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EFFECT OF INDEX FUTURE TRADING AND EXPIRATION DAY ON SPOT MARKET VOLATILITY: A CASE STUDY OF S&P CNX NIFTY

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ABSTRACT

This paper attempts to investigate the effect of index future on spot market and variation in expiration day. For this purpose daily average price related to S&P CNX Nifty, S&P CNX Nifty Junior and S&P 500 Index have been used. The GARCH model is used in this study. The study reveals that spot market volatility has declined and absorbing information faster since the introduction of index future in India. However, a significant decrease in volatility on the expiration day of derivative contract has been observed.

KEYWORDS

GARCH, VAR and Volatility.

INTRODUCTION

India is one of the most successful developing countries in terms of a vibrant market for exchange-traded derivatives. There is an increasing sense that the equity derivatives market is playing a major role in shaping price discovery. India's tryst with equity derivatives began in the year 2000 on the NSE and BSE. Trading first commenced in index future contract, followed by index option in June 2001, option in individual stocks in July 2001 and futures in single stock derivatives in November 2001. Since then, equity derivatives have come a long way. The spot and futures markets provide investors with an opportunity to trade in the same underlying security. So there is some relationship between derivative market and spot market. So this paper attempts to test the volatility of Nifty index before and after the introduction of derivatives contract.

LITERATURE SURVEY

A number of studies have examined the volatility before and after the introduction of derivative securities. Mostly studies in the Indian market find that volatility of the underlying market declined since the introduction of derivative market. **Alexakis (2002)** examined the price discovery function in daily returns and volatilities between price movement of stock index futures and the underlying cash index in ATHEX. They argue that future lead the cash index return, by responding more rapidly to economic events than stock prices. Thus, new market information may be disseminated faster in the future market compared to the stock market, and the future volatility spills some information over to the cash market volatility. This may imply that the future markets can be used as price discovery vehicles. **Y.P and Shalini (2006)** showed that daily spot market volatility in India has marginally declined after the introduction of future trading in India. They also revealed that significant improvement in the information coefficient 'α' and reduction in 'β' the persistence coefficient. **Kiran and Bodla (2008)** studied the introduction and expiration effects of index derivatives on S&P CNX Nifty and arrived at a conclusion that increased market efficiency and reduced volatility with no price change in the underlying market due to introduction of derivatives. It also showed that expiration day volatility is significant increase. **Nalinprava, Ramana and Kanagaraj (2009)** investigates the impact of introduction of derivative instruments and leverage and asymmetric effect on spot market volatility (Nifty) in India during the period October 1995 to December 2006 by using GARCH, EGARCH, TARARCH and component ARCH model. The results suggest towards a decline in spot market volatility and market efficiency improved after introduction of index futures, stock futures, stock options and index options on the spot market due to increase impact of recent news. This study also finds evidence of leverage and asymmetric effect on spot market where the conditional variance is an asymmetric function of past innovation, rising proportionately more during market declines. It is also observed that the asymmetric GARCH models provide better fit than the symmetric GARCH model.

OBJECTIVES

The objectives of this paper are:

- To examine the introduction of index future on S&P CNX Nifty; and
- To test the impact of expiration of derivatives contracts on S&P CNX Nifty.

DATA AND METHODOLOGY

This study attempts to evaluate whether the introduction of index futures has any significant impact on the spot stock return. For this purpose, daily highest and lowest prices for S&P CNX Nifty returns and S&P CNX Nifty Junior are obtained from the NSE website. But data on S&P 500 Index are taken from Yahoo Finance website. Index future was introduced in India on June 12, 2000. Therefore, the daily prices of indices have been collected for the period from January 1997 to March 2010. In order to measure the impact of index future, the data has been divided into two parts, i.e. from January 1, 1997 to June 11, 2000 and June 12, 2000 to March 2010. For removing the effect of world wide price movement S&P500 is taken in this study. The average price (highest and lowest price) is converted to daily compounded return by taking the first log difference. The daily return of the stock markets is calculated as:

$$R_t = \ln(P_t - P_{t-1})$$

In order to test the impact of index future and expiration day effect following equation is used in GARCH (1, 1) model:

$$R_{nifty\ t} = a_0 + b_1 R_{nifty\ junior\ t} + b_2 R_{S\&P\ t-1} + e_t$$

Where:

$R_{nifty\ t}$ is the return on the S&P CNX Nifty;

$R_{nifty\ junior\ t}$ is the return on the S&P CNX Nifty Junior;

$R_{S\&P\ t-1}$ is the return on S&P500; and

e_t is the error term.

D_{future} is introduced in conditional variance equation. If the coefficient is statistically positive, it means the market is affected by index future. For testing the expiration day effect, D_{exp} is taken in conditional variance equation. Expiration day dummy takes the value 0 (no future contract is expire) and 1 (the last Thursday of the month). If the coefficient is significant, then it indicates future contracts causes' abnormal stock price movement on expiration days.

RESULTS

Table-I presents the descriptive statistic of indices. It indicates that there is decrease of volatilities of NSE Nifty and NSE Nifty Junior after the introduction of index future, standard deviation of NSE Nifty has come down from 0.0168 to 0.0145 in case of data is taken from Jan1997 to March 2010 and similarly in case of data used from 12 JUNE 1999 to-12 June2001.

TABLE-I: DESCRIPTIVE STATISTICS-S&P CNX NIFTY RETURN, S&P CNX NIFTY JUNIOR AND S&P 500

BEFORE FUTURE (JAN1997-12JUNE2000)				AFTER FUTURE (12JUNE-MARCH2010)				BEFORE AND AFTER FUTURE(JAN1997-MARCH2010)			
Statistic	S&P CNX NIFTY	S&P CNX NIFTY Junior Returns	S&P500 Index	Statistic	S&P CNX NIFTY	S&P CNX NIFTY Junior Returns	S&P500 Index	Statistic	S&P CNX NIFTY	S&P CNX NIFTY Junior Returns	S&P500 Index
Mean	0.000388	0.001011	7.94E-04	Mean	0.00055	0.0006	-0.000159	Mean	0.000508	0.000707	8.75E-05
Median	0.000896	0.001292	0.00134	Median	0.001556	0.002091	0.000144	Median	0.00148	0.001939	0.000413
Maximum	0.061497	0.076621	0.039018	Maximum	0.100903	0.110056	0.077705	Maximum	0.100903	0.110056	0.077705
Minimum	-0.062556	-0.092407	-0.042644	Minimum	-0.134411	-0.159759	-0.074971	Minimum	-0.134411	-0.159759	-0.074971
Std. Dev.	0.016813	0.020422	0.009859	Std. Dev.	0.014555	0.01768	0.010386	Std. Dev.	0.01517	0.018428	0.010259
Skewness	-0.165285	-0.382514	-0.116357	Skewness	-0.898959	-1.02344	-0.135393	Skewness	-0.648291	-0.80036	-0.136169
Kurtosis	3.890856	4.898068	4.154343	Kurtosis	12.41129	12.03915	11.17291	Kurtosis	9.304872	9.474886	9.621542
Jarque-Bera	31.451	145.8795	48.30209	Jarque-Bera	9142.237	8553.808	6659.116	Jarque-Bera	5569.223	5979.721	5903.444
Probability	0	0	0	Probability	0	0	0	Probability	0	0	0
Sum	0.324135	0.844821	0.663456	Sum	1.315643	1.434415	-0.381084	Sum	1.639778	2.279236	0.282372
Sum Sq. Dev.	0.236027	0.348259	0.081168	Sum Sq. Dev.	0.506103	0.746798	0.257693	Sum Sq. Dev.	0.742146	1.095161	0.339424
Observations	836	836	836	Observations	2390	2390	2390	Observations	3226	3226	3226
BEFORE FUTURE (12 JUNE 1999-12JUNE2000)				AFTER FUTURE (12JUNE2000-12JUNE2001)				BEFORE AND AFTER FUTURE(12JUNE1999-12JUNE2001)			
Mean	0.000748	0.000505	0.000533	Mean	-0.001059	-0.002922	-0.00071	Mean	-0.00013	-0.001232	-7.23E-05
Median	0.001844	0.002287	2.47E-04	Median	0.000668	-0.001593	-0.000848	Median	0.001157	-0.000353	-0.000423
Maximum	0.059042	0.076621	0.034126	Maximum	0.04222	0.054744	0.032944	Maximum	0.059042	0.076621	0.034126
Minimum	-0.053038	-0.092407	-0.023905	Minimum	-0.062079	-0.075706	-0.033841	Minimum	-0.062079	-0.092407	-0.033841
Std. Dev.	0.018665	0.027671	0.010198	Std. Dev.	0.015946	0.018418	0.010688	Std. Dev.	0.017385	0.023582	0.010459
Skewness	-0.041898	-0.31115	0.203672	Skewness	-0.531994	-0.432464	-0.171931	Skewness	-0.208666	-0.26763	-0.007793
Kurtosis	3.31263	3.395863	3.176855	Kurtosis	3.873649	4.254017	3.519683	Kurtosis	3.623763	4.00303	3.410248
Jarque-Bera	1.086874	5.643646	2.04602	Jarque-Bera	19.42717	23.78676	3.980199	Jarque-Bera	11.59347	26.60543	3.469244
Probability	0.580749	0.059497	0.359511	Probability	0.00006	0.000007	0.136682	Probability	0.003037	0.000002	0.176467
Sum	0.186141	0.125835	0.132628	Sum	-0.26056	-0.718796	-0.174766	Sum	-0.064281	-0.60849	-0.035726
Sum Sq. Dev.	0.086403	0.189893	0.02579	Sum Sq. Dev.	0.062296	0.083106	0.027987	Sum Sq. Dev.	0.149003	0.274173	0.053929
Observations	249	249	249	Observations	246	246	246	Observations	494	494	494

For analysis the old and recent news effect, this study is divided into two parts such as before (A) and after(B) introduction of index future. Table-II shows that before index future $\alpha=0.2337$ and $\beta =0.6081$ and after $\alpha=0.2444$ and $\beta =0.72618$. It concludes that importance of current news as well as old news increasing with low per cent after index future was introduced. It reveals that the spot market is absorbing information faster in the post index future.

Table also depicts that the coefficient of lagged S&P 500 has increased from 0.24622 to 0.33127 which presents strong relation between the indices are increasing and significant. The coefficient of S&P 500 (lagged) are positively significant both in case of after and before introduction of future market and , this indicates that lagged international news has effect on sport market volatilities.

Results related to expiration day indicates that coefficient of expiration dummy is negatively significant. It reveals that expiration day has significant effect on spot market, expiration day is some different as compared to other days.

TABLE-II: ESTIMATION OF GARCH (1,1) MODEL

A BEFORE FUTURE (JAN1997-12JUNE2000)					B AFTER FUTURE (12JUNE-MARCH2010)					C BEFORE AND AFTER FUTURE(JAN1997-MARCH2010)				
Variables	Coefficient	Std. Error	z-Statistic	Prob.	Variables	Coefficient	Std. Error	z-Statistic	Prob.	Variables	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000718	0.000529	1.356174	0.175	C	0.001368	0.000213	6.413703	0	C	0.001266	0.000198	6.403740	0
S&P500 Index (-1)	0.246225	0.051021	4.825989	0	S&P500 Index (-1)	0.331273	0.022184	14.93269	0	S&P500 Index (-1)	0.314072	0.019735	15.91445	0
S&P CNX Nifty Junior	0.000636	0.026087	0.024389	0.981	S&P CNX Nifty Junior	0.001162	0.011956	0.097229	0.92	S&P CNX Nifty Junior	0.000896	0.010853	-0.0825	0.93
Variance Equation					Variance Equation					Variance Equation				
C	4.39E-05	1.32E-05	3.319784	9E-04	C	8.42E-06	7.75E-06	1.086386	0.28	C	2.42E-05	8.78E-06	2.75608	0.01
RESID(-1)^2	0.233733	0.051612	4.528628	0	RESID(-1)^2	0.244433	0.014866	16.44268	0	RESID(-1)^2	0.230123	0.013008	17.6911	0
GARCH(-1)	0.608104	0.084765	7.173975	0	GARCH(-1)	0.726185	0.018232	39.83056	0	GARCH(-1)	0.740901	0.015341	48.2954	0
					Expiration Dummy	1.07E-06	8.16E-06	0.130839	0.9	Expiration Dummy	-1.51E-05	8.93E-06	-1.6848	0.09

For removing the effect of other derivative contract, this study covers one year before and after introduction of index future. It gives same results related to coefficient of S&P 500 has increased from 0.2414 to 0.2544 and significant. Therefore, output related to expiration dummy and parameters is same as compares to table-II which also indicates that importance of recent news has an increasing but old news has declined in case of short time period taken.

TABLE-III: ESTIMATION OF GARCH (1,1) MODEL

BEFORE FUTURE (12 JUNE 1999-12JUNE2000)					AFTER FUTURE (12JUNE2000-12JUNE2001)					BEFORE AND AFTER FUTURE(12JUNE1999-12JUNE2001)				
S&P CNX NIFTY					S&P CNX NIFTY Junior Returns					S&P500 Index				
	Coefficient	Std. Error	z-Statistic	Prob.		Coefficient	Std. Error	z-Statistic	Prob.		Coefficient	Std. Error	z-Statistic	Prob.
C	0.001587	0.000996	1.592337	0.11	C	0.000571	0.000987	0.578408	0.56	C	0.001036	0.000684	1.515195	0.13
S&P500 Index (-1)	0.241437	0.10776	2.240514	0.03	S&P500 Index (-1)	0.254487	0.075009	3.392743	0.00	S&P500 Index (-1)	0.25825	0.057644	4.480112	0.00
S&P CNX Nifty Junior	-0.000524	0.036806	-0.014259	0.99	S&P CNX Nifty Junior	-0.037216	0.051437	-0.723518	0.47	S&P CNX Nifty Junior	-0.016354	0.028766	-0.568535	0.58
Variance Equation					Variance Equation					Variance Equation				
C	1.34E-05	1.30E-05	1.024876	0.31	C	6.04E-05	9.43E-05	0.640747	0.52	C	8.60E-05	7.48E-05	1.14916	0.25
RESID(-1)^2	1.66E-01	7.64E-02	2.170437	0.03	RESID(-1)^2	0.237953	8.82E-02	2.70E+00	0.01	RESID(-1)^2	0.227122	0.059898	3.791832	0.00
GARCH(-1)	0.799153	0.103177	7.745486	0.00	GARCH(-1)	0.664149	0.108301	6.132422	0.00	GARCH(-1)	0.697235	0.076647	9.096709	0.00
					Expiration Dummy	-3.44E-05	8.83E-05	-0.389616	0.70	Expiration Dummy	-6.47E-05	7.16E-05	-0.903825	0.37

VAR test has been used for testing the effect of lagged variables such as S&P 500 index return. The results of this model are presented in table-IV. It depicts that lagged returns have significant effect on returns of S&P CNX NIFTY and S&P CNX NIFTY Junior up to one day lag.

TABLE-V: VECTOR AUTO REGRESSION ESTIMATES (Before and After Future (Jan1997-March2010))

	S&P CNX NIFTY (N)	S&P CNX NIFTY Junior Returns(S)
N(-1)	0.202417	-0.009069
S-E	-0.01809	-0.01235
t-value	[11.1917]	[-0.73439]
N(-2)	-0.096137	0.005523
S-E	-0.01776	-0.01213
t-value	[-5.41316]	[0.45545]
S(-1)	0.283277	0.266707
S-E	-0.02624	-0.01792
t-value	[10.7947]	[14.8843]
S(-2)	-0.018178	-0.172585
S-E	-0.02671	-0.01824
t-value	[-0.68064]	[-9.46395]
C	0.000429	8.25E-05
S-E	-0.00025	-0.00017
t-value	[1.68707]	[0.47502]

In order to testing the effect of index future D_{future} is introduced in conditional variance equation. It can be concluded from table-IV that coefficient of lagged S&P 500 have positive and significant effect on NSE Nifty returns. But coefficient of future dummy is negative and significant which shows that there has been decline in volatility after introduction of future market.

TABLE-IV: ESTIMATION OF GARCH (1,1) MODEL FOR BEFORE AND AFTER FUTURE INTRODUCTION

(BEFORE AND AFTER FUTURE(JAN1997-MARCH2010))					BEFORE AND AFTER FUTURE(12JUNE1999-12JUNE2001)				
	Coefficient	Std. Error	z-Statistic	Prob.		Coefficient	Std. Error	z-Statistic	Prob.
C	0.001276	0.000198	6.45422	0.00	C	0.00099	0.00069	1.428358	0.1532
S&P500 Index (-1)	0.313936	0.019792	15.86151	0.00	S&P500 Index (-1)	0.263729	0.05858	4.50199	0.00
S&P CNX Nifty Junior	-0.00099	0.010814	-0.09106	0.9274	S&P CNX Nifty Junior	-0.01294	0.02905	-0.44529	0.6561
Variance Equation					Variance Equation				
C	2.07E-05	3.47E-06	5.961158	0.00	C	2.24E-05	1.09E-05	2.065374	0.0389
RESID(-1)^2	0.233957	0.013219	17.69908	0.00	RESID(-1)^2	2.11E-01	5.40E-02	3.905693	0.0001
GARCH(-1)	0.720719	0.017611	40.92527	0.00	GARCH(-1)	0.725062	0.06149	11.79171	0.00
F	-1.01E-05	2.83E-06	-3.58189	0.0003	F	-2.74E-06	8.08E-06	-0.3387	0.7348

CONCLUSION

Derivatives play a very important role in the price discovery process and in completing the market. This role as a tool for risk management clearly assumes that derivatives trading do not increase market volatility and risk. This study examines the effect of index future and expiration day on spot market. Specifically, the study examines whether the index Futures trading in India have caused a significant change in spot price volatility of the underlying. The result shows that the introduction of Nifty index futures trading in India is associated with reduction in spot price volatility. This is followed by significant and negative impact of introduction of futures on the spot market volatility. This study also shows that expiration day volatility is negative and significant. On comparing the present study with the previous studies, it has been found that there is no variation in the results.

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