INTERNATIONAL JOURNAL OF RESEARCH IN COMMERCE & MANAGEMENT

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THE IMPACT OF GLOBAL FINANCIAL CRISIS ON INDIAN STOCK MARKETS

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ABSTRACT

The study examines the impact of the Global Financial Crisis on the Indian Stock Exchange. The study employs T-test and Binary regression test and Non – parametric test Kruskal - Wallis H –test Wilcoxon rank sum test to examine the short term and long term impact on the return of the Indian stock markets. Parkinson Model and Garman and Klass model are used to know the impact of financial crisis on the volatility of the Indian stock exchange. We document that there was no short term as well as long term negative impact on the Indian Stock Exchange. This study shows that Indian Stock market appear to under react to the news regarding financial crisis.

KEYWORDS

Stock market, Fianancial crisis.

INTRODUCTION

The capital market never been as closely linked as it seems today. The credit crunch in one nation has created turmoil in other economies whether big or small. The financial crisis had its immediate reverberations in developing countries which were closely linked to the global financial markets. The financial crisis turned into a crisis of the real economy with the deepening of the financial crisis, freezing of credit, and the sharp fall in the market value of private wealth It has taken global proportions today and has spread far and wide now. Broadly speaking, financial crises are protracted affairs. The aftermath of severe financial crises share four characteristics. First, asset market collapses are deep and prolonged. Second, the aftermath of banking crises is associated with profound declines in output and employment. Third, the real value of government debt tends to explode. The global economic crisis has led to a sharp reduction in world trade and rapid decline in commodity prices. The economic crisis has led to a sharp deterioration in the fiscal position of all advanced economies which is expected to continue past 2010.

There is also still a great deal of uncertainty with regard to the depth and length of the economic recession in the advanced countries, and expectations with regard to the real economy continue to be revised downward (see, e.g., OECD, 2009).

The current world economic crisis originated in the financial sector of the advanced economies, beginning with sup-prime mortgage problem and the meltdown of mortgage backed securities in the US accelerated with the collapse of banking institutions such as Fortis in Europe, Merril Lynch, Lehman Brothers, Fannie Mac, Freddie Mac and Washington Mutual in US and quickly spreading to affect financial institutions in Europe, has its roots in a combination of factors. These include easy and cheap credit (especially after the dot-com bubble burst in 2000), a bubble in house prices, excessive deregulation and inadequate supervision of financial institutions, rapid innovation in highly leveraged financial derivative instruments that only a few people understood (e.g., CDSs, CDOs, CMOs), expansion of sub-prime mortgage lending via predatory lending practices and skewed incentives, among others, that encouraged inappropriate risk-taking by financiers and traders as well as inappropriate ratings being awarded to securities. In early December 2008, the National Bureau of Economic Research (NBER) confirmed that the US economy was in recession, and a week later estimates were released showing that the UK economy was also contracting. Soon it became clear that other members of the EU, such as France, Germany, Ireland and Sweden amongst others, and other major markets such as Japan and Singapore, were also in recession.

The most immediate effect of this crisis on India has been an outflow of foreign institutional investors from the equity market. Foreign Institutional investors pulled out $11.1 billion during the first nine and half months of calendar year 2008.The Indian stock markets had a dream run in 2007, with the 30-share BSE Sensex rising nearly 47% during this year. Foreign direct investment (FDI) flows which achieved their highest level in 2007 have been declining rapidly since the onset of the financial crisis. The global stock markets, after a sustained bull run of almost four years, have behaved erratically since the beginning of 2008. Indian indices fell sharply accompanied with a high degree of volatility when the sub-prime crisis hit the global markets. After a long spell of growth, the Indian economy experienced a downturn in the industrial growth and the current account deficit widened. Foreign exchange reserves depleted, the rupee plunged to 50.18 against dollar on November 21, 2008. In the capital market new investments through public issues were on hold.

Many researchers including Shekar Gopal (2008) Sam Gian *(*2008) S. Venkitaramanan (2008) Manohar M. Atreya(2008) John B. Taylor (2008) Carmen M. Reinhart (2008) Atif R. Mian and Amir Sufi (2008) Carmen M. Reinhart (2008 b) Naudé, W. A. (2009a). Stephany Griffith-Jones and José Antonio Ocampo (2009) have analysed the impact of US financial crisis. Some researchers Morris (2008), Eichengreen et al. (2009) and Taylor (2009) have focused on the causes of the US financial crisis

The literature concentrated mostly on well – developed equity markets in the US and Europe, and do not pay much attention to other stock markets. The objective of this paper is to measure the impact of the US financial crisis on the return and volatility of the Indian Stock market.

RETURN AND VOLATILITY

Return is the greatest factor that induces the investors to invest money in stock market. Return means the profit earned as a result of rise in share prices. Return helps the investor to compare the benefits available in the alternative investment avenue. Descriptive statistics are used to analyse the return of the various indices. Volatility refers to the amount of uncertainty or risk with regard to changes in a security's value. A higher volatility means that a security's value can potentially be spread over a larger range of values. This means that the price of the security can change radically over a period of time - in either direction. A lower volatility means that a security's value does not fluctuate severely, but changes in value at a steady pace over a period of time. High volatility is likely to occur at times of market stress caused by major economic and political events, record crude oil prices, and military conflicts. On the other hand, low volatility, which generally occurs in quiet markets, can potentially offer better prices for buyers.

HYPOTHESIS AND DATA

In this study, we empirically examine the following null hypothesis (H_0): "The US financial crisis had no impact on the Indian stock market." Our alternative hypothesis (H_1): "The US financial crisis had a negative impact on the Indian stock market." To examine the hypothesis of the study we use the Nifty and Sensex stock indices. Sensex a basket of 30 constituent stocks representing a sample of large, liquid and representative companies and it is regarded the pulse of the Indian stock market. Likewise Nifty is a well diversified 50 stock index accounting for 24 sectors of the economy and represents approximately 55 per cent of the total market capitalization of the market as on 31st March 2009. These two indices are considered to be the leading indices by market experts and represent the Indian stock market. The daily closing values for these stock indices were obtained from the respective stock exchange web site from April 2005 to March 2010. To know the short term and long term effect on the market volatility the period is further sub divided in to two. To know the pre financial crisis effect the period is taken from April 2005 to June 2007 and the post financial crisis effect the period is taken from July 2007 to March 2010 and to know the impact of the financial crisis on the market return the period is taken only from April 2007 to March 2008.

METHODOLOGY

We calculated the daily returns on the two indices using the following method

$r_t = (\log p_t - \log p_{t-1})*100$

In the above equation, r_t is the return on the stock index for the day t, and pt is the daily closing value of the index at the end of the day and p_{t-1} refers to the closing value of the previous day.

A. T –TESTS AND BINARY REGRESSION

We first examine the impact of the event using conventional t-tests and a binary variable regression. The regression is specified as under:

RET = $\beta_0 + \beta_1$ Event Dummy …(2)

In the above equation RET refers to the return on a particular index. β_0 is the intercept and Event Dummy is a dummy variable that takes a value of 1 if the calendar date is between July 1 2007 to March 2008 and zero if it is prior to July 1 2007 . In case of long term return regressions, the Event dummy takes a value of 1 for the daily returns of July 2007 to March 2009 and a value of zero if it is prior to July 2007. The results of the regression analysis are presented in Table 2 below.

B. NON-PARAMETRIC TESTS

Kruskal - Wallis H –test

Kruskal- Wallis test is a nonparametric (distribution free) test, which is used to compare three or more groups of sample data. The measurement scale for Kruskal- Wallis test should be at least ordinal. It analyses the degree of separation between the two groups. Null hypothesis: In Kruskal- Wallis test, null hypothesis assumes that the samples are from identical populations.

Alternative hypothesis: In Kruskal- Wallis test, alternative hypothesis assumes that the sample comes from different populations. The statistic H can be calculated by applying the following formula.

$$H = [12/N(N+1)\sum_{i=1}^{k} R_i^2/n_i] - 3(N+1)$$

Where

K = the number of independent samples

n_i = the number of cases in the i^{th} sample

N = the total number of cases

R_i = the sum of the ranks in the i^{th} sample

Kruskal- Wallis test statistics is approximately a chi-square distribution, with k-1 degree of freedom where n_i should be greater than 5. If the calculated value of Kruskal- Wallis test is less than the chi-square table value, then the null hypothesis will be accepted. If the calculated value of Kruskal- Wallis test H is greater than the chi-square table value, then we will reject the null hypothesis and say that the sample comes from a different population.

WILCOXON RANK SUM TEST

The Wilcoxon rank-sum test is a nonparametric alternative to the two sample t-test. The null hypothesis assumes that there is no difference in the return of the pre and post financial crisis period. The alternative crisis is that the returns are significantly higher in pre financial crisis period. We can treat the distribution of W_A as if it were Normal (μ_A, σ_A), where

$$\mu_A = \frac{n_A(n_A + n_B + 1)}{2}$$

$$\sigma_A = \sqrt{n_A n_B (n_A + n_B + 1)/12}$$

The p value can be determined by comparing

$$Z = (\omega_A - \mu_A)/\sigma_A$$

and Z ~Normal (0,1). Where ω_A used to denote the observed rank sum A and W_A to represent the corresponding random variable .

The null hypothesis H_o: (i.e., $\mu_1 = \mu_2$)

Alternative hypothesis H_1: (i.e,. $\mu_1 > \mu_2$)

C. INTRA–DAY VOLATILITY

Financial time series, unlike other economic series, usually exhibit a set of peculiar characteristics. Stock market returns display volatility clustering or volatility pooling, where large changes in these returns series tend to be followed by large changes and small changes by small changes leading to contiguous periods of volatility and stability.

The variation in share price return within the trading day is called intra–day volatility. It indicates how the indices and shares behave in a particular day. Intra–day volatility is calculated with the help of Parkinson Model and Garman and Klass model. To know the impact of the financial crisis on the volatility of the Indian stock market intraday volatility is calculated before and after the crisis.

PARKINSON MODEL

High–low volatility is calculated with the following formula:

$$\sigma = k\sqrt{1/n\sum \log(H_t/L_t)^2}$$

GARMAN AND KLASS MODEL

The Garman and Klass model is used to calculate the open–close volatility. The formula for Garman and Klass model (1980) takes the following form.

$$\sigma = \sqrt{1/n \sum (1/2)[\log(H_t / L_t)]^2 - [2\log(2)-1][\log(C_t / O_t)]^2}$$

GARCH

The impact of global financial crisis on the Indian stock market volatility is examined using a univariate GARCH (1,1) model. The basic and most widespread model GARCH (1,1) can be expressed as:

$$r_t = \alpha_0 + \alpha_1 r_{t-1} + \varepsilon_t$$

$$\varepsilon_t / \psi_{t-1\approx} N(0, h_t)$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon^2{}_{t-1} + \gamma_2 h_{t-1} + \gamma_3 D_t$$

γ_0 is the mean, ε_{t-1}^2 is the news about volatility from the previous period (the ARCH term), and h_{t-1} the conditional variance is the last period forecast variance (the GARCH term) and must be nonnegative. The GARCH model captures the tendency in financial data for volatility clustering. It therefore enables us to make the connection between information and volatility explicit, since any change in the rate of information arrival to the market will change the volatility in the market. In order to ascertain the impact of financial crisis on the Indian stock market volatility we have run a GARCH (1,1) estimation using dummy variable. Dummy variable takes a value of 1 for the daily returns of July 2007 to March 2009 and a value of zero if it is prior to July 2007. If the coefficient of the dummy is statistically significant then the financial crisis has an impact on the stock market volatility. A significant positive co-efficient would indicate an increase in volatility, a significant negative co-efficient would indicate a decrease in volatility.

EMPIRICAL EVIDENCE

We first examine the impact of the event using conventional t-tests and a binary variable regression. We compare the daily returns of the period of 189 days from July 2007 following the financial crisis up to 31 – 03 2008, with the daily returns of a 61 day period immediately preceding the financial crisis. We also compare the long term impact of the financial crisis by comparing the (562 Nifty, 556 Sensex) days return beginning with April 2005 and ending with June 2007 with (672 Nifty, 671 Sensex) days return beginning with July 2007 and ending with March 2010 from the same indices

TABLE 1: THE RESULTS OF THE T-TESTS

Index	Period	Comparison period mean (N, SD)	Event period mean (N, SD)	t- value
Nifty (Short)	2-4-2007 31-3-2008	0.283 (61, 0.998)	0.048 (189,2.232)	0.79
Sensex (Short)	2-4-2007 31-3-2008	0.266 (61, 0.961)	0.03510 (187, 2.134)	0.81
Nifty (Long)	1-4-2005 31-3-2010	0.133 (562, 1.427)	0.0289 (672, 2.289)	0.944
Sensex (Long)	1-4-2005 31-3-2010	0.143(556, 1.412)	0.026(671, 2.321)	1.035

The results of the t-tests in Table 1 above show that there is no difference in the mean returns between the pre-event comparison period and the event period. It appears that the financial crisis did not affect the Indian stock market return either in the short-run or in the long-run based on the t-tests. We next examine the impact of the financial crisis using a binary variable regression. The event dummy takes a value of zero for all days upto June 2007 for short and takes a value of 1 for trading days following June 2007. The results of the regression analysis are presented in Table 2.

TABLE 2: THE RESULTS OF THE BINARY VARIABLE REGRESSION

	Parameter Estimate	Standard Error	t-value
Regression 1 (Nifty Short term returns)			
(N = 250, R-sq = 0.0025			
Intercept	0.2830	0.2567	1.012
Event Dummy	-0.2343	0.2952	-0.793
Regression 2 (Sensex Short term returns)			
(N = 248, R-sq = 0.0027			
Intercept	0.2661	0.2452	1.084
Event Dummy	-0.231	0.2824	-0.817
Regression 3 (Nifty Long term returns)			
(N = 994, R-sq = 0.0030			
Intercept	0.1338	0.0821	1.630
Event Dummy	-0.0010	0.1111	-0.944
Regression 4 (Sensex Long term returns)			
(N = 984, R-sq = 0.0098			
Intercept	0.1431	0.0831	1.722
Event Dummy	-0.11657	0.1125	-1.035

The results of the regression analysis confirm the results of the t-tests presented in Table 1. The Event Dummy is not significant in any of the short term daily return or long term daily return regressions. This confirms that the financial crisis had no impact on any of the stock indices either in the short run or in the long run.

The results of the t-tests and the binary variable regressions have shown that the financial crisis did not impact the Indian stock markets return. While there appears to be no difference based on the results of the t-tests, we also checked the differences based on standard non-parametric tests. The statistical values of the Wilcoxon two-sample test and the Kruskal Wallis test, Chi-squares are given in Table 3 below:

TABLE 3: RESULTS OF NON-PARAMETRIC TESTS

Index	Wilcoxon Two Sample Test Statistic (Z)	Kruskal –Wallis Test Chi-Square
Nifty (Short)	0.6037	0.3646
Sensex (Short)	0.1804	0.3892
Nifty (Long)	1.489	2.217
Sensex (Long)	1.451	2.554

The results of the two non-parametric tests confirm the earlier results presented in Tables 1 and 2. As can be seen from the table, none of the test statistics are significant in either of the non-parametric tests. It appears that the Indian stock markets returns were completely unaffected by the financial crisis. Based on the results presented in the tables above, we fail to reject the null hypothesis that the financial crisis had no impact on the Indian stock markets Indian stock markets are not adversely affected either in the short term or in the long term after the financial crisis.

As mentioned earlier, in order to estimate the impact of the global financial crisis on the Indian stock market volatility, we introduce a Dummy variable in the conditional volatility equation. A significant positive co-efficient would indicate an increase in volatility; a significant negative coefficient would indicate a decrease in volatility. The results of the estimation for the impact of financial crisis are presented in table 4 and 5. The coefficient of the dummy $\gamma_3 D_t$ is not significantly different from zero, indicating no impact on volatility.

TABLE 4: ESTIMATES OF GARCH (1,1) MODEL WITH DUMMY FOR NIFTY (2005-2009)

VARIABLE	Particulars	Coefficients	t-value
α_0	Intercept	0.000359	0.577
α_1	Sensex lagged return	0.059545	1.877
γ_0	Arch 0	0.000359*	27.915*
γ_1	Arch 1	0.03251*	7.0179*
γ_2	Garch 1	0.02857	0.91147
$\gamma_3 D_t$	Dummy variable	0.00000	0.06124

TABLE 5: ESTIMATES OF GARCH (1,1) MODEL WITH DUMMY FOR SENSEX (2005-2009)

VARIABLE	Particulars	Coefficients	t-value
α_0	Intercept	0.000158	0.5748
α_1	Sensex lagged return	0.076621*	2.4075
γ_0	Arch 0	0.00006*	27.67
γ_1	Arch 1	0.01898*	4.717
γ_2	Garch 1	0.031808	1.8449
$\gamma_3 D_t$	Dummy variable	0.000000	0.58600

The results thus far suggest that the financial crisis has had no effect on the Indian stock market volatility. However, in reality one might expect a lot of uncertainty in the market due to this financial crisis, but our cut-off dates are unable to capture in the model. Table 6 presents results of intraday volatility before and after the crisis.

TABLE 6: ESTIMATES OF THE INTRA-DAY VOLATILITY BEFORE AND AFTER THE FINANCIAL CRISIS (Percentage)

Indices	Parkinson		Garman and Klass	
	Before	After	Before	After
Nifty (short)	0.884	1.726	0.853	1.694
Sensex (short)	1.097	2.118	1.039	2.080
Nifty (long)	1.37	2.08	1.22	2.00
Sensex (long)	1.19	1.77	1.19	1.70

The results suggest that the intraday volatility has increased after the global financial crisis. This was also an extremely volatility period in world stock markets, especially the US stock markets. The increase in volatility in the Indian market might have been a consequence of financial crisis. In conclusion we find little evidence that the stock market volatility changed significantly as a result of financial crisis.

It is interesting to examine further whether the nature of GARCH process was altered as a result of the financial crisis. We therefore estimate the GARCH model separately for the pre-crisis and post- crisis period separately. The results are presented in Table 7 and 8. But it doesn't make any difference, before and after the crisis, only ARCH effect was significant, suggesting that recent news had a lingering on the market volatility; GARCH variable is no longer significant, suggesting that old news has no impact on today's stock price changes.

TABLE 7: ESTIMATES OF THE GARCH (1, 1) MODEL BEFORE AND AFTER THE FINANCIAL CRISIS SENSEX

		BEFORE		AFTER	
VARIABLE	Particulars	Coefficients	t-value	Coefficients	t-value
α_0	Intercept	0.00058*	2.248	-0.00039	-0.7392
α_1	Sensex lagged return	0.056985	1.341	0.079606	1.645
γ_0	Arch 0	0.0003*	21.183	0.00011*	18.678
γ_1	Arch 1	0.035294*	4.981	0.009496*	2.0258
γ_2	Garch 1	0.021437	0.5079	0.07335	1.507

TABLE 8: ESTIMATES OF THE GARCH (1, 1) MODEL BEFORE AND AFTER THE FINANCIAL CRISIS NIFTY

		BEFORE		AFTER	
VARIABLE	Particulars	Coefficients	t-value	Coefficients	t-value
α_0	Intercept	0.00125*	2.0693	-0.00077	-0.64505
α_1	Sensex lagged return	0.043665	1.0351	0.06232	1.2928
γ_0	Arch 0	0.0001	19.845	0.000575*	19.08901
γ_1	Arch 1	0.05675	6.908*	0.2168*	3.722
γ_2	Garch 1	0.0254	0.3022	0.043148	0.897988

CONCLUSION

In this study, we look at the impact of the global financial crisis on the Indian stock market return and volatility. We hypothesized that the Indian stock market return and volatility would not be adversely affected by the financial crisis. Our results indicate that the Indian stock market was unaffected by the global financial crisis. A study of this type would enable the investment community to have a clear knowledge about the financial crisis. We further examined the effects of financial crisis on the market volatility using a model that captures the heteroskedasticity in returns that characterize stock market returns. The results indicate that financial crisis has had no significant impact market volatility. This result is robust to different model specification.

We then estimated the model separately for the pre and post financial crisis period and find that the nature of the GARCH process has not changed after the financial crisis. Both in pre financial and post financial crisis shock to today's volatility has an effect on tomorrow's volatility. However, we prefer to treat our results here with some caution since we are estimating the GARCH model with only two and a half years of data. Further, it should be noted that a relatively long time series, is required to obtain reliable GARCH parameter estimates. For the model estimated over the entire sample period April 2005 to March 2009, this might not be a problem. In summary we find that Indian stock market was not affected by the financial crisis either in the short term or in long term.

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