TATAMOF	-0.01575	0.059657	-0.263995	0.7918
TATAPOF	-0.02434	0.124105	-0.196119	0.8445
TATASTF	0.021872	0.113445	0.192801	0.8471
TCSF	-0.01087	0.054559	-0.199163	0.8421
ULTRAF	0.01148	0.127996	0.089692	0.9285
WIPROF	0.003212	0.058529	0.054887	0.9562
T-DIST. DOF	6.104789	0.695783	8.77398	0
R-squared	0.042881	**Mean dependent var**	17.75588	
Adjusted R-squared	0.052129	**S.D. dependent var**	0.684771	
S.E. of regression	0.666684	**Akaike info criterion**	1.485035	
Sum squared resid	560.0292	**Schwarz criterion**	1.692771	
Log likelihood	-886.057	**Hannan-Quinn criter.**	1.563093	
Durbin-Watson stat	0.607917			

GED with fix Parameters

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	4.834657	0.581596	8.312738	0
S&P CNX NIFTY	0.994585	0.044609	22.29566	0
Variance Equation				
C	0.171124	4.765447	0.035909	0.9714
RESID(-1)^2	0.840733	0.109921	7.648512	0
GARCH(-1)	-0.01727	0.004841	-3.566475	0.0004
ACCF	-0.02432	0.248742	-0.09778	0.9221
AMBUJAF	0.066998	0.120517	0.555919	0.5783
AXISF	-0.02132	0.220568	-0.096648	0.923
BAJAJF	0.080666	0.035595	2.266197	0.0234
BHARTIF	-0.03602	0.081909	-0.439764	0.6601
BHELF	-0.03294	0.198474	-0.165984	0.8682
BOBF	0.034944	0.142718	0.244849	0.8066
BPCLF	-0.00663	0.132738	-0.049919	0.9602
CAIRNF	-0.04729	0.160445	-0.294741	0.7682
CIPLAF	-0.0433	0.225852	-0.191736	0.8479
COALF	-0.0148	0.066723	-0.221779	0.8245
DRREDDYF	0.021351	0.13533	0.157773	0.8746
GAILF	-0.00068	0.175013	-0.003904	0.9969

GRASIMF	-0.03195	0.135708	-0.235459	0.8139
HCLF	-0.02744	0.146492	-0.187297	0.8514
HDFCBKF	-0.01766	0.093091	-0.189711	0.8495
HDFCCOF	0.048988	0.021955	2.231279	0.0257
HEROF	-0.01716	0.165719	-0.103537	0.9175
HINDALCOF	0.001162	0.150928	0.007697	0.9939
HLLF	0.000799	0.20739	0.003853	0.9969
ICICIF	0.032206	0.185744	0.173391	0.8623
IDFCF	0.003117	0.169045	0.018441	0.9853
INFYF	-0.03798	0.188956	-0.201018	0.8407
ITCF	-0.05231	0.133772	-0.391011	0.6958
JINDALF	0.033302	0.022672	1.468882	0.1419
JPF	0.029765	0.103965	0.286301	0.7746
KOTAKF	0.057402	0.130002	0.44155	0.6588
LNTF	0.016967	0.155243	0.109295	0.913
LUPINF	-0.01493	0.070179	-0.21271	0.8316
MARUTIF	-0.03625	0.191163	-0.189632	0.8496
MNMF	0.059126	0.08865	0.666953	0.5048
NTPCF	-0.00912	0.18006	-0.050639	0.9596
ONGCF	-0.02547	0.051561	-0.494046	0.6213
PGRIDF	-0.00249	0.240076	-0.010389	0.9917
PNBF	-0.04141	0.255479	-0.162086	0.8712
RANBAXYF	0.073072	0.108894	0.67104	0.5022
RILF	-0.00824	0.108534	-0.075875	0.9395
RILINFF	9.44E-05	0.158262	0.000597	0.9995
SBIINF	-0.0266	0.219088	-0.121415	0.9034
TATAMOF	-0.00914	0.080374	-0.113698	0.9095
TATAPOF	-0.03231	0.160417	-0.201403	0.8404
TATASTF	0.018088	0.158618	0.114034	0.9092
TCSF	-0.00187	0.061499	-0.030414	0.9757
ULTRAF	0.036345	0.197544	0.183984	0.854
WIPROF	0.01424	0.10506	0.135542	0.8922
R-squared	0.045684	**Mean dependent var**	17.75588	
Adjusted R-squared	0.044926	**S.D. dependent var**	0.684771	
S.E. of regression	0.669212	**Akaike info criterion**	1.570986	
Sum squared resid	564.2847	**Schwarz criterion**	1.774649	
Log likelihood	-941.292	**Hannan-Quinn criter.**	1.647513	
Durbin-Watson stat	0.603364			

Table 5: Serial Correlation Test

Normal Gaussian		Students t Dist.		GED with Fix Parameters	
Q-Stat	**Probability**	**Q-Stat**	**Probability**	**Q-Stat**	**Probability**
0.5671	0.451	0.5464	0.46	2.1505	0.143
1.1987	0.549	1.0285	0.598	2.446	0.294
1.8503	0.604	1.446	0.695	3.4427	0.328
2.2137	0.697	1.619	0.805	3.5793	0.466
2.5091	0.775	2.0773	0.838	6.1823	0.289
3.4867	0.746	2.5093	0.867	7.1615	0.306
3.7902	0.804	2.7761	0.905	7.59	0.37
4.439	0.816	2.8888	0.941	8.1768	0.416
4.7784	0.853	3.1613	0.958	8.5535	0.479
5.1986	0.878	3.2675	0.974	8.8691	0.545
5.6754	0.894	3.563	0.981	9.5073	0.575
5.8122	0.925	3.6158	0.989	9.5717	0.653
6.0395	0.945	3.7737	0.993	9.8981	0.702
6.0492	0.965	3.78	0.997	9.9038	0.769
6.052	0.979	3.889	0.998	10.165	0.809
6.1814	0.986	3.9138	0.999	10.29	0.851
7.2826	0.98	4.0905	0.999	10.649	0.874
7.7517	0.982	4.3073	1	10.997	0.894
9.053	0.973	4.5971	1	11.901	0.89
10.223	0.964	6.2067	0.999	13.223	0.868
10.624	0.97	6.3511	0.999	13.478	0.891
12.147	0.954	7.3183	0.999	14.064	0.899
13.457	0.941	7.3636	0.999	14.6	0.908
13.796	0.951	7.513	0.999	14.923	0.923
14.081	0.96	7.6004	1	15.005	0.941
14.206	0.97	7.6376	1	15.022	0.957
14.247	0.979	8.0682	1	15.253	0.966
14.967	0.979	8.2744	1	15.867	0.968
15.51	0.981	8.3263	1	16.133	0.974
15.51	0.987	8.331	1	16.133	0.982
15.722	0.99	8.3848	1	16.208	0.987
15.762	0.993	8.4235	1	16.296	0.99
21.968	0.928	8.475	1	16.296	0.993
21.996	0.944	8.6214	1	16.548	0.995
22.109	0.956	8.6819	1	16.602	0.996
22.603	0.96	8.9251	1	16.897	0.997

Table 6: Jarque-Bera Statistics

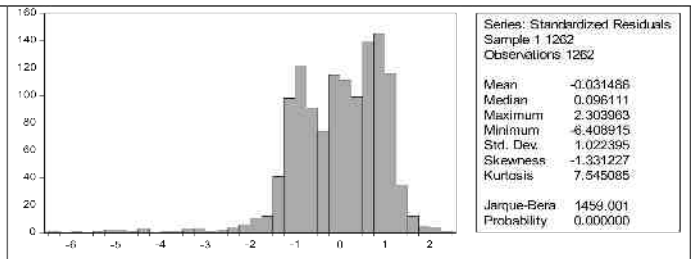
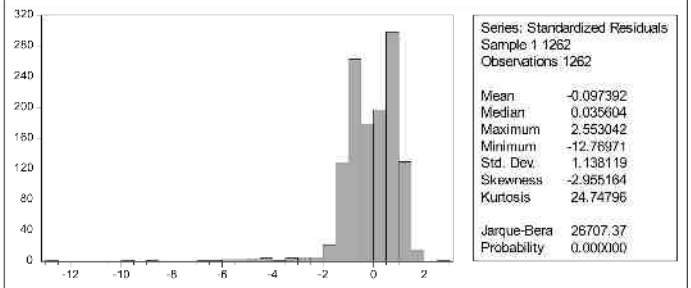
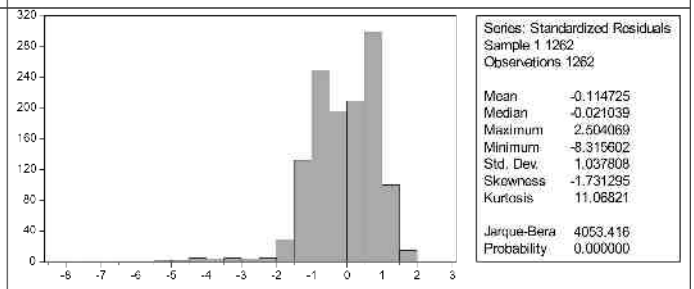
Normal Gaussian	
Students t Dist.	
GED with Fix Parameters	

Table 7: ARCH Effect

Normal GAUSSIAN Test	F-statistic	0.564671	Prob. F(1,1259)	0.4525
	Obs*R-squared	0.565314	Prob. Chi-Square(1)	0.4521
Student t Distribution Test	F-statistic	0.544023	Prob. F(1,1259)	0.4609
	Obs*R-squared	0.544652	Prob. Chi-Square(1)	0.4605
GED with Fix Parameter Test	F-statistic	2.144013	Prob. F(1,1259)	0.1434
	Obs*R-squared	2.143769	Prob. Chi-Square(1)	0.1431