

DEMATERIALIZATION OF EQUITY SHARES IN INDIA: LIQUIDITY, RETURNS AND VOLATILITY

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Abstract

Dematerialisation of shares is an important milestone in the annals of Indian Capital Markets. Understanding and measuring the impact of it on various segments is necessary since it stirred the microstructure of Indian capital markets in general and stock exchanges in particular. Demand and Supply forces determine prices of a product. Liquidity plays an important role in the interplay of demand and supply forces. The impact of dematerialisation on liquidity in the Indian stock exchanges is quantified and analysed. Quality of shares changed for better owing to dematerialisation and thus investors are expected to earn higher returns as a natural step, albeit, for sometime only. Changes in quality of shares are expected to cause changes in demand and supply for shares, which in turn, influences, the levels in share prices (volatility). All these three issues are studied in the present paper. Liquidity and returns improved substantially in the post-demat period while volatility was very much below the daily changes permitted.

Introduction

Dematerialised securities trading, settlement and custody has changed considerably the market microstructure of Indian stock exchanges. Dematerialisation is the process by which "physical certificates of an investor are converted to an equivalent number of securities in electronic form". The converted securities are owned, traded and utilised like physical securities. Order routing, trading and settlement, that is delivery and payment in demat form, changed the way markets started functioning. These changes have brought tremendous impact on the behaviour of investors, stock exchanges, depository participants and custodians.

Generally, an investor would look for more liquidity to less liquidity in a stock. Higher liquidity means lower transaction costs and easy entry and exit options. Therefore, higher liquidity is preferred. Ownership transfer of demat shares is quite fast. Investors would be able to churn their portfolio many a times over, contributing to the increase in turnover and liquidity. This paper attempts to measure post-demat increased level of activity (liquidity). Whenever a new product is made available, there will be an additional demand for that particular product. Dematerialised shares are definitely superior to physical (paper) form of shares. Physical form of shares are fraught with fake, forgery, stolen and duplicate problems. Logically speaking, higher demand should emanate for demat shares, which is expected to push up (pull down to a lesser extent) shares prices resulting in higher returns (lesser losses) to the investors compared to pre-demat period. This higher demand will continue for sometime (adjustment period lasting, sometimes, a few months) only.

Once all investors understand the merits and value of demat shares or when all shares of all stocks are demated, then the superior or higher returns will disappear or will not be there. Some markets are quite quick enough to discount the new information while some other markets take longer time (a few weeks to a few months) to discount the new information. In this period, investors can make abnormal profits. One of the objectives of this paper is to measure these abnormal returns, if any.

Movements in share prices provide investment opportunities for investors. In this context a pertinent quote from John Wilmot, Earl of Rochester of 1600s, "Since it is Nature's law to change, Constancy alone is strange", makes lot of sense. So an oblique reading of this would say that volatility has been viewed as natural for a long time, certainly pre-dating any sophistication in capital markets. Now, as the forces of supply and demand vie around changing equilibria, asset price variations (and instruments based on it) are a way of life. Almost every important financial decision to make is interesting because of volatility. However, the wild fluctuations (high volatility) in share prices will erode the confidence of investors in the market place. Once confidence is lost, the investors will shift partly or fully their savings from the capital market to other forms of investments. Therefore,

there is a need to strike a balance between no-volatility and high-volatility. It is easy to define no-volatility but difficult to measure what is high-volatility. However, the intensity in volatility varies from market to market depending on their stage of development. It is desirable to have an optimum level of volatility in any given market.

In the present study, an attempt has been made to measure changes in the liquidity, returns and volatility before and after demat of shares. Volume of shares traded is considered as a surrogate for liquidity. Continuously compounded returns are used to denote returns and standard deviation is calculated as a proxy for volatility measure. All the three aspects of the investigation will be tested with the help of sophisticated statistical and econometric techniques. The empirical findings revealed that dematerialisation increased volumes traded thus providing higher liquidity. Further, control group recorded negative growth or lesser growth in the number of shares traded. In terms of abnormal returns, dematerialised shares produced positive returns which are significant.

The structure of the remaining part of the paper is organized in the following fashion:

Section-1 analyses growth and developments related to trading and settlement of shares in the dematerialised segment. Relevant institutional structure and changes thereon are provided in Section-2. Impact of dematerialisation on market microstructure is explained in Section-3. Relevant event study literature review is discussed in Section-4. Selection procedure of companies for the study and control groups from demat and non-demat groups of stocks respectively is discussed in Section-5. Choice of length of period, selection of source and collection of data are also explained in Section-5. Statistical quantification and measurement of parameters are detailed again in Section-5. Section-6 discusses and interprets findings of the study, while the last Section-7 gives implications of the research.

1. Descriptive Statistics of Dematerialisation in India

The Securities and Exchange Board of India (SEBI), in its pursuit to make Indian capital market safe, transparent and disclosure oriented, has been pursuing to reform so that the Indian capital market match with the standards of developed capital markets of the world. Introduction of trading in demat form of securities was at the top of SEBI's agenda. In this direction, Government of India legislated Depositories Act in August 1996 that superceded ordinances issued by the government earlier. The Act permits multiple depositories to operate in the country. This will remain as one of the land mark developments in creating new technology to transact in financial instruments. SEBI passed Depositories & Participants Regulations in May 1996 to enable depositories to start and operate. National Securities Depository Ltd (NSDL) was the first to get itself incorporated in June 1996 and to start its business. Subsequently, Central Depository

Services Ltd (CDSL) also became operational in March 1999. Currently only these two depositories are operating in the country.

Panel A of Table 1 provides information on stock market developments in India. The Market capitalisation of the domestic stocks listed in India rose sharply from Rs.4.73 trillion to Rs.9.13 trillion during 1994-95 to 1999-00 period, registering about 93.02 per cent growth. Since economic liberalization, foreign institutional investors (FIIs) have been continuously showing interest to invest in the country. From 1994-95 till December 2000, the investment jumped from \$ 3.1 billion to \$ 11.7 billion; this is a staggering 277 per cent jump. Though, there are 23 stock exchanges in the country, two major stock exchanges contribute to the lion's share of turnover: The all India turnover doubled during 1999-00 over previous year. The National Stock Exchange of India Ltd (NSE) and The Stock Exchange, Mumbai (BSE), together roughly accounted for 73.7 per cent of the total turnover during 1999-00. In the new millennium, the daily turnover of all the stock exchanges crossed \$ 3.5 billion. The leading Indian stock market barometer, BSE Sensex, appreciated by 40.7 per cent over the period, 1994-95 to 1999-00. For the ten months ended on 30th December 2000, it depreciated by 24.5 per cent. This trend is in tandem with the international phenomena of new economy stocks fall. Further, in the calendar year 2000, Sensex reached all time high of 6000.

Panel B gives the details of micro level developments pertaining to dematerialisation of both NSDL and CDSL. Over 1997-98 the value of dematerialised shares increased manifold with a growth of 1932.6 per cent till the end of 1999-00. The extent of growth from January to December 2000 is 15.94 per cent. During the same period, the number of shares dematerialised showed a whopping increase of 130.41 per cent. An astonishing growth of 3779.34 per cent recorded in number of client accounts during 1998-99 over corresponding previous year. For the same variable, a further impressive growth of 454 per cent was registered during 1999-00 and 106.4 per cent growth in the calendar year 2000 over the previous year is achieved. In line with the above achievements, shares settled in demat form in value and volume terms showed an impressive growth of 3169.14 per cent and 2519.46 per cent respectively during the 1998-99 over the previous year. For the same variables, a growth of 314 and 77 per cents respectively is achieved during 1999-00 over the previous year. The statistics of CDSL also shows an impressive performance from all the directions.

Table 1 : Descriptive Statistics

Panel A : Stock Market Indicators

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01 ⁺
No of Stock Exchanges	22	22	22	22	23	23	23
No of listed companies	4702*	9100	9890 (8.68)	9833 (-0.58)	9877 (0.45)	9871 (-0.06)	9871\$
All India Market Capitalisation (Rs bn)	4733.49	5722.57 (20.90)	4883.32 (-14.67)	5898.16 (20.78)	5740.64 (-2.67)	9128.42* (59.01)	6911.62*
FII Investments(in \$ millions)	3166.50	5202.20 (64.29)	7634.10 (46.75)	9284.30 (21.62)	8892.50 (-4.22)	11237.27	11702.1
No of Depositories	0	0	1	1	2	2	2
Total Number of companies available for demat	0	0	23	171 (643.48)	365 (113.45)	821 (124.93)	Na
Total Market Capitalisation of companies available for demat(Rs bn)	0	0	NA	2883.47	4006	7658	6548
No of DPs	0	0	24	49 (104.17)	84 (71.43)	124	178
No of DP Service centres	0	0	24	200 (733.33)	750 (275.00)	1425 (90.00)	1800
All India Turnover(Rs bn)	1629.05	2373.76 (45.71)	6461.16 (172.19)	9086.91 (40.64)	10233.82 (12.62)	20670.31 (101.98)	17331.07 @
BSE 30-share index	3260.96	3366.61 (3.24)	3360.89 (-0.17)	3892.75 (15.82)	3739.96 (-3.92)	5261.77 (40.69)	3972.12

* indicates listed stocks at BSE only

+ upto December 2000 only.

\$ indicates same as March 2000

@ indicates turnover of BSE and NSE only

NA means not available

Figures within brackets indicate growth in percentage over the previous period.

Panel B: Dematerialisation Growth in India

MONTH	Dec-96	Dec-97	Growth	Dec-98	Growth	Dec-99	Growth	Dec-00	Growth	Mar-97	Mar-98	Growth	Mar-99	Growth	Mar-00	Growth
Panel A: NSDL																
COS. – Agreement signed	12	160	1233	301	88	638	112	2331	265.36	40	191	378	375	96	918	145
COS. – Available for Demat	4	128	3100	291	127	608	109	2291	276.81	23	171	643	365	113	821	125
COS. – Available for Trading	3	115	3733	279	143	549	97	na		18	160	789	340	113	621	83
DPs -- live	10	40	300	76	90	112	47	178	58.93	24	49	104	84	71	124	48
DP locations	10	103	930	610	492	1400	130	1800	28.57	24	200	733	750	275	1425	90
DP cities/towns				158		285	80	335	17.54				165		285	73
Demat Qty (Mn.)	8	1030	12605	5057	391	12744	152	29364	130.41	22	1763	7803	7109	303	15501	118
Demat Value (Rs. Bn.)	2	119	5229	702	491	3238	361	3754	15.94	5	227	4419	1143	404	4614	304
Settlement Quantity (Mn.)	0	0		155	43578	947	513	888	-6.23	0	16	21244	407	2519	720	77
Settlement Value (Rs. Mn.)	0	19		22206	115421	224267	910	162629	-27.48	21	2287	10841	74774	3169	309531	314
Client accounts		7375		171317	2223	1666730	873	3440756	106.44		11238		435960	3779	2414306	454
Mkt Cap Of cos joined NSDL (Rs. Bn.)	734	2318	216	3351	45	6076	81	6548	7.77	908	2883	217	3966	38	7659	93
Mkt Cap of Cos listed at The Stock Exchange, Mumbai (Rs. Bn.)	4033.7	4671.1	15.8	4470.1	-4.3	8033.5	79.7	6911.62	-13.97	4639.2	5603.3	20.8	5453.6	-2.7	9128.4	67.4
Demat Mkt Cap as %age of total Mkt Cap	18.20	49.62	172.64	74.96	51.70	75.63	0.90	94.74	25.27	19.57	51.45	162.90	72.72	41.30	83.90	15.40
Panel B: CDSL																
COS. – Agreement signed								2203					27		786	2811
COS. – Available for Trading								2136					Nil		596	-
DPs -- live								204					6		61	916.7
DP locations								103					3		72	453.8
DP cities/towns								51					1		16	1500
Demat Qty (No. Crore)								110.56					23091		52.29	2264423
Demat Value (Rs. Crore)								10612.58							N.A.	
Settlement Quantity (No. Crore)								84.83					Nil		58.40	-
Settlement Value (Rs Crore)								10610.02					Nil		11205	-
Client accounts								56738					46		26762	58078

Source: NSDL and CDSL

2. Institutional Structure

There are quite a few institutions that are directly and/or indirectly connected with dematerialised operations of securities. Understanding the inter-linkages and functional responsibilities of these institutions will help us to have correct and holistic perspective about functioning of dematerialisation. The institutions connected with demat operations include; a) Depositories, b) Stock Exchanges (SEs), c) Clearing Corporations (CCs) / Clearing Houses (CHs), d) Depository Participants (DPs), e) Registrars and Transfer Agents (RTAs).

Both the depositories NSDL and CDSL are primarily promoted by the two leading stock exchanges viz., National Stock Exchange of India Ltd (NSE) and The Stock Exchange, Mumbai (BSE) respectively. Besides, there are many other institutional promoters in both the depositories. Both are registered as organisations-for-profit and professionally managed. Inter-connectivity between these two depositories has been established, thus DPs and investors can transfer smoothly their shares from one account to another between the depositories. Most of the stock exchanges are connected with the depositories to provide trading in dematerialization segment. Eventually, all the exchanges will be connected to either of or both the depositories. Resultantly, functioning of exchanges altered with the commencement of depositories; shorter trade cycles, negligible bad-deliveries, immediate transfer of beneficial ownership and lower transaction costs. An in-depth study on transaction cost for equity shares in India by Raju (2000) revealed substantial decrease in transaction costs and observed that the dematerialisation as one of the important factor for this trend. Functioning of clearing corporations / clearing houses materially changed after the entry of depositories; reduced manpower requirements and faster clearing operations. It also helped them to diversify into related businesses such as on-line stock lending. Depository participants are the new commercial intermediaries that sprang up. They interpose between investor and depository. It can be stated that they are the back-bone for the success of dematerialisation. RTAs facilitate dematerialisation and rematerialisation of shares.

3. Market Microstructure

Trading in dematerialised shares brought in many changes to the entire structure of the capital market functioning. With the introduction of demat, stock exchanges switched over (with a choice) from five day accounting period to T + 5 trading and settlement for demat stocks. Even for demat stocks dual settlement is in operation: fixed account period as well as rolling settlement. This partial change to T + 5 rolling settlement system is a major shift in the market. Thus dematerialisation smoothly paved the way for rolling settlement and India joined

other developed markets that are following T+ settlement system. In the physical segment there is a long gap between delivery and payment. This gap narrowed down, and it is almost on Delivery Versus Payment basis (DVP). This near real time DVP reduced market risks considerably. Clearing corporations / clearing houses and stock exchanges are able to smoothly coordinate and settle the trades effectively and timely. Clearing corporations / Clearing houses are electronically directly connected to depositories that make settlements faster and easier. Trading in dematerialised shares attracts lesser brokerage and custodial charges, as a result. Reduced transaction costs prompts investors to trade more frequently resulting in higher volumes. This also makes bid-ask-spreads narrower, which reduces implicit transaction costs.

4. Review of Literature

The usefulness of an event study comes from the fact that, given rationality in the market place, the effect of an event will be reflected immediately in asset prices. Thus the event's economic impact can be measured using asset prices observed over a relatively short time period. In the academic finance field, event study methodology has been applied to variety of firm specific and economy wide events. The event studies are also used in the field of law and economics by Schwert (1981) to measure the impact on the value of a firm of a change in the regulatory environment.

The first published event study is by Dolley (1933) which examined the price effects of stock splits, studying nominal price changes at the time of the split. Over the decades from the early 1930s until the late 1960s the level of sophistication of event studies increased. Mayer and Bakay (1948), Baker (1956, 1957, 1958) and Ashley (1962) are examples of studies during this time period. The improvements include removing general stock market price movements and separating out confounding events. In the late 1960s seminal studies by Ball and Brown(1968) and Fama, Fisher, Jensen, and Roll (1969) introduced the methodology that is essentially still in use today. Ball and Brown considered the information content of earnings, and Fama, Fisher, Jensen, and Roll studied the effects of stock splits after removing the effects of simultaneous dividend increases.

5. Methodology

The event of importance in the present study is the start-date of compulsory dematerialised trading in equity shares. Therefore, task of conducting an event study and identifying the period over which the event started having its impact on various variables are of interest to. In order to measure impact of the event (demat) on the behaviour of various identified variables (liquidity, returns and volatility), there is a need to consider equal lengths of time periods, as much as possible, before and after the event. Therefore, data on various variables before

and after the compulsory trading in dematerialised shares are obtained for various lengths. Trading and settlement in shares, for all classes of investors, is made compulsory starting from January 4, 1999 in select group of companies. Thereafter, gradually, more number of companies are added to the list of compulsory demat trading and settlement.

5.1 Data and Sample Characteristics

Demat was introduced in phased manner in India. For different classes (institutional and retail) of investors varying levels (compulsory and optional) of dematerialisation has been introduced at different points of time. Compulsory dematerialisation is one where all classes of investors (institutional as well as retail) need to trade and settle only in demat form with an exception that a small investor has been permitted to deliver in physical form who has 500 or fewer shares. Second category of dematerialisation is only for institutional investors who are required to trade only in demat form but not the small investors. Yet, another class where almost all the investors by their own volition trade in demat form. The study considered the first style of demat (compulsory) for the analysis because in this category all investors are required to trade and settle in the demat form while in other categories exceptions are granted to some classes of investors. If exceptions are granted, then certain classes of investors have options. These investors trade and settle in physical segment also. Trading and settling in physical form, however, distorts the full impact of demat. Owing to this reason, the study did not consider non-compulsory demat trading and settling segments. In order to measure the full impact of demat, it should be applicable to all classes of investors.

5.1.1 Demat Companies

Compulsory trading in the demat form for all classes of investors was introduced starting from January 4, 1999 in a phased manner. In each phase, a number of companies were added to compulsory demat category. In the first phase 12 companies on January 4, 1999, in the second phase 19 companies from February 15, in the third phase 33 more companies from April 5, and in the fourth phase 40 scrips were included with effect from May 31, 1999. Study considered first three phases only starting from January 4, 1999 till April 5, 1999. Further, it is intended to have minimum of six months of post-demat period which will give reasonable number of data points for statistical and econometric analysis. Selection of the companies for the study is made by using random sampling technique. Names of the companies selected for the study are listed in the Annexure A1.

5.1.2 Control Group of Companies

Another matching sample group of companies is considered for the study. Matching is, generally, done on the basis of relevant parameters. Parameters considered consist of size of company, market capitalisation, paid-up capital/number of shares outstanding, number of shares traded, sales and others. In this study, the most relevant parameter is number of shares outstanding. In order to measure liquidity, returns and volatility, control group of companies on the basis of paid-up capital of the companies is selected. Paid-up capital has direct bearing on the number of shares issued and traded. Thus, it rightly represents liquidity. Paid-up capital is also a size parameter so that it can be used to measure returns and volatilities. Similar econometric analysis is carried out on control group to examine the impact of a non-occurrence of the event on this group. Results of control group and study group are compared and analysed. Analysis throws up impact (in this case demat) or no-impact on sample companies. Control group of companies that are not subjected to the proposed change (in this case dematerialisation). Matching of companies has been done first on the basis of industry classification and then paid-up capital. Companies from demat group and non-demat group are matched on the basis of industry classification and paid-up capital in that order. In many instances, it was always not possible to get two companies having similar paid-up capital (one from demat and another from non-demat group). Then, nearest company in terms of paid-up capital which is closer to demat company, is considered. In some instances, there was no company having paid-up capital closer to demat company's paid-up capital, therefore, for these companies where there is no matching company available. Thus, fewer number of companies are considered in control group for the analysis. Inequality in both the groups in terms of number of companies will not pose any methodological problem since the study is not a cross-sectional comparison. The names of the companies of control group are also mentioned in the Annexure AI.

For the control group also, computation of liquidity, abnormal returns and volatility by using the same methodology as is explained below. Since control group is not exposed to dematerialisation, the companies are free from demat influence. *Ceterus paribus*, changes in liquidity, returns and volatility should be equal in both the sets. If changes in liquidity, returns and volatility are more in non-control group, than that is recorded in controlled group, then the difference can be attributed to the demat. The hypothesis is that demat has no impact on liquidity, returns and decrease volatility. Absence of positive growth in all the three parameters in controlled group and presence of growth in these parameters in the demat groups clearly indicates that demat does affirmatively influence liquidity, returns and volatility.

Event studies pose certain research methodological challenges as to whether the changes in the behaviour of variables studied are due to, entirely, the impact of the event or there are any other exogenous factors responsible for the change. One way of overcoming of this problem is to construct and observe the behaviour of control group.

5.2 Data and Period

For each company and index, daily closing prices are taken from the National Stock Exchange of India Ltd (NSE) before and after dematerialisation period till October 8, 1999. The study considered a six months pre- and post-demat period for the analysis. The benchmark index considered for the purpose of research analysis is the S&P CNX Nifty. It is quite logical to take S&P CNX Nifty as the reference benchmark since all other relevant data are considered from NSE. Number of shares traded for each company in pre- and post-demat period are also collected for the same length of the time.

Three groups of companies consisting of seven, ten and eleven are selected from the first, second and third groups where compulsory demat trading started from January 4, 1999, February 15, 1999 and April 5, 1999 respectively. Names of the companies are given in Annexure A1. The daily closing stock prices of these companies are collected from National Stock Exchange of India Ltd starting from July 1, 1998 to July 7, 1999 for group 1, from August 17, 1998 to August 10, 1999 for group 2 stocks and for Group 3 stocks the data is collected from October 5, 1998 to October 8, 1999. The benchmark index S&P CNX Nifty data are also collected for the respective corresponding periods. Besides, information on daily trading volumes in quantity and value terms and number of daily trades also obtained for the same periods for all the stocks.

5.3 Liquidity

The data on trading volumes in both value and quantity terms and number of trades are also analyzed to see the impact of dematerialisation. In order to observe whether there is any growth (lack of it) in the number of shares traded in the post-demat period compared to pre-demat period, growth rates are calculated over the pre-demat period. The growth in percentages is computed using the following formula:

$$G_j = (T_a / T_b) 100 - 100 \quad (1)$$

Where G_j denotes the growth in volumes of company j , T_a denotes total traded volumes during the post-event period and T_b denotes total traded volumes in the pre-event period.

Further, per trade volume in a five day period is computed as follows:

$$P_t = \frac{\text{Traded quantity during five days}}{\text{Number of trades during five days}} \quad (2)$$

where P_t denotes number of shares per trade.

In order to summarize the changes in per trade volumes, a five-day period is selected starting from the event day in the post-event analysis till the latest data available or six months, whichever is longer. At the same time, the pre-event data is also aggregated backwards starting from the day prior to the event till the end of sixth months. Similarly, a five-day growth in trading volumes and value is also computed using continuously compounded growth. By using the following formula:

$$G_t = \ln(TV_t/TV_{t-1}) \quad (3)$$

where G_t indicates five-day growth and
TV denotes either trading volumes or value.

The aggregation procedure is same as explained earlier for calculating growth in shares traded. Same procedure is used for control group also.

5.4 Returns

As mentioned elsewhere in the paper, *ceteris paribus*, returns from a company before and after demat should be the same, if demat has no influence on returns. If demat influences them (returns) then there should be abnormal returns. In the following paragraphs, explained methodology, adopted to measure returns, abnormal returns, significance of abnormal returns both for demat and control group of companies. These procedures are advocated by Campbell, Lo and Makinlay(1997) in their seminal work.

The following analysis is carried out to assess the impact of the event on abnormal returns. The abnormal return is the actual ex-post return of the security minus the expected normal return of the company over the period. The normal return is defined as the return that would have been expected if the event did not take place. For each company j and event date 't',

$$\varepsilon_{jt}^* = R_{jt} - E[R_{jt} | X_t] \quad (4)$$

where ε_{jt}^* , R_{jt} , and $E[R_{jt} | X_t]$ are the abnormal, actual and normal returns respectively for time period 't'. X_t is the conditioning information for the normal performance model. There are two common choices for modeling the normal return namely, the constant mean return model where X_t is a constant, and the market model

where X_t is the market return. The constant mean return model assumes that the mean return of a given security is constant through time. On the contrary, the market model assumes a stable linear relationship between the market return and the security return.

We used market model to estimate parameters of interest. The most common choice is to use the period prior to the event day for the estimation window. Here, the event data itself is not included in the estimation period to prevent it from influencing the performance of model parameter estimates.

The absolute values of closing stock prices and indices are converted into continuously compounded returns by using the following formula :

$$r_{jt} = \ln\left(\frac{S_{jt}}{S_{jt-1}}\right) \quad (5)$$

where r_{jt} and S_{jt} indicate logarithmic returns and stock price/stock index at time 't' respectively.

The time series market model for security j is estimated with the help of formula given below. The market model for security 'j' and observation 't' at event time is

$$r_{jt} = \alpha_j + \beta_j r_{mt} + \varepsilon_{jt} \quad (6)$$

where r_{jt} is logarithmic returns of security 'j', r_{mt} is logarithmic returns of S&P CNX Nifty index, ε_{jt} is residuals of security 'j' and α_j and β_j are intercept and slope parameters. The estimation window observations can be expressed as a regression system,

$$r_j = X_j \theta_j + \varepsilon_j \quad (7)$$

Where $r_j = [r_{jt+1} \ r_{jt+2} \ r_{jt+3} \ \dots \ r_{jt+L}]'$ is an $(L \times 1)$ vector estimation window returns of security 'j', $X_j = [1 \ r_m]$ is an $(L \times 2)$ matrix with a vector of ones in the first column and the vector of market return observations $r_m = [r_{mt+1} \ r_{mt+2} \ r_{mt+3} \ \dots \ r_{mt+L}]'$, and $\theta_j = [\alpha_j \ \beta_j]'$ is the (2×1) parameter vector. X_j has a subscript because the estimation window may have timing that is specific to firm 'j'. Under general conditions ordinary least squares (OLS) is a consistent estimation procedure for the market model parameters. After estimating parameters for the normal performance model, the abnormal returns can be calculated using equation 4.

The abnormal returns will be aggregated in order to draw overall inferences for the event of interest. The aggregation is along time dimension for a company, which can be called as cumulative abnormal returns (CAR). The aggregation of the abnormal returns starts from the event day onwards and ends either at the end of third month or six months as the case may be.

To carry out the testing for the significance of abnormal returns, constructed a test of H_0 for company j using the standardized cumulative abnormal return (SCAR),

$$SCAR = \frac{CAR_j}{s_j} \quad (8)$$

where σ_j is calculated using abnormal returns and CAR_j is cumulative abnormal returns.

$$\sigma_j^2 = (1/L-2) \varepsilon_j / \varepsilon_j \quad (9)$$

Under the null hypothesis the distribution of SCAR is Student t with $L-2$ degrees of freedom where L is the length of CAR. For a large estimation window greater than 30, the distribution of SCAR will be well approximated by the standardised normal distribution. The study has more than 30 observations in each of the equation.

In the present analysis, testing of the significance of abnormal returns is carried out in two stages. In stage one, six months post-demat data starting from the event day and in stage two, three months post-demat data starting from the event day is used.

5.5 Volatility

Volatility has become a topic of enormous importance to almost anyone who is involved in the financial markets even as a spectator. To many among the general public, the term is simply synonymous with risk. High volatility is to be deplored, because it means that security values are not dependable and the capital markets are not functioning as well as they should. While investor protection and solvency of financial institutions are paramount concerns underlying public regulation of securities markets, it is also evident that the regulatory framework is to a considerable extent based on the premise that unregulated securities markets are fragile and prone to inefficiencies and systemic crises.

The absolute values of closing stock prices are converted into continuously compounded returns. The returns data is analyzed to compute standard deviation for each month starting from the event day for both pre- and post-demat periods covering a maximum of six months period. Besides, cumulative standard deviation from the event day for pre- and post-period is also computed. In order to avoid the swings of extreme values three per cent of return observations are eliminated from both the sides of the data.

The formula used for computing standard deviation is:

$$s_j = \sqrt{\sum (r_{jt} - \bar{r}_j)^2 / n - 1} \quad (10)$$

Where r_{jt} is returns at the time 't', \bar{r}_j is the mean return and n is sample size. For the monthly analysis, t takes observations of all the trading days during the corresponding month period as a result the number of trading days might vary from one month to another month depending upon the number of trading days during the month. In the cumulative analysis, for three-month period, it takes observations starting from beginning of either post- or pre-event data to till the end of third month. The standard deviation, which is proxy for volatility, is computed for six months period on either side of the event day (Symmetry is observed).

6. Empirical Findings and Discussion

The results of the study are presented in different tables that follow end of the section. Statistics on growth in volumes, returns and volatility are not annualised .

6.1 Liquidity

Number of shares traded and number of trades executed on each day, for each settlement, and for the entire pre- and post-demat sample periods are computed and analysed. Table 2A provides information on the total number of shares traded before and after dematerialisation of shares for all the selected companies. Of the seven companies in the first group, five companies recorded substantial growth in the volumes traded ranging from 14 per cent to 141 per cent, in the post-demat period compared to pre-demat period. In case of only two companies, there was a decline in the number of shares traded, which ranged from 5 per cent to 50 per cent. Out of the seven companies, 71 per cent accounted for positive growth and the remaining 29 per cent for contraction - more than two-thirds showed increase in volumes traded.

From the second phase of demat companies, ten companies are selected for the study. Out of the ten companies seven companies exhibited increase in their trading volumes in the post-demat period compared to pre-demat period which ranged from 20 per cent to 879 per cent while in case of remaining three companies, traded volumes contracted compassing between 13 per cent to 68 per cent. Once again 70 per cent of the companies exhibited expansion in the volumes traded while only less than one-third of the sample companies down with volumes traded.

There were in all 11 companies from the third phase of demat companies. Of the total 11 companies, eight companies posted growth in shares traded on the other hand three companies recorded negative growth. The ambit of growth is from 15.6 per cent to 380 per cent and on the negative side it is nine to 71 per cent.

The pertinent information related to the growth in volumes of control group is presented in Table 2B. Seventy two percent of the companies selected had positive growth. This is much less than what is recorded for study group. Even the growth rates are relatively smaller. Clearly indicating that dematerialisation had positive impact in the volumes traded.

The study measured the impact of dematerialisation and compulsory trading in the dematerialised form on various selected parameters. Since it is confined to the impact of dematerialisation on liquidity, *ceterus paribus*, dematerialisation positively impacts liquidity.

Another scale to measure liquidity is the number of shares traded per trade before and after the dematerialisation. If the shares traded per trade are higher which means more and more investors are coming to the market with larger and larger orders. It also indicates the ease with which shares are bought and sold which is a sign of confidence of investors. Dematerialisation does away with the concept of market lot which benefits small investor to buy high value shares. Therefore, number of shares traded per trade before and after dematerialisation for each settlement also analysed. This analysis runs into large number of pages therefore, the tables are not included as part of the paper. The data clearly indicates that there is a considerable expansion in the number of shares traded per trade in almost all the cases. Control group did not have more number of shares traded per trade in the study period. This analysis brings out a few important points: a) liquidity and confidence levels of investors improved in the post-demat period, b) large number of trades took place with big deals, c) in the absence of market lot concept, small investors are able to buy high value stocks such as Infosys, Wipro, Hindustan Lever and others, d) since the concept of market lot is not there that this tantamount to stock split. Under some circumstances even it is better than stock split, for example, if company's market lot is 100 shares under demat the investor can buy even one share i.e. one-hundredth of original thus enhancing liquidity and enabling participation of small investor.

Table 2 A: Traded Volumes and Growth in Volumes

	Company	Before Demat	After Demat	Growth (%)
Group I	BPCL	9,485,376	15,004,663	58.19
	BSES	27,072,298	31,485,668	16.30
	ICICI	110,821,672	104,796,770	-5.44
	Infosys	10,024,645	11,472,686	14.44
	L&T	127,861,708	309,102,915	141.75
	SBI	594,846,911	852,337,364	43.29
	Wipro	1,177,098	577,700	-50.92
Group II	ACC	29,493,150	207,307,608	602.90
	Asian Paints	1,318,937	1,786,339	35.44
	Bajaj Auto	14,560,136	17,857,782	22.65
	Dr Reddy Labs	44,988,941	14,344,615	-68.12
	Guj Ambuja Cement	16,972,770	14,680,562	-13.51
	Hero Honda	2,843,616	1,510,112	-46.89
	M&M	9,017,424	19,575,021	117.08
	Ranbaxy	18,841,403	184,557,739	879.53
	Thermax	3,858,922	4,899,165	26.96
	TVS Suzuki	1,325,785	1,594,800	20.29
	Group III	BHEL	63175602	73017593
CIPLA		1413600	1807044	27.83
HLL		18843848	7866622	-58.25
HDFC		17463099	17729790	1.53
Indian Hotels		1862259	2214311	18.90
Zee		192527397	56631110	-70.59
Tisco		348245234	455318821	30.75
Telco		461046780	332902133	-27.79
RPL		54700329	262501377	379.89
RIL		1023533524	1259719989	23.08
MTNL		174015003	248834563	43.00

Table 2 B: Traded Volumes and Growth in Volumes (Control Group)

	Company	Before Demat	After Demat	Growth (%)
Group I	Bank of Baroda	33795200	33077124	-2.12
	DSQ Software	40420000	92462400	128.75
	Rolta	113417500	425477200	275.14
Group II	Nicholas Piramal	484000	1751650	261.91
	LML	64675500	32759200	-49.35
	Berger Paints	1835100	1419400	-22.65
	Alfa Laval	381850	1067450	179.55
Group III	Torrent Pharma	942400	4769000	406.05
	Hotel Leelaventure	2350500	8347150	255.14
	Crest Comm	8285400	13971700	68.63
	Ashok Leyland	30130550	47648100	58.14

6.2 Abnormal Returns

It is well recorded in the literature of financial economics that earning abnormal returns consistently is impossible. There could be some occasions; short periods, during which one can obtain abnormal positive or negative returns. The occasions include macro or micro-economic as well as non-economic shocks. Dematerialisation of shares is one such a micro-economic event. In the present research study makes an attempt to study the possibility of investors earning abnormal returns. Demat stocks are better quality products compared to non-demat stocks of the same company for the reasons mentioned elsewhere. Therefore, there will be a greater demand for these stocks. Higher demand naturally pushes up share prices resulting in higher positive returns. This is what exactly the study has tried to measure and find out whether there is any positive impact of dematerialisation on returns if so what is the extent of it. Abnormal returns are measured for the first three months and six months in the case of group I, group II and for group III shares. Since these are expressed in terms of percentages there will not be any problem in interpretation.

Table 3A provides details of abnormal returns and significance of these abnormal returns. Six months after the demat period in the first group, 86 per cent of the companies provided abnormal returns which are statistically significant at one per cent level in all the cases excepting one case, i.e., BPCL. The maximum cumulative abnormal returns is 59.51 per cent in the first three months for Wipro and lowest CAR is 5.55 per cent during the six month period for BPCL. BSES showed abnormal negative returns to the extent of 12.6 per cent in the first three month period and 25.92 per cent in six month period. However, in the shorter period of three months, 57 per cent of the companies provided abnormal returns and the remaining 43 per cent abnormal negative returns. ICICI has showed a negative CAR of 10 per cent in the first three months but it accelerated in the remaining period to register a whopping positive 58.07 per cent. Of the ten companies of group II, 80 per cent of the companies returned statistically significant abnormal returns at one per cent level for the longer period of the study i.e. six months and the remaining small 20 per cent of them posted abnormal negative returns. The highest CAR is recorded by ACC with 52.37 per cent during the six month period and lowest is achieved by Dr Reddy Labs with 6.01 per cent in the six month period. On the negative side of CAR, Guj Ambuja Cements accounted for the highest at 27.13 per cent and Bajaj Auto least CAR at 8.91 per cent. The scene is evenly balanced for three-month period analysis.

Companies belonging to group III indicated very strong and high percentage of abnormal returns. The highest positive CAR recorded by Zee Telefilms with 105.89 per cent in 6 months period and least positive returns are by Telco at 11.84 per cent. The only negative returns are showed by HLL at 30.42 per cent. One may be able to say that the initial period was an observation and learning period for the investors. Having seen the success of dematerialisation, they might have started giving more and more credence to the change. More than

99.9 per cent of companies for the six month period and about 82 per cent of the companies for the three-month period posted abnormal positive returns in the third group of sample stocks.

Analysis of control group clearly indicates that forty six percent of the companies showed negative returns, which are statistically significant. This is quite contrary to the study group. In the study group most of the companies posted statistically significant positive returns. Once again, the results strongly support the hypothesis that dematerialisation has short term positive impact on returns.

Table 3 A: Abnormal Returns and Significance levels

Company		Out of Sample 6 Month		Out of Sample 3 Month	
		CAR(in %)	SCAR	CAR(in %)	SCAR
Group I	BPCL	5.55	1.4202\$	-23.19	-5.9105
	BSES	-25.92	-10.4513	-12.60	-5.3352
	Wipro	54.43	14.9760	59.51	14.1369
	SBI	21.51	7.8969	8.79	3.0404
	L&T	43.33	18.4482	18.98	9.1258
	Infosys	27.63	9.0922	32.99	8.6896
	ICICI	58.07	17.2274	-10.00	-3.7343
	Group II	ACC	52.37	17.4632	44.93
	Asian Paints	32.40	12.7078	-0.07	-0.0270
	Bajaj Auto	-8.91	-3.5914	4.22	1.4682\$
	Dr Reddy Labs	6.01	2.2584£	13.55	4.8974
	Hero Honda	17.16	7.0791	11.65	5.3187
	Guj Ambuja Cement	-27.13	-10.2969	-22.58	-7.7557
	TVS Suzuki	13.33	5.1922	-21.14	-8.7362
	Thermax	14.05	4.5517	-33.41	-11.5184
	M&M	17.27	4.9744	-5.13	-1.4245\$
	Ranbaxy	45.58	14.8306	38.51	11.0827
Group III	BHEL	24.48	8.2013	11.31	3.6679
	Cipla	56.91	18.1286	-19.98	-7.4103
	HLL	-30.42	-18.5777	-10.84	-6.0953
	HDFC Bank	17.47	6.5413	1.12	0.4501\$
	Zee	105.89	13.7079	13.56	16.1397
	Tisco	19.39	6.4226	34.44	10.7545
	Telco	11.84	4.0617	10.85	4.1058
	RPL	89.33	30.1709	32.79	32.4289
	RIL	31.91	14.4837	23.03	9.7876
	MTNL	17.21	6.4037	15.60	5.1002
	Indian Hotels	55.05	19.6248	18.41	6.4945

*Note: \$ indicates not significant; £ indicates significant at 5% level
No mark against the numbers of SCAR variable indicates significant at 1% level*

Table 3 B: Abnormal Returns and Significance levels (Control Group)

Company		Out of Sample 6 Month		Out of Sample 3 Month	
		CAR(in %)	SCAR	CAR(in %)	SCAR
Group I	BoB	38.89	12.36	-13.42	-4.63
	DSQ	-134.73	-26.13	-45.84	-9.47
	Rolta	-64.02	-16.12	37.37	8.90
Group II	Nicholas Piramal	-16.95	-6.51	-19.18	-5.93
	LML	-57.63	-22.82	-41.71	-16.25
	Berger Paint	74.84	25.89	46.95	12.66
	Alfa Laval	-22.13	-5.82	-34.31	-7.66
Group III	Torrent Pharma	135.05	31.12	-41.81	-13.24
	Hotel Leela	38.97	11.01	39.87	10.57
	Crest Comm	34.96	7.50	-72.70	-17.48
	Ashok Leyland	17.58	4.04	32.13	7.93

Note: No mark against the numbers of SCAR variable indicates significant at 1% level

6.3 Volatility

Volatility for each company is calculated by using two methods: one is on during the period and another is on cumulative basis. During the period as well as cumulative volatility is calculated for pre- and post-demat periods. Volatility calculated for during the period is for the period of corresponding month only for pre- and post- demat event (standard deviation) without any overlap. Under cumulative method, volatility is calculated starting from pre-demat (backwards) and post-demat event date till the end of the corresponding month. These are explained elaborately in the methodology. Further, it is calculated standard deviations for the benchmark index i.e. S&P CNX Nifty for comparing with the volatility of each company for the corresponding period. Overall the volatility is more in the post-demat period which is reflected in most of the company cases also. Tables 4A-4F give details of volatility movements for each company.

Table 4A: Volatility Analysis of Returns of Group I

Company	Period	During the Period		Cumulative	
		Pre-demat(%)	Post-demat(%)	Pre-demat(%)	Post-demat(%)
BPCL	One-month	2.07	2.82	2.07	2.82
	Two-month	3.45	4.25	2.78	3.51
	Three-month	2.87	4.53	2.87	3.87
	Four-month	3.14	4.43	2.93	4.00
	Five-month	1.94	4.58	2.74	4.21
	Six-month	3.13	3.39	2.79	4.07
BSES	One-month	2.44	2.67	2.44	2.67
	Two-month	1.93	3.01	2.21	2.80
	Three-month	1.85	1.62	2.09	2.46
	Four-month	2.16	4.33	2.09	3.00
	Five-month	1.68	3.56	2.01	3.11
	Six-month	1.48	2.01	1.92	2.92
ICICI	One-month	2.25	3.31	2.25	3.31
	Two-month	2.23	2.53	2.30	2.93
	Three-month	2.38	3.54	2.33	3.16
	Four-month	4.55	4.22	2.93	3.42
	Five-month	3.44	5.29	3.02	3.91
	Six-month	2.46	3.64	2.94	3.85
Infosys	One-month	2.52	4.01	2.52	4.01
	Two-month	2.17	4.11	2.37	4.01
	Three-month	2.02	3.54	2.25	3.94
	Four-month	2.23	3.29	2.25	3.78
	Five-month	0.93	2.42	2.04	3.51
	Six-month	1.81	2.25	2.02	3.30
L&T	One-month	3.10	3.96	3.10	3.96
	Two-month	2.75	2.91	2.90	3.44
	Three-month	2.34	3.19	2.74	3.33
	Four-month	2.84	4.14	2.77	3.51
	Five-month	1.69	3.97	2.59	3.59
	Six-month	2.47	2.89	2.59	3.47
SBI	One-month	3.01	3.04	3.01	3.04
	Two-month	2.27	2.90	2.66	2.95
	Three-month	2.46	4.62	2.58	3.55
	Four-month	2.49	4.17	2.55	3.69
	Five-month	2.03	4.58	2.44	3.88
	Six-month	2.10	3.12	2.39	3.75
Wipro	One-month	2.47	4.68	2.47	4.68
	Two-month	2.85	3.52	2.64	4.31
	Three-month	2.59	4.04	2.62	4.29
	Four-month	2.30	5.24	2.54	4.53
	Five-month	1.19	2.38	2.34	4.22
	Six-month	1.71	1.74	2.26	3.92
Nifty	One-month	1.88	2.09	1.88	2.09
	Two-month	1.35	1.82	1.67	1.94
	Three-month	1.39	1.34	1.59	1.78
	Four-month	1.85	2.25	1.64	1.91
	Five-month	1.18	2.02	1.55	1.94
	Six-month	1.40	1.49	1.53	1.86

Table 4B: Volatility Analysis of Returns of Control Group I

Company	Period	During the Period		Cumulative	
		Pre-demat(%)	Post-demat(%)	Pre-demat(%)	Post-demat(%)
Bank of Baroda	One-month	2.63	3.51	2.63	3.51
	Two-month	2.66	2.75	2.63	3.15
	Three-month	4.22	4.19	3.22	3.51
	Four-month	2.68	3.84	3.07	3.57
	Five-month	2.59	4.84	2.98	3.89
	Six-month	3.71	4.27	3.14	3.97
DSQ Software	One-month	4.27	4.20	4.27	4.20
	Two-month	3.31	4.51	4.08	4.34
	Three-month	5.07	5.93	4.38	5.09
	Four-month	4.69	7.02	4.44	5.62
	Five-month	4.80	5.56	4.50	5.58
	Six-month	5.86	5.85	4.74	5.62
Rolta	One-month	3.13	5.14	3.13	5.14
	Two-month	2.90	5.99	3.08	5.50
	Three-month	4.47	4.52	3.55	5.14
	Four-month	3.41	6.09	3.50	5.52
	Five-month	5.14	3.90	3.96	5.22
	Six-month	5.77	4.27	4.30	5.05

Table 4C: Volatility Analysis of Returns of Group II

Company	Period	During the Period		Cumulative	
		Pre-demat(%)	Post-demat(%)	Pre-demat(%)	Post-demat(%)
ACC	One-month	2.47	2.63	2.47	2.63
	Two-month	2.47	3.68	2.49	3.17
	Three-month	3.02	3.78	2.64	3.51
	Four-month	2.00	3.55	2.47	3.56
	Five-month	3.27	3.16	2.65	3.46
	Six-month	3.56	3.98	2.79	3.54
Asian Paints	One-month	1.46	1.98	1.46	1.98
	Two-month	0.97	2.25	1.23	2.10
	Three-month	1.02	2.76	1.16	2.44
	Four-month	0.64	2.92	1.03	2.57
	Five-month	1.81	3.42	1.23	2.76
	Six-month	2.26	1.31	1.47	2.61
Bajaj Auto	One-month	1.78	2.54	1.78	2.54
	Two-month	2.58	3.37	2.24	2.95
	Three-month	1.57	3.90	2.03	3.26
	Four-month	1.45	2.22	1.87	3.01
	Five-month	2.19	1.69	1.94	2.79
	Six-month	2.40	1.87	2.00	2.68

Dr Reddy Labs	One-month	3.18	3.55	3.18	3.55
	Two-month	3.15	3.56	3.24	3.57
	Three-month	1.80	3.47	2.86	3.59
	Four-month	1.59	2.92	2.57	3.42
	Five-month	3.35	2.12	2.74	3.19
	Six-month	3.97	3.02	2.94	3.16
Guj Ambuja	One-month	2.83	2.87	2.83	2.87
Cements Ltd	Two-month	2.68	3.41	2.75	3.14
	Three-month	1.66	3.28	2.44	3.16
	Four-month	2.63	2.15	2.48	2.91
	Five-month	2.62	2.77	2.49	2.87
	Six-month	3.09	2.10	2.58	2.77
Hero Honda	One-month	2.15	2.38	2.15	2.38
	Two-month	2.59	2.08	2.34	2.22
	Three-month	1.80	2.98	2.18	2.47
	Four-month	0.96	2.58	1.91	2.50
	Five-month	2.06	2.14	1.94	2.42
	Six-month	2.40	3.67	2.02	2.63
M & M	One-month	3.09	3.55	3.09	3.55
	Two-month	3.83	2.86	3.47	3.32
	Three-month	2.92	4.02	3.28	3.60
	Four-month	2.27	3.64	3.02	3.59
	Five-month	3.27	3.30	3.06	3.53
	Six-month	2.01	4.10	2.92	3.61
Ranbaxy	One-month	2.28	3.89	2.28	3.89
	Two-month	1.58	4.16	1.95	4.06
	Three-month	3.25	4.39	2.42	4.18
	Four-month	2.90	3.02	2.55	3.97
	Five-month	3.04	2.69	2.64	3.74
	Six-month	3.17	3.43	2.73	3.69
Thermax	One-month	2.86	3.72	2.86	3.72
	Two-month	3.10	3.33	3.00	3.50
	Three-month	3.12	3.30	3.04	3.49
	Four-month	1.36	3.12	2.66	3.38
	Five-month	3.08	3.45	2.77	3.46
	Six-month	3.80	3.52	2.92	3.46
TVS Suzuki	One-month	2.07	2.75	2.07	2.75
	Two-month	1.96	2.20	1.99	2.46
	Three-month	1.93	2.85	1.96	2.59
	Four-month	1.04	1.29	1.77	2.31
	Five-month	1.25	2.10	1.67	2.29
	Six-month	2.25	3.85	1.76	2.58
Nifty	One-month	1.61	1.67	1.61	1.67
	Two-month	1.76	1.74	1.70	1.74
	Three-month	1.31	1.64	1.56	1.77
	Four-month	1.11	1.95	1.44	1.82
	Five-month	1.77	1.20	1.52	1.70
	Six-month	1.60	1.46	1.54	1.67

Table 4D: Volatility Analysis of Returns of Control Group II

Company	Period	During the Period		Cumulative	
		Pre-demat(%)	Post-demat(%)	Pre-demat(%)	Post-demat(%)
Nicholas Piramal	One-month	2.51	3.65	2.51	3.65
	Two-month	2.30	4.10	2.44	3.86%
	Three-month	1.16	4.34	2.09	4.00
	Four-month	2.27	1.99	2.13	3.59
	Five-month	2.33	1.92	2.16	3.31
	Six-month	2.47	2.57	2.20	3.20
LML	One-month	4.55	3.09	4.55	3.09
	Two-month	2.98	3.57	3.89	3.30
	Three-month	2.83	4.55	3.55	3.82
	Four-month	3.75	3.62	3.59	3.75
	Five-month	3.80	2.97	3.63	3.64
	Six-month	2.52	3.23	3.48	3.57
Berger Paints	One-month	3.51	3.56	3.51	3.56
	Two-month	3.31	4.41	3.52	3.99
	Three-month	2.21	3.43	3.15	3.78
	Four-month	4.16	2.20	3.41	3.45
	Five-month	2.99	1.53	3.34	3.14
	Six-month	2.24	1.63	3.19	2.96
Alfa Laval	One-month	4.03	3.75	4.03	3.75
	Two-month	2.65	5.22	3.45	4.53
	Three-month	2.25	4.86	3.11	4.61
	Four-month	3.00	2.62	3.10	4.19
	Five-month	2.95	3.62	3.07	4.09
	Six-month	2.13	3.34	2.95	3.97

Table 4E: Volatility Analysis of Returns of Group III

Company	Period	During the Period		Cumulative	
		Pre-Demat(%)	Post-Demat(%)	Pre-demat(%)	Post-Demat(%)
BHEL	One-month	3.40	4.60	3.40	4.60
	Two-month	2.65	3.92	2.99	4.26
	Three-month	2.18	2.80	2.76	3.83
	Four-month	3.65	4.04	2.98	3.86
	Five-month	2.72	3.58	2.91	3.80
	Six-month	2.71	3.81	2.87	3.79
Cipla	One-month	1.30	3.54	1.30	3.54
	Two-month	1.48	2.15	1.41	2.82
	Three-month	2.07	1.59	1.64	2.48
	Four-month	3.19	3.67	2.09	2.91
	Five-month	2.76	2.90	2.28	2.90
	Six-month	3.36	4.16	2.47	3.18

HDFC Bank	One-month	2.90	3.17	2.90	3.17
	Two-month	2.64	4.00	2.77	3.61
	Three-month	2.09	2.02	2.57	3.18
	Four-month	4.17	2.52	2.99	3.00
	Five-month	2.70	2.91	2.93	2.97
	Six-month	4.05	4.09	3.14	3.18
HLL	One-month	1.64	1.74	1.64	1.74
	Two-month	0.66	2.13	1.26	1.99
	Three-month	1.71	1.71	1.41	1.89
	Four-month	2.40	1.52	1.69	1.80
	Five-month	1.92	1.23	1.74	1.71
	Six-month	1.13	1.82	1.65	1.73
Indian Hotels	One-month	1.28	2.48	1.28	2.48
	Two-month	1.60	3.27	1.44	2.89
	Three-month	1.56	2.37	1.48	2.72
	Four-month	2.12	2.86	1.63	2.75
	Five-month	1.84	3.87	1.67	3.01
	Six-month	2.08	2.47	1.74	2.94
MTNL	One-month	2.33	3.87	2.33	3.87
	Two-month	1.96	4.46	2.13	4.24
	Three-month	2.32	3.61	2.19	4.03
	Four-month	2.94	4.39	2.37	4.10
	Five-month	2.58	2.39	2.40	3.81
	Six-month	3.00	2.60	2.50	3.61
RIL	One-month	2.78	3.78	2.78	3.78
	Two-month	2.31	4.03	2.51	3.88
	Three-month	2.07	2.98	2.37	3.60
	Four-month	3.01	2.20	2.51	3.29
	Five-month	2.72	2.32	2.56	3.11
	Six-month	2.24	3.06	2.53	3.10
RPL	One-month	2.95	2.57	2.95	2.57
	Two-month	1.03	2.84	2.14	2.70
	Three-month	2.28	4.23	2.19	3.24
	Four-month	2.13	1.99	2.16	2.95
	Five-month	2.09	4.18	2.14	3.22
	Six-month	1.45	3.54	2.04	3.27
Telco	One-month	3.94	4.48	3.94	4.48
	Two-month	3.32	4.26	3.59	4.35
	Three-month	3.31	3.68	3.51	4.11
	Four-month	4.69	4.57	3.79	4.21
	Five-month	3.30	4.29	3.69	4.21
	Six-month	3.39	2.79	3.65	3.99
Tisco	One-month	2.47	4.40	2.47	4.40
	Two-month	2.51	4.28	2.50	4.32
	Three-month	3.40	3.84	2.89	4.15
	Four-month	2.94	3.45	2.90	4.02
	Five-month	2.39	3.79	2.80	3.96
	Six-month	2.02	2.96	2.71	3.80

Zee	One-month	2.36	5.16	2.36	5.16
	Two-month	1.84	3.34	2.23	4.30
	Three-month	3.31	2.58	2.60	3.86
	Four-month	3.06	3.41	2.69	3.74
	Five-month	3.49	3.79	2.91	3.74
	Six-month	3.29	4.12	2.96	3.82
Nifty	One-month	1.66	2.08	1.66	2.08
	Two-month	1.49	1.96	1.57	2.01
	Three-month	1.80	1.57	1.63	1.86
	Four-month	1.43	1.35	1.57	1.73
	Five-month	1.18	1.31	1.50	1.65
	Six-month	1.85	1.66	1.55	1.64

Table 4F: Volatility Analysis of Returns of Control Group III

Company	Period	During the Period		Cumulative	
		Pre-Demat(%)	Post-Demat(%)	Pre-demat(%)	Post-Demat(%)
Torrent Pharma	One-month	4.43	4.63	4.43	4.63
	Two-month	4.73	4.32	4.53	4.52
	Three-month	3.84	1.71	4.31	3.81
	Four-month	3.24	3.92	4.04	4.04
	Five-month	1.59	5.72	3.71	3.71
	Six-month	2.75	4.27	3.57	3.57
Hotel Leela	One-month	3.18	3.92	3.18	3.92
	Two-month	2.94	4.09	3.03	4.01
	Three-month	3.55	4.59	3.17	4.22
	Four-month	1.65	4.97	2.86	4.42
	Five-month	3.04	4.02	2.88	4.34
	Six-month	3.70	2.53	3.01	4.08
Crest Comm	One-month	5.69	4.98	5.69	4.98
	Two-month	4.79	4.77	5.47	4.94
	Three-month	5.50	3.13	5.46	4.42
	Four-month	3.41	5.07	5.01	4.71
	Five-month	4.20	4.30	4.85	4.98
	Six-month	5.95	5.28	5.06	5.02
Ashok Leyland	One-month	3.95	5.00	3.95	5.00
	Two-month	5.09	4.73	4.47	5.44
	Three-month	4.79	3.90	4.55	4.95
	Four-month	4.21	4.97	4.52	4.94
	Five-month	5.53	4.10	4.67	4.78
	Six-month	4.24	5.55	4.61	4.92

7. Implications of the Study

Dematerialisation of shares was a major change in the Indian securities markets and it has wide ramifications on various sectors of the capital markets. In order to rightly understand and appreciate the implications, there is a need to make a scientific study of the impact that dematerialisation generated on the market microstructure of Indian stock exchanges.

- To classify a stock market either as a matured market or emerging market one of the important parameters is liquidity. Higher liquidity provides opportunity for easy entry and exit options to the investors. Dematerialisation definitely increased volumes traded thus providing higher liquidity. At the same time, control group recorded negative growth or lesser growth in the number of shares traded, definitely suggesting the positive impact of dematerialisation on liquidity.
- More number of shares traded per trade is yet another sign to indicate better liquidity. More and more institutional players appear to be participating in a bigger way in post-demat period in the market indicating increased level of confidence in the Indian stock market.
- Ultimate test of any stock market is the returns to the investor. Generally, always though not possible, investors expect to earn abnormal returns on their investments. Dematerialised shares by and large provided in most cases abnormal returns in short-run. Not only did they earn abnormal returns but also they are statistically significant. The abnormal returns taper off over a period. This abnormal returns are a phenomenon of a short term in nature due to any event in the capital markets. Non-demat (control group) companies, in fact, mostly posted negative returns in the study period.
- Volatility and returns go hand-in-hand. Higher volatility sometimes brings higher positive returns. In the study period, volatility as a whole (index) slightly increased and concurrently the companies studied also had higher volatility.
- On the whole, dematerialisation played a very positive role in further modernisation of Indian capital market by providing higher liquidity, higher returns and lower volatility.
- The findings are based on the assumptions of CAPM in a given market, therefore, the findings have same criticism as for the underlying model.

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Annexure AI

Names of the Companies

Group I

- Bharat Petroleum Corporation Limited(BPCL)
- BSES Limited (BSES)
- Wipro Limited
- State Bank of India(SBI)
- Larsen &Toubro(L&T)
- Infosys Limited
- Industrial Credit and Investment Corporation of India(ICICI)

Group II

- Associate Cement Company(ACC)
- Asian Paints
- Bajaj Auto
- Dr Reddy Laboratories Limited
- Hero Honda Motors Limited
- Gujarat Ambuja Cements Limited
- TVS Suzuki
- Thermax
- Mahindra & Mahindra Limited(M&M)
- Ranabaxy

Group III

- Baharat Heavy Electricals Limited(BHEL)
- Cipla Limited
- Hindustan Lever Limited (HLL)
- HDFCBank
- Zee Telefilms Limited(Zee)
- Tata Iron and Steel Company Limited (TISCO)
- Tata Engineering and Locomotive Company Limited(TELCO)
- Reliance Petroleum Limited(RPL)
- Reliance Industries Limited(RIL)
- Mahanagar Telephone Nigam Limited (MTNL)
- Indian Hotels Company Limited

Control Group

- Bank of Baroda(BoB)
- Prism Cement
- Torrent Pharmaceutical
- DSQ Software
- Rolta India Ltd
- Nicholas Piramal
- LML
- Hotel Leelaventure
- Crest Communications
- Berger Paints
- Ashok Leyland
- Alfa Laval