

Competition, Liquidity and Volatility - A Comparative Study of Bombay Stock Exchange and National Stock Exchange

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Abstract

India currently has two major stock exchanges: The Bombay Stock Exchange and the National Stock Exchange. There are important differences in ownership structure, geographic reach, internal control systems and institutionalised risk management facilities between the Bombay Stock Exchange and the National Stock Exchange. The purpose of this study is to examine if these significant structural differences between these stock exchanges contribute to variations in observed measures of quality of markets. We use a paired comparison approach and document significant differences in liquidity and price volatility between the two markets.

1.0 Introduction

Provision of liquidity is the major function of a stock exchange. Extant research has focused on various measures of liquidity in order to quantify the quality of liquidity services. More recently, research attention has focused on comparing the relative efficacy of various trading systems and stock exchanges¹. The major intent of such studies is to highlight the differences in the quality markets and to determine the basis for the observed variation.

While there has been plethora of studies concerning the quality of stock exchanges of developed countries, there has been negligible research attention devoted to the comparative study of stock markets in emerging countries. Such research serves two useful purposes. First, they help to identify potential efficiencies of the different markets and facilitates additional investments in them. Second, it helps discretionary investors to choose the market with the lowest transaction costs. Technology has also played an important role in how the markets are structured and how the stock markets can compete between themselves. This paper concerns itself with recent developments in Indian stock markets, where there are two major stock exchanges competing between themselves. We try to provide empirical evidence on measures of quality of these stock exchanges.

There have been important structural changes in the Indian financial sector. One of them is the stock market reforms. Bombay stock exchange (BSE) used to be the premier exchange in India until 1994. The National stock exchange (NSE) began its operations in 1994 and has dramatically transformed the Indian stock markets. From the inception NSE started stealing a march over BSE both in terms of trading performance and in establishing itself as the foremost stock exchange in the country.

¹ See for instance the work of Huang and Stoll (1996).

They pioneered a completely transparent computerised trading network, which covers the entire country.

NSE has within a short period of time, won popular acclaim. However, it is an empirical issue to determine if in fact, NSE provides a better quality market compared to BSE. The primary aim of this paper is to provide a methodology and empirical evidence regarding this important issue.

The paper is organized as follows. The next section provides an overview of the stock market reforms in India, which served as a precursor to the establishment of NSE. In section 3, we provide a brief comparison of BSE and NSE. Section 4, describes the data and methodology used in the study. The empirical findings are outlined in section 5. In the final section, we offer our conclusion and discuss the implications of our research results.

2.0 Stock market reforms in India

Despite a seemingly high savings rate, India, faced a severe shortage of investible resources. By early 1990's it was recognized that it is crucial to raise funds from abroad to fill the gap. Financial sector reforms were needed to remedy the structural weaknesses and inefficiencies in the stock markets, primary markets, banking and insurance sectors. Reforms were required in order to boost investor confidence and broaden the investor base. The Indian corporate sector demanded these reforms in order to reduce the cost of capital and to enhance its competitiveness. The government seriously deliberated about these reforms in order to facilitate participation by foreign institutions and corporates.

Prior to the creation of the National Stock Exchange (NSE), India ranked last among 12 emerging markets on settlement, safekeeping and operational risk. Poor liquidity and high bid-ask spreads were common. The system was vulnerable to

defaults. The following major problems were frequently cited: outdated trading and settlement mechanisms, lack of transparency in transactions, delays in physical delivery and registration of transfer, poor disclosure, price manipulation, insider trading, lack of liquidity and “excessive speculation”.

The Government of India appointed the Narasimhan Committee to study the implementation of possible measures to strengthen India’s financial sector. Among the major measures recommended by the Committee were: free pricing of initial public offers, and provision of access to Indian firms to tap global capital markets through global depository receipts, and foreign currency convertible bonds. The other steps advocated by the Narasimhan committee are: empowerment of the regulator – Securities Exchange Board of India (SEBI); access of foreign institutional investors (FIIs) and non-resident Indians to Indian capital and stock markets.

The Pherwani Committee which was appointed to specifically look at stock exchange reforms proposed the following actions: setting up of a National Stock Market System (NSMS); uniform settlement across exchanges; shortening of the settlement cycle; electronic transfer of funds and scripless trading; and the establishment of a central depository trust. It must be noted that the NSMS envisages an electronic linkage of principal national and regional exchanges.

The Bombay Stock Exchange (BSE), which was the premier stock exchange at that point in time was not enthusiastic to these proposals. As a result the NSMS did not take off. The main reason is that “BSE is a brokers’ club”. They knew that NSMS could not take off without their support. BSE continued to exploit its preeminent position in the Indian stock markets. As might be expected, BSE also took little steps to put its own house in order. BSE brokers opposed regulator’s strictures tooth and

nail – they resorted to lawsuits and strikes. Another development at this juncture was the mushrooming of illegal stock exchanges all over the country.

Stock exchange reforms were seen as an essential component of the reform process to attract foreign investment. The government was increasingly frustrated with BSE's recalcitrant attitude. The Development Financial Institutions were asked to set up a modern electronic stock exchange drawing upon the recommendations of the Pherwani Committee. The National Stock Exchange was set up in response to the request from the government of India to make the Indian stock markets more efficient and transparent.

The National Stock Exchange started trading in November 1994. NSE introduced for the first time, a national network of computerized trading, a clearinghouse, and special facilities for institutional investors and fully automated screen based trading. NSE is a completely order driven market, while BSE at that point used a system of market makers. BSE and other regional stock exchanges used floor-trading systems at that time. NSE also shortened the settlement cycle in its trading.

NSE has transformed the Indian stock markets in several ways. First, it has brought about increased transparency to the Indian stock market. Second, it has built up a more efficient settlement and delivery system. Third, it has improved risk management systems by the institution of collateralization based on the risk of a trader's position. NSE has carried out these reforms through a combination of new technology, new processes and enforcement of new regulations.

NSE has largely succeeded in implementing many of the reforms suggested by the Pherwani Committee. It must be noted that BSE had failed to implement them initially. One of the reasons behind the success of NSE is that it has a completely different organizational structure compared to BSE. In NSE membership on the

exchange is separated from the ownership. A Board of Directors appointed by the promoters consisting of a group of Development Financial Institutions, Public Sector Banks and other Financial Institutions manages the exchange. In BSE ownership and membership of the exchange are not separated. BSE is essentially a brokers' club.

The benefits from NSE initiated reforms permeated to all stock exchanges in India. First, it brought about increased competition. For the first time, BSE really felt the heat of a serious competition and was forced to shed many of its investor-unfriendly customs. A second fall-out is the increase in overall trading volumes. Trading volumes increased due to two reasons. Some investors shifted their trading from illegal to recognized stock exchanges. Trading also increased as investors experienced a user-friendlier environment with regard to settlement and delivery systems. A third outcome was the lower transaction costs – bid-ask spreads – paid by investors.

The entry of NSE brought about major repercussions to most participants in India's stock markets. The price of a seat on BSE fell from about Rs. 40 million to Rs. 10 million. Bombay Stock Exchange launched screen based trading system called BOLT - Bombay On-line Trading System - in response to NSE's online trading system. Other Regional Exchanges also followed suit in establishing their own online trading systems. In terms of regulation, NSE leads while others follow suit rather reluctantly. In SEBI's books, NSE is a good boy whose example others are urged to follow.

3.0 A comparison of BSE and NSE

3.1 The Stock Exchange, Mumbai (BSE)

Started as the "The Native Share and Stockbrokers Association" in 1875, BSE is the oldest stock exchange in India. In fact it is the oldest exchange in Asia, beating

even Tokyo Stock Exchange (which was founded in 1878) to the honor. For many years, BSE had been *the* premier exchange in the country. It had been referred to as *the Gateway to the capital market in India*, [and] *a linchpin of the Indian Capital market*.² As would be expected of a near monopolistic entity, BSE's investors were pretty much dependent on the stockbrokers for fairness and good service. This situation however would change as Indian economy opens up. Faced with economic deregulation and increased local competition, BSE had to keep its operations at par with international standards, and to make for a more transparent and more liquid market.

3.2 National Stock Exchange (NSE)

NSE is the newcomer in the financial markets scene in India. *The impetus for its establishment [had] came from policy makers in the country, who had in mind to set up facilities [that would] serve as a model for the securities industry in terms of trading systems, practices and procedures*.³

The exchange was founded as recently as 1994. The NSE Wholesale Debt Market started its operations on June 30, 1994 while the NSE Capital Market segment started on November 3, 1994. In 1996, NSE set up the Settlement Guarantee Fund, and launched indices like NIFTY (NSE-50 Index), NIFTY Junior (Midcap-50 Index) and DEFTY Index (Dollar denominated Nifty Index).

One important differentiation of NSE from most other exchanges in India is that in NSE, the ownership and management of the exchange is completely separated from the right to becoming a trading member. A Board of Directors manages the exchange. The Board reports to an Executive Committee, which includes representatives from the Trading Members, the public and the management, delegates

² Information about BSE could be obtained via its website at <http://www.bseindia.com>

³ Information about NSE could be obtained via its website at <http://www.nse-india.com>

decisions relating to market operations. Furthermore, the exchange operates various committees to advise it on areas such as good market practices, settlement procedures, risk containment systems etc. Industry professionals, Trading Members and exchange staff manage these committees. The day to day management of the exchange is delegated to the Managing Director who is supported by a team of professional staff.

These institutional features present a breath of fresh air to the general trend in Indian stock exchanges, whereby membership on an exchange also meant ownership of the exchange. A separation of the above should prevent clash of interests on the part of the member/management, when safeguarding the investing public's welfare.

4.0 Data and methodology

4.1 Data

The primary data used for this paper is high-frequency transaction record of all trades for a sample of 26 issues cross-listed on both exchanges (See Table 1). The observations were for a period of 42 days, from 1 January 1997 to 6 March 1997. BSE and NSE on request made the data available.

Table 1 presents 26 paired issues from each exchange. Table 2 shows a sample of the data set. For constructing the liquidity measure, trading hours for the exchanges was taken to be 1000 hours to 1600 hours, and any transactions outside this time range was ignored in the analyses.

4.2 Methodology

The liquidity measure used in this paper is the Market Efficiency Coefficient (MEC) developed by Hasbrouck and Schwartz (1987). There are a few advantages for using this measure. Firstly, the primary data does not differentiate between buy and sell transactions, and MEC does not require this differentiation for its construction. Secondly, volume of transactions does not play a role in the construction

Table 1
Paired samples from NSE and BSE

Company Name	Symbol
Asea Brown Boveri Limited	Abb
Andhra Valley Power Supply Company Limited	Andravally
Arvind Mills Limited	Arvindmill
Ashok Leyland Limited	Ashokleyland
Asian Paint India Limited	Asianpaint
Bharat Heavy Electricals Limited	Bhel
Castrol India Limited	Castrol
Cochin Refineries Limited	Cochinref.
Colgate Palmolive India Limited	Colgate
East India Hotels Limited	Eihotel
Grasim Industries Limited	Grasim
Housing Development Finance Limited	Hdfc
Hindustan Lever Limited	Hindlever
Industrial Credit and Investment Corporation of India Limited	Icici
Industrial Finance Corporation of India Limited	Ifci
Indian Hotel Company Limited	Indhotel
Indo Gulf Fertilizers and Chemicals Corporation Limited	Indogulf
Indian Rayon and Industries Limited	Indrayon
Mahindra & Mahindra Limited	M&M
Mangalore Refinery and Petrochemicals Limited	Mrpl
Nestle India Limited	Nestle
Ponds India Limited	Ponds
Ranbaxy Laboratories Limited	Ranbaxy
Tata Chemicals Limited	Tatachem
Tata Tea	Tatatea
Thermax Limited	Thermax

Table 2
Sample of Primary Data

Issue	Date	Time	Exchange	No. of shares traded	Price
EIHOTEL	97-02-27	10:10	BSE	50	410
EIHOTEL	97-02-27	10:21	BSE	150	410
EIHOTEL	97-02-27	10:28	BSE	50	413.75
EIHOTEL	97-02-27	10:43	BSE	50	413.5
EIHOTEL	97-02-27	10:47	BSE	50	408
EIHOTEL	97-02-27	11:09	BSE	50	407.75
EIHOTEL	97-02-27	11:10	BSE	50	407.75
EIHOTEL	97-02-27	11:10	BSE	50	408
EIHOTEL	97-02-27	11:20	BSE	50	407.75
EIHOTEL	97-02-27	11:36	BSE	50	407.75

of this measure, and thus one does not have to worry about the misleading effect that volume has on conventional liquidity ratio. Thirdly, this measure takes into consideration the need to distinguish between liquidity and efficiency in the marketplace, by factoring in both short-period and long-period price volatilities.

However, Schwartz (1988) warns that *‘it may be tempting to believe that liquidity can be measured by using very short period price movements without separately accounting for the impact of news. This is not correct; news also affects short period price behavior’*.

We describe below the procedure for computing MEC.

An issue’s price relative over the long period may be expressed as the product of price relatives over T shorter periods:

$$P_T / P_0 = P_1 / P_0 \times P_2 / P_1 \dots\dots\dots P_T / P_{T-1} \dots\dots(1)$$

Taking the logarithms of the above equation gives:

$$R_L = \sum R_{S,t}$$

Where R_L is the long period logarithmic return and $R_{S,t}$ is the short period logarithmic returns. For the analysis, long period will be taken to be two days and short period will be taken as one half-hour, and the trading hours are taken to be 1000 hours to 1600 hours. Thus for every two trading days, there would be one R_L and twenty-four $R_{S,t}$ s computed.

The next step is to find price volatilities over the long and short periods, which are measured by the variances, $\text{Var}(R_L)$ and $\text{Var}(R_{S,t})$ respectively. Hasbrouck and Schwartz (1987) show that in the absence of execution costs, and assuming informationally efficient markets, the implied variance of half-hour returns, $\text{Var}(R_S)^*$, would be given by : $\text{Var}(R_L) / 24$

MEC is then taken to be the ratio of implied volatility to observed volatility:

$$\text{MEC} = \text{Var}(R_S)^* / \text{Var}(R_S) = \text{Var}(R_L) / 24 \text{Var}(R_S)$$

Execution cost, C, can then be estimated using MEC:

$$C = [0.5 \text{Var}(R_S) (1 - \text{MEC})]^{1/2} > 0 \text{ for MEC less than } 1$$

And

$$C = - [0.5 \text{ Var}(R_S) (\text{MEC} - 1)]^{1/2} > 0 \text{ for MEC greater than 1}$$

There is one obvious limitation of using MEC to measure liquidity. In the event that MEC is greater than unity, the estimated C would be negative, which is meaningless. This can happen when ‘other aspects of the market’s operations such as marketmaker intervention to stabilize trading, the presence of stale limit orders on the book, sequential information arrival, and inaccurate price determination that involves partial adjustment to news’ (Hasbrouck and Schwartz (1987)) dampen short period volatility.

Hasbrouck and Schwartz (1987) however also posited that factors causing excessive short period volatility should dominate the factors dampening short period volatility for most issues, and on average, MECs should be less than unity. (Schwartz (1988) has found that MECs based on short period variances are predominantly less than unity) returns.

The empirical analysis has two objectives. Firstly, it aims to establish whether liquidity level differs across the two markets. Secondly, it aims to uncover some of the variables that move liquidity in the two markets. By establishing these two empirical effects, it is hoped that the liquidity-market microstructure relationship in NSE and BSE can then be better isolated and discussed.

5.0 Empirical Findings

In table 3, we show paired comparisons of the mean and standard deviation values of liquidity measures and firm characteristics of our sample.

Our results indicate that MEC is consistently higher on the NSE as compared to BSE. In a frictionless market MEC would equal unity. We interpret our results to mean that trading frictions on NSE is less as compared to BSE. The other

important measure, execution cost, C, measured both in percent and in the Indian currency – Rupees, is significantly lower in NSE as compared to BSE. The average execution cost in NSE is less than half the average value of the cost in BSE.

We note that trading frequency is higher on the NSE as compared to BSE, while the average size per trade is higher on the BSE. It would be interesting to examine if these differences in trading characteristics on the two exchanges have an effect on MEC and C.

Table 3

Paired Comparison of Liquidity Measures and Firm Characteristics

Variable	Total Sample	NSE	BSE
Number of issues	46	23	23
MEC	0.4585 (0.2932)	0.6275 (0.2443)	0.2896 (0.2376)
C(percent)	0.0065 (0.0041)	0.0037 (0.0019)	0.0092 (0.0038)
C(Rupees)	2.9220	1.6818	4.1622
AP	5.6279 (1.0102)	5.6273 (1.0215)	5.6286 (1.0217)
AST	5.3103 (0.7157)	5.1459 (0.6586)	5.4748 (0.7466)
ANT	4.6252 (0.9250)	4.7651 (0.8879)	4.4853 (0.9597)
MC	7.5452 (0.7424)	7.5452 (0.7508)	7.5452 (0.7508)

Note: i) The results are reported for 23 issues in each exchange, omitting Icici, Mrpl and Ranbaxy, which were found to be outliers, ii) Standard deviations are given in parentheses.

The Variables are described below:

AP: The logarithm of the average price of an issue in Rupees over the observation period.

AST: The logarithm of the average size per trade of an issue over the observation period.

ANT: The logarithm of the average number of trades per day, for an issue over the observation period.

MC: The logarithm of the market capitalization for an issue in 10 millions of Rupees.

Table 4
Regression with MEC as dependent variable

Equation	Constant	AP	AST	ANT	MC	DNSE	R-square
1	-0.9843 (-1.6297)	0.1063 (1.5488)	0.1677 (2.3840)	0.0979 (1.9119)	-0.0904 (-1.1529)	0.3658 (5.0923)	0.3752
2	-0.4520 (-0.8950)		0.0923 (1.7876)	0.0494 (1.1990)	0.0020 (0.0379)	0.3544 (4.8774)	0.3538
3	0.1757 (0.4652)	-0.0070 (-0.1338)		0.0514 (1.0289)	-0.0103 (-0.1374)	0.3235 (4.4028)	0.3038
4	-0.5490 (-0.9511)	0.0261 (0.4652)	0.1165 (1.7357)		0.0072 (0.1164)	0.3763 (5.0910)	0.3347
5	-0.9648 (-1.5916)	0.0461 (1.0308)	0.1329 (2.0834)	0.0595 (1.5237)		0.3650 (5.0617)	0.3701
6	0.1744 (0.4673)			0.0549 (1.3028)	-0.0174 (-0.3349)	0.3225 (4.4635)	0.3201
7	-0.4250 (-0.8379)		0.0969 (1.8728)		0.0244 (0.5029)	0.3698 (5.1429)	0.3471
8	-0.4375 (-1.3439)		0.0919 (1.8419)	0.0500 (1.3164)		0.3541 (4.9605)	0.3692
9	0.2256 (0.6018)	-0.0350 (-0.7849)			0.0346 (0.5698)	0.3379 (4.6802)	0.3028
10	0.1449 (0.4821)	-0.0121 (-0.3334)		0.0474 (1.1822)		0.3246 (4.4980)	0.3200
11	-0.5282 (-0.9736)	0.0300 (0.6796)	0.1185 (1.8493)			0.3769 (5.1766)	0.3503
12	0.4026 (1.9359)	-0.0201 (-0.5606)				0.3379 (4.7177)	0.3138
13	-0.2130 (-0.7616)		0.0918 (1.8253)			0.3681 (5.1702)	0.3584
14	0.0656 (0.3607)			0.0499 (1.2796)		0.3239 (4.5376)	0.3341
15	0.2397 (0.6432)				0.0066 (0.1349)	0.3379 (4.7019)	0.3090

Note: i) For a 46-issues sample, ii) T-statistics are given in parentheses, iii) R-square is adjusted for degree of freedom and iv) average R-square is 0.3375. v) DNSE: An intercept dummy variable that is assigned a value of 1 for all NSE issues and a value of 0 for BSE issues.

The purpose of tables 4 and 5 is to find out whether firm-specific trading characteristics or the stock market used has a greater impact on liquidity and execution costs. In table 4, we regress MEC, the liquidity measure, on the different variables outlined above. The price per share and market capitalization do not have an effect on MEC. The average size per trade has a beneficial impact on MEC. The number of transactions variable has a weak positive effect on MEC. The most significant impact comes from the dummy variable, DNSE, which takes the value 1 for NSE and 0 for BSE. The empirical evidence indicates that MEC is significantly higher on NSE as compared to BSE even after controlling for firm specific variables that have an effect on trading.

In table 5, we regress $C \times 100$ on the same variables as before. The dummy variable, DNSE, is the only one that is statistically significant. The coefficient of this variable is negative, indicating that firms have significantly lower execution costs on NSE as compared to BSE. None of the other variables have any discernible effect on C.

Overall, we can conclude that NSE provides a more liquid market than BSE as evidenced by lower execution costs and higher MEC. The size per trade exerts a positive influence on the observed MEC. We also notice that BSE has a higher mean size per trade compared to NSE. It appears that the NSE system provides a more liquid market for the stocks trading in it.

The observation that the newer NSE provides better liquidity is interesting. However, NSE also shows a higher average number of transactions relative to BSE. Earlier studies have documented that number of trades has a positive significant impact on price volatility. If that is so, then NSE should have a higher volatility compared to BSE. An implication of higher volatility on NSE is that it would make it

Table 5
Regressions with C (x 100) as dependent variable

Equation	Constant	AP	AST	ANT	MC	DNSE	R-square
1	2.3636 (3.0254)	-0.1145 (-1.2900)	-0.1733 (-1.9044)	-0.0779 (-1.1757)	0.0668 (0.6589)	-0.5865 (-6.3125)	0.4582
2	1.7901 (2.7642)		-0.0920 (-1.3903)	-0.0256 (-0.4851)	-0.0327 (-0.4923)	-0.5743 (-6.1634)	0.4495
3	1.1650 (2.4401)	0.0025 (0.0384)		-0.0299 (-0.4726)	-0.0160 (-0.1689)	-0.5428 (-5.8446)	0.4235
4	2.0173 (2.7750)	-0.0507 (-0.7184)	-0.1326 (-1.5682)		-0.0108 (-0.1392)	-0.5949 (-6.3910)	0.4532
5	2.3492 (3.0291)	-0.0700 (-1.2235)	-0.1476 (-1.8078)	-0.0495 (-0.9906)		-0.5860 (-6.3507)	0.4657
6	1.1655 (2.4715)			-0.0311 (-0.5843)	-0.0134 (-0.2038)	-0.5425 (-5.9403)	0.4372
7	1.7761 (2.7706)		-0.0944 (-1.4438)		-0.0443 (-0.7227)	-0.5822 (-6.4068)	0.4595
8	1.5485 (3.6988)		-0.0852 (-1.3285)	-0.0350 (-0.7176)		-0.5694 (-6.2021)	0.4594
9	1.1360 (2.4218)	0.0188 (0.3369)			-0.0420 (-0.5527)	-0.5512 (-6.1011)	0.4342
10	1.1172 (2.9395)	-0.0054 (-0.1176)		-0.0361 (-0.7116)		-0.5411 (-5.9308)	0.4369
11	1.9861 (2.9066)	-0.0566 (-1.0184)	-0.1356 (-1.6798)			-0.5959 (-6.4974)	0.4660
12	0.9211 (3.5397)	0.0007 (0.0151)				-0.5512 (-6.1512)	0.4433
13	1.3911 (3.9232)		-0.0852 (-1.3354)			-0.5792 (-6.4159)	0.4655
14	1.0818 (4.7084)			-0.0350 (-0.7102)		-0.5414 (-6.0058)	0.4498
15	1.1284 (2.4336)				-0.0270 (-0.4430)	-0.5512 (-6.1652)	0.4459

Note: i) For a 46-issues sample, ii) T-statistics are given in parentheses, iii) R-square is adjusted for degree of freedom and iv) average R-square is 0.4498.

less attractive as a trading venue. We therefore, examine this issue empirically.

For this part of the study, we use the price volatility measure, PV, which is defined as follows:

$$PV_{it} = \text{ABS} [(P_{it} - P_{it-1}) / P_{it-1}]$$

where P_{it} is the closing price of issue i on day t , and P_{it-1} is the closing price of the same stock on day $t-1$. PV is calculated for each trading day for each firm.

Table 6
Comparative statistics on volatility, trading frequency and trade size

Variable	Total Sample	NSE	BSE
Number of issues	46	23	23
PV	0.0195 (0.0248)	0.0184 (0.0202)	0.0206 (0.0286)
N	4.3942 (1.1356)	4.5380 (1.0931)	4.2504 (1.1593)
AS	5.0436 (0.9411)	4.9598 (0.8111)	5.1274 (1.0489)

Note: i) For 1886 observations, ii) Standard deviations are given in parentheses

The variables used as described below:

AS: The logarithm of the daily average size of trade for an issue

N: The logarithm of the daily number of trades for an issue.

In table 6, we show mean and standard deviation values for price volatility, trade size and number of trades for our sample on the two exchanges. We find that volatility is lower on NSE as compared to BSE. The daily number of transactions is higher on NSE compared to BSE, but BSE has larger size of trade on average.

Jones, Kaul and Lipson (1994) have shown that the number of transactions has a positive impact on price volatility and that trade size does not have an effect. In table 7, we show results of regressing our price volatility measure on trade size and number of transactions. We confirm the strong effect of number of transactions and a weak effect of trade size on price volatility for our sample. The dummy variable, DNSE, has a negative and statistically coefficient. This indicates that price volatility is lower on NSE as compared to BSE even after controlling for number of trades and

trade size. Our empirical evidence indicates that NSE provides a better quality market for traders on account of its higher liquidity, lower execution costs and lower price volatility.

Table 7
Regression with PV as dependent variable

Equation	Constant	N	AS	DNSE	R-Square
1	-0.0038 (-1.0600)	0.0052 (10.4121)	0.0005 (0.7774)	-0.0036 (-3.2106)	0.0572
2	-0.0016 (-0.7248)	0.0052 (10.6197)		-0.0037 (-3.3125)	0.0574
3	0.0139 (4.3005)		0.0013 (2.1633)	-0.0020 (-1.7286)	0.0034

Note: i) For 1886 observations, ii) T-statistics are given in parentheses, iii) R-square is adjusted for degree of freedom and iv) average R-square is 0.0393. v) DNSE: An intercept dummy variable that is assigned a value of 1 for all NSE issues and a value of 0 for BSE issues.

6.0 Conclusion

6.1 Structural explanations

By using MEC and price volatility as measures of liquidity, it has been established that liquidity is indeed better in NSE than in BSE. This is in sync with the expectation held before empirical evidence made its entry. The last major task left in this paper is to put in order the consequential differences in the two exchanges' market microstructure, which had initially led to the prima facie expectation.

It has been mentioned that fairness in a marketplace has substantial effects on its liquidity. NSE is superior in this department on many counts. To begin with, the impetus for founding NSE had been to buck the trend of slack regulations and to challenge BSE's near monopolistic hold on Indian's capital market scene. The separation of management from membership in NSE ensures that a trading member's interests shall not override the interests of the exchange as a whole. Such protection

is not assured in BSE, where membership is an automatic privilege of ownership and management.

Another count on fairness from NSE lies in its rules for order matching priority. In NSE, strict price priority followed by time priority is observed. In the BSE however, a jobber with a history of large number of transactions can influence the priority of order matching. As such, investors trading via junior jobbers face possible sidestepping in their wait to transact. Cohen, Maier, Schwartz and Whitcomb (1986) have discussed the evidence that violation of priority rule can lead to thinner market and consequently, illiquidity.

The reputation of the surveillance system in NSE is better too. Although, with the inception of NSE, BSE had been forced to keep up with market transparency and regulation, it has only been presenting investors with a 'minimum acceptable level' of such goods. Coincidentally, at the time of our data analysis, the Securities and Exchange Board of India had sacked the president of BSE for alleged price manipulations⁴. With headlines like this one, it is difficult to expect investors to keep faith in BSE's surveillance system and the receipt of equitable treatment in the exchange.

The presence of a share depository in NSE also gives it an edge in liquidity. Without a share depository, the settlement of transactions is much slower as investors have to wait for administrative work on scrip transfers to be done at the registrar level. As one cannot sell what (s) he does not own yet, the waiting time taken up for scrip transfer actually holds up the potential for further transactions. This inevitably slows down trading volume, which in turn has adverse effect on liquidity. Furthermore, the time taken up for scrip transfer also affects the rate of information flow in an

⁴ '<http://www.economictimes.com/today/25lead01.htm>', 'MAR 25 1999 TOP-STORIES; BSE chief Parekh gets Sebi sack, HC stay'

exchange. For example, the lack of identity of share ownership can hide the intention of a takeover, and this delay of information flow adds to the price volatility when the takeover intention becomes clear. Such price volatility again adds to illiquidity.

NSE adopts a completely order driven system while BSE has a system that is part order driven and part quote driven. An order driven system is one where bid-ask spreads are driven by the agency market-style limit order book. A quote driven system is like that of a dealer market system, where dealers quote bid-ask spreads.

Furthermore, BSE's choice of a mixed system presents ambiguity to investors. There is no standard specifying when spread would be order driven, and when it is subjected to jobber's quote intervention.

Both exchanges have price stabilization features. NSE has *price freezes* while BSE has *price protection limits*. Such features should be arguably having the same effect on liquidity. The differentiating factor, however, is that NSE is reputed to be stricter and more partial in its employment of price freezes. BSE on the other hand, somewhat chooses the instants to trigger the price protection limits, particularly with regards to the company whose issue is in question. This lack of equitability inevitably causes investors to question BSE's integrity, which will ultimately affect trade volume.

6.2 Implications

Before the founding of NSE, BSE had accounted for about 90% of equity trade volume in India. At last count, BSE and NSE together accounts for about 80% of volume. There is little reason to believe why NSE should not continue to overtake BSE.

The only possible exception is the existence of the Badla system in BSE. Such a derivative-like system is absent in NSE, and could have helped to generate continued

interest in BSE. The Badla system allows investors to cut transaction costs by taking forward position instead of actual position in shares, and the limit order book in BSE is thickened by such forward positions. As such, liquidity level in BSE is still not as bad as it should be given its structural inferiority. However, one should bear in mind that derivative instruments could result in speculation-driven price volatility, and the Badla system is only unique as far as derivative markets are not in place in India. When such markets are in place, the Badla system would be rendered redundant.

In the light of the empirical evidence, we take the view that BSE's survival is in jeopardy, unless it takes additional steps to improve the quality of its market. BSE must of its own accord undertake structural reforms to become more efficient and better regulated.

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Figure 1.

