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Impact of equity futures trading on spot market volatility: A study of select IT companies in India

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Abstract
The current study uses the daily returns of five IT companies from April 1, 1998, to March 31, 2008, excluding holidays when no transactions occurred, to investigate the impact of equity derivatives trading on spot market volatility, specifically the impact of equity derivatives introduction on spot market volatility in the Indian stock market. The GARCH (1, 1) model that captures the heteroscedasticity in returns has been applied to study market volatility. However, all the companies under study showed asymmetric response and, accordingly the GJR GARCH model that captures the asymmetric response has been applied by using CNX Nifty index return as the independent variable in order to remove the influence of market-wide factors on equity returns. The results indicate that the coefficient of the dummy variable is significant and negative. Thus, it can be said that introduction of equity derivatives trading has reduced spot market volatility.

Keywords: Equity derivatives, Spot market volatility, Indian stock market, GARCH (1,1) model

Introduction
The proliferation of stock derivatives trading has shown tremendous growth in securities markets worldwide. In consonance with the international practice, market regulators introduced trading in option on individual stock in July 2001 followed by futures on individual stock in November 2001. Since its inception, Indian stock market has shown commendable growth in stock derivatives trading. Like other securities markets of developed and developing countries, Indian Stock market has also evidenced the growth by showing highest turnover in stock derivatives in recent years. During the year 2007-08, stock futures itself account for forty-eight percent of the total turnover in F&O segment of National Stock Exchange, the premier exchange for derivatives trading in India. With the introduction of stock derivative instruments, it is anticipated that speculative trading, which currently take place in the spot market, can be diverted towards the derivatives segment of the stock market. Moreover, introduction of derivative instruments would also facilitate investors to select the level of portfolio risk that they are capable to bear and any risk beyond this level can be hedged away.

Having the capability of stock futures to influence market volatility, what impact the stock derivatives would have on the underlying market volatility, has received considerable and increasing attention in the recent years, after the introduction of stock derivatives in Indian stock market. To examine the impact of stock derivatives trading on spot market volatility in a manner that accommodates asymmetric response to news not only provide important guidance but also yield insights into the reasons why asymmetries exist in stock market. If market dynamics are the cause of asymmetries, then structural innovation such as the onset of stock derivatives trading may be capable of influencing not only the level of volatility in the underlying market but also the structure and characteristics of volatility.

The aforementioned fact instigated researchers to undertake empirical investigation into the issue of what impact, stock derivatives would have, on the underlying volatility. A comprehensive review of literature illustrates that even when one group of researchers accept the fact that stock derivatives trading influences the spot market volatility and reduce the underlying volatility, the other group assert a contradictory conclusion of an increase in the volatility of spot market with the onset of stock derivatives trading. Further, some

researchers find that stock derivatives trading do not influence the volatility of spot market. Researchers like Ma and Rao (1988) [12] and Bessembinder and Seguin (1992) [3] found that the volatility of underlying market increases after the introduction of equity derivatives. Watt, Yadav and Draper (1992) and Dennis and Sim (1999) [7] concluded that equity derivatives do not influence the spot market volatility and the impact is statistically insignificant.

On the other hand, Chamberlin, Cheung and Kwan (1993), Stucki and Wasserfallen (1994) [15], Kumar, Sarin and Shastri (1995) [11] and Conrad (1989) [6] found that there is a decline in spot market volatility with the onset of equity derivatives trading. The issue remains inconclusive and seems to be far from settled yet in the international markets.

Taking on the polemic issue emanating from the divergent conclusions about the impact of equity derivatives on spot market volatility in different international markets, Indian researchers tried to arrive at a conclusion with regard to the impact of equity derivatives in Indian stock market. There are not many studies that analyse the impact of derivatives trading in individual stocks on the volatility of the underlying. One significant study was done by Vipul (2006) [16]. The study reports a reduction in unconditional volatility and persistence in volatility in the post derivative period. Another study was done by Afsal and Mallikarjunappa (2007) [1]. The study finds persistence and clustering of volatility in general and little or no impact of stock futures trading on the market volatility in majority of the cases. The conclusions drawn by researchers are contradictory and in consonance with the international literature.

Owing to the aforementioned deliberations, it can be concluded that the impact of introduction of equity derivatives trading has been different in different markets with respect to different span of time. And, it is difficult to arrive at a consensus with respect to the impact of equity derivatives introduction on the volatility. Particularly in Indian context, different studies show different conclusions. Further, the two studies have been done by taking a very small sample and do not test for asymmetric response. This in turn, necessitates further empirical investigation on the impact of equity derivatives trading on spot market volatility. The present paper examines the impact of introduction of equity derivatives trading on the volatility of spot market in India. In particular, whether, trading of equity derivatives reduce spot market volatility and improve informational efficiency. The study is aimed at testing the null hypothesis that the introduction of equity derivatives contract does not influence the spot market volatility.

Data and Model Specification

The data employed in this chapter comprises of daily close prices of select IT company stocks on which derivative trading has commenced by March 31, 2006. The data spans from April 01, 1998 to March 31, 2008 excluding holidays when there were no transactions.

Since, the underlying asset being analyzed is a stock, the probability of the series being characterized by heteroscedasticity is very high (Mandelbrot, 1963; Fama, 1965, Kamaiah and Amanulla, 1997) [13, 9, 2]. Hence, the present study begins by examining the presence of heteroscedasticity in the asset return series. The results indicated presence of heteroscedasticity. As a consequence, it is hypothesized that the asset returns series follows a GARCH process.

The standard GARCH (p, q) model introduced by Bollerslev (1986) suggests that conditional variance of returns is a linear function of lagged conditional variance and past squared error terms. A model with errors that follow the standard GARCH (1, 1) model can be expressed as follows:

$$R_t = c + \varepsilon_t \ \ where,\ \varepsilon_t/\psi_{t-1} \sim N\ (0, h_t) \quad \textbf{Equation 1}$$

$$and\ h_t = \ \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} \quad \textbf{Equation 2}$$

The mean return equation, given in (1) is written as a function of exogenous variable and the error term ε_t. R_t is the daily return on the underlying asset calculated as the first difference of the log of the underlying asset price for the period t and ε_t is the error term. ψ_{t-1} is the information set available at time $t-1$. The variance equation, given in (2), is the one period ahead forecast of variance based on past information and hence called conditional variance. In equation (2), α_0 represents the mean, ε_{t-1}^2 is a measure of news about volatility from the previous period, measured as the lag of squared residuals from the mean equation (ARCH term), h_{t-1} represents the last periods forecast variance (GARCH term). Further, to isolate market wide factors other than those which are associated with the introduction of equity derivatives, CNX Nifty is used as the independent variable in mean return equation, and the equation is specified as follows:

$$R_{scrip,t} = \gamma_0 + \gamma_1 R_{nifty,t} + \ \varepsilon_t \quad \textbf{Equation 3}$$

However, the standard GARCH models assume symmetry in the response of volatility to information. In other words, the models assume that the response of volatility, to 'bad' news as well as 'good' news, is similar. If the response is asymmetric, then the standard GARCH models will end up mis specifying the relationship and further, inferences based on this model may be misleading. However, the standard GARCH model can be easily extended to include asymmetric effects (Glosten, Jagannathan and Runkle, 1993). In the model, the asymmetric response of conditional volatility to information is captured by including, along with the standard GARCH variables, squared values of ε_{t-1} when ε_{t-1} is negative. In other words, the model allows for asymmetries by augmenting the standard GARCH model with a squared error term following 'bad' news. In doing so, it allows the negative return shocks to generate greater volatility than positive return shocks. Hence, equation (1) is extended as follows:

$$h_t = \ \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} \ + \ \lambda_1 S_{t-1}^- \ \varepsilon_{t-1}^2 \quad \textbf{Equation 4}$$

Where $S_{t-1}^- \ = 1$ if $\varepsilon_{t-1} < 1$

In studying the impact of equity derivatives, firstly, the existence of asymmetric response is tested individually for each asset, for all the three periods. Test of asymmetry in the period pre and post introduction of derivatives, reveals the impact that introduction of derivatives trading has had on the

response of volatility to new information generated. The test of asymmetric response for the full period helps in identifying the GARCH model to be specified while analyzing the impact of equity derivatives trading on spot market volatility. For this purpose, a dummy variable is added while specifying the volatility dynamics with the dummy taking a value of zero before introduction of equity derivatives trading and one for the period after introduction. For all the equity scrips that demonstrate asymmetric response, for the full period of analysis, the GJR model along with a dummy is specified as follows:

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \lambda_1 S_{t-1}^- \varepsilon_{t-1}^2 + \alpha_3 D_{Scrip,t}$$

Equation 5

Empirical Results

The descriptive statistics of each scrip for three time periods are presented in Table 1, 2 and 3. The summary statistics indicate that there is a decline in standard deviation of sample IT companies with the onset of equity derivatives trading. This may lead to the fact that there has been a marginal decline in volatility after the introduction of equity derivatives trading in the Indian stock market. However, at this stage, it is difficult to say that the decline in volatility after the introduction of equity derivatives is due to derivatives trading and not because of other factors that influence market wide movements. To make any significant inferences, one needs to further analyze the behaviour of equity returns and account for any predictability associated with other factors that may be having an impact on the volatility of the time series.

Further the tables report the Jarque-Bera (JB) test statistics which examines the normality of the data. The said test is based on the result that a normally distributed random variable should have a skewness equal to zero and kurtosis equal to three. The test statistic follows a chi-square distribution. The results indicate that, in almost all the scrips analyzed and for all the three time periods, the skewness is non-zero and the kurtosis is in excess of three. The Jarque-Bera (JB) test indicates that the assumption of normality is violated by log return series of all the scrips analyzed.

Table 1: Descriptive Statistics of Daily Returns of Scrips for the Total Period

Company	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
HCL Technologies Ltd.	-0.000362	0.01828	-5.415301	89.53386	589736.3	0
Infosys Technologies Ltd.	-4.33E-05	0.02059	-13.25043	329.3452	11220630	0
Satyam Computer Services Ltd.	8.61E-05	0.02235	-12.33997	344.1617	12246043	0
Siemens Ltd	0.000176	0.01989	-20.74101	722.0672	54298803	0
Wipro Ltd.	-9.31E-05	0.02332	-13.42519	344.3544	12266628	0

Source: Computed

Table 2: Descriptive Statistics of Daily Returns of Scrips for the Pre Period

Company	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
HCL Technologies Ltd.	-0.00155	0.024861	-3.537676	43.07505	38848.65	0
Infosys Technologies Ltd.	0.000375	0.022714	-5.399478	72.67466	169434.2	0
Satyam Computer Services Ltd.	-0.00018	0.033125	-10.73773	210.6547	1485409	0
Siemens Ltd	0.000502	0.012276	0.03807	5.699816	538.9037	0
Wipro Ltd.	0.000231	0.02715	-12.16043	299.741	4480354	0

Source: Computed

Table 3: Descriptive Statistics of Daily Returns of Scrips for the Post Period

Company	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
HCL Technologies Ltd.	0.000154	0.01452	-7.61759	161.332	1368367	0
Infosys Technologies Ltd.	-0.00025	0.01949	-19.0731	543.884	20752249	0
Satyam Computer Services Ltd.	0.000216	0.01454	-5.13941	110.688	825984.6	0
Siemens Ltd	-0.00061	0.03136	-17.9562	395.832	4791394	0
Wipro Ltd.	-0.0004	0.01906	-14.7904	341.622	6248785	0

Source: Computed

Also, given the fact that the presence of a stochastic trend or deterministic trend in a financial time series or its stationary or non-stationary in levels is a prerequisite for conducting any analysis, the study begins with testing of return series for a unit root using Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. The coefficients of all the three window periods are statistically significant and indicate the presence of unit root in daily return of equity shares under study.

Another characteristic of time series that needs attention is the heteroscedasticity. The Lagrange Multiplier (LM) test is used to reject the null hypothesis of no ARCH effect, which is indicative of the fact that equity return series are heteroscedastic. The Lagrange Multiplier (LM) test for no ARCH effect of equity returns is significant with a zero probability, implying that there is a significant ARCH effect in equity returns. The result of LM test indicates that equity returns series are heteroscedastic. Consequently, in order to study the impact of information on volatility of stock returns, a Generalised ARCH measure of volatility was deemed fit. However, as discussed earlier, the standard GARCH models assume symmetry in the response of volatility to information, which may not be the case always. Hence, the study first tests for existence of asymmetric response in each of the three time periods by specifying the GJR GARCH (1,1) specification of volatility dynamics.

Finally, the impact of introduction of equity derivatives on the conditional volatility is analyzed. In order to isolate the effect of market pervasive factors on asset returns, the returns on nifty have been introduced in the mean equation.

The results of the analysis as reported in Table 4 indicate that in each case nifty significantly and positively influence scrip returns, which is in conformity with standard asset pricing theories. As documented earlier, in order to analyze the overall impact of introduction of equity derivatives on spot market volatility, a dummy has been introduced in the variance equation. The dummy would take a value 'zero' in the pre introduction period and 'one' in the post introduction period. The results as reported in Table 4 indicate that in the case of about ninety per cent of the scrips analyzed, the coefficients of the dummy variable are significant and negative. Thus, it can be said that introduction of derivatives trading has resulted in reduction in spot market volatility.

Table 4: Estimates of GJR GARCH (1, 1) Model of Companies

Estimates of GJR GARCH Model of Companies						
Company	**Variables**	**Description**	**Co-efficient**	**Standard Error**	**Z-Statistics**	**Probability**
HCL Technologies Ltd.	γ_0	Intercept	-0.000195	0.000278	-0.701477	0.483
	γ_1	Nifty (R)	1.48864	0.029211	50.96242	0
	α_0	Constant	0.00031	1.28E-05	24.26495	0
	α_1	ARCH	1.424437	0.09563	14.89523	0
	α_2	GARCH	-1.043813	0.116767	-8.93926	0
	α_3	Asymmetric response	0.099651	0.023121	4.31001	0
	α_4	DUMMY	-0.000251	9.75E-06	-25.68689	0
Infosys Technologies Ltd.	γ_0	Intercept	0.000102	0.001281	0.079779	0.9364
	γ_1	Nifty (R)	0.951298	0.14069	6.761644	0
	α_0	Constant	0.000207	7.61E-05	2.7261	0.0064
	α_1	ARCH	0.302558	0.066141	4.574424	0
	α_2	GARCH	-0.304958	0.066052	-4.616957	0
	α_3	Asymmetric response	0.641608	0.107742	5.955064	0
	α_4	DUMMY	-0.000108	2.48E-05	-4.353852	0
Satyam* Computer Services Ltd.	γ_0	Intercept	0.000249	0.000208	1.197594	0.2311
	γ_1	Nifty (R)	1.18469	0.041551	28.51166	0
	α_0	Constant	0.000126	4.87E-06	25.87047	0
	α_1	ARCH	1.192443	0.038314	31.12301	0
	α_2	GARCH	-0.000436	0.004575	-0.095324	0.9241
	α_3	Asymmetric response	-0.00164	0.0039	-0.420452	0.6742
	α_4	DUMMY	0.000192	5.37E-06	35.77429	0
Siemens Ltd	γ_0	Intercept	3.57E-05	0.000243	0.146541	0.8835
	γ_1	Nifty (R)	0.35806	0.025935	13.80579	0
	α_0	Constant	5.96E-06	1.06E-06	5.60381	0
	α_1	ARCH	0.237148	0.024526	9.669372	0
	α_2	GARCH	0.553085	0.06328	8.740346	0
	α_3	Asymmetric response	0.686632	0.017203	39.91367	0
	α_4	DUMMY	-7.47E-05	4.38E-06	-17.04994	0
Wipro Ltd.	γ_0	Intercept	-0.002047	0.000179	-11.4355	0
	γ_1	Nifty (R)	1.581634	0.036571	43.24849	0
	α_0	Constant	3.42E-05	3.15E-06	10.87057	0
	α_1	ARCH	0.584718	0.00068	859.3413	0
	α_2	GARCH	-0.586243	0.002392	-245.0658	0
	α_3	Asymmetric response	0.70321	0.014893	47.21885	0
	α_4	DUMMY	0.000147	8.02E-06	18.34403	0

Source: Computed

Conclusion

The present paper examines the impact of equity derivatives trading on spot market volatility, particularly the effect of equity derivatives introduction on spot market volatility and informational efficiency in Indian stock market by using daily return of sample companies from April 01, 1998 to March 31, 2008 excluding holidays when there were no transactions. The GARCH (1, 1) model that captures the heteroscedasticity in returns has been applied to study market volatility. However, all the companies under study showed asymmetric response and, accordingly the GJR GARCH model that captures the asymmetric response has been applied by using CNX Nifty index return as the independent variable in order to remove the influence of market-wide factors on equity returns.

The results indicate that the coefficient of the dummy variable is significant and negative. Thus, it can be said that introduction of equity derivatives trading has resulted in reduction in spot market volatility. Hence, the null hypothesis that the introduction of equity derivatives contract does not influence the spot market volatility is rejected.

References

1. Afsal EM, Mallikarjunappa T. Impact of Stock Futures on the Stock Market Volatility. Icfai J Appl Finance. 2007;13(9):54-75.
2. Amanulla S, Kamaiah B. Asset Price Behaviour in Indian Stock Market: Is Conditional CAPM Relevant? Artha Vijnana. 1997;34:421-456.
3. Bessembinder H, Seguin PJ. Futures-trading activity and stock price volatility. J Finance. 1992;47:2015-2034.
4. Bollen NPB. A note on the impact of options on stock return volatility. J Bank Finance. 1998;22:1181-1191.
5. Bollerslev T. Generalised autoregressive conditional heteroscedasticity. J Econometrics. 1986;33:307-327.
6. Conrad J. The price effect of option introduction. J

Finance. 1989;44:487-498.
7. Dennis SA, Sim AB. Share Price Volatility with the Introduction of Individual Share Futures on the Sydney Futures Exchange. Int Rev Financ Anal. 1999;8:153-163.
8. Detemple J, Jorion P. Option Listing and Stock Returns. J Econometrics. 1990;31:307-328.
9. Fama EF. The Behaviour of Stock Market Prices. J Bus. 1965;38:34-105.
10. Glosten LR, Jagannathan R, Runkle DE. On the Relations between the Expected Value and the Volatility of the Nominal Excess Returns on Stocks. J Finance. 1993;48:1779-1791.
11. Kumar R, Sarin A, Shastri K. The impact of the listing of index options on the underlying stocks. Pac-Basin Finance J. 1995;3:303-317.
12. Ma CK, Rao RP. Information Asymmetry and Option Trading. Financial Review. 1988;23:39-51.
13. Mandelbrot B. The variation of certain speculative prices. J Bus. 1963;36:394-419.
14. Skinner DJ. Options markets and stock return volatility. J Financ Econ. 1989;23:61-78.
15. Stucki T, Wasserfallen W. Stock and Option Market: The Swiss Evidence. J Bank Finance. 1994;18:881-893.
16. Vipul. Impact of Introduction of Derivatives on Underlying Volatility: Evidence from India. Appl Financ Econ. 2006;16:687-697.