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Stock Price Volatility Estimators in Merger Announcement – An Empirical Analysis

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ABSTRACT

The purpose of this study is to estimate the stock price volatility with respect to merger announcement using an event study methodology. Merger announcements do not significantly alter the trading liquidity and pricing efficiency of the sample stocks. However, return volatility does decline on post event basis. It is also observed that while stock financed mergers are value creating, cash financed mergers seem to be value destroying in the short run. Specifically, this study analyzed the effects of service and manufacturing industries in mergers announcements the stock price volatility in India. Volatility as a measure of risk plays an important role in many financial decisions in such a situations. The main purpose of this study is to examine the volatility of the merger announcement period and its related stylized facts using Garman and Klass estimators.

Keywords: Mergers And Acquisitions, Event Study Analysis, Garman And Klass Estimators

1.INTRODUCTION

Industry streamlining refers to a broad array of activities that expand or contract a company's operations and its financial structure or bring about a significant change in its organizational structure and internal financing. A major research approach assessing corporate reshuffle events is the value effect (short and long term) of the announcement of restructuring. Typical findings from early studies suggest that M&As did not enhance firm value, either in the short-run (Dodd, 1980; Asquith, 1983; Malatesta, 1983; Jarrell &Poulsen, 1989) or in the long-run (Asquith, 1983; Agrawal, Jaffe, &Mandelker, 1992; Loderer& Martin, 1992). More specifically, acquisitions were often found to erode acquiring firm value (Chatterjee, 1992; Datta, Pinches, & Narayanan, www.ccsenet.org/ijef International Journal of Economics and Finance Vol. 4, No. 11; 2012 77 1992; Seth, Song, & Pettit, 2002; King, Dalton, Daily, &Covin, 2004; Moeller, Schlingemann, &Stulz, 2004) and produce highly volatile stock returns (Langetieg, Haugen, &Wichern, 1980; Pablo, Sitkin, & Jemison, 1996).As limited work is available regarding corporate restructuring events in India

The present study attempts to fill this important void in M&A literature. We specifically examine the following propositions for acquirer company: 1) Industry reform event generates significantly abnormal returns around the merger announcement date (i.e. in the short run). 2) Industry reform event significantly changes stock trading volume, volatility of returns and pricing efficiency, from pre to post event periods around the announcement date. 3) The cross correlations of stock price volatility between service and manufacturing industries.. The outcome of the study will be useful to policy makers for regulation, companies planning restructuring event, corporate finance managers, consultants as well as existing and prospective shareholders

2.LITERATURE REVIEW

Stock prices volatility is an extremely important concept in finance for numerous reasons. The literature on stock price volatility agrees on one key phenomenon. There is evidence of sever movements in stock prices. In other words, dynamic nature of stock prices behavior is an accepted phenomenon and all participants in stock markets include regulators, professionals and academics have consensus about it. But, what causes stock prices volatility is a question that remains unsettled in finance field. Answer to this question, because of the great number of involved variables is not an easy task and up to now there is no consensus about it. However researchers in quest of answer this question has investigated the stock prices volatility from different angels. In this regards, from late twentieth century and particularly after introducing ARCH model by Engle (1982), as said by Bollerslev (1999) and Granger and Poon (2000) several hundred research that mainly accomplished in developed country and to some extent in developing countries has been Vol. 5, No. 2 International Journal of Business and Management 92 done by researchers in this area using different methodology.

Volatility estimates are used extensively in empirical research, risk management and derivative pricing by the finance professionals and researchers. volatility of stock prices estimated using sample standard deviation of close-to-close daily prices and is scaled to estimate volatility for the period (41 days event window). Following work by Parkinson (1980), numerous extreme value (or range based) estimators have been suggested in the literature. These estimators take into

account the highest and the lowest prices observed during the trading. Theoretically, these estimators are shown to be more efficient (5 to 14 times) than traditional ones, yet they have not been very popular. This is mainly because such estimators are derived assuming that asset prices follow geometric Brownian motion (GBM), and that market is trading continuously. This could make them biased estimators of volatility if the returns generating process is different. Recently however, Li and Weinbaum (2000) have pointed out that the assumed "unbiasedness" of the traditional estimator itself holds only for particular return generating processes.

Parkinson (1980) was first to propose an extreme-value volatility estimator for a security following driftless GBM, which is theoretically 5 times more efficient, compared to traditional close-to-close estimator. His estimator is based on the highest and the lowest prices of each day over the estimation period. Extending his work, Garman and Klass (1980) constructed an extreme-value estimator incorporating the opening and the closing prices in addition to the trading range, which is theoretically 7.4 times more efficient than its traditional counterpart. Both the Parkinson and the Garman-Klass estimator despite being theoretically more efficient, are based on assumption of driftless GBM process. Rogers and Satchell (1991) relaxed this assumption and proposed an estimator, which is valid even if there is drift. Recently, Yang and Zhang (2000) proposed an estimator independent of drift, which also takes into account an estimate of closed market variance

The realized volatility measure developed by Andersen et al. (2001), for day t is simply the sum of squared intra-day (frequently sampled) returns. The realized volatility so computed can be annualized, by multiplying it with square root of number of trading days in a year. While choosing appropriate time intervals is an important issue (Andersen et al., 2001), we have used 5-minute returns to compute the realized volatility.

Statement of the problem

Various academic studies internationally have looked to answer this question in the following, more general form. Do corporate acquisitions create value for shareholders? From, the literature review made, it is observed that there are limited studies done in Indian M&A context to judge the change in stock price performance. Again, in the light of literature review made studies shows inconsistent results in event study; it might be because the stock price reaction of merger announcement period is not explored in depth. Therefore, to fill this gap, the present study is an attempt to analyse **the impact of merger announcement on stock price** of manufacturing and service industries in India.

Objective of the study

The main objective of the present study to estimate the stock price volatility of service and manufacturing industries using Garman & Klass and measure its variance through econometric model

3.METHODOLOGY

Period of the Study

Mergers and Acquisitions (M&A) are strategic management aspects, which provides an opportunity to corporate as buying, selling, dividing and combining of different companies as similar business entities. This activity can help a company to leverage their existing value and improve the welfare of shareholders. This study trying to evaluate the effectiveness of merger announcement on stock prices of acquiring companies during the financial year from 2004-05 to 2013-14.

The data was collected from CMIE's Prowess database, which shows 844 merger announcements during this period. Further, we have classified the list of companies based on service industry, manufacturing industry and other industry. The following Table 4.1 depicts the distribution pattern of companies involved in M&A deals.

Table 1: Industry-wise classification of companies

Industry-wise M&A Deals	**No. of Companies**	**Percent**
Service Industry	222	26.30%
Manufacturing Industry	206	24.41%
Other Industry	416	49.29%
Total	844	100.00%

The observation states that there are about 844 M&A deals during the study period and out of which 49.29% of deals belonging to other industry, 26.30% of deals belonging to service industry and remaining 24.41% of deals belonging to manufacturing industry. Key finding states that majority 49.29% of the deals happened in other industry, whereas the

researcher keen in evaluating the effectiveness merger announcement of service and manufacturing industry. Hence, the subsequent part of the analysis considers only service and manufacturing industry.

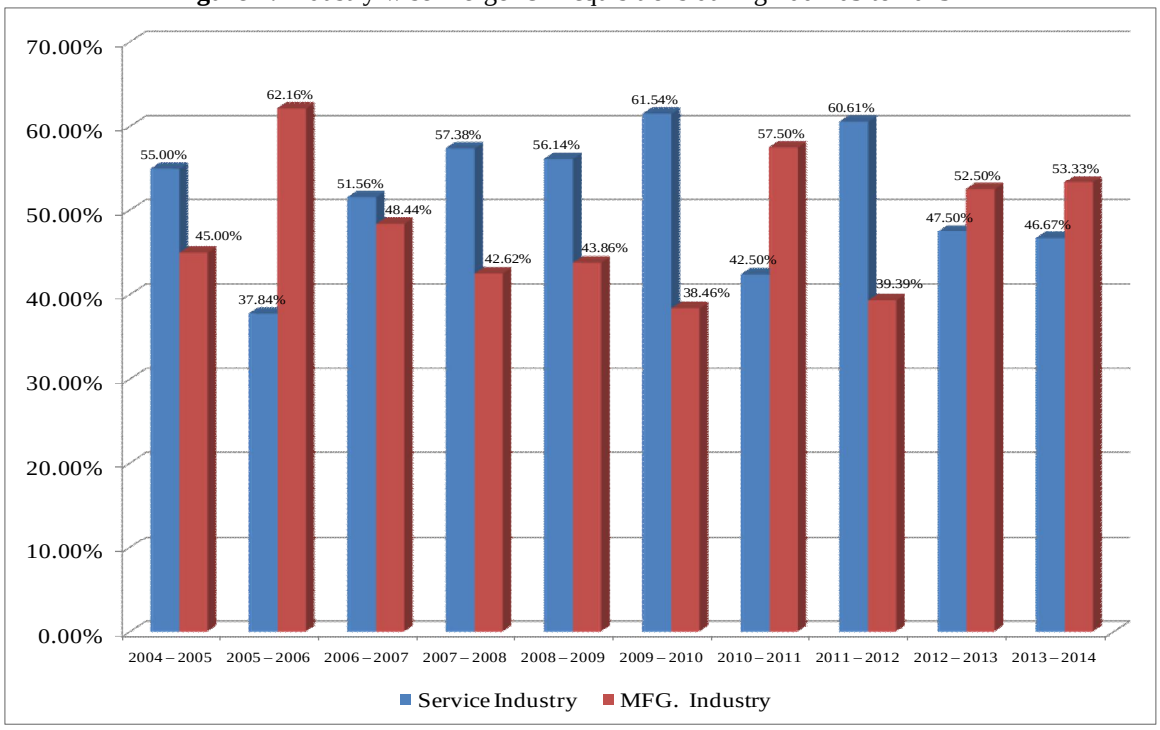
The subsequent table describes year and industry-wide distribution pattern of companies listed under the M&A deals.

Table 2: Year and Industry-wide classification of M&A companies

Industry / Year	Service Industry	MFG. Industry	Total
2004 – 2005	22	18	**40**
2005 – 2006	14	23	**37**
2006 – 2007	33	31	**64**
2007 – 2008	35	26	**61**
2008 – 2009	32	25	**57**
2009 – 2010	16	10	**26**
2010 – 2011	17	23	**40**
2011 – 2012	20	13	**33**
2012 – 2013	19	21	**40**
2013 – 2014	14	16	**30**
Total	**222**	**206**	**428**

Key finding states that total number of M&A deals considered for this study is 428, out of which 222 (51.87%) companies in service industry and 206 (48.13%) companies in manufacturing industry. In this study both industries have been assessed equally, irrespective of its varying number of companies. It is also observed that an average of 30-56 M&A deals has been recorded every year and the financial year 2006-07 has found the maximum entry of 64 deals during the study period.

Figure 1: Industry-wise Merger & Acquisitions during 2004-05 to 2013-14



Sources of Data
The present study is based on the secondary data. The required data for the study were obtained from the corporate database software of CMIE's Prowess database and www.captialine.com, www.bse-india.com and www.nseindia.com.

Table 3: Service industry

Service industry	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Banking and financial industry	4	3	7	6	9	3	2	5	2	2
IT/ITEz	10	8	15	19	13	7	10	8	10	8
Media industry	3	2	5	6	5	5	4	3	3	2
Hotels	3	1	4	1	2	0	0	2	3	2
telecom industry	2	0	2	3	3	1	1	2	1	0
Total	22	14	33	35	32	16	17	20	19	14

(Source : compiled from CMIE Prowees database)

Table 4: Manufacturing industry

Manufacturing industry	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Automobile industry	0	4	3	2	4	3	3	4	4	1
Cement industry	1	2	3	4	1	3	4	1	1	2
Chemical industry	4	4	3	2	5	1	0	0	1	1
Fertilisers	2	0	0	2	0	0	2	2	0	2
Pharma industry	6	3	6	7	6	0	4	3	7	2
Steel industry	3	4	8	3	6	1	6	1	1	4
Sugar industry	0	1	1	2	1	1	2	0	3	1
Textile industry	2	5	7	4	2	1	2	2	4	3
Total	18	23	31	26	25	10	23	13	21	16

(Source : compiled from CMIE Prowees database)

The announcement date is identified as the day when the target or acquiring company first publishes disclosed information about the merger. This was specified as day zero in the event time of the study.

Tools

1. Event study methodology

To examine the share pattern of merger announcement on share prices volatility and behaviour of investors or traders, the statistical technique called event study approach has been used in our research. Under this approach, the method behaviour of the daily stock return series around 41 days of the event announcement day has been examined.

2. Volatility estimators

Volatility has become a topic of enormous importance to almost anyone who is involved in the financial markets, even as a spectator. To many among the general public, the term is simply synonymous with risk: high volatility is thought of as a symptom of market disruption. To them, volatility means that securities are not being priced fairly and the capital market is not
functioning as well as it should. But for those who deal with derivative securities, understanding Volatility, forecasting it accurately, and managing the exposure of their investment portfolios to its effects are crucial.

Modern option pricing theory, beginning with Black and Scholes [1973], accords volatility a central role in determining the fair value for an option, or any derivative instrument with option features. While the returns volatility of the underlying asset is only one of five parameters in the basic Black-Scholes (BS) option pricing formula, its importance is magnified by the fact that it is the only one that is not directly observable. Stock price, strike price, time to option expiration, and the interest rate are all known or can be easily obtained from the market, but volatility must be forecasted. Although the realized volatility over recent periods can easily be computed from historical data, an option's theoretical value today depends on the volatility that will be experienced in the future, over the option=s entire remaining lifetime. Simply projecting observed past volatility into the future is a common way to make a forecast, but it is only one of several common methods, and need not be the most accurate. Moreover, there are numerous variations in exactly how historical price data are used in predicting volatility. Volatility forecasting is vital for derivatives trading, but it remains very much an art rather than a science, particularly among derivatives traders.

From the beginning, volatility prediction has posed significant problems for those interested in applying derivatives valuation models, but the difficulty has become greater in recent years as the maturities of available instruments have

lengthened dramatically. In the 1970s, most options trading was in equity options with maturities of only a few months. While it was recognized that a security's return volatility could be expected to change over time, as long as this only occurs gradually, it should be possible to get a reasonably good short term forecast by simply assuming that volatility over the near future will remain about the same as what was realized in the recent past. That assumption becomes less tenable the longer the maturity of the option that is being priced.

Volatility analysis is given importance to evaluate the proportional volatility on merger announcement using Garman-Klass volatility estimator. The Garman-Klass estimation of volatility was developed by Graman and Klass and it uses the open, high, low and close prices to estimate volatility. This estimator is up to eight times more efficient that the close-to-close estimator, which is estimated through the following equation.

$$\sigma 2=(H-L)2/2-(2\ln(2)-1)(C-O)2$$

Limitations of the study

1. The study has made only service and manufacturing industries.
2. The study has analysed only the impact on acquiring company .The impact on Target Company could also have been analysed.
3. The study has considered the impact on share prices only. Other factors could also have been considered

4.RESULTS

The table shows the Garman & Klass based volatility of stock prices reference to service industry on specified event window.

Table 5: Garman & Klass Volatility Estimator – Service Industry

Year	-20	-15	-10	-5	-3	0	3	5	10	15	20
2004 - 05	0.188	0.191	0.190	0.190	0.186	0.186	0.201	0.198	0.191	0.192	0.191
2005 - 06	0.178	0.177	0.176	0.184	0.184	0.185	0.168	0.180	0.182	0.182	0.181
2006 - 07	0.168	0.169	0.170	0.174	0.174	0.183	0.179	0.179	0.184	0.183	0.183
2007 - 08	0.173	0.171	0.173	0.175	0.177	0.174	0.174	0.170	0.171	0.170	0.169
2008 - 09	0.198	0.200	0.201	0.201	0.199	0.206	0.198	0.195	0.202	0.198	0.197
2009 - 10	0.174	0.176	0.177	0.181	0.182	0.183	0.169	0.170	0.165	0.164	0.164
2010 - 11	0.156	0.157	0.155	0.159	0.159	0.176	0.179	0.170	0.165	0.163	0.162
2011 - 12	0.174	0.173	0.176	0.176	0.180	0.200	0.170	0.166	0.174	0.173	0.172
2012 - 13	0.156	0.156	0.156	0.159	0.161	0.163	0.160	0.158	0.159	0.157	0.159
2013 - 14	0.173	0.170	0.170	0.176	0.178	0.167	0.157	0.160	0.157	0.158	0.160
Mean	**0.174**	**0.174**	**0.174**	**0.177**	**0.178**	**0.182**	**0.176**	**0.174**	**0.175**	**0.174**	**0.174**

The table exhibits Garman & Klass based volatility estimation towards historical stock prices of service industry fitted on ±20 days event window. The main objective of this evaluation is to measure the presence of high volatility during the study period on ±20 days event window. It is observed from the resultant table that highest volatility of 2004-05 is triggered on 3 days event window (0.201), 2005-06 is triggered on event day (0.185), 2006-07 is triggered on 10 days window (0.184), 2007-08 is triggered on -3 days window (0.177), 2008-09 is triggered on event day (0.206), 2009-10 is triggered on event day (0.183), 2010-11 is triggered on 3 days window (0.179), 2011-12 is triggered on event day (0.200), 2012-13 is triggered on event day (0.163) and 2013-14 is triggered on -3 days window (0.178). The mean observation is taken for the study period with reference to the corresponding event window, which states that highest mean volatility of stock price (0.182) is obtained on event day in service industry.

Key finding states that highest mean volatility of stock price (0.182) is obtained on event day in service industry.

The table shows the Garman & Klass based volatility of stock prices reference to manufacturing industry on specified event window.

Table 6: Garman & Klass Volatility Estimator – Manufacturing Industry

Year	**-20**	**-15**	**-10**	**-5**	**-3**	**0**	**3**	**5**	**10**	**15**	**20**
2004 - 05	0.171	0.173	0.175	0.186	0.185	0.173	0.161	0.164	0.167	0.166	0.163
2005 - 06	0.169	0.171	0.170	0.174	0.181	0.181	0.174	0.171	0.166	0.169	0.173
2006 - 07	0.168	0.170	0.167	0.172	0.173	0.148	0.175	0.163	0.170	0.174	0.171
2007 - 08	0.170	0.171	0.174	0.171	0.168	0.180	0.163	0.167	0.164	0.163	0.162
2008 - 09	0.187	0.189	0.195	0.195	0.184	0.175	0.183	0.184	0.197	0.193	0.190
2009 - 10	0.185	0.182	0.184	0.189	0.183	0.196	0.181	0.178	0.178	0.173	0.172
2010 - 11	0.162	0.162	0.163	0.166	0.166	0.183	0.182	0.177	0.170	0.165	0.162
2011 - 12	0.155	0.156	0.158	0.159	0.158	0.158	0.170	0.173	0.173	0.169	0.167
2012 - 13	0.156	0.157	0.160	0.165	0.165	0.165	0.154	0.155	0.160	0.160	0.158
2013 - 14	0.160	0.161	0.160	0.160	0.161	0.187	0.165	0.165	0.164	0.167	0.171
Mean	**0.168**	**0.169**	**0.170**	**0.174**	**0.172**	**0.175**	**0.171**	**0.170**	**0.171**	**0.170**	**0.169**

The table exhibits Garman & Klass based volatility estimation towards historical stock prices of manufacturing industry fitted on ±20 days event window. The main objective of this evaluation is to measure the presence of high volatility during the study period on ±20 days event window. It is observed from the resultant table that highest volatility of 2004-05 is triggered on -5 days event window (0.186), 2005-06 is triggered on event day & -3 days window (0.181), 2006-07 is triggered on 3 days window (0.175), 2007-08 is triggered on event day (0.180), 2008-09 is triggered on 10 days window (0.197), 2009-10 is triggered on event day (0.196), 2010-11 is triggered on event day (0.183), 2011-12 is triggered on 5 days event window (0.173), 2012-13 is triggered on event day (0.165) and 2013-14 is triggered on event day window (0.187). The mean observation is taken for the study period with reference to the corresponding event window, which states that highest mean volatility of stock price is obtained on event day (0.175) in manufacturing industry.

Key finding states that highest mean volatility of stock price (0.175) is obtained on event day in manufacturing industry.

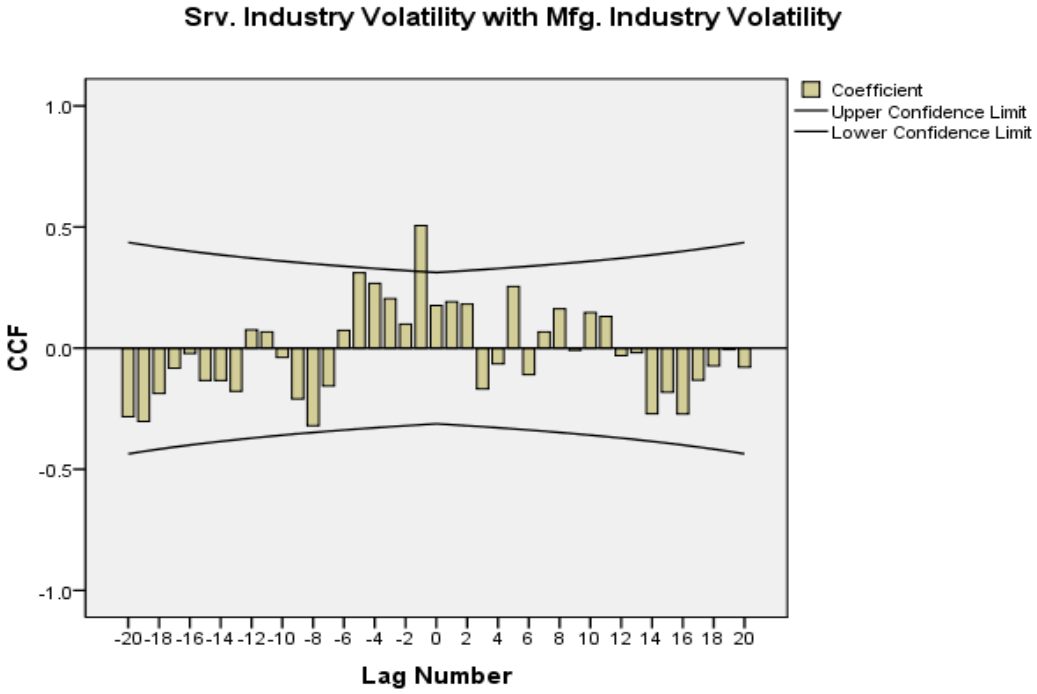
Table 7: Cross Correlation – Service and Mfg. Industry's Stock Price Volatility

Series Pair: Srv. Industry Volatility with Mfg. Industry Volatility					
Lag	**Cross Correlation**	**Std. Error**	**Lag**	**Cross Correlation**	**Std. Error**
-20	-0.284	0.218	1	0.191	0.158
-19	-0.302	0.213	2	0.181	0.160
-18	-0.187	0.209	3	-0.169	0.162
-17	-0.082	0.204	4	-0.065	0.164
-16	-0.022	0.200	5	0.254	0.167
-15	-0.134	0.196	6	-0.110	0.169
-14	-0.134	0.192	7	0.067	0.171
-13	-0.178	0.189	8	0.162	0.174
-12	0.076	0.186	9	-0.009	0.177
-11	0.066	0.183	10	0.147	0.180

-10	-0.039	0.180	11	0.130	0.183
-9	-0.209	0.177	12	-0.031	0.186
-8	-0.320	0.174	13	-0.019	0.189
-7	-0.156	0.171	14	-0.271	0.192
-6	0.073	0.169	15	-0.183	0.196
-5	0.311	0.167	16	-0.272	0.200
-4	0.267	0.164	17	-0.132	0.204
-3	0.204	0.162	18	-0.073	0.209
-2	0.099	0.160	19	-0.006	0.213
-1	0.506	0.158	20	-0.079	0.218
0	0.176	0.156			

The table depicts the cross correlations analysis of historical stock price volatility between service and manufacturing industries on ±20 days event window.
The resultant table exhibits a positive correlation begins from -6 days to +2 days on event window and the rest of period indicates the negative correlations.
Key finding states that stock price volatility begins before the actual merger announcement was released and it is persistent up to two days from the date of announcement. The cross correlations analysis confirms that volatility has found significant relationship with merger announcements irrespective of specific industry. The subsequent figure 2 illustrates the cross correlations of stock price volatility between service and manufacturing industries.

Figure 2: Cross Correlation of Volatility between Service and Mfg. Industries



Suggestions
1. The volatility estimators have found difference in the predicted results. According to the study result Parkinson estimator has found more accuracy than close-to-close estimator. Therefore it is suggested to use Parkinson estimator for further studies in this research direction.
2. Finally, it is suggested to use appropriate econometrics in the further research. It is also suggested to use alternative regression analysis techniques (e. g., system equation, optimum/equilibrium equation) and other data analysis techniques (e. g., factor analysis, discriminant analysis, and rank correlation, etc.). It is also suggested to use alternative

data analysis techniques in the event study (e. g., cumulative effect of the abnormal returns, buy and hold strategy, comparison period return approach, regression analysis, and mean adjusted return method, etc.).

5.CONCLUSION

The research paper makes a number of contributions to the finance literature in general and to studies about the Indian Stock market in particular. The event study result shows that there is a significant return on merger announcements and comparatively merger announcement has shown better returns. It construes that investors can earn abnormal profit when these kind of announcement happens and this will not implies on all situations.

Garman & Klass volatility estimator is used to predict the stock price volatility on specific event windows. The result confirms that event-day has found highest level of volatility compared to pre-event and post-event days. It is also explored that volatility is speculated from pre-event window and exists up to two days in the post-event window. The cross correlations analysis has evaluated to confirm the relationship of volatility among service and manufacturing industries. The result states that volatility has found significant relationship on the effect of merger announcements in both industries.

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