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UPSHOT OF DERIVATIVES ON SPOT MARKET VOLATILITY - AN INDUSTRY SPECIFIC ANALYSIS ON INDIAN STOCK MARKET

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Abstract

This paper attempts to check whether the spot market volatility variation is an act of derivatives or merely industry specific factors only. This study is based on 23 stocks of six different industries of the Indian stock market. Among the 23 stocks, 10 stocks are derivatives stocks and the remaining 13 are non-derivative stocks of National Stock Exchange of India. Volatility in the selected stocks was modelled with GJR GARCH model for both pre-introduction and post introduction period of derivatives as it measures asymmetric effect also in addition to volatility changes. Changes in volatility, asymmetric effect, and volatility pattern of the selected stocks were examined separately. It was found that all the derivative stocks except HUL and CIPLA had a reduction in volatility after the introduction of derivatives. Most of the Non-Derivatives stocks had also experienced reduced volatility. Further, an industry wise analysis was done to find the effect of industry specific factors influencing volatility. Among the six select industries, five industries' stocks prove the effect of derivatives while one industry, Finance-Housing confirms the effect of industry specific factors.

Keywords:

Derivatives, Volatility, Volatility Pattern, GJR GARCH, Asymmetry

1. INTRODUCTION

Derivatives were introduced with the intention of stabilizing the market by shifting speculators from spot market to derivatives market, creating more investment avenues and by passing on information about likely changes in the price of the underlying security. Capitalizing on changes in prices in short term is one of the main concerns of speculators which always destabilize the market. Derivatives market attracts speculators by profiting them with any changes in market price of the underlying security in a short span of time besides requiring only margin money. It also gives rise to many investment alternatives which in turn could reduce volatility in the spot market. It passes on information to spot market about the likely changes in the price of securities and helps predict price movement in the near future as well as reduce volatility [1], [2].

However, derivatives may also destabilize the market as per the study of Husey in Gulen and Stewart, 2000 [3]. Low trading cost intensifies leveraged trading and poorly informed speculators make the market unstable [4]. In practice, there are many historical instances where derivatives played spoilsport and were the prime cause behind financial crisis. Hence it is crucial to be careful while introducing derivatives. A constant watch over the impact of derivatives is important. Any deviation felt in the expected way of functioning of the derivatives in the market may be adjusted with procedural impositions. A study on impact of derivatives on volatility helps realize need for corrective mechanism.

Worldwide, the impact of derivatives on volatility is well documented and there are many studies on market indices [5]-[7] and individual securities of the Indian stock market [8], [9]. Conventionally, impact of derivatives is understood by comparing volatility before and after introduction of derivatives [10]. Though contradictory results were evidenced by different researchers, any change, either increase or decrease in volatility could not be attributed to derivatives alone [11] as evidenced by Grucharan Singh and Salony Kansal from their studies. There are other factors influencing volatility which is still partly accounted for. Worldwide factors, market related factors [12], day of the week effects [13]-[17], industry and company specific factors also play a role in altering volatility. There have been several attempts earlier to incorporate all these factors into consideration.

The previous studies tried to separate the effect of derivatives from the effect of other factors on volatility. But in none of the studies, industry specific factors were considered. Stock price movements are influenced by changes in industry lifecycle and government policy initiatives towards any industry. These changes affect the stocks of a particular industry as a whole. The stocks of a particular industry are expected to move in a same direction. Hence the effect of industry specific factors cannot be ignored.

In this paper, industry specific factors have been accounted for, by taking samples from some 6 industries namely, Finance-Housing, Infra-General, Personal care, Pharma, Plantations, Power. These sample stocks were categorized into stocks with and without derivative contracts. Any significant change in volatility was assessed whether it is being caused by derivatives or any other factor common to the industry, by comparing securities within the same industry. Among the company specific factors, corporate announcements regarding share split, rights issue, and bonus issues were most influential. Here this effect has been isolated by converting the adjusted data into unadjusted one. Since the stock exchanges make adjustment in the stock prices whenever companies come out with such announcements, this particular effect has been nullified by readjusting stock prices to their original levels.

2. RELATED LITERATURE

Structure of volatility pattern of single stock futures of South African Market was studied by Johan de Beer, 2009 [8]. The study revealed the faster dissemination of information after the derivatives introduction and increase in the long term impact of

old news. Corredar Pilar et al. 2002 [30] analyzed the Spanish stock market Ibex 35, and found the stabilizing nature of derivatives in spot market volatility.

Time varying properties of volatility of Indian stock market was studied by Manmohan Mall et al. 2011 [21]. They came up with the clear evidence for leverage effect on Indian stock market while taking index futures contracts of NSE India for their study. The role of hedgers and speculators in derivatives market was verified by Johnni Ulrich Jacobsen et al. 2010 [24]. They have conducted the study on Swedish major Index, OMXS 30 and on selected component stocks. It was ascertained that the shocks from speculators are large and positive and the overall effect of trading is negative due to stabilizing effect from hedgers' trading. Ravi Agarwal et al. 2009 [1] checked the changes in volatility of spot market are due to derivatives introduction or any macroeconomic factors. They concluded that derivatives significantly contribute towards the stabilization of market.

Koustubh Kanti Ray et al. 2011 [26] studied the volatility pattern changes in Indian stock market with the help of 15 stocks on which derivative contracts are available. It was found that 8 stocks had a significant change in pattern of volatility after the implementation of derivatives and observed pattern changes in volatility are little sensitive to immediate market movements and experiencing stronger persistence of volatility. Asian stock markets, India - S&P CNX NIFTY, Hong Kong - Hang Seng, Japan - TOPIX 100, Korea - KOSPI 200, Malaysia - FTSE Bursa Malaysia KLCI, Singapore - SGX MSCI Singapore, Taiwan - MSCI Taiwan, and Thailand - SET 50 were analyzed by Hasen et al. 2011 [31], to examine the effect of option introduction. They observed the increased liquidity in markets of Hong Kong, Japan, Korea, Taiwan, Thailand and decreased liquidity in India, Malaysia and Singapore.

Krunal K. Bhuva et.al. 2015 [15] tried to assess the effect of derivatives by explaining the effect of last Thursday on selected shares of NSE as last Thursday is the settlement day of derivatives contracts. They found significant effect of expiration day and attributed it to the cash based settlement mechanism of futures market. Sumbul Kabir et al. 2012 [2] analysed the Indian capital market and proved that there is a very strong relationship between capital market and financial derivatives. Effect of derivatives trading on Indian stock market was tested by Ravi Singla, 2011 [4] using S&P CNX Nifty Index. Though he asserted that there can be role of derivative in volatility reduction, he didn't negate the role of other factors too.

All these previous studies concluded with the scope for extending the studies to disprove the effect of other factors on volatility of the stock market. Industry specific effect is one among the other factors which might have influenced the volatility. Hence this paper attempts to check the industry specific effect on the volatility of Indian Stock Market by taking samples from six different industries.

3. METHODOLOGY

3.1 MODEL USED FOR THE STUDY

The GJR GARCH method was chosen to model the volatility. Basically, GARCH family models are best suited for a long term volatility check. It is widely documented that stock prices exhibit varying volatility. Conditional variance and unconditional variance are perfectly modelled in GARCH models [18], [19]. Among the GARCH family models, GJR GARCH model was chosen for this study as it gauges asymmetric effect on the time series data in addition to volatility changes. Asymmetric effect [20], [21] on stock prices is also considered as a factor in volatility calculations, as the impact of negative news is more than positive news on stock prices.

3.2 GARCH MODELS

The standard GARCH (p, q) model introduced by Bollerslev, 1986 [22] 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 [23] can be expressed as follows:

$$R_t = C + \varepsilon_t \tag{1}$$

$$h_t = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j} \tag{2}$$

where, R_t is the log return of the underlying asset, ε_t is the error term and it is assumed independently identically distributed, h_t indicates conditional variance, α_i represents the recent news coefficient, β_j represents persistent coefficient.

GARCH model assumes that stock return series is characterized by heteroskedasticity. Stock return series was calculated from daily closing prices using the following Eq.(3).

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \tag{3}$$

Log return is preferred over percentage return as it can accommodate any negative value [24]; hence, positively skewed return series is avoided. To account for company specific factors like share split, bonus and rights issues adjusted closing price data were converted into unadjusted closing prices. Hence impact of company specific factors was nullified.

3.3 CHANGES IN VOLATILITY DUE TO DERIVATIVES

Under GARCH model, Conditional variance is calculated using Eq.(2). Any change in volatility before and after introduction of derivatives is understood from the same equation after incorporating dummy variables into it.

$$h_t = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j} + \gamma D \tag{4}$$

D Represents Dummy variable. It assumes value 0 before introduction of derivatives and 1 after introduction of derivatives. γ represents the coefficient of dummy variable. If the Gamma γ is significant, derivatives have had impact on volatility. The sign of the coefficient is also important. A negative sign indicates stabilising effect of the derivatives and positive sign indicates destabilising effect of the derivatives on volatility.

3.4 ASYMMETRIC EFFECT

GARCH model assumes symmetrical response to both positive and negative news in volatility. Since stock market

prices are highly sensitive to negative news than the positive news, an asymmetric model must be adopted [25]. GARCH model can also be extended to include asymmetric effects. GJR GARCH (Glosten, Jagannathan and Runkle, 1993 [32]) model captures asymmetric effect by including, squared values of ε_{t-i} when ε_{t-i} is negative.

$$h_t = \omega + \sum_{i=1}^{q} \left(\alpha_i \varepsilon_{t-i}^2 + \gamma_i d_{t-i} \varepsilon_{t-1}^2\right) + \sum_{j=1}^{p} \beta_j h_{t-j} + \gamma D \quad (5)$$

where, $d_t = 1$ if $\varepsilon_{t-I} < 0$ and 0 otherwise.

GJR GARCH method was applied to see the asymmetric effect on stock return series. Unconditional volatility was calculated using Eq.(6) for those stocks which do not have significant asymmetric effect, "γ" Gamma. For stocks with significant Gamma values, the following Eq.(7) was used to calculate unconditional volatility.

$$h = \frac{\omega}{(1-\alpha-\beta)} \quad (6)$$

$$h = \frac{\omega}{(1-\alpha-\beta-0.5\gamma)} \quad (7)$$

Since GARCH models involve lot of iterations, GRETL statistical package was used for calculations.

3.5 CHANGE IN VOLATILITY PATTERN

Change in volatility pattern is understood from comparison of α and β values in the pre and post - introduction period. α coefficient refers to impact of recent news or short term shocks and β coefficient refers to the impact of old news or persistent factor. Derivatives must have reduced the short term shocks or the impact of recent news, if it really works well against volatility.

Coefficients of α_i, β_j indicate the impact of recent news and old news respectively [26], [27]. Any change in coefficients after introduction of derivatives implies changes in the pattern of volatility due to those derivatives.

3.6 PRELIMINARY TEST TO CHECK NORMALITY

Before applying GARCH model, time series data must be proved to be not normal and exhibiting a varying variance. So the three time series data, pre - Introduction, post introduction and full period were subjected to normality test and heteroskedasticity test [28]. Normally distributed data should have zero skewness and kurtosis 3. It was further decided to apply Jarque-Bera (JB) test, an ideal test for normality. If the *p* values of Jarque-Bera statistic for all the stocks is less than 5%, the return series is not normally distributed. Hence application of simple standard deviation for volatility calculation is not possible. A method like GARCH is required to test this varying variance.

3.7 PRELIMINARY TEST TO CHECK HETEROSKEDASTICITY

To apply GARCH family models, the stocks return series should have heteroskedasticity. Robert F. Engle, 1984 [29] explained the use of Breusch Pagan test in econometrics to check the heteroscedasticity [29]. This test assumes the null hypothesis of no heteroskedasticity and *p* values less than 5% confirms the rejection of null hypothesis and shows the presence of heteroskedasticity.

3.8 DATA

This study is based on 10 stocks of the National Stock Exchange (NSE) of India, on which derivatives were introduced on 1st January 2002. These stocks represent six different industries namely, Finance-Housing, Infra-General, Pharma, Plantations, Power and Personal care. Another 13 stocks representing non-derivatives stocks were also taken from all these industries. Totally there were 23 stocks taken from 6 industries.

The daily closing prices of selected stocks were taken from NSE India website from the date of its listing till 31st December 2013. Among the non-derivative stocks, few stocks do not have derivative contracts till date, but on a few stocks, derivative contracts were introduced at a later point of time. Hence for such stocks, data were taken only up to the date of introduction of derivatives which is mentioned in all tables used in this paper. To take into account the effect of market related factors on volatility, NSE benchmark index CNX Nifty was taken as proxy and its daily closing values were incorporated into the conditional mean equation of the GJR GARCH model. The closing values of CNX Nifty index were also taken from NSE website.

3.9 PERIOD OF STUDY

The whole period of study covers data from 1996 to 2013. To check the effect of derivatives the data were classified into three periods, before, after introduction of derivatives and full period taking 1st January 2002 as a dividing line between pre-introduction and post-introduction period. Moreover, the sample stocks taken were listed on the NSE at different point in time and the derivative contracts were introduced on few non-derivatives stocks later on, the detailed description of study period is as follows:

- Pre-Introduction Period - From the date of listing of each stock to 31st December 2001
- Post-Introduction Period
- For derivative stocks - From 1st January 2002 to 31st December 2013
- For Non-Derivative stocks - From 1st January 2002 to 31st December 2013 or till the date of introduction of derivatives whichever is earlier.
- Full Period
- For derivative stocks - From the date of listing to 31st December 2013
- For Non-Derivative stocks - From the date of listing to 31st December 2013 or till date of introduction of derivatives whichever is earlier.

4. PRELIMINARY TEST RESULTS

Few preliminary tests were carried out to find the eligibility of sample data to be used in GJR GARCH volatility modelling technique. The test results are given below.

4.1 NORMALITY TESTS

All the three time period's, pre-introduction, post introduction and full period data of the all the 23 stocks were proved to be not normal. Normally distributed data should have zero skewness and kurtosis 3. But all the stocks chosen, showed contradictory results which are given in the appendices I, II and III. To confirm these results Jarque-Bera (JB) test, an ideal test for normality was applied. Since the *p* values of Jarque-Bera statistic for all the stocks is less than 5%, the return series is not normally distributed. Hence application of simple standard deviation for volatility calculation is not possible.

4.2 HETEROSKEDASTICITY TEST

Breusch-Pagan test was used to test the heteroskedasticity. This test assumes the null hypothesis of no heteroskedasticity and *p* values less than 5% confirms the rejection of null hypothesis and shows the presence of heteroskedasticity. Appendices I, II and III exhibit that almost in all the samples heteroskedasticity is present. Hence GARCH family models will be suitable to model the volatility of the samples taken.

5. RESULTS AND DISCUSSION

5.1 CHANGES IN VOLATILITY DUE TO DERIVATIVES

All the Derivatives stocks except HUL and CIPLA had reduced volatility after the introduction of derivatives. Among the 10 derivatives stocks 4 stocks had significant reduction in volatility. Most of the Non-derivative stocks also experienced reduced volatility and three stocks among them had significantly reduced volatility. The Table.1 presents the effects of derivatives on volatility. It implies that market related factors might have influenced the volatility of all stocks chosen for this study. But the other changes surfaced must also be compared with this phenomenon to confirm the effect of other factors on volatility.

Table.1. Effect of Derivatives on volatility

Securities Code	Omega × 10-07	Log Return Nifty	Dummy × 10-07	Alpha	Gamma	Beta	LBTSR	LBTSSR
HDFC	0.36	0.14***	-0.32	0.09***	0.03	0.91***	9.02***	14.45***
CANFINHOME	118.38**	0.52***	-36.42	0.09***	-0.14*	0.82***	8.17***	1.13
GICHSGFIN	151.35**	0.68***	-65.98**	0.12**	-0.25**	0.81***	11.77***	21.30***
BHEL	59.47**	0.46***	-58.47**	0.35*	-0.06	0.76***	11.22***	0.04
L&T	16.71	0.54***	-15.44	0.12***	-0.26*	0.89***	5.25**	0.06
ENGINERSIN	0.45	0.06***	-0.4	0.18***	-0.09	0.86***	43.72***	15.20***
ABB	511.68***	0.52***	-109.85	0.41***	0.06	0.17	8.81***	0.32
SIEMENS	74.48	0.64***	-28.96	0.10**	-0.06	0.85***	20.63**	5.16**
THERMAX	6.04	0.24***	-5.51	0.05***	0.06	0.95***	13.43***	7.06***
HINDLEVER	0.05	0.05***	0.03	0.14***	0	0.87***	7.55***	12.91***
MARICO	32.77**	0.03***	-32.62**	0.12***	-0.08	0.88***	5.80**	9.44**
CIPLA	-0.62	0.11***	0.72	0.04***	-1.00***	0.95***	11.94***	0.05
DRREDDY	7.37	0.20***	-6.41	0.04***	-0.18*	0.95***	7.32***	5.32**
RANBAXY	8.94*	0.21***	-7.25*	0.10***	0.01	0.90***	31.91***	6.30**
IPCALAB	19.76*	0.14***	-19.50*	0.07***	0.02	0.93***	15.87***	25.47***
NATCOPHARM	162.29	0.69***	-103.85	0.09	0.01	0.87***	51.66***	21.37***
SUNPHARMA	5.17	0.14***	-4.21	0.12**	-0.01	0.88***	14.66***	21.88***
TATA GLOBAL	14.38**	0.12***	-14.31**	0.10***	0.13***	0.91***	30.01***	1.15
NORBTEAEXP	362.78	0.31**	-205.87	0.14**	-0.05	0.84***	57.71***	0.37
RELINFRA	34.48**	1.17***	-5.5	0.06***	-0.04	0.91***	11.93***	5.24**
TATAPOWER	25.50***	0.20***	-25.40**	0.10***	0	0.90***	11.08***	7.84***
GIPCL	60.14	0.74***	-24.78	0.09	-0.06	0.88***	34.15**	8.75***
CESC	750.58***	0.96***	416.04**	0.15***	-0.23**	0.40***	10.12***	27.70***

Note: (i) ***, ** and * indicates significance level at 1%, 5%, and 10% respectively (ii) LBTSR and LBTSSR stand for Ljung-Box Test of Standardized Residuals and Squared Standardised Residuals respectively

Table.2. Changes in Volatility Pattern

Securities Code	Pre-Introduction Period			Post-Introduction Period		
	Alpha	Gamma	Beta	Alpha	Gamma	Beta
HDFC	0.10***	0.06	0.91***	0.09***	0.05	0.92***
CANFINHOME	0.19***	-0.17	0.70***	0.09***	-0.05	0.84***
GICHSGFIN	0.35***	-0.08	0.37***	0.10***	-0.24**	0.87***
BHEL	0.10***	0.29***	0.78***	0.39*	0.02	0.76***
L&T	0.09	0.07	0.85***	0.12***	-0.26	0.89***
ENGINERSIN	0.32***	-0.13	0.73***	0.17***	-0.06	0.87***
ABB	0.29**	0.1	0.65***	0.25**	-0.05	0.23
SIEMENS	0.11***	0	0.88***	0.23**	0.05	0.54**
THERMAX	0.15***	0.03	0.79***	0.05***	0.02	0.96***
HINDLEVER	0.23***	0.18***	0.83***	0.27***	-0.03	0.59***
MARICO	0.31***	0	0.44***	0.14***	-0.08	0.88***
CIPLA	0.04**	-1.00***	0.94***	0.13	-0.21	0.90***
DRREDDY	0.08**	0.01	0.90***	0.03***	-0.24*	0.97***
RANBAXY	0.15***	0.02	0.85***	0.08***	0.04	0.91***
IPCALAB	0.14***	-0.04	0.72***	0.09***	0.06	0.92***
NATCOPHARM	0.21***	0.07	0.59***	0.13**	0.04	0.85***
SUNPHARMA	0.14***	0.07	0.87***	0.06	-0.39	0.91***
TATA GLOBAL	0.1	0.18**	0.82***	0.13***	0.10*	0.89***
NORBTEAEXP	0.11**	0.14	0.89***	0.12	-0.17	0.86***
RELINFRA	0.11	-0.08	0.80***	0.12***	0.20***	0.86***
TATAPOWER	0.12***	0.01	0.70***	0.15***	0.06	0.87***
GIPCL	0.15***	-0.02	0.74***	0.07*	0.01	0.92***
CESC	0.19***	-0.07	0.41***	0.03	-0.22	0.92***

Note: ***, ** and * indicates significance level at 1%, 5%, and 10% respectively

5.2 CHANGES IN VOLATILITY PATTERN

Derivatives introduction must have reduced the short term shocks or the impact of recent news, if it really works well against volatility. But only three stocks had reduced Alpha value, meaning that the effect of short term shocks were not nullified by the derivatives. Much to the contradiction, the 11 out of 13 non-derivative stocks had reduced Alpha value. But the sum of Alpha and Beta values of these stocks were not nearer to one which means the speed with which the information is reflected on the stock prices is low. On the other hand, derivatives stocks had good dissemination of information into stock prices as its sum of Alpha and Beta values are almost one. This passing on of information to spot market is one of the expected benefits of derivatives which were already discussed in the introduction part. It reveals the effect of derivatives on volatility pattern changes. The Table.2 presents the changes in volatility pattern of the selected stocks.

5.3 ASYMMETRIC EFFECT

Six out of ten derivative stocks had significant change in the Asymmetric effect while only one out of 13 non – derivative stocks had a change. Moreover, four derivatives stocks had significant decrease in asymmetric effect as an expected benefit out of derivatives introduction. It shows the ability of derivatives in mitigating the overreaction of the investors with respect to any negative news about a stock or market. The Table.3 shows the presence of asymmetric effect. A significant 'Gamma' value reveals the presence of asymmetric effect on the volatility of underlying stock.

Table.3. Asymmetric Effect measured with Gamma Value

Securities Code	Gamma			Date of Derivative Introduction	Industry
	Pre-Introduction Period	Post-Introduction Period	Full Period		
HDFC	0.06	0.05	0.05	HDFC	0.06
CANFINHOME	-0.17	-0.05	-0.1	CANFINHOME	-0.17
GICHSGFIN	-0.08	-0.24**	-0.15*	GICHSGFIN	-0.08

BHEL	0.29***	0.02	0	BHEL	0.29***
L&T	0.07	-0.26	-0.15	L&T	0.07
ENGINERSIN	-0.13	-0.06	-0.08	ENGINERSIN	-0.13
ABB	0.1	-0.05	0.08	ABB	0.1
SIEMENS	0	0.05	0.03	SIEMENS	0
THERMAX	0.03	0.02	0.05	THERMAX	0.03
HINDLEVER	0.18***	-0.03	0.06	HINDLEVER	0.18***
MARICO	0	-0.08	-0.06	MARICO	0
CIPLA	-1.00***	-0.21	-1.00***	CIPLA	-1.00***
DRREDDY	0.01	-0.24*	-0.12*	DRREDDY	0.01
RANBAXY	0.02	0.04	0.04	RANBAXY	0.02
IPCALAB	-0.04	0.06	0.02	IPCALAB	-0.04
NATCOPHARM	0.07	0.04	0.06	NATCOPHARM	0.07
SUNPHARMA	0.07	-0.39	0.04	SUNPHARMA	0.07
TATA GLOBAL	0.18**	0.10*	0.13***	TATA GLOBAL	0.18**
NORBTEAEXP	0.14	-0.17	-0.07	NORBTEAEXP	0.14
RELINFRA	-0.08	0.20***	0.12**	RELINFRA	-0.08
TATAPOWER	0.01	0.06	0.01	TATAPOWER	0.01
GIPCL	-0.02	0.01	-0.01	GIPCL	-0.02

Note: ***, ** and * indicates significance level at 1%, 5%, and 10% respectively

5.4 INDUSTRY SPECIFIC ANALYSIS

Industry wise categorisation of the select sample stocks was done and the results are given in a summarised form for each industry. Any change in the volatility of derivative stocks is compared with volatility of non-derivative stocks of that same industry. Uniformity in volatility changes in both derivative and non-derivative stocks confirms the presence of industry specific factors influencing volatility. Radically distinctive changes in volatility of derivative stocks confirm the presence of derivative effect.

In Table.4, there is no significant difference between derivative and non-derivative stocks as it has the similar pattern of changes in volatility, asymmetric effect, persistence effect and the effect of short term shocks. Though the derivative stock had the expected alteration in volatility, it cannot be purely attributed to derivatives introduction on that stock. There exists the industry specific pattern of changes.

In Table.5, though the pattern of decrease in volatility is seen in all the stocks, one derivative stock BHEL had a significant decrease in volatility and significantly reduced asymmetric effect in the post introduction period. But non derivative stocks had no significant effect on the volatility. This asserts the effect of derivatives in stabilising price volatility. However the increased alpha value implies that the short term shocks are not yet belittled.

In Table.6, the derivatives may give higher exposure to more number of stocks with very little investment. This leveraged exposure may destabilise the market at worst times. In personal care industry, HINDLEVER had increased volatility when the industry counterpart had a decreased volatility. Moreover, the asymmetric effect has come down significantly and short term shocks effect has increased. These changes are completely in contradiction with the industry counterpart MARICO where it has decreased short term effect and increased long term persistent effect. This shows the difference in the pattern of volatility between derivative and non-derivative stocks and proved the effect of derivatives.

In Table.7, all the stocks both derivative and non-derivative stocks except CIPLA, had a decreased volatility. Though it looks like industry specific pattern, some disruptions found in the derivative stocks make it hard to reject the effect of derivatives. While all the non-derivative stocks follow a uniform pattern of changes, derivative stocks CIPLA had increased volatility and DRREDDY had increased asymmetric effect. The effect of short term shocks also increased in CIPLA. This shows the destabilizing effect of derivatives.

In Table.8, derivative stock had distinctive changes comparing to non-derivative stock which supports the role of derivative in stabilizing market fluctuations. Derivative stock had a significant decrease in volatility as well as asymmetric effect. It also has increased effect of both short term shocks and persistence factor. In Table.9, as all the stocks did not have a uniformed pattern of changes, any industry specific effect was ruled out. One non-derivative stock had a significant increase in volatility while the derivative stocks had a decreased one. Derivative stock also had an increased asymmetric effect. The alpha and beta values exhibit an increased effect of short term shocks as well as long term persistence effect in the study period. It assures the role of derivative on these stocks.

Among the 10 derivatives stocks under consideration, all stocks except HUL and CIPLA had a decrease in their volatility. Moreover four derivative stocks had significant reduction in volatility. When non-derivative stocks were compared with derivative stocks, five industries among the six, confirm the effect of derivatives and one industry confirms the effect of industry specific factors.

Table.4. Finance-Housing

Classification	Stocks Code	Volatility Change	Gamma (Asymmetry)	Alpha	Beta
Derivative Stocks	HDFC	Decreased	No Significant effect	Decreased	Increased
Non Derivative Stocks	CANFINHOME	Decreased	No Significant effect	Decreased	Increased
	GICHSGFIN	Decreased**	Decreased**	Decreased	Increased

Table.5. Infra-General

Classification	Stocks Code	Volatility Change	Gamma (Asymmetry)	Alpha	Beta
Derivative Stocks	BHEL	Decreased**	Decreased**	Increased	Decreased
	L&T	Decreased	No Significant effect	Increased	Increased
Non Derivative Stocks	ENGINERSIN	Decreased	No Significant effect	Decreased	Increased
	ABB	Decreased	No Significant effect	Decreased	Decreased
	SIEMENS	Decreased	No Significant effect	Increased	Decreased
	THERMAX	Decreased	No Significant effect	Decreased	Increased

Table.6. Personal Care

Classification	Stocks Code	Volatility Change	Gamma (Asymmetry)	Alpha	Beta
Derivative Stocks	HINDLEVER	Increased	Decreased***	Increased	Decreased
Non Derivative Stocks	MARICO	Decreased**	No Significant effect	Decreased	Increased

Table.7. Pharma

Classification	Stocks Code	Volatility Change	Gamma (Asymmetry)	Alpha	Beta
Derivative Stocks	CIPLA	Increased	Decreased***	Increased	Decreased
	DRREDDY	Decreased	Increased*	Decreased	Increased
	RANBAXY	Decreased*	No Significant effect	Decreased	Increased
Non Derivative Stocks	IPCALAB	Decreased*	No Significant effect	Decreased	Increased
	NATCOPHARM	Decreased	No Significant effect	Decreased	Increased
	SUNPHARMA	Decreased	No Significant effect	Decreased	Increased

Table.8. Plantations

Classification	Stocks Code	Volatility Change	Gamma (Asymmetry)	Alpha	Beta
Derivative Stocks	TATA GLOBAL	Decreased**	Decreased*	Increased	Increased
Non Derivative Stocks	NORBTEAEXP	Decreased	No Significant effect	Increased	Decreased

Table.9. Power

Classification	Stocks Code	Volatility Change	Gamma (Asymmetry)	Alpha	Beta
Derivative Stocks	RELINFRA	Decreased	Increased ***	Increased	Increased
	TATAPOWER	Decreased**	No Significant effect	Increased	Increased
Non Derivative Stocks	GIPCL	Decreased	No Significant effect	Decreased	Increased
	CESC	Increased**	No Significant effect	Decreased	Increased

6. CONCLUSION

Based on the analysis and the results, it is confirmed that the alteration in spot market volatility is an effect of derivatives in five different industry stocks namely Infra-General, Personal care, Plantations, Pharma and Power. The industry specific pattern of volatility prevailed in one industry namely Finance-Housing. Usually stocks of banks and financial institutions are referred as defensive stocks as it would not fluctuate as other stocks would do. Hence derivatives had played a role of stabilising market fluctuation on all the stocks except these defensive stocks. There are some stabilising effects of derivatives on volatility of Indian stock market. Since this study confines to only six selected industries, further studies in an elaborate way by including more industries is recommended.

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APPENDICES

Appendix I: Summary statistics for pre-introduction period

Securities Code	Skew	Kurtosis	JB	LM (hetero)	Date of Derivative Introduction	Industry
HDFC	0.22	8.4	4414.05***	55.68***	1/1/2002	Finance-Housing
CANFINHOME	0.55	6.09	2343.33***	124.00***	No derivative	Finance-Housing
GICHSGFIN	0.24	3.18	617.64***	79.23***	No derivative	Finance-Housing
BHEL	0	2.84	501.89***	44.17***	1/1/2002	Infra-general
L&T	-0.07	1.57	154.89***	47.56***	1/1/2002	Infra-general
ENGINERSIN	0.75	12.35	4407.20***	195.61***	No derivative	Infra-general
ABB	-0.59	6.78	2951.98***	59.14***	2/5/2005	Infra-general
SIEMENS	0.04	1.44	129.38***	47.68***	2/5/2005	Infra-general
THERMAX	-0.01	0.86	46.30***	20.72***	2/2/2009	Infra-general
HINDLEVER	0.47	5.22	1753.89***	41.47***	1/1/2002	Personal Care
MARICO	0.02	1.08	43.25***	22.29***	No derivative	Personal Care
CIPLA	-12.48	331.33	6881890.00***	2221.20***	1/1/2002	Pharma
DRREDDY	0.1	1.26	101.89***	48.40***	1/1/2002	Pharma
RANBAXY	0.03	2	248.73***	37.64***	1/1/2002	Pharma
IPCALAB	0.06	0.99	61.59***	20.32***	No derivative	Pharma
NATCOPHARM	0.3	2.33	352.40***	29.24***	No derivative	Pharma
SUNPHARMA	0.44	2.81	539.00***	142.62***	2/5/2005	Pharma

TATA GLOBAL	0.31	1.5	163.52***	45.84***	1/1/2002	Plantations
NORBTEAEXP	0.42	6.6	1691.43***	101.16***	No derivative	Plantations
RELINFRA	0.18	1.39	128.325***	30.5405**	1/1/2002	Power
TATAPOWER	0.18	3.18	640.31***	23.66***	1/1/2002	Power
GIPCL	0.21	1.2	100.29***	21.40***	No derivative	Power
CESC	0.27	0.85	63.75***	17.12	1/6/2005	Power

Notes:

i) Kurtosis given in the table are excess of three

ii) ***, **, and * indicates significance at 1%, 5% and 10% respectively

iii) JB indicates the Jarque-Bera test statistic used to test normality of the data.

iv) LM indicates Lag range multiplier test statistic results from Breusch-Pagan test for heteroskedasticity.

Appendix II: Summary statistics for post-introduction period

Securities Code	**Skew**	**Kurtosis**	**JB**	**LM(hetero)**	**Date of Derivative Introduction**	**Industry**
HDFC	0.6	12.2	18764.00***	331.94***	1/1/2002	Finance-Housing
CANFINHOME	0.68	7.75	7723.88***	75.61***	No derivative	Finance-Housing
GICHSGFIN	0.65	8.85	9994.36***	295.72***	No derivative	Finance-Housing
BHEL	-6.3	171.99	3714840.00***	599.41***	1/1/2002	Infra-general
L&T	0.4	58.72	427697.00***	906.50***	1/1/2002	Infra-general
ENGINERSIN	1.66	14.71	28411.70***	501.58***	No derivative	Infra-general
ABB	-0.18	6.28	1386.46***	27.86***	2/5/2005	Infra-general
SIEMENS	-0.38	8.59	2604.32***	118.75***	2/5/2005	Infra-general
THERMAX	1.05	9.3	6726.49***	298.21***	2/2/2009	Infra-general
HINDLEVER	1.71	23.95	73114.70***	500.05***	1/1/2002	Personal Care
MARICO	1.28	26.88	91101.10***	767.37***	No derivative	Personal Care
CIPLA	-6.89	198.26	4933810.00***	2338.20***	1/1/2002	Pharma
DRREDDY	-0.11	18.05	40712.50***	180.84***	1/1/2002	Pharma
RANBAXY	-0.03	10.85	14716.20***	174.02***	1/1/2002	Pharma
IPCALAB	0.7	11.28	16132.10***	313.67***	No derivative	Pharma
NATCOPHARM	0.92	5.41	4075.10***	141.84***	No derivative	Pharma
SUNPHARMA	0.01	3.03	321.23***	28.79***	2/5/2005	Pharma
TATA GLOBAL	0.17	7.07	6252.75***	309.41***	1/1/2002	Plantations
NORBTEAEXP	-0.31	6.49	4048.22***	105.61***	No derivative	Plantations
RELINFRA	-0.48	8.96	10142.2***	565.650527***	1/1/2002	Power
TATAPOWER	-0.25	10.87	14796.20***	299.54***	1/1/2002	Power
GIPCL	0.64	6.35	5247.12***	139.38***	No derivative	Power
CESC	1.11	3.68	664.52***	41.84***	1/6/2005	Power

Notes:

i) Kurtosis given in the table are excess of three

ii) ***, **, and * indicates significance at 1%, 5% and 10% respectively

iii) JB indicates the Jarque-Bera test statistic used to test normality of the data.

iv) LM indicates Lag range multiplier test statistic results from Breusch-Pagan test for heteroskedasticity.

Appendix III: Summary statistics for full period

Securities Code	Skew	Kurtosis	JB	LM(hetero)	Date of Derivative Introduction	Industry
HDFC	0.33	15.74	46490.60***	191.63***	1/1/2002	Finance-Housing
CANFINHOME	0.62	7.28	10155.70***	168.86***	No derivative	Finance-Housing
GICHSGFIN	0.45	6.25	7369.11***	267.62***	No derivative	Finance-Housing
BHEL	-3.04	76.19	1093630.00***	279.41***	1/1/2002	Infra-general
L&T	0.05	18.8	65890.70***	312.27***	1/1/2002	Infra-general
ENGINERSIN	1.25	23.09	82765.40***	798.65***	No derivative	Infra-general
ABB	-0.55	7.19	5148.99***	60.35***	2/5/2005	Infra-general
SIEMENS	-0.07	2.68	698.74***	56.03***	2/5/2005	Infra-general
THERMAX	0.17	3.25	1451.49***	23.44***	2/2/2009	Infra-general
HINDLEVER	0.96	20.88	82325.60***	253.74***	1/1/2002	Personal Care
MARICO	0.15	9.49	14610.50***	197.27***	No derivative	Personal Care
CIPLA	-18.19	780.02	114176000.00***	14014.80***	1/1/2002	Pharma
DRREDDY	0.23	7.04	9322.88***	184.97***	1/1/2002	Pharma
RANBAXY	0.03	6.69	8390.65***	148.40***	1/1/2002	Pharma
IPCALAB	0.13	4.78	4294.06***	74.73***	No derivative	Pharma
NATCOPHARM	0.5	4.47	3898.35***	47.41***	No derivative	Pharma
SUNPHARMA	0.59	5.81	3414.04***	391.62***	2/5/2005	Pharma
TATA GLOBAL	0.25	4.12	3222.59***	264.54***	1/1/2002	Plantations
NORBTEAEXP	0.11	8.19	8951.79***	210.90***	No derivative	Plantations
RELINFRA	-0.3	7.05	9367.6***	407.224048***	1/1/2002	Power
TATAPOWER	-0.03	7.02	9224.48***	198.75***	1/1/2002	Power
GIPCL	0.47	4.35	3706.34***	105.50***	No derivative	Power
CESC	0.66	2.37	723.23***	50.05***	1/6/2005	Power

Notes:

i) Kurtosis given in the table are excess of three

ii) ***, **, and * indicates significance at 1%, 5% and 10% respectively

iii) JB indicates the Jarque-Bera test statistic used to test normality of the data.

iv) LM indicates Lag range multiplier test statistic results from Breusch-Pagan test for heteroskedasticity.