
The Examination of Contemporaneous Relationship between Intraday Return, Volume and Volatility Measures in Indian Equity Market

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This paper examines the contemporaneous relationship between intraday returns, volume and volatility dynamics, by using 1 minute intraday data of 35 composite stocks of S&P CNX Nifty index, during the period from April 2010 to March 2011. The empirical analysis for majority of the stocks under study depicts no contemporaneous relationship between the intraday return-volume and intraday volume-volatility associations. The present paper thus concludes that for majority of stocks listed on the index, neither the intraday return-volume measures, nor the intraday volume-volatility parameters, can be used in predicting each other.

Keywords: High Frequency Data, Stock Return, Trading Volume, Return Volatility, S&P CNX Nifty index

INTRODUCTION

The efficiency of equity market is principal prerequisite for the development of any economy. Understanding the efficiency has been on the target of investors and speculators for a long time. It has also been accredited time and again, that return and volume are two major pillars around which the stock market revolves. While returns are interpreted as the evaluation of the new information, volume is an indicator to which the investors disagree about this information (Mahajan and Singh, 2009). Reviewing the combined dynamics of stock prices and trading volume is essential to improve the understanding of the microstructure of stock markets (Mestral et al., 2003). Return-volume associations are of mutual interest as they may excavate reliance that can form the basis of lucrative trading strategies, and this has implications for market efficiency (Chen, Firth and Yu, 2004).

Hussain (2011) supports the mixture of distribution hypothesis (MDH) and sequential information arrival hypothesis (SIAH) to be the two academic elucidations for the perceived return, volume and volatility associations of stocks. The SIAH assumes that traders receive new information in a chronological, random fashion. From an opening position of steadiness where all traders possess the same set of information, new evidence reaches in the

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market and traders revise their expectations as a result. But, traders do not obtain the information indicators simultaneously. Responses of different traders to information are parts of a series of half-finished equilibrium. Once all traders have reacted to the information signal only then a final equilibrium is reached.

On the other hand, MDH implies a substitute volume and volatility connection, in which the relation is critically dependent upon the rate of information flow into the market. MDH assumes that the combined dissemination of volume and volatility is bivariate normal, conditional upon the arrival of information. It implies that all the traders concurrently receive the new price signals. As such, the shift to a new evenness is instantaneous and there will be no midway partial evenness. This is contrary to the SIAH, which assumes that there is intermediate equilibrium on the road to the final equilibrium. Thus, under the MDH, there should be no information content in past volatility data that can be used to forecast volume (or vice versa) since these variables contemporaneously change in response to the arrival of new information.

The contemporaneous relationship between return and volume holds significance, as it discloses information about symmetry/ asymmetry of trading volume in market. To observe this aspect of trading volume in Indian market, the present study examines the contemporaneous correlation between intraday return and volume based minute by minute data for the 35 composite stocks of S&P CNX Nifty index.

Thereafter this paper delves into the contemporary relationship between trading volume and its impact on volatility of financial assets. Karpoff (1987) seminal paper summarizes the importance of this research area by presenting the following arguments. First, the theory of the stock returns volatility-volume relationship provides insight into

the structure of financial markets. It predicts that this relationship depends upon the rate of information flow to the market, information dissemination, market size, and the existence of short sale constraints. Second, the stock returns volatility-volume relationship has important implications for event studies that use a combination of price and volume data. Third, this relationship has important implications for the empirical distribution of speculative assets (Alsubaie, 2008).

In addition, the intraday return, volume and volatility relationship sheds light on the efficiency of stock markets. Despite the obvious importance of return-volatility-volume relationship, there is a paucity of research on this topic with studies based on intraday analysis (see table 2 and 4). This paper attempts to fill this gap by investigating intraday return-volatility-volume relationship, based minute by minute data of S&P CNX Nifty index. The findings of this paper can aid investors to understand the dynamics of the Indian equity market, which are extremely imperative for investors in determining the allure of market restrictions.

REVIEW OF LITERATURE

Voluminous literature is available (see Table 1 and Table 3) with respect to studies which have reported the evidence (or the lack thereof) of contemporaneous relationship between return, volume and volatility with low frequency data (daily, weekly, monthly). The intraday based analysis (minute, hourly) is a relatively new phenomenon in the stock market. There is a dearth of literature (see Table 2 and Table 4) with respect to high frequency based studies, particularly in the Indian context, to the best of our knowledge. This study thus aims to plug this literature gap by empirically examining the contemporaneous relationship between intraday return, volume and volatility measures of the Indian equity market.

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APPENDIX

Table 1 Contemporaneous Relationship between Return and Volume

Sr No	Author	Year of Study	Time Interval	Sample Size / Database	Sample Period	Findings
1.	Granger and Morgenstern	1963	Weekly	Sec Composite Index And Total NYSE Volume	1939-1961	Negative Correlation
2.	Godfrey et al.,	1964	Weekly And Daily	Stock Market Aggregate And 3 Common Stocks	1959-1962 1951-1953	Negative Correlation
3.	Epps and Epps	1976	Transactions	20 Common Stocks	Jan 1971	Positive Correlation
4.	Epps	1977	Daily	20 Common Stocks	Jan 1971	Positive Correlation
5.	Rogalski	1978	Monthly	10 Common Stocks And 10 Associated Warrants	1968-1973	Positive Correlation
6.	Hanna	1978	Transactions	20 NYSE Bonds	1971	Positive Correlation
7.	Tauchen and Pitts	1983	Daily	T-Bill Futures Contracts	1976-1979	Positive Correlation
8.	Cornisky et al.,	1984	Yearly	211 Common Stocks	1976-1979	Positive Correlation
9.	Richardson	1987	Weekly	106 Common Stocks	1973-1982	Positive Correlation
10.	Chordia et al.,	2001	Daily	S&P500 (ISSM) and the NYSE (TAQ)	1993-1998	Negative Correlation
11.	Ciner	2002	Daily	NASDAQ	1990-2002	Negative Correlation
12.	Mestel et al.,	2003	Daily And Weekly	25 Individual Stocks (Turkish Stock Market)	2000-2003	Negative Correlation
13.	Gurgul et al.,	2005	Daily	WIG20	1995-2005	Negative Correlation
14.	Mahajan and Singh	2007	Daily	NIFTY INDEX	2001-2006	Positive Correlation
15.	Sabri	2008	Daily	Nifty 50 Companies	1994-2006	Positive Correlation
16.	Balios	2008	Daily	NYSE Stocks	2002-2005	Negative Correlation
17.	Mahajan and Singh	2008	Monthly	Arab Monetary Fund Database	2001-2006	Positive Correlation
18.	Al-Jafari and Tilti	2013	Daily	Nifty Index	2006-2011	Positive Correlation

Where: NYSE = New York Stock Exchange, ISSM = Integrated Surgical Systems, TAQ = Trade and Quote Database, NASDAQ = National Association of Securities Dealers Automated Quotations, WIG 20 = The 20 most liquid companies quoted on the primary market of the Warsaw Stock Exchange.

Source: Compiled from Various Studies

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Table 2 Contemporaneous Relationship between Intraday Return and Volume

Sr No	Author	Year of Study	Time Interval	Sample Size / Database	Sample Period	Findings
1	Crouch	1970	Hourly and Daily	Stock Market Aggregates, 3 Common Stocks	1966-1968	Positive Correlation
2	Wood et al.,	1985	Minutes	946 Common Stocks 1138 Common Stocks	1971-72 and 1982	Negative Correlation
3	Jain And Joh	1988	Hourly	NYSE	1979-1983	Positive Correlation
4	Chung And Joo	2005	2 minute interval	KRW/USD Spot Foreign Exchange Market	2001-2002	Positive Correlation
5	Gwilym et al.,	2010	5 minute interval	FTSE-100, Short Sterling and Long Gilt LIFFE futures		Positive Correlation
6	Hussain	2011	5 minute interval	DAX 30	2004-2005.	Positive Correlation

Where: NYSE= New York Stock Exchange, KRW/USD Korean Won/Us Dollart, DAX 30= Deutscher Aktien Index, FTSE-100- Co Owned By London Stock Exchange And The Financial Times.

Source: Compiled from Various Studies

Table 3 Contemporaneous Relationship between Volume and Volatility

Sr No	Author	Year of Study	Time Interval	Sample Size / Database	Sample Period	Findings
1	Ying	1966	Daily	Stock Market Aggregates	1957-1962	Positive Correlation
2	Epps	1976	Transactions	20 Common Stocks	Jan, 1971	Positive Correlation
3	Bessembinder and Seguin	1993	Daily	8 Futures Contracts	1982-1990	Positive Correlation
4	Jones et al.,	1994	Daily	NASDAQ	1986-1991	Positive Correlation
5	Kocagil and Shachmurove	1998	Daily	16 Major U.S. Futures Contracts	1995-1998	Negative Correlation
6	Daigler and Wiley	1999	Daily	LDB	1986-1988	Positive Correlation
7	Lee and Rui	2000	Daily	SHSE, SZSE	1990-1997	Positive Correlation
8	Chan And Fong	2000	Daily	New York Stock Exchange, NASDAQ	1993	Positive Correlation
9	Chen et al.,	2001	Daily	New York, Tokyo, London, Paris, Toronto, Milan, Zurich, Amsterdam and Hong Kong	N.A	Positive Correlation
10	Mestel et al.,	2003	Daily	31 Common Stocks in ASM	2000-2003	Negative Correlation
11	Gurgul et al.,	2005	Daily	20 most liquid companies of WSE	1995-2005	Positive Correlation
12	Otávio and Bernardus	2006	Daily	BOVESPA	2000-2005	Negative Correlation
13	Long	2007	Daily	CBOE	1983-1985	Positive Correlation
14	Mahajan and Singh	2008a	Daily	Sensex	1996-2007	Positive Correlation

Where: KLSE= Kuala Lumpur Stock Exchange, LDB= Liquidity Data Bank NYSE= New York Stock Exchange CBOE= Chicago Board of Option Exchange, WSE= The Warsaw Stock Exchange, CBOE = Chicago Board Of Option Exchange, BOVESPA = Brazilian Stock Index, SENSEX = Sensitive Index, SHSE = Shanghai Stock Exchange , SZSE = The Shenzhen Stock Exchange, ASM = Austrian Stock Market, NASDAQ = National Association of Securities Dealers Automated Quotations,

Source: Compiled from Various Studies.

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Table 4 Contemporaneous Relationship between Intraday Volume and Volatility

Sr No	Author	Year	Country	SAMPLE PERIOD	Sample Size/ Database	Time Interval	Findings
1	Jain and Joh	1986	India	1979-83	Stock Market Aggregates	Hourly	Positive Correlation
2	Darrat Et Al.,	2003	USA	1998	30 Stocks of DJIA	5 minute interval	Negative Correlation
3	Celik	2013	Istanbul	2005-2010	30 index data/ISE	5 minute interval	Positive Correlation
4	Darrat et al.,	2002	USA	2002	NYSE	1 minute interval	Positive Correlation
5	Worthington and Higgs	2003	Australia	2002- 2003	S&P/ASX 50 index	5 minute interval	Positive Correlation
6.	Fuertes	2009	UK	1997-2003	14 largely trades stocks of S&P 500 on NYSE and NASDAQ	5 minute interval	Positive Correlation

Empirical endeavors with low frequency data into the contemporaneous relationship between return and volume measures can be traced back to Osborne (1959). He made an early attempt to study the price volume relationship, in which he demonstrated that variance of change in stock price is governed by the volume of transactions. Granger and Morgenstern (1963) analyzed SEC composite index and NYSE volume, and concluded no association between volume and its subsequent prices. Thereafter, Ying (1966) studied S&P 500 index return and total volume of NYSE for the period 1957-1962 and established the stock price and volume to be positively correlated with each other.

In the year 1975, Epps established a concept that in bull market, the proportion of volume to price change on individual transactions should be more than in the bear market. Further in 1977 he examined the rationality for stock returns, under the influence of transaction costs and concluded that the relationship between stock returns and volume remained positive over a period of days. Further on Rogalski (1978) tested the connection between volume and returns and became responsible for maintaining to the assumption that a variation in stock price change and its subsequent volume, are positively interrelated for the individual stocks under examination. Tauchen and Pitts (1983) claimed the improbability that changes in stock price are likely to increase with growing volume of

transactions. In fact they were of the opinion that an increase in number of market participants would act as a smoothening agent to market price fluctuations and hazards.

Additionally, Comiskey et al., (1984) using yearly data on 211 Common Stock for a period 1976-1979 found the stock prices to be positively correlated to its volume measures. As per Grammatikos and Saunders (1986), the resulting positive correlation between its stock returns and volume could be attributed to the combined reliance on a conjoint guiding event or occurrence. Thereafter, Hasbrouch (1991 and 1996) and O'Hara (1995) in their respective studies found that prices (returns) are affected by the four variables, namely, volume, trade, characteristics of the market and the bid ask spread atmosphere of the stock market.

More recently, the endeavors of Chen et al., (2001) explored the price-volume relationship in nine major stock markets, namely, U.S., Japan, U.K., France, Canada, Italy, Switzerland, Netherlands and Hong Kong. Their outcomes showed momentous positive association between trading volume and returns. Pathirawasam (2008) directed a study using stock volume and returns from Colombo Stock Exchange (CSE) and revealed that stock returns are positively related to the contemporary change in trading volume. Further, he established that past trading volume alteration is deleteriously connected

to stock returns. Depositor misspecification regarding the upcoming remunerations or illiquidity of low volume stocks can be the reason for the negative relationship between trading volume and stock returns. Khan and Rizwan (2008) had conducted the same study before using the data of KSE 100 index for the period 2001-2007 and deduced a positive contemporaneous relationship between the trading volume and returns.

Mahajan and Singh (2009) explicate that the price volume relationship depends on the rates of information flow, the diffusion of information into the market, the extent to which markets convey information, the size of the market and level of market efficiency. Trading volume alone is thought to reflect information about the changes in investors' expectations. Similar results were found by Alsubie and Najand (2009) who tested the effect of trading volume on the persistence of the conditional volatility of returns in the Saudi stock market. All in all, their consequences maintained the conformance to mixture of distribution hypothesis at the company level.

Tripathy (2011) had investigated the dynamic contemporaneous relationship between stock return and trading volume of Indian stock Market and found positive correlation between them. Thereafter, a research of 98 companies listed in Karachi Stock Exchange (KSE) of Pakistan by Rehman et al., (2012) revealed a strong positive relation between returns and trading volume. In the case of emerging markets, numerous literatures can be found that had discussed this return-volume relationship and how volatility can be understood in this context.

These studies based on low frequency data, support a positive contemporaneous relationship between return and volume measures, thus providing identification to the succeeding explanation. The existence of positive contemporaneous correlation is based on a famous Wall Street adage by Karpoff (1987) which says "it takes prices to make volume

move". This implies that investors commonly use trading volume to predict price movements and have a peek of an opportunity to earn supernormal profits.

The empirical studies which found the return and volume series to be negatively correlated, thus lending support to the sequential information arrival hypothesis are those of Granger and Morgenstern (1963), who studied the weekly data for the sample period of 1939-1961 and found significant negative correlation among return and volume. Further, Godfrey et al., (1964) studied the weekly and daily data and found the measures of return-volume to be negatively correlated. More recently, Chordia et al., (2001) studied the S&P 500 index of ISSM and NYSE on a daily regularity, and reported negative correlation between stock return and trading volume. Ciner (2002) studied the NASDAQ index at daily interval and reported the return and volume measures to be negatively correlated. Following these conclusions, Mestel et al., (2003) examined the 25 individual stocks on the Turkish stock market on a daily and weekly basis and supported the same. Further Gurgul et al., (2005) reported the WIG20 index to be insignificantly correlated with each other with respect to the stock price volume measures.

This paper provides a comprehensive review of studies, which have reported positive correlation on intraday basis. These studies are in conformance with the mixture of distribution hypothesis. An early instance of such findings can be traced back to Jain and Joh (1988) who studied the NYSE on an hourly basis and established noteworthy positive connexion among the intraday variables of stock price and volume. Further, Chung and Joo (2005) considered the KRW/ USD Spot Foreign Exchange Market and testified outcomes authorizing the sustenance of MDH belief of positive and simultaneous correlation between intraday return and volume measures. Kaniel et al., (2006) studies ASX stock exchange at a 6 hourly interval and found positive contemporaneous correlation among the

intraday measures of return and volume. Gwilyn et al., (2010) examined the FTSE-100, Short Sterling and Long Gilt LIFFE futures and Hussain (2011) studied the DAX 30 (Deutscher Aktien Inde), at 5 minute interval each. Both these authors confirmed presence of positive correlation among the intraday return and volume measures under scrutiny

Further on, the studies on intraday analysis to have reported negative correlation those of Wood et al., (1985) who with the help of high frequency data studied the 946 Common Stocks 1138 Common Stocks on a minute by minute basis and found the intraday return and volume to be negatively correlated with each other. And lastly, Mcmillen and Speight (2002) examined the intraday data of Toronto Stock Exchange-100 Short Sterling Contracts Long Gilt Series and found contemporaneous negative correlation coefficients for the intraday return and volume measures. More recently, Jong and Donders (2014) studied the AEX index, options and futures at 10 minute interval and found the intraday return and volume to be negatively correlated and thereby supporting the sequential information arrival hypothesis.

A perusal of table 3 depicts all the imperative studies piloted with low frequency data which shows the endeavours of various academicians and researchers with respect to the relationship between trading volume and volatility measures. There is extensive and voluminous literature in finance supporting the positive relationship between trading volume and volatility (Karpoff (1987)). O'Hara (1995) elucidate that the positive correlation between the measures trading volume and return volatility is constant with maximum hypothetical market microstructure models. Lamoureux and Lastrapes (1990) concluded that trading volume has a positive impact on volatility measure. Further, Board and Sutcliffe (1990) also find results in sustenance to the hypothesis of a positive relationship between volatility and volume for the Toronto Stock Exchange-100 index. Thereafter, Bessembinder and Seguin (1993) deduce the results

by adopting the methodology of dividing the volume into expected and unexpected components. This was done in order to examine the relation between price volatility and trading volume for markets under study. Their results advocate the influence of unexpected volume shocks on volatility to be irregular. This leads them to conclude, that the hypothesis that volatility is affected by existing market depth holds true for their study.

By means of variant statistical methods, Gallant et al. (1993) studied the S&P 500 Index for a period from 1928-1987 and reported positive correlation among volume and volatility measures. Subsequently, Tauchen et al. (1993) and Hiemstra and Jones (1994) conclude similar evidences of positive correlation between volatility and trading volume measures in their respective studies. Further Brailsford (1994) examination into this relationship supports the supposition that the disproportionate relationship between volume and price changes. Additionally, Brailsford (1996) volatility models are found to be inconsequential when the volume is taken into view. Ragunathan and Pecker (1997) arrange for robust confirmation that unanticipated volume has a greater impact on volatility than anticipated volume. Following this, Hogan et al. (1997) show that there is a strong positive relationship between the parameters of trading volume and volatility. Further contributions into this relationship was made by Kocagil and Shachmurove (1998) who studied the daily parameters of 16 Major U.S. Futures Contracts for a period of 1995-1998 and found that there existed negative correlation between the volume and volatility under study.

Further on, Wang and Yau (2000) examined the relationship between trading volume and price volatility and supported a positive relationship between trading volume and price volatility. Gallo and Pacini (2000), using data on 10 actively traded U.S. stocks from 1985 to 1995, found that persistence decreased when trading volume was used in the conditional variance equation. Sabri (2004) discovered that trading volume is one of the main

factors which had an effect on predicting the volatility for the emerging markets under examination. Watanabe (2001) suggests that there is negative relation between price volatility and volume. Mestel et al., (2003) studied daily data of 31 Common Stocks in Austrian Stock Market and found negative correlation persistence between volume and volatility estimators. Otavio and Bernardus (2006) estimated the existence of significant negative correlation using daily data of the Bovespa Index for a period of study from 2000-2005, thus supporting Copeland's SIAH.

Thereafter a review of table 4 lists the studies which have examined the relationship between volume and volatility with the help of intraday data. Jain and Joh (1986) examined hourly data and found positive correlation thus supporting the MDH. Celik (2013) studied the ISE-30 index, Worthington and Higgs (2006) studied the ASX-30 Index and Fuertes (2009) studied the S&P 500 stocks all with 5 minute interval respectively and found the variables to be positively correlated. All these studies confirmed to the MDH implying a positive contemporaneous correlation between intraday volume and volatility measures. Darrat et al., (2002) studied the NYSE at 1 minute interval and reported intraday volume and volatility to be positively correlated. On the contrary, the sequential information arrival hypothesis has been supported by Darrat et al., (2003) who studied NYSE at 1 minute interval and established the intraday volume and volatility to be negatively correlated.

As can be seen from table 2 and table 4, there is a literature gap with respect to intraday based studies into the contemporaneous relationship between return-volume-volatility measures in context of the Indian equity market. Thus this paper will contribute to understanding the market efficiency and information processing of the Indian equity market by analyzing the S&P CNX Nifty index (a flag ship index of NSE, which is one of the leading stock exchange in India) on an intraday basis.

DATA AND METHODOLOGY

This study is based on 1 minute interval data of stocks listed at S&P CNX Nifty index, during the period from 1st April 2010 to 31st March 2011. The S&P CNX Nifty index is a well-differentiated 50 stock index precisely imitating general market environments, characterized by very dynamically dealt stocks. This study applies the filters of bonus issue and stock split announcement and derives a concise and well balanced sample of 35 stocks. The intraday stock return measure is comprised of continuous rates of return, computed as log of ratio of present minute's price to previous minute's price (i.e. $R_t = \ln(P_t / P_{t-1})$). Volume is taken as per the trading volume data. Volatility is calculated as the squared value of minute by minute stock returns (in confirmation with Andersen et al., 2001, 2003).

EMPIRICAL FINDINGS AND ANALYSIS

The examination of relationship between return, volume and volatility provides significant information regarding the price discovery efficiency of an asset. The summary statistics of the sample stocks suggests that dispersion of mean returns represent trivial values, thereby indicating a steady index. This authorizes to the belief that the index under examination is a very safe index. Substantial Jarque-Bera (JB) statistics undoubtedly discards the hypothesis, which suggests that all variables do not conform to the normal distribution, which is the precondition for any market to be efficient in the weak form (Fama (1965), Stevenson and Bear (1970), Reddy (1997) and Kamath (1998)).

Further, the statistics of skewness and kurtosis preserve the substantiation of withdrawal from normality hypothesis. The realistic distribution of the return, volume and volatility series in this paper is positively skewed, indicating a right tail of distribution. These positively skewed series accentuate the asymmetric nature of the series. Additionally, the excess kurtosis projected for trading volume series is a strong indication of

leptokurtic peaked series. The extreme kurtosis values of Indian markets demonstrate extraordinary erratic behavior in the returns measure. The results of this paper thus suggest the high probability of extreme values (profit/ loss) occurring. These results further stress, that only the chief and dominant players attained the core of trading activity while the small time traders could not participate actively in the trading activity.

For the 35 composite stocks of S&P CNX Nifty index, this paper verifies the existence (inexistence) of contemporaneous relationship between intraday return, volume and volatility variables. This study applies the correlation test for determining whether one intraday measure can be used to forecast the other measure. For this the pre-condition is that the series under study should be stationary in nature. Therefore, the ADF unit root test results are estimated on the basis of the technique. The unit root test results shows that intraday return, volume and volatility are stationary at 1% and 5% levels of significance for all the stocks comprising the sample.

Table 5 depicts that only 8 stocks (constituting 22.85% of the sample) depict positive contemporaneous relationship between intraday stock return and trading volume measure of the index. These stocks are namely, ACC, ASIANPAINT, CIPLA, COALINDIA, DRREDDY, NTPC, TATAMOTORS and WIPRO. If the joint distribution of volume and price change is non-normal, this relationship will conform to the mixture of distribution hypothesis, which predicts positive relationship between return and volume. Majority of these positively significant stocks in the sample, depict low significance levels at 5% and 10%, thus indicating weak correlation persistence. Trading restrictions, such as higher costs for short sales, may cause the positive price-volume relationship in the equity market (Long, 2007).

Further the contemporaneous relationship results for the S&P CNX Nifty index (see Table 5), shows that 27 stocks, constituting a 77.14% of the sample (namely, AMBUJACEM, AXISBANK,

BANKBARODA, BHEL, BPCL, CAIRN, DLF, GRASIM, HCLTECH, HDFCBANK, HEROHONDA, HINDALCO, HINDUNILVR, ICICIBANK, IDFC, INDUSINDBK, INFOSYSTCH, LT, MARUTI, PNB, POWERGRID, RANBAXY, SBIN, SESAGOA, TATAPOWER, TATASTEEL and ULTRACEMCO) depict no positive contemporaneous relationship between intraday volume-return. This implies that trading volume does not show any predictive power for future returns in the presence of current and past returns. It further implies that these stocks of the S&P CNX Nifty index supports the mixture of distribution hypothesis of Clark (1973), which elucidates the new information is simultaneously absorbed by the market participants at the same time. This implies that no investor can propose to hold a profitable position as everyone receives and reacts to new information concurrently. The results of this paper propose that this index is a successful index, which relate the Indian equity market being efficient. The findings of this paper are consistent with those of Grammatikos and Saunders (1986), Karpoff (1987), Gunduz and Hatemi-J (2005), Alsubie and Najand (2009) and Tripathy (2011). Studies which have reported similar results on an intraday analysis are those of Wood et al., (1985) and Jong and Donders (1998).

The results of this study are consistent with prior intraday based analysis of return and volume measures (see Wood et al., (1985) and Jong and Donders (1998)), which concluded no evidence for contemporaneous correlation suggesting that the measures scrutinized in this study, cannot be used in forecasting each other. Further, the insignificant contemporaneous relationship of intraday return and volume measures of S&P CNX Nifty index could be attributed to the impact of introduction of rolling settlement in Indian capital market. As explained by Mahajan and Singh (2013), who administered that no contemporaneous relation was detected between volume and returns in post rolling settlement period for the Nifty index. Positive relationship between volume and return has been seen only in pre-rolling

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settlement period for the index. This indicates that markets became more efficient after introduction of rolling settlement. This further implies that neither are the rising markets accompanied by rising volume and nor are the declining markets accompanied by the falling volume. Further this explanation is consistent with the theory that implies that information content of volume does not affect future stock return by any method. In short, the knowledge of one of these variables cannot improve the short-run forecasts of the other (Mestel et al., (2003))

Further, the results of this study for the contemporaneous relationship between intraday volume and volatility measures. Table 6 depicts that only 8 stocks (constituting 22.85% of the sample) exhibit a positive contemporaneous correlation

relationship between intraday trading volume and intraday stock volatility. These stocks conforming to the MDH criteria are those of, CAIRN, COALINDIA, HINDALCO, IDFC, PNB, SBIN, TATASTEEL and ULTRACEMCO.

A careful appraisal of Table 6 depicts that 27 stocks constituting 77.14% of the sample (namely, ACC, AMBUJACEM, ASIANPAINT, AXISBANK, BANKBARODA, BHEL, BPCL, CIPLA, DLF, DRREDDY, GRASIM, HCLTECH, HDFCBANK, HEROHONDA, HINDUNILVR, ICICIBANK, INDUSINDBK, INFOSYSTCH, LT, MARUTI, NTPC, POWERGRID, RANBAXY, SESAGOA, TATAMOTOR, TATAPOWER and WIPRO) show no positive correlation between the intraday volume and volatility measures. This leads the study to refute a profound Wall Street adage by Karpoff

Table 5 Contemporaneous Relationship between Intraday Return and Volume

Symbol	Return-Volume	P Value	Symbol	Return-Volume	P Value
ACC	0.003646**	0.0268	ICICIBANK	0.003575	0.2848
AMBUJACEM	-0.00226	0.1882	IDFC	0.001394	0.3959
ASIANPAINT	0.00324***	0.0544	INDUSINDBK	0.00213	0.1963
AXISBANK	-0.00277	0.1088	INFOSYSTCH	-0.00062	0.7074
BANKBARODA	-0.00084	0.6116	LT	-0.0014	0.3928
BHEL	-0.00193	0.2394	MARUTI	-0.00082	0.6173
BPCL	-5.66E-05	0.9726	NTPC	0.002844***	0.0833
CAIRN	-0.0021	0.2009	PNB	0.00106	0.5197
CIPLA	0.003634**	0.0271	POWERGRID	0.002549	0.1471
COALINDIA	0.009462***	0.0555	RANBAXY	-3.77E-06	0.9982
DLF	-0.00353	0.0374	SBIN	-0.02769	00000
DRREDDY	0.007722*	0	SESAGOA	-0.00025	0.878
GRASIM	0.00112	0.4983	TATAMOTORS	0.010491*	00000
HCLTECH	0.000617	0.7079	TATAPOWER	0.002318	0.1599
HDFCBANK	-0.00292	0.076	TATASTEEL	-0.18143	00000
HEROHONDA	7.51E-05	0.9637	ULTRACEMCO	-0.0027	0.1052
HINDALCO	-0.02755	0	WIPRO	0.003845**	0.0194
HINDUNILVR	4.36E-05	0.9797			

* Significant at 1% level of significance, ** Significant at 5% level of significance, *** Significant at 10% level of significance.

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(1987) that states “volume is relatively heavy in bull markets and light in bear markets” for these stocks. The rationale behind insignificant intraday volume-volatility association is that trading volume is negatively related to the magnitude to which traders differ when they review their price anticipations. This is accredited to the uniformity of information amongst the investors. Accordingly, as information equilibrium increases, these investors are unable to protect themselves against the jeopardy of trading against remote information. Hence, this leads the trading volume to be insignificantly correlated with volatility. This further leads to the decrease in correlation, characterized by increasing information symmetry between intraday volume and volatility measures. These findings of the paper are in conformance with the intraday based volume-volatility analysis of Darrat et al., (2003).

CONCLUSION

It is a pre-conceived notion that the activity of the stock market cannot be decided, only on the basis of prices. This implies that stock prices deprived of their related volume measures, delivers ambiguous information about market movement. This paper examines the empirical relationship between intraday return, volume and volatility dynamics of stock market by using 1 minute interval data for the 35 composite stocks listed on the S&P CNX Nifty index of the National Stock Exchange (India's primary stock exchange).

The findings of this study, support the viewpoint that, for majority of the 35 sample stocks listed on S&P CNX Nifty index, the businesses are implemented as soon as they finds a similar auction

Table 6 Contemporaneous Relationship between Intraday Volume and Volatility

Symbol	Volume-Volatility	P Value	Symbol	Volume-Volatility	P Value
ACC	0.001963	0.2333	ICICIBANK	0.001389	0.6778
AMBUJACEM	-2.85E-05	0.9868	IDFC	0.005527*	0.0008
ASIANPAINT	0.001015	0.5468	INDUSINDBK	0.000159	0.9232
AXISBANK	-0.00277	0.4501	INFOSYSTCH	1.74E-05	0.9915
BANKBARODA	-0.00047	0.7743	LT	-0.00025	0.8777
BHEL	0.000225	0.8911	MARUTI	0.000783	0.634
BPCL	6.40E-06	0.9969	NTPC	0.000489	0.7661
CAIRN	0.003056***	0.063	PNB	0.002812***	0.0878
CIPLA	0.00045	0.7845	POWERGRID	0.000688	0.6957
COALINDIA	0.012976*	0.0086	RANBAXY	0.00101	0.5388
DLF	0.001111	0.5119	SBIN	0.032706*	0
DRREDDY	0.000119	0.9424	SESAGOA	-0.00023	0.8899
GRASIM	0.000298	0.8569	TATAMOTORS	0.001216	0.4591
HCLTECH	0.000311	0.8501	TATAPOWER	-3.00E-05	0.9855
HDFCBANK	0.002139	0.1938	TATASTEEL	0.183001*	0
HEROHONDA	9.29E-05	0.9551	ULTRACEMCO	0.005248*	0.0016
HINDALCO	0.025858*	0	WIPRO	0.00033	0.8408
HINDUNILVR	-0.00016	0.9253			

* Significant at 1% level of significance, ** Significant at 5% level of significance, *** Significant at 10% level of significance.

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Sample Stocks in the Study

Company Name	Industry	Symbol
ACC Ltd.	CEMENT & CEMENT PRODUCTS	ACC
Ambuja Cements Ltd.	CEMENT & CEMENT PRODUCTS	AMBUJACEM
Asian Paints Ltd.	CONSUMER GOODS	ASIANPAINT
Axis Bank Ltd.	FINANCIAL SERVICES	AXISBANK
Bank of Baroda	FINANCIAL SERVICES	BANKBARODA
Bharat Heavy Electricals Ltd.	INDUSTRIAL MANUFACTURING	BHEL
Bharat Petroleum Corporation Ltd.	ENERGY	BPCL
Cairn India Ltd.	ENERGY	CAIRN
Cipla Ltd.	PHARMA	CIPLA
Coal India Ltd.	METALS	COALINDIA
DLF Ltd.	CONSTRUCTION	DLF
Dr. Reddy's Laboratories Ltd.	PHARMA	DRREDDY
Grasim Industries Ltd.	CEMENT & CEMENT PRODUCTS	GRASIM
HCL Technologies Ltd.	IT	HCLTECH
HDFC Bank Ltd.	FINANCIAL SERVICES	HDFCBANK
Hero MotoCorp Ltd.	AUTOMOBILE	HEROMOTOCO
Hindalco Industries Ltd.	METALS	HINDALCO
Hindustan Unilever Ltd.	CONSUMER GOODS	HINDUNILVR
ICICI Bank Ltd.	FINANCIAL SERVICES	ICICIBANK
IDFC Ltd.	FINANCIAL SERVICES	IDFC
IndusInd Bank Ltd.	FINANCIAL SERVICES	INDUSINDBK
Infosys Ltd.	IT	INFOSYSTCH
Larsen & Toubro Ltd.	CONSTRUCTION	LT
Maruti Suzuki India Ltd.	AUTOMOBILE	MARUTI
NTPC Ltd.	ENERGY	NTPC
Power Grid Corporation of India Ltd.	ENERGY	POWERGRID
Punjab National Bank	FINANCIAL SERVICES	PNB
Ranbaxy Laboratories Limited	PHARMA	RANBAXY
State Bank of India	FINANCIAL SERVICES	SBIN
Sesa Sterlite Ltd METALS	SSLT	
Tata Motors Ltd.	AUTOMOBILE	TATAMOTORS
Tata Power Co. Ltd.	ENERGY	TATAPOWER
Tata Steel Ltd.	METALS	TATASTEEL
UltraTech Cement Ltd.	CEMENT & CEMENT PRODUCTS	ULTRACEMCO
Wipro Ltd.	IT	WIPRO

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or attainment order from a counter party. All the orders in this index are automatically harmonized on a value/ period precedence basis. This has thus resulted in a substantial decrease in the time spent, cost and risk of scams, thereby, ensuing enhanced functioning competence of the index. The resultant characteristics permits for quicker assimilation of price sensitive information into prevalent prices, as the market participants then are able to see the entire market in the actual scenario. Hence, this enhances better informational adeptness for the index, which accordingly makes the market conditions more obvious. The insignificant contemporaneous relationship between the variables under examination in this study enables the S&P CNX Nifty index to refute the Wall Street adage, "Volume is relatively heavy in bull markets and light in bear markets". The results of the paper therefore, solidify belief that the S&P CNX Nifty index comprises of the most abundantly and actively traded securities. These inherent features thus impart sustenance to the efficiency results of Indian stock market in this study.

In nutshell, the faintness in correlation can be attributed to the fact that the index is rendered to be weak form efficient with respect to a joint contemporaneous study of these measures. With the exploration into these intraday contemporaneous relationships of 35 composite stocks of S&P CNX Nifty index, market investors and regulators can obtain a healthier understanding of the risk evolution of their financial exposure in trading sessions within a day. The results of this study are supportive of NSE's transparent transactions combined with lower operational prices and efficiency, which has greatly increased the attractiveness of the Indian stock market to the domestic and international investors.

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