IMPACT OF FINANCIAL CRISIS ON CROSS LISTING INDIAN CORPORATE: AN EMPIRICAL STUDY

Dr. Rachna Jain,

Assistant Professor,
Maharaja Agrasen Institute of Management
Studies, Rohini, Delhi, India

ABSTRACT

Global financial crisis in 2008 emerged as huge problem in India. Indian Companies have been allowed to tap the global market through cross listing. The study examines the impact on returns, liquidity and volatility of the underlying domestic stocks due to cross listing during financial crisis period. The sample of the study comprises of 235 Indian companies which went for international listing on New York Stock Exchange (NYSE), National Association of Securities Dealers Automatic Quotation (NASDAQ), London Stock Exchange (LSE) and Luxemburg Stock Exchange (LXSE) over the period 1st January, 1991 –31st December, 2014. Out of 203 Indian sampled companies, 87 companies consist of pre financial crisis period while 116 companies consist of post financial crisis period. Various statistical tools like regression, ARCH models, turnover ratios, variance ratios etc. have been used for examining the impact of cross listing on domestic stocks return, liquidity and volatility.

Even in global financial crisis period bifurcation, when crisis period considered separately during pre-listing, listing day and post listing period of the underlying domestic stocks, it is found that in long term, a negative and significant change on return of underlying domestic stocks after cross listing while in short term, positive immediate effect has been shown on returns. Liquidity significantly declined after financial crisis while volatility has no significant impact due to global crisis. One probable reason for our empirical findings may be that Indian stock markets are not efficiently integrated as compare to developed markets. Overall results support investor recognition theory. Indian corporates, investors and regulators of stock market mainly get benefit from the results of the study.

Keywords*: Financial crisis, Return, Liquidity, Volatility, Stock Market.*

Introduction:

Global financial crisis is engrained in the subprime calamity which surfaced over a year ago in the United States of America. Different views on the reason of disaster includes thriving in housing marketplace, speculation, great risky mortgage loans, lending practices, securitization practices, inaccurate credit ratings and poor principles of financial institutions. The financial crisis has not mainly exaggerated United States of America, but also U.K, European Union, and Asia. The first hint of the trouble came from New York based global investment bank and trading securities firm that collapse in early 2007. Subsequently a number of other banks and financial institutions also express symptoms of suffering. Matters really came in the limelight with the bankruptcy of fourth largest investment bank in the United States i.e. Lehman Brothers in September 2008. The U.S. banks have huge running relations with Indian Software Companies. Approximation proposes that at least a minimum of 30,000 Indian jobs could be impacted immediately in the wake of endeavors in the U.S. financial system. Exchange rate volatility in India has increased in the year 2008-09 as compared to earlier years. Substantial selling by Foreign Institutional Investors and transformation of their holdings from rupees to dollars for deportation has resulted in the rupee devaluing sharply against the dollar. The most immediate effect of the crunch has been a huge depletion of foreign institutional investment from the

equity market. Investment in tourism, hospitality and medical care has slowed down. The financial disorder impacted the stock markets even in India. The combination of a hasty sell off by financial establishments and the vision of economic slowdown have pulled down the stocks and commodities market. FIIs dragged out nearby to $ 11 billion from India, tiresome the capital market down with it (Lakshman 2008). Stock prices have dropped by 60 per cent. India's stock market index, Sensex, touched 21,000 marks in January, 2008 and has leaped below 10,000 during October 2008 (Kundu 2008). The slowdown in the world economy has affected the clothing industry. The manufacturing works which are dependent on exports, mainly to the U.S have come down following deferred purchasing by vast apparel brands. While the developed world, including the U.S, the Euro Zone and Japan, has embarked into recession, the Indian Economy being affected by the spillover effects of the global financial crisis (Chidambaram 2008).

Literature Review:

Biswal et al. (2001) used viz, size, liquidity, and volatility and two time series trend break techniques of Perron were applied on monthly data of Bombay Stock Exchange. They found that the Indian stock market grew and became more liquid after liberalization but period covered by them was up to 1998. Subsequently, there were significant changes in the regulations and development of Indian stock market. After that, Kumar (2003) studied the impact of Indian companies overseas on the Returns of the domestic underlying shares. The sample of firms studied was derived from Sixty-eight Indian firms out of 85 listed DR programs on the foreign markets from 1992 to 2001. The sample of study comprised all ADRs and GDRs during the sample period. It displayed that DR listing recorded significant positive abnormal return on the listing day and negative abnormal return after the listing period. GDR programs mainly were associated with increase in the liquidity; the ADR programs mainly were associated with decrease in the liquidity of the domestic shares. Volatilities of the underlying domestic shares of the foreign listed Indian firms have reduced after the listing event irrespective of ADR or GDR market.

Batra (2004) analyzed the time variation in volatility in the Indian stock market during 1979-2003. A generalized reduction in stock market instability is observed in the post reform period in India. In India, volatility on stock return appears to be influenced more by the domestic political and economic events rather than global events. Tripathy and Jha (2010) studied an Indian stock market reaction to international cross-listing. The study examined cross-listing impact on ADRs of the Indian stock market for the period June 2004 to July 2009, the results indicates a significant negative abnormal local market return on the ADR listing day.

Goel et al. (2011) studied a longer period from 1990-91 to 2006-07 to know the impact of globalization on stock market development in India using commonly recognized indicators market capitalization ratio, value-traded ratio, turnover ratio and volatility ratio. They found market capitalization ratio, value-traded ratio and turnover ratio increases after liberalization while volatility ratio has declined. They indicated that Indian stock market experienced exponential growth over the period.

Objective of the Study:

The objective of the study is to analyze the impact on return, liquidity and volatility of the underlying domestic stocks due to global financial crisis in Indian stock market. However, prior studies (such as Foerster and Karolyi (1999), Alexander, Eun and Janakiramanan (1988), Miller (1999) etc.) mainly focused on developed markets. Limited studies such as Kumar, B. et.al (2001), Batra (2004), Tripathi and Jain (2012) etc. has been based on selected sample of international listing firms from India. The present case study has taken to fill the gap by taking a sample from the Indian companies. For this purpose the study has divided domestic Indian stocks on basis of financial crisis period i.e. pre financial crisis period from 1st January, 1991 to 31st December, 2007 and post financial crisis period from 1st January, 2008 – 31st march 2014. Pre Financial Crisis period comprises of listing done from 1st January 1991 till 31st December 2007. It comprises of 87 companies from total sample of 203 companies. Post Financial Crisis period comprises of listing done from 1st January 2008 till 31st December 2014. It comprises of 116 companies out of 203 sample companies.

Data Collection:

The data comprises of daily closing adjusted share prices of the sample companies during the estimation period and the test period. BSE 100 indexes had used as the proxy for market portfolio. The data obtained from Centre for Monitoring Indian Economy (CMIE) database PROWESS. The firms studied were derived from 203 Indian firms' listed DR programs on the foreign markets between January 1991 and December 2014.The listing dates obtained from Bank of New York website. The test periods of the study are $\pm$100 days, $\pm$50 days and $\pm$25 day.

Research Methodology:
Research Design:

Internationally accepted methodology for analyzing the impact of international listing of stocks on stock returns, volatility and trading volume, as developed by Karolyi and Foerster (1998) has been used. The study used an event study methodology in which event date (listing date in the study) is denoted as 0 and stock

returns for some days (say 100 days) before and after that event date are analyzed to detect whether there is any listing effect of foreign listings or not. The estimation period is 108 days before the starting of test period. The following market model is used to estimate the parameters used in calculating:

$$Rit = \alpha i + \beta i Rmt + \varepsilon it \quad (1)$$

Rit = rate of return of the common stock of the firm on the t day.
Rmt = rate of return of market index on the t-day.
αi and βi are the estimated parameters that vary from security to security. αi is the intercept which shows Ri when Rm is zero. βi is a parameter that measures the sensitivity of Rit to market index.
These parameters are then used to find out expected return of different working days say -50 before listing, 0-event date and +50 after listing.

$$ERit = \alpha i + \beta i Rmt \quad (2)$$

Where, ERit = Expected return on stock i at period t dependent on Rmt.
Rmt = Rate of return of market index on the t-day.

Then to find out the actual return, the adjusted closing prices data has been taken up by using the following formula:

$$Rit = \frac{Pt - Pt-1}{Pt-1} \quad (3)$$

Then ABRs was computed as the difference between the actual ex-post returns and the expected normal returns estimate during the market model of returns.

$$ABRit = Rit - ERit \quad (4)$$

Next, the abnormal returns on individual stocks are cross-sectionally averaged in event time to calculate the average abnormal returns (AARs) (average excess returns):

$$AARit = \frac{\sum_{i=1}^{N} ABRit}{N}$$

Where ABRit is the abnormal return for stock i on t trading day relative to the event date.
N is the number of foreign listed firms in our sample.
Further, to measure the impact of firms' foreign listing decisions around listing date, cumulated average abnormal returns (CAAR) for the different holding period are calculate. Over an interval of two or more trading days beginning with day T_1, ending with T_2, the cumulative average abnormal return is

$$CAAR_{T1,T2} = \frac{1}{N} \sum_{i=1}^{N} \sum_{t=T1}^{T2} ABRit$$

Finally, tests of statistical significance are conducted to know whether the ABRit, AARit and CAARit are statistically significant or not.

$$Zit = \frac{\sum SABRit}{\sqrt{N}}$$

Where, SABRit = Standardized abnormal return of i stock at period t.
N = Number of companies listed in our sample.
The mean, standard deviation and t-test individually computed of pre as well post listing event period to check whether individually pre listing or post listing or both the listing periods are statistically significant or not as well as mean is deviating from standard deviation too much or it's close to the deviation. The difference in pre and post listing period has been computed on average abnormal returns. Paired t-test used for testing whether pre and post listing AARs and actual returns (AR) are statistically different or not.
ARCH (autoregressive conditional heteroskedasticity) & GARCH (generalized autoregressive conditional heteroskedasticity) model used to check the problem of heteroskedasticity.
AARit = ω +α Resid (-1) ^2+β GARCH (-1)
Where,
ω, α , β are the estimated parameters.
Resid (-1) ^2 is the first lag of squared return.
GARCH (-1) is the first lag of conditional variance
Turnover ratio measures applied to know the impact on liquidity on underlying domestic stocks. Liquidity turnover ratio which equals to number of shares traded divided by number of shares outstanding. Variance ratio has been computed as proxy of stock price volatility.
Assumption taken that, at equilibrium, the single factor market model specification of the securities return generating process is appropriate.

Hypothesis:

H1: There is no significant impact on return of the underlying domestic stocks due to global financial crisis in 2008.
H2: Cross listing effects vary significantly on liquidity of the underlying domestic stocks due to financial crisis in 2008.
H3: There is a considerable increase in the volatility of the underlying stocks in the domestic market after international listing.

Results:
Impact on Return:

In Pre Financial Crisis Period i.e. during 1st January 1991 till 31st December 2007, In ±100 days, AAR (average abnormal return) is significant at listing day and after listing event, only 10 days out of 100 days are statistically significant while in post financial crisis period, values of listing day is insignificant and after listing event only 7 days out of 100 days are statistically significant. Result of AAR is not conclusive because it is not proving any particular trend. While, study found that CAAR (Cumulative average abnormal return) values are statistically significant from 3rd day to 100th day after listing event in pre financial crisis period as well as from 1st to 46th

day except 42nd day after listing event in post financial crisis period. It shows that returns either abnormal return or cumulative returns are significantly negative after listing event. It proves that in long term, impact on return is substantial due to cross listing.

In ± 50 days window period, before and after financial crisis, values of AAR are not significant during pre and post listing event. At listing day only results are different. Before crisis, listing day is significant while after crisis, it is insignificant. CAAR result is totally reverse from AAR results. Values after listing event in CAAR is significant for almost whole period except 42nd day in post financial crisis period and in pre financial crisis period, values of CAAR is significantly negative from 20th to 50th day. It again proves that returns have been declined markedly after cross listing event.

In ± 25 days event period, result of AAR is insignificant during pre and post financial crisis period except just one day before listing and on 13th day after listing event. One day before listing event can be considered as announcement effect on stock returns. In pre financial crisis period, CAAR values are insignificant during listing day but in post financial crisis period, CAAR values are significant at listing day and after listing event also from 1st day to 20th day. In short term period, CAAR values have shown an upward trend.

Overall, results might be interpreted as the returns have positive immediate impact after cross listing while in long term returns are declining significantly. This might be due to overreaction of corporates during listing event. In long term period, markets are diversified and globalized then returns get reduced.

Paired t-test Results:

Paired t-test (Table 2) has been computed for testing whether before listing and after listing. In ± 100 days, ± 50 & ± 25 days window period, mean difference before and after listing event is negative but insignificant during pre-financial crisis and post-financial crisis. Results are almost same for both pre listing period as well as post listing period. Hence, null hypothesis cannot be rejected that difference in means after cross listing is not significantly different.

Unit Root Test:

A unit root test has been computed to check the stationary of our AARs values by using augmented dickey fuller test statistic which shows that null hypothesis of unit root test is rejected. Series of AAR is stationary for ± 100 days & ± 50 days window period but not for ± 25 days. This might be due to over-reaction of corporates after cross listing. It would take time to auto correct the market variances. Adjusted R-square also explains that in long and medium term, returns explained by financial crisis factors is less than 15%. There might be other important factors like behavior of investors, competitors, political stability etc.

Impact on Liquidity:

In Pre Financial Crisis (Table4), the mean differences of post listing and pre listing period turnover ratios are positive i.e. '0.0017' in +-100 period. This shows post listing turnover ratio is higher as compared to pre listing turnover ratio. The results are statistically significant (4.2114) also. Overall, according to turnover ratio measure, because of cross listing the liquidity of domestic stocks has increased significantly.

In Post Financial Crisis (Table 4), mean differences are negative for all the test windows. For e.g. +-100 test period is -0.00144. This shows that pre listing has higher turnover as compared to post listing period. These mean differences are statistically significant (-11.267) for all test window periods. This shows that cross listing has declined but significant impact on liquidity. That negative impact of cross listing is applicable on all test periods i.e. long term (+-100), medium term (+-50) & short term (+-25) period also. Overall, the study shows that cross listed companies has negative and significant impact.

Impact on Volatility:

In Pre Financial Crisis period, variance ratio (Table 5) has increased for all test periods. All the values of variance ratio are greater than one such as in + -150 days test period it is 1.0732. According to F-test, mixed result found. Window period shows no change in pre and post volatility. According to p-value, mixed result has been found.

In Post Financial Crisis period, variance ratio (Table 5) has decreased for event period + -50 days (1.3246) window period and + -25 days (1.5780) window period. According to F-test and p-value, null hypothesis has been accepted for all test periods as F-values< F-critical values and p-value >0.05. This shows pre listing return variances is almost equal to post listing return variances. Overall, no significant impact found on volatility of domestic stocks after listing event in financial crisis period. The study is not rejecting the hypothesis that cross listing effects varied on volatility of the underlying domestic stocks.

Overall, when bifurcation on pre and post financial crisis period done on basis of global financial crisis in 2008, results have shown different impact on volatility in different periods. Variance ratio increased in pre financial crisis period while decreased in post financial crisis period. In pre financial crisis period, volatility has mixed impact while in post financial crisis period, volatility has no significant impact on domestic stocks.

A more sophisticated model has been applied for volatility i.e. ARCH & GARCH model. ARCH (autoregressive conditional heteroskedasticity) models recognize the presence of successive periods of relative volatility and stability. This model is employed commonly in modeling financial time series that exhibit time-varying volatility clustering, i.e. periods of

swings followed by periods of comparative calm. Table 6 shows the results after applying ARCH & GARCH model. This model result explains whether there is any problem of volatility clustering due to financial time series data or not.

Overall, pre and post classification is done on basis of global financial crisis in 2008; results (Table 6) have shown different impact on volatility in different periods. Variance ratio increased in pre financial crisis period while decreased in post financial crisis period. In pre financial crisis period, volatility has mixed impact while in post financial crisis period; volatility has no significant impact on domestic stocks.

Conclusions:

Even in global financial crisis period bifurcation, when crisis period considered separately during pre-listing, listing day and post listing period, in Pre Financial Crisis period, there is a decrease in abnormal returns after cross listing which are significant also in all test periods but in Post Financial Crisis period, in long term period, average abnormal return values were declined after cross listing but in short term period, returns were increased after cross listing. Hence, no conclusive results were found. Results of paired t-test on AARs are similar in Pre financial crisis as well as in Post financial crisis period. Hence, in different 'Financial Crisis Period' different price reaction has been found depending on the event period. No conclusive result has been found.

The liquidity measure of turnover ratio, pre financial crisis period has positive impact while post financial crisis period has negative impact on liquidity of domestically listed stocks. Overall, pre and post financial crisis period has contradicting results. This is an important finding from prospective investor's point of view as want to hold the company's stock after listing event.

According to global financial crisis event classification, in pre financial crisis period, volatility has mixed result while in post financial crisis period; volatility has no significant impact on domestic stocks.

Overall, the study has found a significant change on return of underlying domestic stocks after cross listing, liquidity significantly declined after financial crisis while volatility has no significant impact due to global crisis. One probable reason for our empirical findings may be that Indian stock markets are not efficiently integrated as compare to developed markets. Overall results support investor recognition theory. Investor recognition theory explains that wider in investor's base due to cross listing reduce the return and risk. Due to cross listing markets get integrated and that risk premium gets reduced simultaneously with reduction in risk.

Implications:

Indian stock markets are considered to be an efficient and effectively integrated market in comparison to other countries market. Results of the study provide insights about the possible merits and impacts of their international listing decisions. Corporate managers must consider the impact of each stock exchange in which it wants to list before taking stock exchange decision. Policy makers and stock exchange regulators should work out policies, so that liquidity again increases in Indian stock exchange. Results of the study found relevant for prospective investors as well as present investors while investing in the stock market.

Limitations of the Study:

Another approach for computing abnormal returns is Event Parameter Approach, also called Multivariate Regression Model (MVRM) which combines event periods and estimations into a single time series. Future researchers could replicate the study by applying Event Parameter Approach. The study investigates the impact of cross listing on liquidity and volatility of Indian domestic stocks. However, it would be useful to compare this impact across different host markets. Future researchers could also consider the impact of cross listing not on cross listed domestic stocks but also on the rival stocks which are not cross listed.

References:

[1] Alexander, G. J., Eun, C.S., & Janakiramanan S. (1988). International Listings and Stock Returns: Some Empirical Evidence. Journal of Financial and Quantitative Analysis, 23 (2),135-151.

[2] The Bank of New York, (2009).The Depository Receipt Markets Mid-Yearbook 2009. The Bank of New York Depository Receipts Division.

[3] Batra, A. (2004). Stock Return Volatility Patterns in India. Indian Council For Research on International Economic Relations. Working Paper 124, March.

[4] Biswal, P.C. and Kamaiah, B. (2001). Stock Market Development in India, Is There Any Trend Break? Economic and Political Weekly, Vol. 36, No. 4, pp.377-384.

[5] Chidambaram, P. (2008). Spill – over effects of global crisis will be tackled. The Hindu, Daily, November 19, 2008, pp. 15.

[6] Foerster, S. R., Karolyi, G. A., & Wiener, D.(1998). The Lure of American Exchanges for Canadian Issuers. Research study sponsored by National Public Relations and Scotia Capital Markets.

[7] Foerster, S. R. & Karolyi, G. A.(1999). The Effects of Market Segmentation and Investor Recognition on Asset Prices: Evidence from Foreign Stocks Listing in the United States. Journal of Finance, 54, 981-1013.

[8] Goel, K. & Gupta, R. (2011). Impact of globalization on stock market development in India. Delhi Bussiness Review. Vol. 12, Issue 1,

pp. 69-74.

[9] Kumar, M., Bhole, L. M., & Saudagaran, S. M. (2001). The Impact of International Listings on Liquidity: Evidence from the Indian Stock Market. Vikalpa, 26, 35-50.

[10] Kundu, S. (2008). Can the India economy emerge unscathed from the global financial crisis? From<http://www.observerindia.com> (Retrieved December 3, 2008).

[11] Lakshman, N. (2008).World Financial Crisis: India's Hurting, Too. From <http:// www. businessweek.com. (Retrieved October 29, 2008).

[12] Miller, D. (1999). The market reaction to international cross-listings: Evidence from depositary receipts, Journal of Financial Economics 51, 103–123.

[13] Tripathi, V. & Jain, R. (2012). Short-term Return Effect of International Listing of Stocks: Evidence from Pharmaceutical and Chemical Companies in India. Asia-Pacific Journal of Management Research and Innovation, September 2012, Vol. 8, Issue 3, pp. 255-263.

[14] Tripathy, N. & Jha, M. K. (2010). Indian Stock Market Reaction To International Cross-Listing: Evidence From Depository Receipts. China Business Review, Vol. 9, pp. 1-16.

Table 1: Returns of Financial Crisis Period

		Mean	Standard Deviation	T			Mean	Standard Deviation	T
Pre FC (100)	Pre AR	0.3531	0.3509	10.0641	Post FC (100)	Pre AR	0.2382	0.7860	3.0305
	Pre AAR	-0.0408	0.3052	-1.3356		Pre AAR	0.2044	0.7398	2.7635
	List AR	-0.3950				List AR	-0.8438		
	List AAR	-0.8150				List AAR	-1.0422		
	Post AR	0.0118	0.4169	0.2832		Post AR	-0.2054	0.7504	-2.7378
	Post AAR	-0.2768	0.3613	-7.6590		Post AAR	-0.1952	0.7001	-2.7882
Pre FC (50)	Pre AR	0.4017	0.4005	7.0925	Post FC (50)	Pre AR	0.3136	0.7517	2.9495
	Pre AAR	-0.0107	0.3513	-0.2158		Pre AAR	0.3709	0.6798	3.8575
	List AR	-0.3950				List AR	-0.8438		
	List AAR	-0.8150				List AAR	-1.0422		
	Post AR	-0.0519	0.4150	-0.8841		Post AR	-0.1866	0.8651	-1.5254
		Mean	**Standard Deviation**	**T**			**Mean**	**Standard Deviation**	**T**
	Post AAR	-0.2880	0.3812	-5.3412		Post AAR	-0.1335	0.7602	-1.2414
Pre FC (25)	Pre AR	0.4327	0.4077	5.3072	Post FC (25)	Pre AR	0.3976	0.6778	2.9328
	Pre AAR	0.0122	0.3339	0.1833		Pre AAR	0.3688	0.6606	2.7911
	List AR	-0.3950				List AR	-0.8438		
	List AAR	-0.8150				List AAR	-1.0422		
	Post AR	0.0869	0.4504	0.9647		Post AR	0.0364	0.8515	0.2140
	Post AAR	-0.1940	0.4287	-2.2629		Post AAR	0.0053	0.6188	0.0431

Table reports actual and average abnormal return-mean, standard deviation and t-test of before and after cross listing event of sample of 87 Indian Companies before financial crisis in 2008 & 116 Indian Companies after financial crisis in 2008. Paired t-test results are also given to know whether difference before and after listing return is significant or not. Period of sample is from 1991-2014. Test window period is 100, 50, 25 days before and after cross listing and zero as listing day.

Table 2: Paired t-test return during financial crisis period

Window period		Mean difference	T-test*	Window period		Mean difference	T-test*
AAR	**Pre FC (100)**				**Post FC (100)**		
Post-Pre	Before listing	-0.3413	-6.1254	Post-Pre	Before listing	-0.4436	-3.7788
	After listing	-0.2360	-4.8296		After listing	-0.3996	-3.6536
	Pre FC (50)				**Post FC (50)**		
Post-Pre	Before listing	-0.4536	-5.3797	Post-Pre	Before listing	-0.5002	-2.8330
	After listing	-0.2773	-3.9825		After listing	-0.5043	-3.4048
	Pre FC (25)				**Post FC (25)**		
Post-Pre	Before listing	-0.3458	-2.8348	Post-Pre	Before listing	0.3611	0.0330
	After listing	-0.2062	-1.8632		After listing	-0.3634	-0.2404

* Significance at 5% level

Table 3: Unit root test Results

Window Period	t-statistic	Probability	Adjusted R-square
	Pre FC/Post FC	Pre FC/Post FC	Pre FC/Post FC
± 100 days	-10.14/-12.01	0.0000/0.000	.1055/.0862
± 50 days	-6.76/ -7.35	0.0000/0.000	.1592/.1376
± 25 days	-5.01/-2.94	0.001/0.0785	0.0466/0.0660

Table 4: Turnover Ratios of Pre Financial Crisis Period

Turnover Ratio = Number of Shares Traded/ Number of Shares Outstanding

DAYS	Post-pre	Mean Difference	Std. Deviation	t- test	sig(2-tailed)
100	Pre Financial Crisis	0.00170	0.004	4.214	0.000
50		0.00180	0.004	3.28	0.002
25		No results	$	$	$
100	Post Financial Crisis	-0.00144	0.002	-8.106	0.000
50		-0.00233	0.001	-11.267	0.000
25		-0.00212	0.002	-6.79	0.000

$-Here t-test cannot be computed because standard deviation is 0.

Table 5: Comparison of Variances before and after Cross Listing

S. No.	Particular	Days(+ -)*	Pre-Variance	Post Variance	Variance Ratio	F-value**	F critical**	P-value** (double)
1	Pre –FC	100	0.1231	0.1738	1.4115	1.4115	1.3941	0.0880
		50	0.1604	0.1722	1.0737	1.0737	1.6073	0.8043
		25	0.1662	0.2028	1.2204	1.2204	1.9838	0.6295
2	Post-FC	100	0.6178	0.5631	0.9114	1.0972	1.3941	0.6455
		50	0.5651	0.7485	1.3246	1.3246	1.6073	0.3285
		25	0.4595	0.7250	1.5780	1.5780	1.9838	0.2709

Table represents the variances of both pre listing and post listing period. It comprises of data from 1991 to 2014. The study has DRs which went for listing in NYSE, NASDAQ, LSE & LXSE. Variance Ratio is used as proxy of stock price volatility. Variance ratios have been calculated by dividing the return variance in the post-listing period by that in the prelisting period, with all returns defined in local currency terms. Table present results of variance ratio, F-test and p-value.

Table 6: Analysis of Volatility Clustering in Time Series Data

Days	AAR	ω*	t (ω)**	Resid (-1)^2*	t(Resid (-1)^2)**	GARCH (-1)*	T (GARCH(-1))**
	Post Financial Crisis	.3339	.7442	.5881	.5385	-.3736	.7776
	Pre Financial Crisis	.0101	.9581	-.4388	.7665	1.338	.5727

*Values are given in %.

**Significant at 5% level of significance

Table represents the ARCH & GARCH model results. It comprises of data from 1991-2014, all DRs which went for listing in NYSE, NASDAQ, LSE and LXSE. E-views is used to find out the results. ω, α , β are the estimated parameters. Resid (-1) ^2 is the first lag of squared return. GARCH (-1) is the first lag of conditional variance.

*****