Return, Volatility, and Volume : Causality Relationship of Top 10 Companies of Nifty 50

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Abstract

The present paper dealt with the short-run causal relationship between stock returns, stock price volatility, and trading volume of top 10 companies of the National Stock Exchange. Granger causality test was applied to the data taken on a quarterly basis from 2008-09 to 2014-15. The study found bi-directional relationship between stock returns and trading volume of HDFC Bank and TCS, that is, trading volume was found to reinforce stock returns and returns to reinforce trading volume. Again, in case of Reliance Industries, bi-directional or two way causal relationships were found between stock return and volatility. There was uni-directional or one way causality relationship in case of stock returns and trading volume of Infosys and Reliance, which means returns Granger cause trading volume, but this does not apply the other way around. This implies that there is an indication of noise trading model of interaction between stock returns and trading volume in these stocks.

Keywords : stock return, trading volume, volatility, Augmented Dickey Fuller, Granger causality test

JEL Classification : C32, G12, G14

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The relationship between returns, volatility and trading volume is a significant indicator to completely understand the microstructure of financial markets. Information plays an important role in deciding the intrinsic value of a stock. Trading volume and volatility are significant factors for determining what is happening in the market and what can happen in the market in the near future. Volatility and trading volume are considered major considerations for financial practitioners like research analysts, technical analysts, speculators, hedgers, etc. (Abdalla & Winker, 2012). Various researchers have given emphasis to the contemporaneous relationship between stock price changes and trading volume (Gallant, Rossi & Tauchen ,1992 ; Karpoff, 1987).

Apart from that, since the 1980s, several researchers have taken the relationship between stock return, volatility and trading volume as a major area of research (Karpoff, 1987). It is generally said that volume is one of the most important factors which determines price. In the technical analysis, high volume leads to increase in price and vice versa. Volume is generally considered to assess the market sentiment, whether the market is in uptrend or downtrend. Different authors have also applied the stochastic time series model of conditional relationship (Brailsford & Faff, 1996) and found strong relationship between return, volatility, and trading volume. Aim of the paper is to explore causal relationship between stock returns, volatility and trading volume of

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top ten companies of National Stock Exchange Fifty Index (NIFTY 50) for the financial year 2008-09 to 2014-15. "Higher the volume, narrower the spread; as a result there is less slippage, and less volatility" (Mubarik & Javid, 2009). Relationship between stock returns and trading volume has important implications for hedgers, speculators, and policymakers. Trading volume leads to changes in stock returns. Hence, to understand the microstructure of stock markets, interaction of stock returns and trading volume, and stock returns and volatility are highly important (De Medeiros & Van Doornik, 2006).

Karpoff (1987) investigated and gave four important aspects of studying the price-volume relationship. First, one can have an access to the structure of market, by studying the price volume relationship, because price-volume relationship depends on the rate of flow of information into the market. It means how information is incorporated into the market, the extent to which the price conveys this information, existence of short sale, market size, and other market conditions. Second, in event studies, to draw inferences about the market, it is necessary to focus on the price-volume relationship. Third, it helps in recognizing the empirical distribution of speculative prices. Fourth, derivatives markets are growing very rapidly and price-volume relationship is one of the main factors for consideration while investing in the derivatives market. It indicates the significance of public vs. private information to determine demand of investors. Karpoff (1987) and Gallant et al. (1992) concluded that relationship between stock returns and trading volume convey more relevant information than only stock returns.

Scope of the Study

The study focuses on exploring the relationship between stock return and stock volatility; stock return and trading volume.

(i) Top ten firms on the basis of market capitalization listed on National Stock Exchange Nifty 50 are considered for the study.

(ii) The study is for the period of 2008-09 to 2014-15.

(iii) The research has focused almost exclusively on the Indian Capital Market.

Conceptual Framework

(1) Stock Return and Volatility : Hussain and Uppal (1998) studied the relationship between stock return and volatility in Pakistan equity market and found that past volatility is the predictor of the future volatility. They have applied ARCH Model to understand the nature of volatility. Presence of conditional heteroskedasticity in stock returns was one of the factors causing serial dependency in the Pakistani Equity Market. Léon (2008) studied the relationship between expected stock market return and volatility in the regional stock market of West Africa. He found positive relationship between stock returns and volatility and that volatility is higher in bull period than in bear period.

Abdalla (2012) investigated the relationship between volatility and stock market return and found that significant change in volatility leads to significant change in the stock returns. Abdalla and Winker (2012) empirically examined the stock market volatility in two major stock exchanges of Africa; Khartoum Stock Exchange, and Cairo and Alexandria Stock Exchange. They used daily data from January 2006 to November 2010 and applied symmetric and asymmetric GARCH model for data analysis. They found that conditional volatility is an unbalanced process for the Khartoum Stock Exchange Index returns, and for Cairo and Alexandria Stock Exchange persistent index returns series was found. In addition to this, significant risk premium exists in both the markets and there is positive correlation between expected stock return and risk.

(2) Stock Return and Trading Volume : Rogalski (1978) and Jain and Joh (1988) empirically explored the causal relationship between stock return and trading volume in the U.S. market and found a significant basis of one way relationship between stock returns and trading volume.

Chan and Tse (1993) investigated the return volume interaction and found an asymmetrical relationship in a rising market versus a declining market. Silvapulle and Choi (1999) had applied a linear and nonlinear Granger Causality Tests to know the dynamic and causal relationship between daily stock returns and trading volume in South Korean stock exchange and found a bi-directional linear and nonlinear causality exist between stock returns and volume changes.

Hiemstra and Jones (1994) had investigated the causal relationship between stock returns and trading volume in New York Stock Exchange and found evidence of uni-directional causality and significant feedback nonlinear causal relation between returns and volume. Lee and Rui (2002) found uni-directional causality had been found between stock return and trading volume in US and Japan stock exchanges.

Khan and Rizwan (2008) had studied the relationship between return and trading volume by taking into consideration heteroskedasticity. They found two way relationship between stock returns and trading volume, implying that returns cause trading volume and trading volume causes returns, which is consistent with the previous studies. This indicates the effect of information content on stock returns, implying that information on volume can predict future stock returns.

Mubarik and Javid (2009) explored the relationship between return, trading volume and volatility of Pakistan stock market. They found bi-directional relationship between market return and trading volume. The result revealed that past trading volume has significant impact on current return and current market return is affected by the previous day returns and volume. In other words, there is significant interaction between trading volume and return volatility.

Nowbutsing and Naregadu (2009) had examined the relationship between trading volume and volatility in Mauritius Stock Exchange and found very weak evidence of positive relationship between the two on the basis of ARCH, GARCH, and GJR-TGARCH model. This indicated that trading volume did not cause volatility and returns and vice-versa. They also applied autocorrelation analysis, which is an important method for the prediction of stock returns using the previous day's returns and found that weak form of efficiency existed in the Mauritius Stock Exchange.

(3) Stock Return, Volatility, and Trading Volume : Banerjee and Sarkar (2006) found a positive relation between trading volume and volatility of asset return in Indian stock markets. They had observed that overall volatility of market did not increase due to the presence of foreign institutional investors (FIIs) in the Indian capital market.

Chen, Firth, and Rui (2001) explored the causal relation between returns, volatility and volume of nine stock indices, viz. Italy, United States, Hong Kong, Japan, Netherlands, United Kingdom, France, and Switzerland, and found mixed results. They had found that returns cause volume for the United Kingdom, Italy, Hong Kong, Netherlands, France, Switzerland, United States, and Japan. On the other hand, volume is observed to cause returns in the case of Netherlands, Switzerland, Canada, and Hong Kong. This indicates that stock returns have some information content with respect to trading volume. It further means that information about trading volume can be helpful in predicting stock return.

De Medeiros and Van Doornik (2006) applied the ARCH and GARCH Models to study the causal relationships between stock returns, volatility, and trading volume of the Brazilian stock market and found a significant relationship between return, volatility, and trading volume. The result revealed that increase in return volatility is associated with higher trading volume. Further, bi-directional relationship exists between trading volume and return volatility which indicates that information might flow simultaneously rather than sequentially into the market.

Pisedtasalasai and Gunasekarage (2007) examined the relationship between stock returns, volatility and trading volume for ten emerging markets in South-East Asia, namely Thailand, Malaysia, Indonesia, Singapore, and Philippines, and found a significant causal relationship between trading volume and stock return, thereby implying that trading volume has significant impact on stock returns for Singapore but there is no causal relationship found in case of Malaysian, Philippines, Indonesian, and Thailand markets, indicating that stock returns do not Granger cause trading volume and vice versa.

Research Methodology

(1) Research Questions : On reviewing existing literature, following questions were proposed:

(i) What relationship exists between stock return and stock volatility of top ten companies of NIFTY50?
(ii) Is there any casual relationship between stock return and trading volume of Top 10 companies of NIFTY 50?

(2) Research Objectives : The objectives of the study were to examine:

(i) Causal relationship between stock return and volatility of selected companies of NIFTY 50.
(ii) Causal relationship between stock return and trading volume of selected companies of NIFTY 50.

(3) Research Variables : To address the objectives of the study, three variables, namely, stock return, volatility, and trading volume had been collected from National Stock Exchange. Stock Returns, trading volume and stock price volatility were calculated on a quarterly basis. The quarterly data of all the variables, viz. trading volume, stock price volatility and stock return were taken for the period 2008-09 to 2014-15, thereby yielding a total of 420 observations.

(4) Research Hypotheses : A research hypothesis is an assumption and proposition developed to test the relationship between variables with the help of statistical techniques (Bhattacherjee, 2012). To address the objectives of the study, ten principal hypotheses were formulated and divided into 40 sub-hypotheses under the causality framework. Description of null and alternate hypotheses is given in Table 1.

(5) Data Collection/Sample Selection : The study aimed to examine the direction of causality of stock market return with volatility and trading volume of top ten companies of NIFTY 50 as per market capitalization as on 18-08-2015 for the period 2008-09 to 2014-15 on a quarterly basis. The companies that had been analyzed are Tata Consultancy Services, Reliance Industries Limited, HDFC Bank Ltd. Infosys, ITC, Coal India, ONGC, Sun Pharma, State Bank of India, and HDFC Corp. Data for all the variables were collected from the websites of National Stock Exchange.

(6) Research Tools for Data Analysis : Granger Causality Test was applied to address research objectives and to test hypotheses. The prerequisite for using the Granger Causality Test is that the nature of time series data should be stationary. The stationary of the data was checked by employing Unit Root Test consisting of Augmented Dickey Fuller Test. Preliminary analysis such as descriptive and correlation analysis were undertaken to find out the relationship of two series and degree of volatility involved in it. E-views 9 software was applied for the analysis of data.

(7) Stationarity Test - Augmented Dickey Fuller Test : The ADF test involves the estimation of following

Table 1. Description of Hypotheses

H. No.		Null Hypotheses	S. No.		Alternate Hypotheses
		TCS			
$H0_a$	$H0_a^1$	Return does not reinforce volatility	$H1_a$	$H1_a^1$	Return reinforces volatility
	$H0_a^2$	Volatility does not reinforce return		$H1_a^2$	Volatility reinforces return
$H0_b$	$H0_b^1$	Return does not reinforce trading volume	$H1_b$	$H1_b^1$	Return reinforces trading volume
	$H0_b^2$	Trading volume does not reinforce return		$H1_b^2$	Trading volume reinforces return
		RELIANCE INDUSTRIES LTD.			
$H0_c$	$H0_c^1$	Return does not reinforce volatility	$H1_c$	$H1_c^1$	Return reinforces volatility
	$H0_c^2$	Volatility does not reinforce return		$H1_c^2$	Volatility reinforces return
$H0_d$	$H0_d^1$	Return does not reinforce trading volume	$H1_d$	$H1_d^1$	Return reinforces trading volume
	$H0_d^2$	Trading volume does not reinforce return		$H1_d^2$	Trading volume reinforces return
		HDFC BANK LTD.			
$H0_e$	$H0_e^1$	Return does not reinforce volatility	$H1_e$	$H1_e^1$	Return reinforces volatility
	$H0_e^2$	Volatility does not reinforce return		$H1_e^2$	Volatility reinforces return
$H0_f$	$H0_f^1$	Return does not reinforce trading volume	$H1_f$	$H1_f^1$	Return reinforces trading volume
	$H0_f^2$	Trading volume does not reinforce return		$H1_f^2$	Trading volume reinforces return
		INFOSYS			
$H0_g$	$H0_g^1$	Return does not reinforce volatility	$H1_g$	$H1_h^1$	Return reinforces volatility
	$H0_g^2$	Volatility does not reinforce return		$H1_h^2$	Volatility reinforces return
$H0_h$	$H0_h^1$	Return does not reinforce trading volume	$H1_h$	$H1_h^1$	Return reinforces trading volume
	$H0_h^2$	Trading volume does not reinforce return		$H1_h^2$	Trading volume reinforces return
		ITC			
$H0_i$	$H0_i^1$	Return does not reinforce volatility	$H1_i$	$H1_i^1$	Return reinforces volatility
	$H0_i^2$	Volatility does not reinforce return		$H1_i^2$	Volatility reinforces return
$H0_j$	$H0_j^1$	Return does not reinforce trading volume	$H1_j$	$H1_j^1$	Return reinforces trading volume
	$H0_j^2$	Trading volume does not reinforce return		$H1_j^2$	Trading volume reinforces return
		COAL INDIA			
$H0_k$	$H0^{k1}$	Return does not reinforce volatility	$H1_k$	$H1^{k1}$	Return reinforces volatility
	$H0^{k2}$	Volatility does not reinforce return		$H1^{k2}$	Volatility reinforces return
$H0_l$	$H0^{l1}$	Return does not reinforce trading volume	$H1_l$	$H1^{l1}$	Return reinforces trading volume
	$H0^{l2}$	Trading volume does not reinforce return		$H1^{l2}$	Trading volume reinforces return
		ONGC			
$H0_m$	$H0^{m1}$	Return does not reinforce volatility	H0m	$H0^{m1}$	Return reinforces volatility
	$H0^{m2}$	Volatility does not reinforce return		$H0^{m2}$	Volatility reinforces return
$H0_n$	$H0^{n1}$	Return does not reinforce trading volume	$H0_n$	$H0^{n1}$	Return reinforces trading volume
	$H0^{n2}$	Trading volume does not reinforce return		$H0^{n2}$	Trading volume reinforces return
		SUN PHARMA			
$H0_o$	$H0^{o1}$	Return does not reinforce volatility	$H0_o$	$H0^{o1}$	Return reinforces volatility
	$H0^{o2}$	Volatility does not reinforce return		$H0^{o2}$	Volatility reinforces return
$H0_p$	$H0^{p1}$	Return does not reinforce trading volume	$H0_p$	$H0^{p1}$	Return reinforces trading volume
	$H0^{p2}$	Trading volume does not reinforce return		$H0^{p2}$	Trading volume reinforces return
		SBI			
$H0_q$	$H0_q^1$	Return does not reinforce volatility	$H0_q$	$H0_q^1$	Return reinforces volatility
	$H0_q^2$	Volatility does not reinforce return		$H0_q^2$	Volatility reinforces Return
$H0_r$	$H0_r^1$	Return does not reinforce trading volume	$H0_r$	$H0_r^1$	Return reinforces trading volume
	$H0_r^2$	Trading volume does not reinforce return		$H0_r^2$	Trading volume reinforces return
		HDFC CORP			
$H0_s$	$H0_s^1$	Return does not reinforce volatility	$H0_s$	$H0_s^1$	Return reinforces volatility
	$H0_s^2$	Return does not reinforce volatility		$H0_s^2$	Volatility reinforces return
H0t	$H0t^1$	Return does not reinforce trading volume	$H0_t$	$H0t^1$	Return reinforces trading volume
	$H0_t^2$	Trading volume does not reinforce return		$H0_t^2$	Trading volume reinforces return

regression equation as per Gujarati, Porter, and Gunasekar (2012):

$$\Delta Y_t = \beta 1 + \beta 2_t + \delta Y_{t-1} + \Sigma^{m}_{t=1} \alpha_i \Delta Y_{t-1} + \varepsilon_t$$

Where,
ΔY_t is the first difference of the Y_t ($\Delta Y_t = Y_t - Y_{t-1}$), β_1 is the intercept term, t is the linear time or trend variable, ε_t is the white noise error term. Schwarz's Information Criteria as suggested by Schwarz was used to select optimal lag length (m). The hypotheses of this test are:

H0: $\delta = 0$ Non-stationary
H1: $\delta < 0$ Stationary

(8) Granger Causality Test : Granger Causality Test was proposed by C.W.J Granger in 1969. The regression equations for the test are given below:

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_i Y_{t-j} + \mu_{1t}$$

$$X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \delta_i Y_{t-j} + \mu_{2t}$$

In the above equations Y_t , X_t are the variables to be tested, α_i , β_i , λ_i , δ_i are coefficients explaining the relation of dependent variable with the lag terms of independent variable and lag terms of dependent variable ; μ_1 and μ_2 are white noise error terms ; t is the time period and i and j are the number of lags. The null hypothesis is $\alpha_i = \delta_i = 0$. If α_i , is statistically significant but δ_i is not, this means X causes Y. In the reverse case Y causes X. But if both the values are statistically significant, causality runs both ways.

Analysis and Findings

(1) Augmented Dickey Fuller Test : Augmented Dickey Fuller Test (ADF) has been performed to check the stationarity of the data for all the variables. Results of ADF test are shown in Table 2. The test involves a null hypothesis that data has unit root (i.e., the series is non-stationary) and alternate hypothesis that the data is stationary. As per Table 2, some of the variables are found stationary at level, i.e., integrated of order 0 or $I(0)$ or some at first difference $I(1)$. In order to ensure consistency, all the variables have been taken at first difference, in order to perform Granger Causality Test.

(2) Granger Causality Test : Granger Causality Test is the major tool to test the causality relationship between variables. Table 3 shows the results of Granger Causality Test between stock return, stock price volatility and trading volume of top 10 companies of NIFTY 50. On the basis of F statistics, the hypothesis is accepted or rejected.

(3) Hypotheses Testing : In all, as per Table 4, 20 main hypotheses have been formulated and divided into 40 sub-hypotheses under causality framework. Out of 40 sub-hypotheses, 19 hypotheses have been accepted whereas, remaining 21 have been rejected. Table 4 shows the acceptance and rejection of hypotheses in the study and as per Table 4, null hypotheses $H0_a^1$, $H0_a^2$, $H0_d^2$, $H0_e^2$, $H0_g^2$, $H0_h^2$, $H0_i^1$, $H0_j^1$, $H0_k^1$, $H0_l^1$, $H0_l^1$, $H0_m^2$, $H0_n^1$, $H0_n^2$, $H0_o^1$, $H0_o^2$, $H0_q^2$, $H0_r^2$, and $H0_s^1$ are accepted ; whereas, $H0_b^1$, $H0_b^2$, $H0_c^1$, $H0_c^1$, $H0_d^1$, $H0_e^1$, $H0_f^1$, $H0_f^2$, $H0_g^1$, $H0_h^1$, $H0_i^2$, $H0_j^2$, $H0_k^2$, $H0_m^1$, $H0_p^1$, $H0_p^2$, $H0_q^1$, $H0_r^1$, $H0_s^2$, $H0_t^1$ and $H0_t^2$ are rejected.

Table 2. Augmented Dickey Fuller Test

Company	Variables	At Level (*t*-Statistics)		At First Difference (*t*-Statistics)		Decision
		With Intercept	With Intercept and Trend	With Intercept	With Intercept and Trend	
TCS	Return	-3.426583*	-3.365968**	-5.945399*	-5.707896*	I(1)
	Volatility	-1.722079	-7.470373*	-11.17889*	-10.94183*	I(1)
	TV	-4.137331*	-1.348483	-6.389708*	-7.708902*	I(1)
Reliance	Return	-4.810053*	-4.691805*	-7.743725*	-7.617406*	I(1)
	Volatility	-3.064134*	-3.890442*	-10.55921*	-11.30974*	I(1)
	TV	-3.605664*	-5.644739*	-6.141367*	-7.767135*	I(1)
HDFC	Return	-5.202368*	-5.637680*	-12.18561*	-14.23508*	I(1)
	Volatility	1.801912	-5.234200*	-4.210216*	-5.992667*	I(1)
	TV	-1.751961	-2.629836	-5.400494*	-5.305516*	I(1)
Infosys	Return	-5.025511*	-4.922938*	-5.907226*	-5.802014*	I(1)
	Volatility	-5.412017*	-5.495810*	-9.808473*	-10.17058*	I(1)
	TV	-4.138621*	-4.964822*	-8.998371*	-9.212637*	I(1)
ITC	Return	-5.253818*	-3.078123	-5.466739*	-5.703912*	I(1)
	Volatility	-2.293087	-3.524224**	-7.268785*	-7.571581*	I(1)
	TV	-3.517696*	-3.648055*	-7.067871*	-7.856723*	I(1)
Coal India	Return	-4.442167*	-4.872510*	-6.548571*	-6.190140*	I(1)
	Volatility	-3.749668*	-3.985609*	-3.517672*	-14.63742*	I(1)
	TV	-3.094648*	-4.165682*	-6.946925*	-6.622701*	I(1)
ONGC	Return	-3.957087*	-3.892459*	-5.208389*	-5.074788*	I(1)
	Volatility	-4.127596*	-4.294561*	-6.352171*	-6.261874*	I(1)
	TV	-2.811988**	-3.683975*	-7.378541*	-7.351337*	I(1)
Sun Pharma	Return	-4.640769*	-4.631349*	-5.260862*	-5.143156*	I(1)
	Volatility	2.323598	0.667146	-8.437947*	-9.281651*	I(1)
	TV	-4.555174*	-5.023762*	-6.938050*	-6.758208*	I(1)
SBI	Return	-5.635096*	-5.638660*	-8.100514*	-7.927567*	I(1)
	Volatility	2.975802	1.911663	-13.52177*	-14.51411*	I(1)
	TV	-2.893658**	-4.438831*	-5.347482*	-5.281413*	I(1)
HDFC Corp	Return	-4.779881*	-4.683732*	-3.158512*	-3.825455*	I(1)
	Volatility	-2.350576	-2.926031	-6.839062*	-7.105073*	I(1)
	TV	-1.970526	-2.292887	-4.884110*	-4.854493*	I(1)

Note: * p <0.05 **p <0.10

Findings

On the basis of result of Granger Causality test shown in Table 3, the main findings of the study are as follows:

(1) TCS : In the case of TCS, it is found that bi directional Granger causal relationship exists in case of trading volume and stock return. This means that return causes trading volume and volume causes return and there is no causal relationship in case of volatility and stock return. This implies that return does not Granger cause volatility and volatility does not Granger cause return. Hence, the null hypotheses $H0_a^1$ and $H0_a^2$ have been accepted whereas, $H0_b^1$ and $H0_b^2$ have been rejected.

Table 3. Granger Causality Test

Company	Null Hypotheses	Lags	*F*-Statistics
TCS	Return does not Reinforce volatility in Granger Sense.	1	1.28618
	Volatility does not reinforce return in Granger Sense.	1	2.03756
	Return does not Reinforce trading volume in Granger Sense.	2	4.94119*
	Trading volume does not Reinforce Return in Granger Sense.	1	4.31357*
Reliance	Return does not Reinforce volatility in Granger Sense.	1	4.17910**
	Volatility does not reinforce return in Granger Sense.	1	13.5187*
	Return does not Reinforce trading volume in Granger Sense.	4	7.94053*
	Trading volume does not Reinforce Return in Granger Sense.	1	0.00128
HDFC	Return does not Reinforce volatility in Granger Sense.	1	4.25967**
	Volatility does not reinforce return in Granger Sense.	1	0.03582
	Return does not Reinforce trading volume in Granger Sense.	3	6.52991*
	Trading volume does not Reinforce Return in Granger Sense.	1	3.76392**
Infosys	Return does not Reinforce volatility in Granger Sense.	6	3.88658*
	Volatility does not reinforce return in Granger Sense.	1	0.09222
	Return does not Reinforce trading volume in Granger Sense.	6	3.73282*
	Trading volume does not Reinforce Return in Granger Sense.	1	0.61924
ITC	Return does not Reinforce volatility in Granger Sense.	1	1.49457
	Volatility does not reinforce return in Granger Sense.	3	2.67660**
	Return does not Reinforce trading volume in Granger Sense.	1	0.21949
	Trading volume does not Reinforce Return in Granger Sense.	3	4.71574*
Coal India	Return does not Reinforce volatility in Granger Sense.	1	1.50559
	Volatility does not reinforce return in Granger Sense.	1	3.41691**
	Return does not Reinforce trading volume in Granger Sense.	1	0.05280
	Trading volume does not Reinforce Return in Granger Sense.	1	0.02750
ONGC	Return does not Reinforce volatility in Granger Sense.	6	3.67319*
	Volatility does not reinforce return in Granger Sense.	1	0.72565
	Return does not Reinforce trading volume in Granger Sense.	1	0.81731
	Trading volume does not Reinforce Return in Granger Sense.	1	0.11107
Sun Pharma	Return does not Reinforce volatility in Granger Sense.	1	0.01790
	Volatility does not reinforce return in Granger Sense.	1	1.31353
	Return does not Reinforce trading volume in Granger Sense.	4	11.8044*
	Trading volume does not Reinforce Return in Granger Sense.	2	5.56417*
SBI	Return does not Reinforce volatility in Granger Sense.	6	2.70347**
	Volatility does not reinforce return in Granger Sense.	1	1.62468
	Return does not Reinforce trading volume in Granger Sense.	6	2.72770**
	Trading volume does not Reinforce Return in Granger Sense.	1	0.27007
HDFC Corp	Return does not Reinforce volatility in Granger Sense.	1	1.10487
	Volatility does not reinforce return in Granger Sense.	3	2.44135**
	Return does not Reinforce trading volume in Granger Sense.	1	12.9553*
	Trading volume does not Reinforce Return in Granger Sense.	1	4.57933*

Note: *p <0.05 **p <0.10

Table 4. Hypotheses Testing

H. No.	Company	Null Hypotheses	Decision	Direction
		TCS		
$H0_a$	$H0_a^1$	Return does not reinforce volatility	Accept	No relationship
	$H0_a^2$	Volatility does not reinforce return	Accept	
$H0_b$	$H0_b^1$	Return does not reinforce trading volume	Reject	Bi-directional
	$H0_b^2$	Trading volume does not reinforce return	Reject	
		Reliance		
$H0_c$	$H0_c^1$	Return does not reinforce volatility	Reject	Bi-directional
	$H0_c^2$	Volatility does not reinforce return	Reject	
$H0_d$	$H0_d^1$	Return does not reinforce trading volume	Reject	Uni-directional
	$H0_d^2$	Trading volume does not reinforce return	Accept	
		HDFC Bank		
$H0_e$	$H0_e^1$	Return does not reinforce volatility	Reject	Uni-directional
	$H0_e^2$	Volatility does not reinforce return	Accept	
$H0_f$	$H0_f^1$	Return does not reinforce trading volume	Reject	Bi-directional
	$H0_f^2$	Trading volume does not reinforce return	Reject	
		Infosys		
$H0_g$	$H0_g^1$	Return does not reinforce volatility	Reject	Uni-directional
	$H0_g^2$	Volatility does not reinforce return	Accept	
$H0_h$	$H0_h^1$	Return does not reinforce trading volume	Reject	Uni-directional
	$H0_h^2$	Trading volume does not reinforce return	Accept	
		ITC		
$H0_i$	$H0_i^1$	Return does not reinforce volatility	Accept	Uni-directional
	$H0_i^2$	Volatility does not reinforce return	Reject	
$H0_j$	$H0_j^1$	Return does not reinforce trading volume	Accept	Uni-directional
	$H0_j^2$	Trading volume does not reinforce return	Reject	
		Coal India		
$H0_k$	$H0_k^1$	Return does not reinforce volatility	Accept	Uni-directional
	$H0_k^2$	Volatility does not reinforce return	Reject	
$H0_l$	$H0_l^1$	Return does not reinforce trading volume	Accept	No Relationship
	$H0_l^2$	Trading volume does not reinforce return	Accept	
		ONGC		
$H0_m$	$H0_m^1$	Return does not reinforce volatility	Reject	Uni-directional
	$H0_m^2$	Volatility does not reinforce return	Accept	
$H0_n$	$H0_n^1$	Return does not reinforce trading volume	Accept	No Relationship
	$H0_n^2$	Trading volume does not reinforce return	Accept	
		Sun Pharma		
$H0_o$	$H0_o^1$	Return does not reinforce volatility	Accept	No Relationship
	$H0_o^2$	Volatility does not reinforce return	Accept	
$H0_p$	$H0_p^1$	Return does not reinforce trading volume	Reject	Bi-directional
	$H0_p^2$	Trading volume does not reinforce return	Reject	
		SBI		
$H0_q$	$H0_q^1$	Return does not reinforce volatility	Reject	Uni-directional
	$H0_q^2$	Volatility does not reinforce return	Accept	
$H0_r$	$H0_r^1$	Return does not reinforce trading volume	Reject	Uni-directional
	$H0_r^2$	Trading volume does not reinforce return	Accept	
		HDFC CORP		
$H0_s$	$H0_s^1$	Return does not reinforce volatility	Accept	Uni-directional
	$H0_s^2$	Volatility does not reinforce return	Reject	
$H0_t$	$H0_t^1$	Return does not reinforce trading volume	Reject	Bi directional
	$H0_t^1$	Trading volume does not reinforce return	Reject	

(2) Reliance : In the case of Infosys, it is found that bi-directional relationship exists in case of trading volume and stock return, thereby implying that return causes trading volume and volume in turn causes return. Uni-directional relationship exists in case of volatility and stock return means return Granger causes volatility but volatility does not Granger cause return. Hence, the null hypotheses $H0_c^1$, $H0_c^2$ and $H0_d^1$ have been rejected whereas, $H0_d^2$ is accepted.

(3) HDFC Bank : On the basis of result shown by Granger Causality Test of HDFC Bank, it is found that bi-directional causal relationship exists in case of trading volume and stock return, implying that return causes trading volume and trading volume in turn causes return, but there is uni-directional relationship in case of volatility and stock return. This means that return Granger causes volatility but volatility does not Granger cause return. Hence, the null hypotheses $H0_e^1$, $H0_f^1$ and $H0_f^2$ have been rejected whereas, $H0_e^2$ is accepted.

(4) Infosys : In the case of Infosys it is found that uni-directional causal relationship exists in case of trading volume and stock return, meaning that return causes trading volume but volume does not cause return. Again there is uni-directional relationship in case of volatility and stock return meaning that return Granger causes volatility but volatility does not Granger cause return. Hence, the null hypotheses $H0_g^1$ and $H0_h^1$ have been rejected whereas, $H0_g^2$ and $H0_h^2$ are accepted.

(5) ITC : In the case of ITC, it is found that uni-directional causal relationship exists in case of trading volume and stock returns, meaning that return does not Granger cause trading volume but volume Granger causes return. Further, there is uni-directional causal relationship in case of volatility and stock return, indicating that return does not Granger cause volatility but volatility Granger causes return. Hence, the null hypotheses $H0_i^1$ and $H0_j^1$ have been accepted whereas $H0_i^2$ and $H0_j^2$ have been rejected.

(6) Coal India : In the case of Coal India, it is found that unidirectional Granger causal relationship exists in case of volatility and stock return. This indicates that return does not Granger cause volatility but volatility Granger causes return, and there is no causal relationship in case of trading volume and stock returns. This means that return does not Granger cause trading volume and trading volume in turn does not Granger cause return. Hence, the null hypotheses $H0_k^1$, $H0_l^1$ and $H0_l^2$ have been accepted whereas, $H0_k^2$ has been rejected.

(7) ONGC : In the case of ONGC, it is found that unidirectional Granger causal relationship exists in case of volatility and stock return, meaning that return Granger causes volatility but volatility does not Granger cause return. There is no causal relationship in case of trading volume and stock return, implying that return does not Granger cause trading volume and trading volume does not Granger cause return. Hence, the null hypotheses $H0_m^2$, $H0_n^1$ and $H0_n^2$ have been accepted whereas, $H0_m^1$ has been rejected.

(8) Sun Pharma : In the case of Sun Pharma, no causal relationship is found to exist in case of volatility and stock return. This means that return does not Granger cause volatility and volatility does not Granger cause return. Hence, the null hypotheses $H0_o^1$ and $H0_o^2$ have been accepted whereas, $H0_p^1$ and $H0_p^2$ have been rejected.

(9) SBI : In the case of SBI, it is found that uni-directional causal relationship exists between trading volume and stock returns, thereby implying that return causes trading volume but volume does not cause return. Uni-directional relationship is found to exist in case of volatility and stock return, meaning that return Granger causes volatility but volatility does not Granger cause return. Hence, the null hypotheses $H0_q^1$ and $H0_r^1$ have been rejected whereas, $H0_q^2$ and $H0_r^2$ have been accepted.

(10) HDFC Corp : In the case of HDFC Corp, it is found that bi directional Granger causal relationship exists in case of trading volume and stock return, meaning that return causes trading volume and volume causes return. Further, uni-directional Granger causal relationship is found to exist in case of volatility and stock returns, implying that return does not Granger cause volatility but volatility Granger causes return. Hence, the null hypothesis $H0_s^1$ has been accepted whereas, $H0_s^2$, $H0_t^1$ and $H0_t^2$ have been rejected.

Research Implications and Limitations of the Study

(1) Linkages with Trading Scenario : These results can be used as an important analytical input in investment decisions. Since the direction of causality has been established in case of 10 pivotal stocks of the National Stock Exchange of India, investors can take cues from the causal factors of return, prior to making the actual investment decision. The present research is expected to give significant contributions in the field of micro-economics. This research would help policy makers, business analysts and investors in understanding the behavior of the companies listed on National Stock Exchange (NSE) of India. The study can facilitate an understanding towards the investment scenario of the market before taking any decision regarding policy implication, investment, and growth.

(2) Limitations of the Study : Although the present study contributes significantly towards research in capital markets, it also has certain limitations that are enumerated below:

(i) The study is limited only to the analysis of top ten companies of NIFTY 50 index. The same analysis could further extended to the analysis of all the 50 companies of the particular index.

(ii) The data has been taken on quarterly basis that has ignored the short term variations, hence, further analysis on daily basis could be done to give broader perspective of investment behavior on long run basis.

(iii) The causal relationships found in the study might not persist in all periods outside the time period of the study.

Conclusion

In this study, causal relationships between trading volume, volatility in stock prices and stock return are examined by use of data from top 10 companies of National Stock Exchange. The main issue has been whether information about trading volume and volatility is useful in improving forecasts for return. Bi-directional or two way causal relationships have been found with respect to trading volume in HDFC Bank, TCS, Sun Pharma, and HDFC Corp (Table 4), which indicates that information might flow simultaneously rather than sequentially into the market (De Medeiros & Van Doornik, 2006). This implies that the semi- strong form of market efficiency holds since past and publicly available information is reflected in stock prices. It also means that trading volumes Granger cause stock returns and stock returns in turn Granger cause trading volume, thereby indicating that trading volume is the most important factor for forecasting the stock return and vice versa. In another words, it can be said that these 4 stocks are more efficient than any other stock. This result is consistent with the findings of Silvapulle and Choi (1999).

Khan and Rizwan (2008) had also found two way relationship between stock returns and trading volume. Only in the case of Reliance Industries, bi-directional or two way causal relationship has been found between stock returns and volatility, implying that volatility Granger causes stock return and stock return in turn Granger causes volatility. It may therefore be inferred that volatility is the most important factor for forecasting the stock return

and vice versa in the case of Reliance Industries. Volatility may be one of the most important factors for assessing the investment in this stock. There is no Granger causal relationship with respect to volatility in TCS and Sun Pharma, indicating that in the case of TCS and Sun Pharma, return does not Granger cause volatility and volatility also does not Granger cause return. The Granger Causality Test finds the complete absence of causality running in either direction in 2 out of 10 stocks, viz. TCS and Sun Pharma with reference to volatility.

There is no evidence of causal relationship exist with respect to trading volume and stock return in ONGC and Coal India in either direction, indicating that in the case of ONGC and COAL India, return does not Granger cause trading volume and trading volume does not Granger cause return.

There exists uni-directional or one way causality relationship in the case of stock return and trading volume of Infosys, Reliance, and SBI, implying that return Granger causes trading volume for these stocks but this does not apply the other way around. This fact is indicative of noise trading model of return volume interaction in these stocks. This result is consistent with the findings of Rogalski (1978), Jain and Joh (1988), Hiemstra and Jones (1994), and Lee and Rui (2002), who conducted a similar study on the New York Stock Exchange and Japanese stock exchanges and found one way relationship between stock returns and trading volume.

We believe our results can help in enhancing the understanding of the microstructure of Indian stock markets, especially of the emerging variety. However, since the Indian stock market is thin as compared to more developed markets, additional comparable investigations with respect to other markets are desirable.

Directions for Future Research

The limitation of the study has given direction for future research. The present study of top 10 companies of NIFTY 50 index can further be extended to the analysis of all the 50 companies of that index. Daily data could further be taken to give broader perspective to investment scenario on long run in capital market.

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