Securities and Exchange Board of India



Trade Execution Cost of Equity Shares in India

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* The views expressed in the study are those of the authors and they do not reflect the views of SEBI

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Foreword

Indian capital market has been undergoing significant changes for the past one decade. Stock trading has become fully computerized. Almost 100 per cent of equity trading and settlement take place in the dematerialised form. T+5 rolling settlement has been fully operational from December 31, 2001 and our markets will embrace T+3 settlement from April 1,2002. All these changes and many more have their impact on the market in various forms and one of them is transaction cost.

There are essentially two kinds of transaction costs in securities dealings viz. Explicit (direct) and Implicit (indirect) costs. Securities and Exchange Board of India (SEBI) sometime back published a working paper on explicit costs (Third working paper, November 2000). To the surprise of many, our market has second lowest direct cost (for institutional investors) in the world.

The present study deals with indirect cost such as bid-ask-spread. Our research team studied trade execution cost for three months (February, April and July 2001) on both BSE and NSE. Trade execution costs are very important for fund managers, stock exchanges and regulators. Fund managers like to pay as low a cost as possible, stock exchanges introduce new systems to cut down execution cost and regulators facilitate fall in indirect cost. The present study is the testimony of many changes made by SEBI to the efficient functioning of Indian stock market. I congratulate all the members of research team for bringing out this paper and wish them all the best.

D. R. MEHTA
Chairman
Securities and Exchange Board of India

January 22, 2002
Mumbai

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Securities and Exchange Board of India

The Securities and Exchange Board of India (SEBI) was constituted on 12 April 1988 as a non-statutory body through an Administrative Resolution of the Government for dealing with all matters relating to development and regulation of the securities market and investor protection and to advise the government on all these matters. SEBI was given statutory status and powers through an Ordinance promulgated on January 30 1992. SEBI was established as a statutory body on 21 February 1992. The Ordinance was replaced by an Act of Parliament on 4 April 1992. The preamble of the SEBI Act, 1992 enshrines the objectives of SEBI – to protect the interest of investors in securities market and to promote the development of and to regulate the securities market. The statutory powers and functions of SEBI were strengthened through the promulgation of the Securities Laws (Amendment) Ordinance on 25 January 1995, which was subsequently replaced by an Act of Parliament.

TRADE EXECUTION COST OF EQUITY SHARES IN INDIA

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Abstract

Market microstructure of stock trading has assumed great significance in Financial Economics. Market microstructure architecture has implications for professionals and policy makers. Implicit transaction costs to some extent depend on the type of market design. Indian stock exchanges follow electronic limit order book system. The present study attempts to measure quoted and effective bid ask spreads. Many changes have been effected to the market design since February 2001. Their impact is also assessed. It is found that bid ask spreads depend on the nature of market structure. Econometric model reveals that volume traded and market capitalisation has inverse relationship with spreads while volatility exhibited positive relationship. Number of trades also by and large has positive and significant relationship. The spreads are very high at the open of market hours and they start slowly tapering off before they reach nadir before the close of the office hours.

Trade Execution Cost of Equity Shares in India

Stock exchange architecture differs across markets in the world. Market maker system (NASDAQ), specialist system (NYSE) and electronic limit order system (Paris Bourse, BSE, and NSE) are some of the more popular trading systems that are in vogue around the world. Market architecture or micro structure plays key role in order placing preferences, execution speed, trade execution costs, time of the day cost and others.

Each trading system has its own merits and demerits. Some of the functions of trading mechanisms include immediacy and low transaction cost. System such as those of market maker and specialist are good to provide immediacy but are high on costs. Electronic limit order book continuous auction system (as followed in India) is expected to give cost advantage to investors while being slow on immediacy. Symmetrical information flow and speed of information travel are related to the trading systems. All exchanges and regulators strive to ensure free, smooth, speedy and symmetrical information flow to markets so that securities are priced efficiently. Any asymmetry leads to arbitrage opportunities

There are generally three kinds of securities traders: Information, Liquidity and Noise.
Informed trader has information, which is not known, to the market. Liquidity trader trades for portfolio rebalancing. Noise trader feels that the price of the security is currently not at its intrinsic value. In a specialist/market maker system these traders trade against liquidity providers. (specialist / market maker). Therefore, they are required to pay liquidity premium: bid –ask spread. In limit order book system, investors trade directly. Hence, the bid-ask spread should be logically, *ceteris-paribus,* lower than that in specialist and market maker system. Indian Stock exchanges follow electronic limit order continuous auction system. Therefore, in this study it is proposed to study various aspects of bid-ask spreads in Indian stock exchanges.

Quoted and effective bid ask spreads in India are variant to volumes traded, volatility (variance), market capitalisation and number of trades executed. Volume traded and market capitalisation are inversely related to quoted spread while variance has positive relationship with quoted spread. Number of trades also basically has positive relationship with quoted spread. Average spread in February 2001 was lower as compared to April and July 2001 on both the exchanges. Market micro structural changes appear to have influenced spread size. Large variation is found between minimum and maximum spread across months. Effective spread is by and large lower than the quoted spread. Quoted spread is high during the opening hours of the market, starts receding as the market hours progress and almost touches the lowest point at the close hours. It looks that spreads are mostly independent of quantity quoted and traded.

1 Motivation for the study

Several research studies have been conducted to measure different spreads such as quoted, effective, realised and impact. However, many of these studies have been conducted on markets that follow either market marker system or specialist system. Very few studies are undertaken to calculate spreads in the order driven system. India follows electronic limit order book system on continuous auction basis. There has been hardly any study in India that attempted to measure trade execution costs (spreads). Trade execution costs are important for fund managers, management of stock exchanges, policy makers and regulators to effect, if any, policy changes from time to time in order to reduce transaction costs.

Indian stock exchanges have experienced many changes in the recent past. Changes have been effected to

the trading and order placing mechanism, clearing and settlement system, and payment process. All these are expected to impact trade execution cost. Therefore, the present study has been taken up to measure spreads and attribute, if possible reasons for changes in spreads.

The remaining part of the working paper is organised in the following way.

Objectives of this research are listed in section 2. Section 3 reviews some of the past research studies. Ecology of The Stock Exchange, Mumbai, (BSE) and National Stock Exchange (NSE) is described in the fourth section. A list of changes made in the recent past to the market microstructure is provided in section 5 followed by methodology and data used in this paper. Types of transaction costs are briefly explained in section 7. Section 8 discusses results of the study. Section 9 analyses econometric model. Finally section 10, summarises findings.

2 Objectives of the Study

This research paper aims at achieving the following objectives

1. Review market microstructure of The Stock Exchange, Mumbai (BSE) and National Stock Exchange (NSE).

2. Estimate quoted and effective spreads for BSE and NSE.

3. Estimate the relation between trade execution spread and volume, volatility, market capitalisation and number of trades.

4. Examine whether spread depends on trade size, and

5. Attempt to find out the best time to trade in stocks during the day.

3 Review of past studies

Christie and Schultz (1994) focused attention on price rounding practices, documenting that market makers in several large NASDAQ listed firms post bid and ask quotations that are virtually always rounded to quarter dollars, even though the minimum tick on NASDAQ is one-eighth of a dollar or less. They interpret their evidence (Christie and Schultz, 1994, p.1813) as indicative of 'implicit collusion' on the part of NASDAQ market makers to maintain wide bid ask spread

Kleidon and Willing (1995) argue that on NASDAQ markets is infeasible pointing in particular to the presence of multiple dealers in each issue and the absence of explicit barriers to entry. Bessembinder (1994, 1997) focuses on empirical test of some potentially refutable implications of the hypothesis that NASDAQ market makers use the rounding of quotations as a mechanism to collude. The results indicate that higher execution costs are associated with rounding of quotations and trade prices. Reiss and Warner (1995, 1998) find that the spread fall with trade size, whereas Breedon (1993) and Board and Sutcliffe (1996) document a U-shaped pattern with giant trades exhibiting a sudden increase in spread. Board *et al.* (1997) and Naik and Yadav (1997) document stock specific and market maker specific spread with trade size.

The theoretical models of Leach and Madhavan (1992), Madhavan (1995) and Naik et al (1997) have demonstrated that strategic incentives can lead market makers to offer better prices to informed investors

in return for information which they can use in later trading. In contrast, on electronic order driven markets, order routing is automatic and often anonymous, so the strategic price setting would prove much more difficult. Saporta, Trebeschi and Vila (1999) have identified market maker quoting behaviour on the London Stock Exchange (LSE). Their results indicate that order processing costs are a far more important determinant of LSE spread. The stimulated traded spread for trades above the mandatory size of 1 National Market System (NMS) is smaller than the spread for smaller trades.

Indian stock market follows electronic limit order book system in which both buyers and sellers of equity shares post their respective quotes to the Central computer system via their brokers. The computer matches both buy and sell order in price time priority preference. There are no market makers in India. Therefore, to that effect, some of the issues such as adverse selection costs, market spread are not relevant to Indian market. The study is designed keeping in view Indian stock market operating system. Hence, only quoted and effective spread is studied.

4 Brief Ecology of Trading System at NSE and BSE

4.1 BSE Trading System

BSE provides an automated trading facility in the securities listed for trading. The system is referred to as BSE On-Line Trading (BOLT) system that allows trading through approved workstations installed at the approved locations of the member-brokers. BOLT displays five best buy and sell orders. Members trade in the scrips by submitting orders. The BOLT system, which was both order and quote driven, was commissioned on March 14, 1995. The facility of placing quotes (by jobbers) has been removed from August 2001. All orders are entered into an online order book.

4.1.1 Order Handling

Limit orders and market orders are entered into the order book. Nevertheless, all orders are time stamped. Orders may be modified or cancelled at any time. Any modification would mean a new time stamp, and hence the order would lose its earlier time priority. All unmatched day orders would be returned to the respective members and would not be stored in the order book when the market opens on the next day. Brokers would have to resubmit these unexecuted orders, if so desired, from their Trader's Workstation. Members who wish to trade for a very large quantity, but may not wish to reveal the entire quantity to the market, can avail of a facility called drip-feeding. In this facility, he can reveal a fraction of total quantity (fraction should not be less than 10% of total quantity). The system then feeds this revealed quantity as order quantity and when this gets exhausted another fraction is revealed automatically till the total quantity is exhausted.

4.1.2 Matching Logic

The touchline for particular scrip shows best bid and offer rate available in the market at that point in time, along with the quantity at that rate. Whenever bids or offers are more than one, then the total depth of all orders at the touchline price is shown.

All the orders are prioritised based on price and time. All incoming orders are first matched against the best price available in the market. While matching against orders, the system provides for sharing of large orders among traders at the touchline price. This feature is referred to as rotation. In case more than one

trader exists at the touchline, and incoming order that can be satisfied by the touchline price, having an order quantity greater than the revealed depth of the first trader is received, order execution against the first trader in the queue would proceed only to the extent of the revealed depth of this trader, and the balance unexecuted order quantity would be matched against the next trader online to the extent of second revealed depth, and so on, until all traders at the touch line get one share of their revealed depth. Even after this rotation, if the order has not been fully executed, the same set of traders at the touch line price would get their second share of the order, to the extent of their revealed depth. This would continue until the order is fully executed, or the available depths of the traders at the touchline are exhausted.

4.2 NSE Trading System

NSE operates on the National Exchange for Automated Trading (NEAT) system, a fully automated screen based trading system, which adopts the principle of an order driven market. NEAT displays five best buy and sell orders along with the quantity. The NSE trading system provides complete flexibility to members in the kinds of orders that can be placed by them. Orders are first numbered and time-stamped on receipt and then immediately processed for potential match. Every order has a distinctive order number and a unique time stamp on it. If a match is not found, then the orders are stored in different 'books'. Orders are stored in price-time priority in various books in the following sequence:

4.2.1 Best Price (within price, by time priority)

Price priority means that if two orders are entered into the system, the order having the best price gets the higher priority. Time priority means if two orders having the same price are entered, the order that is entered first gets the higher priority.

4.2.2 Order Matching Rules

The best buy order is matched with the best sell order. An order may match partially with another order resulting in multiple trades. For order matching, the best buy order is the one with the highest price and the best sell order is the one with the lowest price. This is because the system views all buy orders available from the point of view of a seller and all sell orders from the point of view of the buyers in the market. So, of all buy orders available in the market at any point of time, a seller would obviously like to sell at the highest possible buy price that is offered. Hence, the best buy order is the order with the highest price and the best sell order is the order with the lowest price.

Members can proactively enter orders in the system, which will be displayed in the system till the full quantity is matched by one or more of counter-orders and result into trade(s) or is cancelled by the member. Alternatively, members may be reactive and put in orders that match with existing orders in the system. Orders lying unmatched in the system are 'passive' orders (limit orders) and orders that come in to match the existing orders are called 'active' orders. Orders are always matched at the passive order price. This ensures that the earlier orders (market orders) get priority over the orders that come in later.

5 Some of the Recent changes to Market Microstructure

Since first week of March 2001, many changes were effected to the market microstructure of Indian stock exchanges, mainly applicable to BSE and NSE. Some of the changes were transitory but the rest may last longer. The changes brought in include the following:

a) Non-allowance of short sales (March 07, 2001 to July 02, 2001)

b) Restricting applicability of Securities Lending Scheme 1997 (SLS), only to transactions under Automated Lending and Borrowing Mechanism (ALBM) and Borrowing and Lending of Equity Shares (BLESS).(restrictions removed from July 02, 2001)

c) Introduction of compulsory rolling settlement (T+5) in 414 scrips from July 02, 2001.

d) Incremental margins on scrips under Modified Carry Forward System (MCFS) / ALBM / BLESS to be calculated and collected on gross basis at client level.

e) Introduction of 99% VaR based margins from July 2, 2001.

f) Deferral products such as ALBM / BLESS / MCFS / Continuous net Settlement (CNS) to cease to exist from July 02, 2001 on all scrips of compulsory rolling settlement, and

g) Index based market wide circuit breaker system introduced with effect from July 02, 2001.

Most of these changes are expected to influence market microstructure of Indian stock market. Some of these changes affect volumes traded adversely thus changing contours of liquidity in the market place. Higher margins at client level add to cost of transactions (but enhance market safety). Therefore, the investor expects higher returns as compensation.

6 Methodology and Data

Most changes in market microstructure took place in March 2001 and later. March 2001 to May 2001 can be considered to be a transitory period because many temporary restrictions, mentioned elsewhere in this paper, were imposed and some of these were subsequently (i.e. July 2001) withdrawn. February, April and July 2001 are chosen for the study over other months for the following reasons. February 2001 is the nearest month to the changes initiated and therefore, it reflects the market environment more closely. Easy availability of data also weighed in favour of February. By April 2001 market microstructure changes became operational and their impact is felt. The impact of transitory changes started sinking in. This study was thought of somewhere in August 2001 and stock exchanges were asked to supply high frequency data. As a result, July 2001 became a natural choice due to availability of data. However, one of the restrictions i.e. compulsory rolling settlement in 414 scrips become operational from July 2, 2001. These months can be divided into following taxonomy.

I. Pre change period (February 2001)
II. Transitory period (April 2001) and
III. Change period (i.e. July 2001)

For the purpose of the study, component companies of BSE Sensex (Sensex) and NSE S&P CNX Nifty (Nifty) are considered. Stocks that are common to both the indices are counted only once. During the study there was reshuffling of indices. Therefore, some stocks are included / excluded in the middle are excluded from the study. Owing to this and other (data) reasons, the sample size is not uniform.

When measured on the basis of turnover, Sensex and Nifty stocks represent 50 percent to 70 percent of the turnover on the respective exchanges with some variations over the months. Thus they truly represent the market. All the Sensex stocks' market capitalisation as a percentage of total market capitalisation of all stocks listed on BSE varies between 54 percent to 57 percent in these three months. Market capitalisation of Nifty stocks, over the three month period, as a percentage to NSE market capitalisation varied between 47 percent (April) to 51 percent (July) (For details see Table 1). Thus the component stocks of the two indices represent the market. In all there are 55 distinctive companies (stocks common to both indices are counted only once). About 2.5 lakh observations have been analysed and this data comes to 40 MB.

A 5-minute interval for BSE data and a 10-minute interval for NSE data are used mainly because of data availability constraints. First occurring quote and trade in the given 5 and 10 minute interval are used for BSE and NSE respectively.

The quantity quoted / traded for each quote or trade was also noted though not included in analysis. Only those observations where the trade has occurred after the quote in the given 5 / 10 minute interval are taken. Aberrant observations where the posted orders (either bid or ask) are ridiculously low / high are excluded. Such observations occurred due to a system snag at the Exchange.

Several methods have been explained and used in finance literature to measure liquidity in the stock market.

a) Turnover as per cent of market capitalisation
b) Value traded as per cent of Gross Domestic Product (GDP)
c) Volatility, and
d) Bid – Ask spread or transaction cost.

In this paper bid-ask spread (BAS) is chosen over other measures of liquidity as a surrogate owing to the following reasons, among many others.

a BAS can be quantified with highest possible frequency.
b It indicates directly the cost investor is expected to incur.
c Though more difficult to measure it is stable and accurate.
d Direct impact of changes in market microstructure on BAS, and
e BAS is a very strong economic policy variable.

7 Kinds of Trade Execution Costs

Analysts, commonly, divide trading costs into two major components: explicit cost and implicit cost.

7.1 Explicit Cost

Explicit costs are the direct cost of trading, such as broker commission and taxes. The main explicit cost is the commission paid to the broker for execution (Raju 1999& 2001).

7.2 Implicit Cost

Implicit cost represents such indirect cost as the price impact of the trade and the opportunity cost of failing to execute in a timely manner.

Table 1 : Descriptive Statistics

	The Stock Exchange, Mumbai					
Month	Turnover (Rs. Crore)			Market Capitalisation (Rs. Crore)		
	Sample	Total	Percent	Sample	Total	Percent
Feb 01	58,508	101,427	57.68	407,776	716,173	56.94
Apr 01	16,188	23,876	67.80	304,862	567,729	53.70
Jul 01	11,572	17,244	67.11	295,587	531,576	55.61

	National Stock Exchange of India					
Month	Turnover (Rs. Crore)			Market Capitalisation (Rs. Crore)		
	Sample	Total	Percent	Sample	Total	Percent
Feb 01	68,331	135,932	50.27	393,365	789,600	49.82
Apr 01	22,968	35,616	64.49	308,298	653,720	47.16
Jul 01	18,369	27,228	67.46	295,159	574,260	51.40

Of primary interest to researchers and practitioners are implicit trading costs, bid-ask spread, price impact, and opportunity costs. These costs are much more difficult to measure than explicit costs.

There are several indicators of trade execution costs. Market structure basically dictates nature of costs. Broadly there are two kinds of order processing system: order driven and quote driven. Indian market follows order driven system. Execution costs relevant to order driven system are discussed and used to measure them in this study.

7.2.1 Quoted bid-ask spread (QBAS)

Early studies of implicit trading cost focused on the bid ask spread (BAS) as the relevant cost. That the percent bid-ask spread is related to the stock's liquidity, typically proxied by the stock's price per share, turnover or market capitalization is well established in the literature.

For several reasons, however, quoted spread may be imprecise estimate of the true cost of transacting. First, the quoted bid ask spread may overstate the true spread because trades are often executed inside the quote spread. Second, both the bid and ask prices have a systematic tendency to rise (fall) following a buy (sell) order, so true round trip trading costs are less than the quoted spread suggests. Third, large block transactions need not occur at the quoted bid or ask prices. In an order driven market, quoted bid-ask spread are not available. However, buy and sell orders existing at any particular point of time may be used as bid and ask prices respectively. In this study, posted buy and sell order prices are used as proxies to bid-ask quotes.

Quoted spread gives signal to an investor about the possible trade cost in a stock. Large spread stocks are said to be costlier and smaller spread stocks are said to be less costly. Regulators, Exchanges and policy makers strive to reduce these spread. Several measures were taken and more are being considered to cut spread. Role of information in asset prices needs no over emphasis. Symmetrical flow and equal and instantaneous availability of information are some of the issues.

7.2.2 Effective bid-ask spread (EBAS)

To avoid the problems associated with quoted spread several authors have proposed measures of the "true" spread, often referred to as the "effective bid-ask spread". The effective spread is based on transaction prices, which may be more representative of market reality than quoted prices. Implicit spread estimates exploit the fact that transaction prices tend to alternate between bid and ask prices. The bid ask bounce induces a negative serial covariance between successive price changes. Thus, the serial covariance of successive price changes or return can be used to derive an estimate of the underlying bid ask spread and its components. With quote data, an alternative way to measure the effective spread is to use average absolute price deviation from prevailing mid quote.

A simple measure of trading costs that reflects execution cost savings due to trading inside the quotations is the percentage effective half spread. The effective half spread is the difference between the trade price and the quote midpoint, which serves as a proxy for the assets pre-trade economic value.

Quoted spread is measured on a (one-way) percentage basis as follows:

$$\text{Quoted percentage half spread}_{it} = 100\,(A_{it} - B_{it}) / 2\,M_{it} \qquad (1)$$

Where A_{it} and B_{it} the posted ask and bid prices for security I at time t and M_{it} is the quote mid point. Quoted spread are measured in effect at the time of each trade, independent of whether quotations have been revised since the prior trade.

It is well documented that many equity trades occur at prices inside posted bid ask quotations (Peterson and Failkowski, 1994). If price improvement is more frequent when quotations are rounded, then traders execution costs may not be related to price rounding, even if quote spread are. A simple measure of trading costs that reflect execution costs savings due to trading inside the quotations is the percentage effective half spread measured are as follows:

$$\text{Effective percentage half spread}_{it} = 100\,[P_{it} - M_{it}]\,/M_{it} \qquad (2)$$

Where P_{it} is the transaction price for security i at time t. The effective half spread is the percentage difference between the trade price and the quote midpoint, which serves as a proxy for the assets pre trade economic value. As such it is a measure of the percentage execution costs actually paid in one-way trade, and of gross revenue to the supplier of immediacy.

7.3 Testing Significance of Quoted Spread

Significance of quoted spread is tested with the help of 't' statistic. This is to see whether the mean quoted spread of each company for April and July, both on BSE and NSE, is same as of February 2001 for the respective exchanges or not. Under unchanged conditions the mean quoted spread should be the same in all the three months but for changes. Any change in spread is attributable to changes in market microstructure. The null and alternate hypotheses are:

A) Null hypothesis for BSE for February-April

$H_{0(\text{Feb-Apr})}^{\text{BSE}}$: $QS_{\text{Feb}} = QS_{\text{Apr}}$

A1) Alternate hypothesis for BSE for February-April

$H_{1(\text{Feb-Apr})}^{\text{BSE}}$: $QS_{\text{Feb}} \neq QS_{\text{Apr}}$

B) Null hypothesis for BSE for February-July

$H_{0(\text{Feb-Jul})}^{\text{BSE}}$: $QS_{\text{Feb}} = QS_{\text{Jul}}$

B1) Alternate hypothesis for BSE for February-July

$H_{1(\text{Feb-Jul})}^{\text{BSE}}$: $QS_{\text{Feb}} \neq QS_{\text{Jul}}$

C) Null hypothesis for NSE for February-April

$H_{0(\text{Feb-Apr})}^{\text{NSE}}$: $QS_{\text{Feb}} = QS_{\text{Apr}}$

C1) Alternate hypothesis for NSE for February-April

$H_{1(Feb\text{-}Apr)}^{NSE}$: $QS_{Feb} \neq QS_{Apr}$

D) Null hypothesis for NSE for February-July

$H_{0(Feb\text{-}Jul)}^{NSE}$: $QS_{Feb} = QS_{Jul}$

D1) Alternate hypothesis for NSE for February-July

$H_{1(Feb\text{-}Jul)}^{NSE}$: $QS_{Feb} \neq QS_{Jul}$

Quoted spread (QS) for April and July for BSE and NSE are equal to quoted spread of February of BSE and NSE respectively. 't' statistic is computed with the help of following equations to test null hypothesis.

$$t = \frac{\Delta X}{S_{\Delta X}} \tag{3}$$

Where

$$S_{\Delta X} = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}} \sqrt{\frac{n_1 + n_2}{n_1 n_2}} \tag{4}$$

ΔX is the difference between quoted spread.
t is t statistic with a critical value of 1.96 at 5 per cent confidence level
n_1 and n_2 are the number of observations in the sample, and
S_1 and S_2 are standard deviation of the sample

8. Analysis of results

In the following sections, discussions of results are carried out in the order of BSE followed by NSE and they are compared across months, exchanges, time and trade size.

8.1. BSE – Quoted spread

In February 2001, prior to the implementation of changes, the average quoted half spread worked out to 1.12 percent on BSE. There are large differences between the smallest and largest spread. The largest (Nagarjuna Fertiliser) spread is six times higher than the smallest (Wipro). The mean and median of the spread 1.12 percent and 1.04 percent respectively follow normal distribution closely. Spread went up in April 2001. Quoted spread increased substantially. Minimum, maximum, standard deviation and median spread are higher than their counter parts in February 2001. The average, minimum (Reliance), maximum

(Nagararjuna Fertilisers) standard deviation and median are 1.42 percent, 0.60 percent, 4.25 percent, 0.67 percent and 1.33 percent respectively. The gap between minimum and maximum also got widened. Mean and Median spread are close to each other, which disclose normally distributed spread. Table 2 provides summary statistics for both BSE and NSE for all the three months.

In July 2001, spread presents some more interesting facts. Average spread has further increased; they have almost doubled. The gap between low and high further got widened. Although, there is a slight fall in case of minimum spread, there is once again rise in maximum. Volatility in spread jumped to 1.10 percent in July from 0.50 per cent in February and 0.67 per cent in April 2001. Average, minimum, maximum, volatility and median for July are 2.07 percent, 0.53 percent (Wipro), 4.92 percent (Vysya bank), 1.10 percent and 1.87 percent respectively. Information on individual stocks as well as average is given in Tables 2 and 3.

April quoted spread of BSE differs from quoted spread of February in 38 cases out of 55 companies at 5 per cent significance level and July quoted spreads is different from that in February in 48 out of 58 companies. With 95 per cent confidence that it can be stated quoted spread is influenced by changes made to market microstructure. Results of NSE further reinforce the influence of changes on spread. April spread of NSE varies in 44 out of a total of 55 and July spread in 52 out of a total of 55 companies and spreads of NSE strongly support are alternative hypothesis. In conclusion it can be stated that the increase in spreads is due to changes effected in the market microstructure.

8.2 BSE Effective Spread

Effective spread in the month of February 2001, is the lowest among all the three months. Mean effective spread is lower at 0.86 percent compared to 1.12 quoted spread. This pattern is observed across other variables such as minimum, standard deviation and median. Only maximum effective spread of February 2001 is higher than the maximum quoted spread. The distribution feature is close to normal. Higher effective spread is noticed in April 2001. All the variables that are interest to us have gone up in comparison to February 2001. Mean, minimum, maximum, volatility and median rose to 1.02 percent, 0.62 percent, 3.52 percent, 0.47 percent (slight decrease) and 0.95 percent respectively. The range between minimum and maximum narrowed down.

Effective trade costs further rose in July 2001. Average is higher by more than 50 percent as against February 2001. Only indicator that came down is that of minimum. Range between minimum and maximum is further widened. Asymmetry in execution costs increased. The average minimum, maximum, volatility and median costs are 1.37 percent, 0.41 percent, 4.56 percent, 0.70 percent and 1.18 percent respectively. Tables 2 and 3 give further information on effective spread.

8.3 NSE Quoted Spread

The maximum spread in February is 3.92 per cent (IFCI) and minimum is 0.46 (Infosystech). The February figures for NSE are at slight variation from those for BSE. Mean Quoted spread at NSE (0.97) is lower than that at BSE (1.12). The range for NSE data at 3.46 per cent is much higher than that in BSE where it is 2.53 per cent. However standard deviation for both the data set is almost same (0.50 at BSE and 0.60 at NSE). Most of the data points fall on the lower side. This is indicated in the figures - first quartile is at 0.68 per cent, third quartile at 1.05 per cent and the mean at 0.97 per cent.

Broadly, quoted spread of NSE and BSE are close to each other in April 2001. Average, minimum and maximum, standard deviation and median are on expected lines only. Maximum quoted spread of NSE is higher than BSE. On both exchanges, Nagararjuna Fertiliser recorded the highest spread. July quoted spread, on both the exchanges, is almost identical. This near identity also exhibits data and methodology consistency. One more aspect that might have contributed to this feature is quick arbitrage opportunities spotted by the brokers on these two exchanges. Average, minimum, maximum, standard deviation and median quoted spread are 2.06 percent, 0.56 percent, 4.81 percent, 1.00 percent and 1.90 percent respectively. Summary statistics are available in Table 2. Table 3A provides detail on quoted spread on NSE including spread for Nifty stocks.

8.4 NSE Effective Spread

The minimum spread is 0.84 per cent (Emerck) and maximum is 3.81 per cent (IFCI). Mean spread (1.38 per cent) is much higher than that for BSE (0.86 per cent). The effective spread is much higher than the quoted spread for the same month. Standard deviation for both the months is same (0.49 per cent). Most of the data points fall on the lower side. This is indicated in the figures - first quartile is at 1.10 per cent, third quartile at 1.47 per cent and the mean at 1.38 per cent. Mean spread for February is 1.38 per cent. Effective spread in April as well as July 2001 on NSE is higher when compared to BSE. Effective spread in April exhibits unexpected behaviour: the average is higher than quoted spread. No specific reasons could be ascertained for this unusual show. July spread is as per expectations: inside the quotes. Charts 2, 2A, 3, 3A, 4 and 4A, present information related to quoted spread, versus daily average turnover, quoted spread versus market capitalisation and quoted spread versus variance. Charts 4 and 4A bring out inverse correlation between quoted spread and volumes traded. Market capitalisation and variance show negative and positive slopes against quoted spread respectively. These findings reinforce earlier findings of other authors in some of the countries.

Both the spread, quoted as well as effective, on the BSE and NSE for all the months studied generally exhibited a pattern as per theory and the previous studies in other countries. Quoted spread is larger than effective spread except in February and April 2001 for NSE. This indicates that actual execution costs are lower. Volumes traded and spread are inversely correlated. When volumes sharply fell down in April and July, the spread rose substantially. Mean and median spread are close to each other which discloses the shape of distribution: nearly normal.

Close look at the tables reveal volume traded predominantly influences BAS. In February, April and July recorded volumes showed descending order whereas the opposite happened for spread. At the company level also the same holds good. Companies with high volume cost less to trade while low volume traded companies are costlier to trade. Variance and market capitalisation also contribute towards spread. Low variance and high market capitalisation companies, generally, *ceteris paribus,* cost less to trade and vice versa. Various factors might have contributed for this wide variation. Some of the economic variables have been identified with the help of financial economics literature. Many researchers reasoned that volume, volatility, market capitalisation, trade time are, among others, cause for this wide gap of BAS among companies.

8.5 Time of the day spread

In symmetrical information *dissemination* condition and identical market environment, the bid ask spread should be almost same at any point of time of a day. If they are significantly different across trading time

Table 2 : Summary Statistics of Quoted and Effective Half Spread (percent)

	The Stock Exchange, Mumbai			National Stock Exchange		
	Feb-01	Apr-01	Jul-01	Feb-01	Apr-01	Jul-01
	Quoted Spread					
Mean	1.12	1.42	2.07	0.97	1.47	2.06
Standard Deviation	0.50	0.67	1.10	0.60	0.86	1.00
Minimum	0.54	0.60	0.53	0.46	0.58	0.56
First Quartile	0.82	0.99	1.19	0.68	1.13	1.47
Median	1.04	1.33	1.87	0.86	1.28	1.90
Third Quartile	1.22	1.59	2.66	1.05	1.60	2.43
Maximum	3.07	4.25	4.92	3.92	5.87	4.81
	Effective Spread					
Mean	0.86	1.02	1.37	1.38	1.65	1.58
Standard Deviation	0.49	0.47	0.70	0.49	0.79	0.61
Minimum	0.44	0.62	0.41	0.84	0.99	0.59
First Quartile	0.64	0.79	0.99	1.10	1.26	1.19
Median	0.77	0.95	1.18	1.32	1.44	1.50
Third Quartile	0.84	1.12	1.45	1.47	1.72	1.89
Maximum	3.58	3.52	4.56	3.81	5.73	3.19

Table 3 : Quoted and Effective Half Spread (percent) on BSE

No	Company	Quoted	Quoted	Quoted	Effective	Effective	Effective
		Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
1	BAJAJAUTO	0.99	1.11	1.72	0.72	0.80	2.53
2	BSES	0.83	0.91	1.51	0.70	0.78	1.39
3	CASTROL	1.09	1.25	2.57	2.14	0.90	1.26
4	CIPLA	0.80	0.89	0.98	0.61	0.75	1.29
5	COLGATE	1.13	1.16	1.53	0.80	0.87	0.99
6	CORPBANK	1.32	1.59	1.79	0.96	1.10	0.91
7	DABUR	1.33	1.60	2.56	0.93	1.11	1.90
8	DRREDDY	0.60	0.96	0.80	0.47	0.82	1.15
9	EIHOTEL	1.18	1.80	3.05	0.86	1.06	1.55
10	EMERCK	1.05	1.59	4.33	0.78	0.95	2.08
11	ESCORTS	1.08	1.45	3.00	0.77	0.99	1.27
12	GERMANREM	1.02	1.37	1.87	0.70	1.01	1.46
13	GLAXO	0.97	1.02	1.94	0.70	0.70	1.14
14	GLOBALTELE	0.85	1.52	0.69	0.73	1.48	0.74
15	GSFC	2.05	2.70	4.49	1.36	1.06	0.60
16	GUJAMBCEM	0.80	0.84	1.67	0.67	0.77	1.42
17	HDFC	1.18	1.25	2.10	0.79	0.79	0.79
18	HDFCBANK	1.21	1.24	1.68	0.84	0.89	1.24
19	HINDLEVER	0.89	0.85	0.91	0.66	0.63	1.15
20	ICICI	1.11	1.53	2.50	0.82	1.14	2.10
21	ICICIBANK	1.29	1.28	1.44	0.91	0.92	1.03
22	IDBI	1.51	1.64	2.34	0.79	0.89	1.30
23	IFCI	2.94	3.48	4.14	1.78	2.67	4.56
24	INDHOTEL	1.09	1.37	2.93	0.77	0.99	0.99
25	INFOSYSTCH	0.55	0.86	0.68	0.45	0.82	1.95
26	ITC	0.63	0.85	0.59	0.47	0.65	0.86
27	L&T	0.64	0.70	0.81	0.55	0.62	0.99
28	M&M	0.93	1.23	2.53	0.74	0.98	2.75
29	MADRASCEM	0.87	1.41	3.34	0.60	0.65	0.79
30	MTNL	0.93	0.96	1.68	0.73	0.77	1.56
31	NAGARFERT	3.07	4.25	3.64	3.58	1.46	2.99
32	NIIT	0.79	1.08	0.85	0.66	1.14	1.37
33	NIRMA	1.17	1.47	2.41	0.85	1.27	1.07
34	ORIENTBANK	1.65	1.66	3.34	1.17	1.16	0.72
35	P&G	1.32	1.72	3.91	0.80	1.15	0.41
36	RANBAXY	0.69	0.92	1.05	0.51	0.76	1.10
37	RELIANCE	0.54	0.60	0.62	0.44	0.62	1.16

Table 3 : Contd.

No	Company	Quoted	Quoted	Quoted	Effective	Effective	Effective
		Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
38	RELPETRO	1.04	1.26	1.72	0.70	0.87	2.56
39	SATYAMCOMP	0.70	1.03	0.93	0.60	1.01	1.10
40	SBIN	0.81	0.79	0.88	0.65	0.62	1.09
41	SIEMENS	0.89	1.42	2.18	0.63	0.86	1.20
42	SILVERLINE	0.88	1.35	1.41	0.77	1.13	1.09
43	SMITHKLPHA	1.10	1.44	2.43	0.79	0.97	0.93
44	SMITKLBECH	1.31	1.81	2.15	0.75	1.37	1.09
45	STERLITE	1.16	1.36	1.81	0.80	0.99	0.94
46	SUNPHARMA	1.05	1.33	1.64	0.61	0.95	0.76
47	TATATEA	0.81	0.99	1.95	0.62	0.76	1.62
48	TELCO	0.99	1.06	2.07	0.79	0.81	2.07
49	THOMASCOOK	1.47	1.81	2.78	0.98	1.00	1.27
50	TISCO	0.77	0.80	1.23	0.62	0.68	1.19
51	UNITEDPHOS	1.56	2.26	3.49	1.00	1.16	1.27
52	VYSYABANK	2.16	3.19	4.92	1.80	0.52	
53	WARTDEISEL	1.24	1.70	2.75	0.90	1.20	1.01
54	WIPRO	0.54	0.98	0.53	0.52	0.91	0.56
55	ZEETELE	0.91	1.44	1.14	0.78	1.30	1.42
	AVERAGE	1.12	1.42	2.07	0.86	1.02	1.37

Table 3A : Quoted and Effective Half Spread (percent) on NSE

No	Company	Quoted	Quoted	Quoted	Effective	Effective	Effective
		Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
1	BAJAJAUTO	0.75	1.17	2.07	1.45	1.44	1.53
2	BSES	0.73	0.94	1.71	1.20	1.18	1.23
3	CASTROL	0.87	1.28	2.06	1.63	1.46	1.66
4	CIPLA	0.63	1.05	1.21	1.19	1.43	0.95
5	COLGATE	0.87	1.18	1.70	1.63	1.38	1.14
6	CORPBANK	1.19	1.75	1.76	1.46	1.71	1.43
7	DABUR	1.10	1.64	2.43	1.49	1.71	1.65
8	DRREDDY	0.64	1.20	1.04	1.29	1.52	0.86
9	EIHOTEL	1.02	1.84	2.46	1.15	1.24	2.29
10	EMERCK	0.92	1.49	3.79	0.84	1.20	2.38
11	ESCORTS	0.95	1.60	2.65	1.17	1.33	1.91
12	GERMANREM	0.95	1.15	1.87	1.06	1.24	1.56
13	GLAXO	0.70	1.16	1.96	1.47	1.36	1.21
14	GLOBALTELE	0.70	1.55	0.94	1.51	2.70	1.46
15	GSFC	1.83	4.56	4.81	1.71	4.07	3.06
16	GUJAMBCEM	0.72	0.98	1.55	1.35	1.31	1.14
17	HDFC	0.84	1.35	1.84	1.33	1.26	1.27
18	HDFCBANK	0.90	1.15	1.85	1.39	1.38	1.41
19	HINDLEVER	0.80	0.91	1.11	1.14	1.05	0.82
20	ICICI	0.90		2.27	1.39		1.65
21	ICICIBANK	1.06	1.53	1.81	1.38	1.67	2.13
22	IDBI	1.18	1.18	2.31	1.10	1.51	2.28
23	IFCI	3.92		4.81	3.81		3.19
24	INDHOTEL	1.04		2.36	1.59		1.85
25	INFOSYSTCH	0.46	1.08	0.73	1.09	1.80	0.70
26	ITC	0.50	0.65	0.68	1.05	0.99	0.59
27	L&T	0.54	0.62	0.88	1.10	1.07	0.66
28	M&M	0.71	1.34	2.51	1.20	1.42	1.61
29	MADRASCEM	0.78	1.44	2.89	0.89	1.11	2.54
30	MTNL	0.95	1.01	1.67	1.37	1.22	1.23
31	NAGARFERT	3.37	5.87	4.55	3.16	5.73	2.77
32	NIIT	0.67	1.15	1.21	1.35	2.33	1.28
33	NIRMA	1.08	1.52	2.21	1.11	1.55	1.54
34	ORCHIDCHEM		2.39	2.76		1.78	2.17
35	ORIENTBANK	1.40	1.57	2.39	1.74	1.58	1.88
36	P&G	0.97	1.67	2.57	1.89	1.86	2.03
37	RANBAXY	0.57	1.00	1.07	1.10	1.39	0.83

Table 3A : Contd.

No	Company	Quoted	Quoted	Quoted	Effective	Effective	Effective
		Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
38	RELIANCE	0.54	0.58	1.08	0.99	1.02	1.03
39	RELPETRO	0.88	1.16	1.76	1.17	1.35	1.21
40	SATYAMCOMP	0.63	0.90	0.82	1.33	2.06	0.90
41	SBIN	0.62	0.75	0.84	1.05	1.01	0.73
42	SIEMENS	0.60	1.23	1.93	0.93	1.25	2.00
43	SILVERLINE	0.59	1.14	1.60	1.33	2.11	1.76
44	SMITHKLPHA	1.01	1.42	2.36	1.08	1.47	1.48
45	SMITKLBECH	1.06	1.72	2.04	2.08	1.73	1.77
46	STERLITIND	1.07	1.52	1.98	1.40	1.57	1.74
47	SUNPHARMA	0.80	1.27	1.79	1.10	1.27	1.37
48	TATATEA	0.72	0.98	1.71	1.24	1.24	1.20
49	TELCO	0.83	1.35	2.08	1.32	1.48	1.44
50	THOMASCOOK	1.31	1.79	2.60	1.38	1.42	1.80
51	TISCO	0.61		1.37	1.22		1.08
52	UNITEDPHOS	1.13	1.88	3.67	1.08	1.59	2.48
53	VYSYABANK	1.63	2.51	4.43	1.51	1.84	2.07
54	WARTSILA		1.62	2.70		1.44	1.81
55	WIPRO	0.54	1.28	0.56	1.06	2.07	1.62
56	ZEETELE	0.69	1.61	1.51	1.49	3.04	1.35
	AVERAGE	0.97	1.47	2.06	1.38	1.65	1.58

of the day, then they should be identified measured and analysed for the purpose of regulatory measures. Any differences, if present could be exploited by the investors and it is a sign of inefficient market. They present arbitrage opportunities.

Table 4 and Chart 1 - provide five-minute interval quoted and effective half spread. A clear pattern is visible. Market open hours present high spread, almost double of spread at close hour. As trading progresses, the spread slowly start falling. A few issues emerge from this. Volatility is considered to be high at the start of the day. Overnight information arrival could be a reason. Investors should postpone their investment decisions towards end day. Day traders should benefit by trading at the close/near close.

8.5.1 Time of the day – BSE

In an efficient stock market the spread should be uniform at all the time of the day. Any differences show up inefficiency, and arbitrage opportunities for market participants. Market efficiency hypothesis is tested to examine if there are any anomalies in the Indian market. Every five minute spread is arranged from 10.00 a.m. to 3.30 p.m. Quoted and effective spread in February 2001, are 1.64 percent and 1.07 percent at opening of the market (10.00 a.m.) respectively. Towards close both these decreased to 0.64 percent and 0.51 (15:15 p.m.) percent respectively. Quoted spread has fallen by recording around 60 per cent and effective spread by 52 per cent. An investor who postpones his decision to buy/sell saves more than 50 per cent and thus increases his return to that extent. The fall in the spread is gradual except for a few minor interruptions.

Time of the day spread exhibits almost identical pattern in the month of April 2001 also. The spread is higher at the start and they slowly recede towards close of trade time. The quoted and effective spread starts off at 2.01 percent and 1.87 percent respectively and end at 0.79 percent and 0.66 percent respectively. Range between start and end spread increased further in April and this can be attributed to the various changes effected. The fall in quoted and effective spread is almost 60 percent and 65 percent respectively. However, in the month of April also minor interruptions are noticed to continuous fall.

A close look at time of the day spread of July 2001 further reinforces two main patterns noticed earlier in February and April 2001 data. Quoted and effective spread are high at the start of trade time at 3.21 percent and 1.75 percent respectively and both these spread decreased to 0.55 percent and 0.79 percent respectively. The gap between start time and the end time quoted and the effective spread increased further to more than 80 percent and 55 percent respectively. These gaps and falls are in line with overall increase in average quoted and effective spread from February to April to July 2001. Chart 1 clearly marks this continuous fall. As time progresses quoted spread decreases. It is true for all months in BSE.

8.5.2 Time of the day - NSE

Time of the day spread on NSE reflect almost what was noticed on BSE. Market open hours spread is higher as compared to close hour spread. Spread gradually decreases over the time. Of course, the decrease is not smooth. The fall is smooth in February. Both the maximum and minimum spread are lower than those for April and July. The fall is very sharp in April 2001. The range between minimum and maximum spread rose from April to July 2001 both in case of quoted and effective spread. Chart 1A depicts Time of the day spread on NSE.

Table 4 : Time-of-day Quoted and Effective Half Spread (percent) on BSE

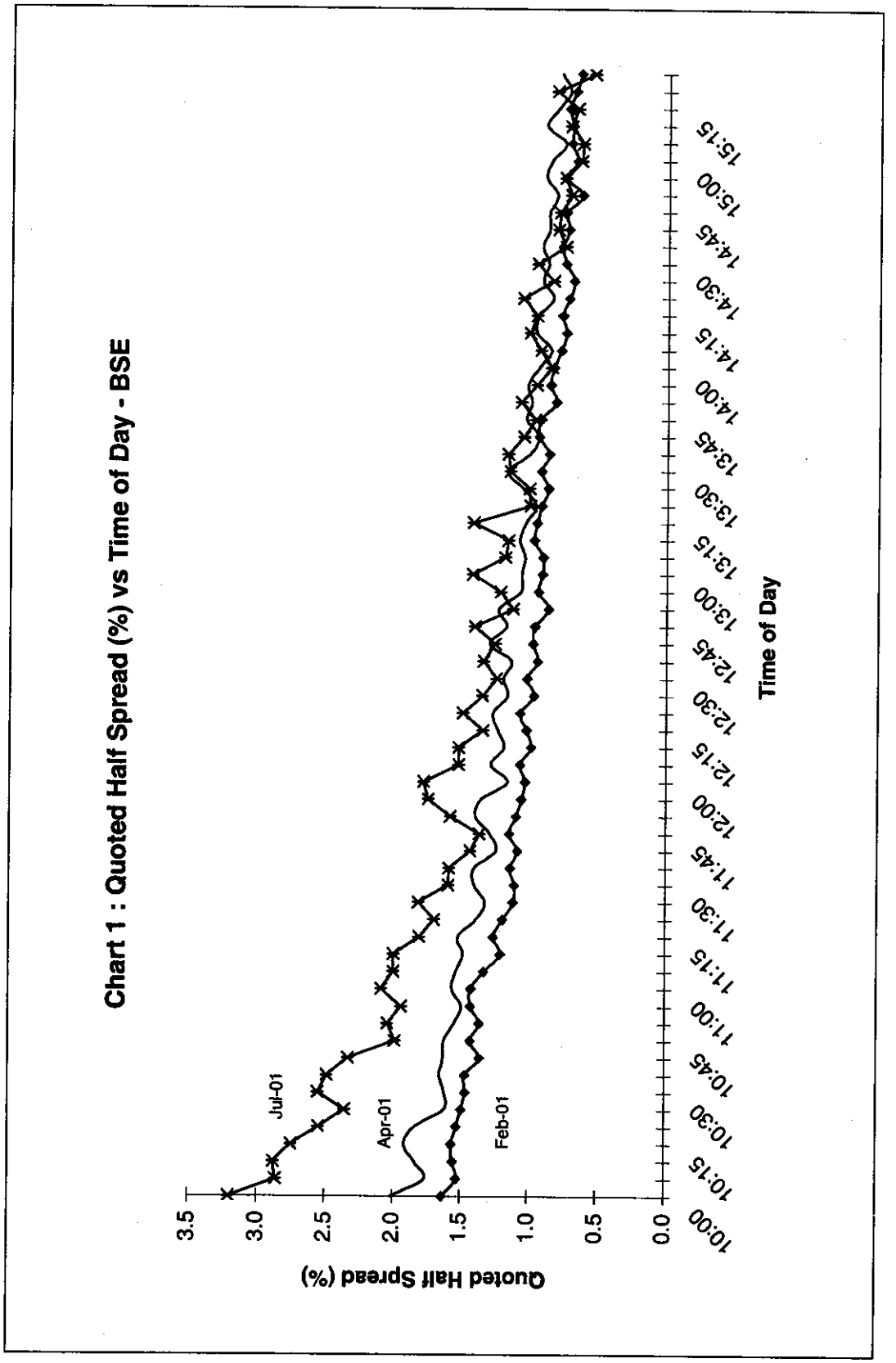
No	Time	Quoted	Quoted	Quoted	Effective	Effective	Effective
		Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
1	10:00:00	1.64	2.01	3.21	1.07	1.87	1.75
2	10:05:00	1.53	1.77	2.86	0.99	1.33	1.61
3	10:10:00	1.56	1.84	2.88	1.01	1.13	1.24
4	10:15:00	1.57	1.92	2.75	1.03	1.13	1.74
5	10:20:00	1.53	1.84	2.55	1.01	1.08	1.36
6	10:25:00	1.49	1.62	2.36	0.95	1.03	1.70
7	10:30:00	1.46	1.62	2.55	0.96	1.14	1.82
8	10:35:00	1.47	1.65	2.49	0.98	1.13	1.52
9	10:40:00	1.36	1.63	2.33	0.90	1.04	1.40
10	10:45:00	1.43	1.63	1.99	0.84	1.17	1.31
11	10:50:00	1.36	1.55	2.04	0.90	1.03	1.37
12	10:55:00	1.43	1.50	1.94	0.84	1.06	1.81
13	11:00:00	1.43	1.57	2.09	0.90	0.96	1.83
14	11:05:00	1.33	1.54	2.00	0.93	0.99	1.75
15	11:10:00	1.21	1.49	2.00	0.83	1.04	1.50
16	11:15:00	1.26	1.52	1.81	0.76	0.93	2.85
17	11:20:00	1.19	1.39	1.70	0.88	1.00	1.43
18	11:25:00	1.11	1.32	1.82	0.81	0.84	1.62
19	11:30:00	1.11	1.40	1.60	0.73	0.88	1.25
20	11:35:00	1.14	1.41	1.59	0.79	0.96	1.21
21	11:40:00	1.09	1.25	1.44	0.73	0.92	1.27
22	11:45:00	1.15	1.29	1.37	0.66	0.94	1.37
23	11:50:00	1.10	1.40	1.59	0.68	0.90	1.19
24	11:55:00	1.06	1.36	1.75	0.76	1.01	1.77
25	12:00:00	1.03	1.16	1.78	0.71	0.93	1.74
26	12:05:00	1.07	1.28	1.53	0.71	0.87	1.74
27	12:10:00	0.99	1.19	1.52	0.71	0.86	0.82
28	12:15:00	1.02	1.23	1.35	0.70	0.82	2.02
29	12:20:00	1.07	1.27	1.49	0.67	0.74	1.55
30	12:25:00	0.97	1.16	1.35	0.64	0.84	1.05
31	12:30:00	1.02	1.19	1.25	0.71	0.69	0.82
32	12:35:00	0.94	1.14	1.34	0.67	0.78	1.24
33	12:40:00	0.98	1.30	1.26	0.67	0.80	0.99
34	12:45:00	0.96	1.17	1.41	0.58	0.86	2.03
35	12:50:00	0.86	1.23	1.13	0.63	0.75	1.28
36	12:55:00	0.94	1.07	1.22	0.62	0.80	1.26
37	13:00:00	0.91	1.06	1.43	0.63	0.76	1.44

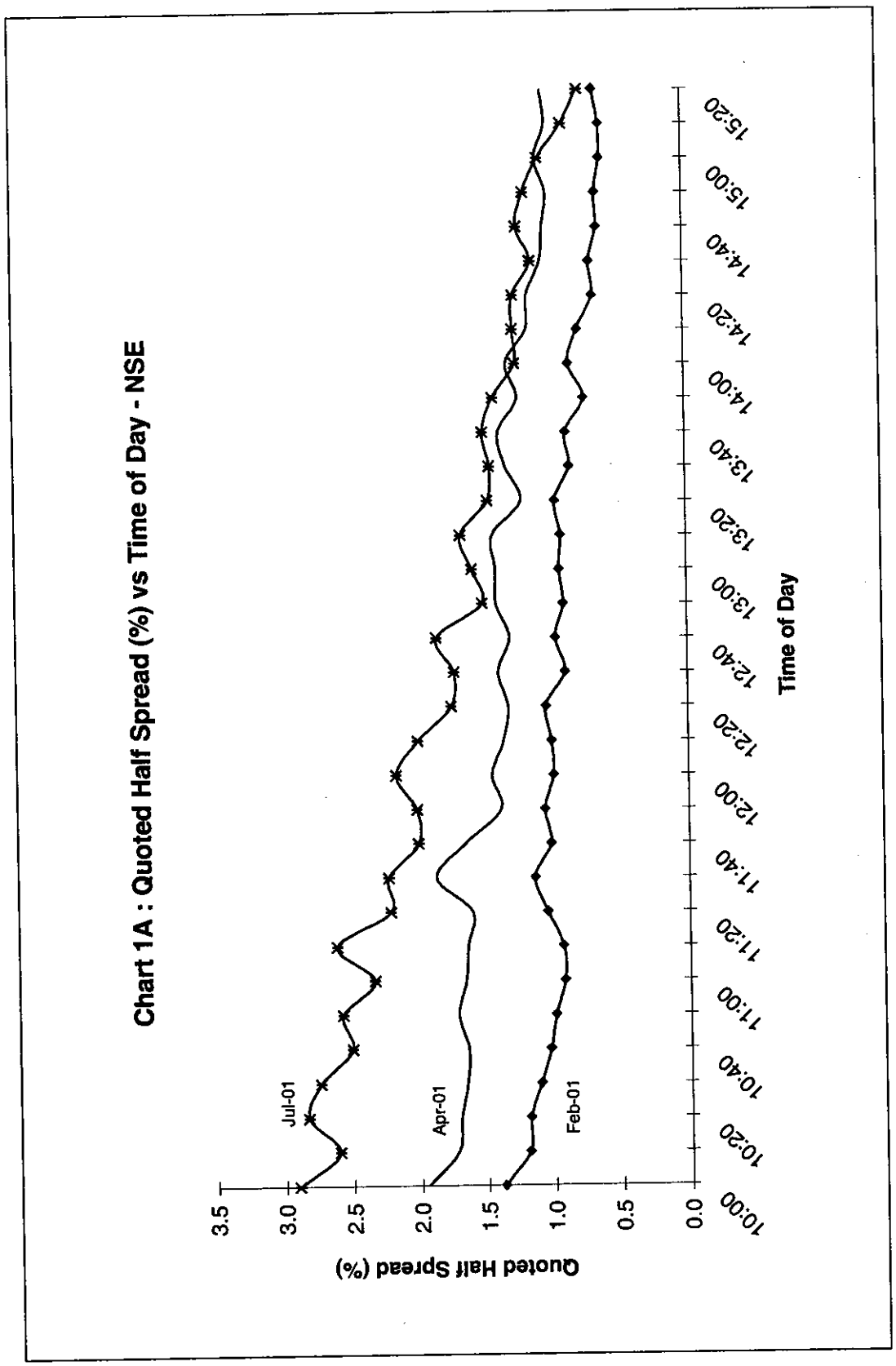
Table 4 : Contd.

No	Time	Quoted	Quoted	Quoted	Effective	Effective	Effective
		Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
38	13:05:00	0.91	1.04	1.19	0.66	0.73	1.12
39	13:10:00	0.97	1.08	1.16	0.63	0.82	1.15
40	13:15:00	0.95	1.04	1.42	0.55	0.73	1.10
41	13:20:00	0.92	0.96	1.00	0.60	0.77	1.57
42	13:25:00	0.87	1.06	1.01	0.60	0.72	1.55
43	13:30:00	0.92	1.17	1.15	0.60	0.75	1.07
44	13:35:00	0.86	1.01	1.17	0.55	0.76	1.07
45	13:40:00	0.94	0.94	1.05	0.63	0.73	1.14
46	13:45:00	0.93	1.03	0.97	0.65	0.71	1.23
47	13:50:00	0.82	1.00	1.07	0.62	0.71	1.13
48	13:55:00	0.86	1.03	0.96	0.60	0.70	0.89
49	14:00:00	0.83	0.94	0.85	0.54	0.89	0.94
50	14:05:00	0.78	0.86	0.93	0.54	0.63	0.59
51	14:10:00	0.74	0.96	1.01	0.61	0.64	0.64
52	14:15:00	0.77	0.95	0.96	0.60	0.75	2.30
53	14:20:00	0.72	0.84	1.06	0.53	0.70	0.98
54	14:25:00	0.69	0.92	0.84	0.57	0.71	0.85
55	14:30:00	0.75	0.88	0.96	0.55	0.70	0.61
56	14:35:00	0.77	0.92	0.75	0.54	0.61	1.32
57	14:40:00	0.73	0.87	0.81	0.56	0.74	0.46
58	14:45:00	0.75	0.87	0.79	0.56	0.71	0.93
59	14:50:00	0.63	0.82	0.71	0.60	0.58	0.86
60	14:55:00	0.75	0.89	0.76	0.58	0.77	0.52
61	15:00:00	0.67	0.86	0.64	0.60	0.72	0.60
62	15:05:00	0.71	0.76	0.63	0.52	0.70	1.51
63	15:10:00	0.71	0.89	0.72	0.53	0.74	0.47
64	15:15:00	0.73	0.81	0.67	0.51	0.69	1.15
65	15:20:00	0.68	0.73	0.82	1.27	0.71	0.58
66	15:25:00	0.64	0.79	0.55	1.29	0.66	0.79
	Average	1.03	1.21	1.45	0.72	0.86	1.28

Table 4A : Time-of-day Quoted and Effective Half Spread (percent) on NSE

No	Time	Quoted	Quoted	Quoted	Effective	Effective	Effective
		Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
1	10:00:00	1.38	1.95	2.90	2.02	11.66	
2	10:10:00	1.19	1.73	2.60	1.51	1.74	1.57
3	10:20:00	1.18	1.70	2.83	1.57	1.79	1.63
4	10:30:00	1.10	1.65	2.74	1.54	1.90	1.74
5	10:40:00	1.03	1.64	2.50	1.34	1.70	1.61
6	10:50:00	0.99	1.71	2.57	1.35	1.69	1.68
7	11:00:00	0.92	1.65	2.33	1.34	1.73	1.76
8	11:10:00	0.93	1.64	2.61	1.31	1.69	1.57
9	11:20:00	1.04	1.60	2.21	1.41	1.73	1.87
10	11:30:00	1.13	1.87	2.22	1.28	1.76	1.48
11	11:40:00	1.01	1.65	2.00	1.40	1.71	1.62
12	11:50:00	1.05	1.38	2.01	1.25	1.85	1.50
13	12:00:00	0.99	1.44	2.16	1.39	1.56	1.40
14	12:10:00	1.00	1.36	2.00	1.30	1.58	1.60
15	12:20:00	1.04	1.32	1.74	1.42	1.47	1.59
16	12:30:00	0.89	1.39	1.72	1.39	1.54	1.42
17	12:40:00	0.96	1.30	1.85	1.27	1.48	1.39
18	12:50:00	0.90	1.40	1.50	1.59	1.39	1.42
19	13:00:00	0.93	1.40	1.58	1.20	1.46	1.37
20	13:10:00	0.92	1.42	1.66	1.40	1.59	1.28
21	13:20:00	0.96	1.21	1.46	1.35	1.49	1.30
22	13:30:00	0.85	1.32	1.44	1.32	1.41	1.31
23	13:40:00	0.87	1.37	1.49	1.38	1.67	1.21
24	13:50:00	0.74	1.23	1.41	1.31	1.61	1.26
25	14:00:00	0.84	1.31	1.24	1.20	1.52	1.15
26	14:10:00	0.78	1.15	1.25	1.28	1.52	1.05
27	14:20:00	0.66	1.14	1.25	1.34	1.45	1.11
28	14:30:00	0.68	1.04	1.12	1.22	1.33	1.22
29	14:40:00	0.63	1.02	1.22	1.36	1.46	1.16
30	14:50:00	0.64	0.99	1.16	1.17	1.62	1.15
31	15:00:00	0.60	1.07	1.05	1.31	1.51	1.16
32	15:10:00	0.60	1.00	0.88	1.40	1.49	1.21
33	15:20:00	0.64	1.03	0.76	1.41	1.47	1.21
	AVERAGE	0.91	1.40	1.80	1.37	1.90	1.41


Chart 1 : Quoted Half Spread (%) vs Time of Day - BSE
Quoted Half Spread (%)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul-01
Apr-01
Feb-01
10:00
10:15
10:30
10:45
11:00
11:15
11:30
11:45
12:00
12:15
12:30
12:45
13:00
13:15
13:30
13:45
14:00
14:15
14:30
14:45
15:00
15:15
Time of Day


Chart 1A : Quoted Half Spread (%) vs Time of Day - NSE
Quoted Half Spread (%)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul-01
Apr-01
Feb-01
10:00
10:20
10:40
11:00
11:20
11:40
12:00
12:20
12:40
13:00
13:20
13:40
14:00
14:20
14:40
15:00
15:20
Time of Day

8.6 Trade size and Quoted spread

Investment world thinks that quoted and effective spread change depending on the size of the quantity traded. Small quantities lead to small quotes and large quantities lead to large quotes. In this article, an attempt is made to find out whether spread differs on the basis of size of the order or is it invariant to the quantity traded.

8.6.1 Trade size and spread - BSE

Should spread depend on quantity traded? In dematerialised trading and settlement environment, investor can choose to trade from one share upwards. Theoretically, it makes sense to say that spread does depend on traded quantity. There is a popular belief in India to measure impact cost. Impact cost is measured for a predefined portfolio value. This value takes into consideration number of shares required though they are away from 'best quote'. Fundamentally, this is not correct measure of impact cost for the reason that the quotes considered are unobserved and subject to change before they become 'best quotes'.

Entire data of each month divided into deciles to find out, if there are any substantial differences in quoted and effective spread between deciles. If changes are small, then it would be possible to say that spread are independent of quote and trade size. Quoted and effective spread for the month of February 2001, are 0.81 percent and 0.62 percent respectively for the smallest decile quantity. For the largest quantity (tenth decile) they are at 0.97 percent and 0.75 percent respectively. In fact highest quoted spread occurred at eighth decile and same for effective spread has occurred at fourth decile. Taking quantity into consideration of highest effective spread is also spotted at eighth decile only. Differences between the spread of first and tenth deciles are not very large. No statistical test is conducted to state that the differences are significant or not. However, looking at the differences in quantity and deciles, it may be possible to state that the differences between deciles are in fact small.

April 2001 decile data more or less discloses what was observed in February 2001, with one general additional information i.e. overall spread are higher. Differences in spread between deciles are not large. Differences between first and tenth are also not substantial. This observation holds well for both quoted and effective spread. The highest spread occurred in different deciles (7^{th} and 9^{th}) for the two kinds of spread.

July 2001, data reveals some additional interesting points. Some common points observed in February and April continue to hold well. In case of quoted spread the range between the smallest and largest deciles narrowed down and also differences in spread between deciles are small. In case of effective spread the highest spread appeared in the smallest decile (1.58 percent). Another observation is that effective spread is outside quoted spread implying higher costs to investors. Table 5 presents information on deciles.

Lack of difference may have something to do with implementation of stock market microstructure. Participants can see, on the computer screen, only best five quotes. Entire book cannot be seen. In case of large quantities, participants exhibit small quantity to find out the pulse of the market and hide the balance to release depending on responses.

8.6.2 Trade size and spread – NSE

February spread is lower than that for both April and July. Range for the data is 0.46 per cent, which is much higher than that for BSE for the same period (0.16 per cent). April and July 2001, NSE decile data

Table 5 : Traded Quantity Decile: Quoted and Effective Half Spread (percent) on BSE

Decile	Quoted	Quoted	Quoted	Effective	Effective	Effective
	Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
Smallest	0.81	0.99	0.98	0.62	0.82	1.58
Second	0.86	1.04	1.09	0.69	0.82	1.22
Third	0.91	1.05	0.92	0.77	0.89	1.16
Fourth	0.95	1.07	1.10	0.81	0.86	1.35
Fifth	0.94	1.10	1.15	0.73	0.88	1.26
Sixth	0.98	1.01	0.99	0.73	0.85	1.33
Seventh	0.96	1.14	1.08	0.76	0.92	1.20
Eighth	1.00	1.02	1.08	0.78	0.90	1.29
Ninth	0.97	1.12	1.16	0.73	0.93	1.41
Largest	0.97	1.11	1.02	0.75	0.91	1.22

Table 5A : Traded Quantity Decile: Quoted and Effective Half Spread (percent) on NSE

Decile	Quoted	Quoted	Quoted	Effective	Effective	Effective
	Feb 2001	Apr 2001	Jul 2001	Feb 2001	Apr 2001	Jul 2001
Smallest	0.71	1.23	1.36	1.26	1.51	1.37
Second	0.79	1.26	1.65	1.25	1.45	1.34
Third	0.85	1.28	1.66	1.27	1.52	1.23
Fourth	0.82	1.30	1.68	1.28	1.54	1.42
Fifth	0.91	1.31	1.63	1.27	1.46	1.38
Sixth	0.89	1.31	1.76	1.31	1.54	1.30
Seventh	0.99	1.36	1.68	1.34	1.57	1.43
Eighth	0.91	1.40	1.78	1.41	1.60	1.50
Ninth	0.94	1.42	1.72	1.46	1.85	1.48
Largest	1.17	1.53	1.91	1.71	1.90	1.69

pattern somewhat different from BSE. Differences between smallest and largest decile spread are not large. However, the differences are larger compared to BSE spread. In both months gradual progress in spread from first to tenth decile is visible. Largely, minimum and maximum spread occurred at first and tenth deciles respectively. Therefore, the realised impact cost does not depend on trade size. Further information is included in Table 5A.

9. Econometric Analysis

BAS assumes significant place in Financial Economics literature. Investors (fund managers), traders, policy makers, stock exchanges and regulators are either affected or concerned about high spread. They continually strive to bring them down. In a very competitive fund management environment, fund manager tries to reduce spread to increase return to investor. Stock exchanges have come to think that one of the ways of attracting and increasing volumes on exchanges is by introducing changes to trading platforms so that trading costs come down. Regulators are also interested in reducing trade execution costs. International competition and developments are coercing regulators to respond quickly to changes and benefit investors without compromising on safety and integrity of the market place.

In order to make effective regulatory policy, it is necessary to know the impact of intensity and interaction of various micro variables on quoted half spread. Past research studies state that economic variables such as: market capitalisation of the company, variance, value traded, closing price and number of shares traded influence spread. Many of these variables are highly correlated with each other, which poses the problem of multi-collinearity. Closing price has correlation of around 70% with both volume and value traded. Therefore, closing price has been excluded from the model. Volume traded also has been eliminated owing to its insignificant economic relationship. Finally, the model has log turnover, variance of log returns log market capitalisation (MCAP) and number of trades in it as explanatory variables. These are regressed on the dependent variable quoted half spread.

Financial Economics literature states that turnover, volatility (variance), market capitalisation and number of trades cause changes in BAS. Higher turnover is expected to bring down trade execution costs. Lower spread encourages investor to trade more. Thus, these two have complimentary role. Investor is expected to make profit on volume not on high margin. This motivates investors to trade further offering thin spread. The relationship between turnover and BAS is negative. Interaction between volatility and spread is a complex one. Higher variance means higher risk, which means higher expected return on investment. Higher return can be achieved either by reducing costs (spread is one of them) or by increasing return or by both. Ex ante, the relationship is positive.

Market capitalisation is yet another variable, which is expected to influence the behaviour of spread. Though simple to measure market capitalisation, its flow concept is tricky one. Free float is the relevant one. But free float market capitalisation is not readily available in India. Therefore, entire market capitalisation of each company is considered for the study. A *priori* relationship is negative.

Multiple regression equation is employed to study economic relationship. The following cross-sectional multiple regression is employed.

$$S = a_0 + a_1 \log V + a_2 \sigma^2 + a_3 \log MV + a_4 \log N + e \quad (5)$$

Where S is the stock's proportional quoted half spread defined as ½ (ask quote – bid quote)*100, V is the daily turnover (Rs.), σ^2 is the return variance, MV is the stock's market capitalisation, N is number of trades and e is the error term.

Turnover, on expected lines, consistently has inverse relation with BAS. All the coefficients are significant at 5 percent level. It is possible to say that turnover influences trade execution costs. Policy makers and regulators should strive improve turnover on stock exchanges to reduce costs and increase return to investor. The ex-post relationship between variance and BAS is positive as expected. This variable is statistically significant at 5 percent level. July results exhibit somewhat weird behaviour. July results can be attributed to the changed market structure – rolling settlement. Owing to changes volumes decreased resulting in lower turnover. Lower turnover, sometimes, reduces variance. However, lower turnover also enhances trade cost.

Ceteris Paribus, market capitalisation is expected to have inverse relationship. Both in February and April the relationship is positive and it is negative only in July. However, all the three times, coefficients are statistically insignificant. The above results are in line with the study by Stoll (2000).

Table 6 : Regression Results

Quoted Half Spread on Turnover, Return Variance, Market Capitalisation and Number of Trades

	The Stock Exchange,			Mumbai National Stock Exchange		
	Feb-01	Apr-01	Jul-01	Feb-01	Apr-01	Jul-01
Intercept	6.46	7.36	6.41	-0.76	-0.92	3.44
	(12.26)	(11.98)	(11.34)	(-1.43)	(-1.13)	(6.28)
Turnover	-0.53	-0.51	-0.03	-0.78	-1.07	-0.39
	(-7.10)	(-5.85)	(-0.38)	(-7.42)	(-6.58)	(-4.35)
Return Variance	41.94	97.66	-56.02	14.02	119.39	252.42
	(2.20)	(5.78)	(-3.89)	(0.42)	(3.48)	(2.52)
Market Capitalisation	0.08	0.09	-0.23	0.08	0.31	0.04
	(2.09)	(1.90)	(-3.51)	(1.49)	(3.26)	(0.43)
Number of Trades	0.46	0.24	-0.32	0.81	0.79	-0.01
	(4.82)	(2.23)	(-4.16)	(6.19)	(4.37)	(-0.12)
Adjusted R-Square	0.78	0.81	0.85	0.67	0.66	0.79

t statistic in parenthesis

The dependent variable is quoted half spread in percent terms.

Turnover is log of average daily turnover.

Variance is variance of daily returns for the month.

Market Capitalisation is log of market capitalisation as at end of month.

Number of trades is log of average daily number of trades.

10 Summary Findings

1. Quoted spread on BSE, on an average, for the month of February 2001 worked out to 1.20 per cent. The range between high and low is very high. The smallest and largest spread is 0.44 per cent (Reliance Industries) and 3.58 per cent (Nagarjuna Fertilisers) respectively.

2. Spread went up in April 2001. All other parameters are also higher than their counterparts in February 2001. The average spread is 1.42 per cent. Range between minimum and maximum also increased.

3. July quoted spread almost doubled to 2.07 per cent and it is higher than that of February and April 2001. Other statistics such as minimum, maximum, standard deviation and mean also exhibited further hike.

4. Effective spread is an indicator of actual cost incurred by an investor to execute a trade. Effective spread for February 2001 is 0.86 per cent and is lower than the quoted spread for February.

5. April and July effective spread on BSE rose to 1.02 per cent and 1.37 per cent respectively.

6. Quoted spread for April 2001, both on NSE and BSE, roughly works out to the same. However at 0.97 per cent it is much lower than BSE spread for February (1.12 per cent). Average spread on NSE is 1.47 per cent. Again spread for July too are almost identical on both the exchanges. The average is 2.06 per cent.

7. Effective spread is higher on NSE for both April and July.

8. Graphical relation between quoted spread and average daily turnover, market capitalisation and volatility are presented in charts 2, 2A, 3, 3A, 4 and 4A. Turnover and quoted spread are inversely related. Market capitalisation too has negative relationship with spread. Variance exhibited positive relationship.

9. Speed and time of arrival of information in the market affects trade cost. Symmetrical arrival is expected to have uniform trade cost. Table 4 and chart 1 present information related to time of the day spread. Spread is higher in the open hours but tapers off as trading progresses.

10. Volatility, as expected, has positive influence on BAS, which is mostly significant. Efforts are required to be made to reduce volatility.

11. Market capitalisation parameter has expected relationship except in July 2001. However, the coefficients are found to be statistically significant.

12. The model explains roughly 80 per cent variation in the dependent variable and has good fit.

13. The results are important for fund managers, stock exchanges and regulators. Exchanges and regulators in India, should take further steps to bring down spreads.

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Quoted Half Spread (Ascending), BSE, February 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
1	WIPRO	0.54	0.52	5154.49	0.0010	64474.36
2	RELIANCE	0.54	0.44	6077.96	0.0002	42939.04
3	INFOSYSTCH	0.55	0.45	6246.04	0.0010	41623.11
4	DRREDDY	0.60	0.47	269.92	0.0002	3459.52
5	ITC	0.63	0.47	1620.19	0.0011	20184.15
6	L&T	0.64	0.55	2401.23	0.0007	6781.76
7	RANBAXY	0.69	0.51	525.52	0.0001	7762.56
8	SATYAMCOMP	0.70	0.60	9457.63	0.0019	10313.04
9	TISCO	0.77	0.62	1221.09	0.0006	5683.49
10	NIIT	0.79	0.66	726.38	0.0009	5407.96
11	CIPLA	0.80	0.61	363.34	0.0003	6822.74
12	GUJAMBCEM	0.80	0.67	514.58	0.0012	2913.46
13	TATATEA	0.81	0.62	443.41	0.0015	1557.92
14	SBIN	0.81	0.65	1146.32	0.0010	12529.84
15	BSES	0.83	0.70	732.76	0.0013	3246.90
16	GLOBALTELE	0.85	0.73	5367.92	0.0042	2549.46
17	MADRASCEM	0.87	0.60	28.79	0.0003	633.50
18	SILVERLINE	0.88	0.77	2935.03	0.0041	1698.53
19	HINDLEVER	0.89	0.66	1670.00	0.0010	46558.54
20	SIEMENS	0.89	0.63	93.95	0.0003	1077.94
21	ZEETELE	0.91	0.78	5480.56	0.0026	9423.37
22	MTNL	0.93	0.73	1310.56	0.0009	11316.53
23	M&M	0.93	0.74	768.09	0.0012	1867.82
24	GLAXO	0.97	0.70	148.99	0.0011	2689.19
25	TELCO	0.99	0.79	844.63	0.0019	2592.79
26	BAJAJAUTO	0.99	0.72	145.35	0.0005	3218.52
27	GERMANREM	1.02	0.70	47.13	0.0009	430.52
28	RELPETRO	1.04	0.70	885.81	0.0003	30839.45
29	SUNPHARMA	1.05	0.61	34.54	0.0001	2780.08
30	EMERCK	1.05	0.78	31.35	0.0005	787.74
31	ESCORTS	1.08	0.77	145.75	0.0016	838.58
32	INDHOTEL	1.09	0.77	60.34	0.0013	1326.27
33	CASTROL	1.09	2.14	58.41	0.0003	3404.87
34	SMITHKLPHA	1.10	0.79	60.28	0.0009	600.09
35	ICICI	1.11	0.82	368.47	0.0030	7813.19

Quoted Half Spread (Ascending), BSE, February 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
36	COLGATE	1.13	0.80	102.50	0.0006	2514.20
37	STERLITE	1.16	0.80	222.89	0.0021	922.40
38	NIRMA	1.17	0.85	61.99	0.0018	5583.16
39	EIHOTEL	1.18	0.86	35.77	0.0008	1143.40
40	HDFC	1.18	0.79	171.29	0.0004	6813.41
41	HDFCBANK	1.21	0.84	107.57	0.0006	6233.82
42	WARTDEISEL	1.24	0.90	66.89	0.0017	176.98
43	ICICIBANK	1.29	0.91	120.88	0.0028	3321.91
44	SMITKLBECH	1.31	0.75	13.56	0.0004	1817.41
45	CORPBANK	1.32	0.96	47.97	0.0036	1410.96
46	P&G	1.32	0.80	22.24	0.0004	1507.62
47	DABUR	1.33	0.93	67.92	0.0009	2015.97
48	THOMASCOOK	1.47	0.98	5.36	0.0005	425.02
49	IDBI	1.51	0.79	19.31	0.0113	3386.97
50	UNITEDPHOS	1.56	1.00	29.25	0.0013	195.30
51	ORIENTBANK	1.65	1.17	15.51	0.0004	810.21
52	GSFC	2.05	1.36	5.15	0.0029	233.95
53	VYSYABANK	2.16	1.80	1.20	0.0024	257.17
54	IFCI	2.94	1.78	3.25	0.0037	457.46
55	NAGARFERT	3.07	3.58	0.64	0.0014	402.12
	AVERAGE	1.12	0.86	1063.78	0.0015	7414.11

Turnover is for the month

Market Capitalisation is at end of month

Quoted Half Spread (Ascending), BSE, April 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
1	RELIANCE	0.60	0.62	2002.61	0.0022	36821.90
2	L&T	0.70	0.62	786.56	0.0007	5474.23
3	SBIN	0.79	0.62	196.65	0.0005	10956.68
4	TISCO	0.80	0.68	284.54	0.0017	4726.13
5	GUJAMBCEM	0.84	0.77	118.24	0.0013	2522.71
6	ITC	0.85	0.65	323.50	0.0002	20651.66
7	HINDLEVER	0.85	0.63	386.68	0.0002	47208.55
8	INFOSYSTCH	0.86	0.82	2585.57	0.0068	24128.37
9	CIPLA	0.89	0.75	194.07	0.0014	6180.36
10	BSES	0.91	0.78	49.77	0.0007	2633.34
11	RANBAXY	0.92	0.76	174.91	0.0029	5731.02
12	DRREDDY	0.96	0.82	174.96	0.0019	3375.21
13	MTNL	0.96	0.77	266.88	0.0006	8744.57
14	WIPRO	0.98	0.91	1269.46	0.0085	28590.27
15	TATATEA	0.99	0.76	91.98	0.0009	1204.17
16	GLAXO	1.02	0.70	28.01	0.0007	2402.39
17	SATYAMCOMP	1.03	1.01	3146.53	0.0097	6276.94
18	TELCO	1.06	0.81	180.08	0.0011	1716.93
19	NIIT	1.08	1.14	667.75	0.0107	1975.30
20	BAJAJAUTO	1.11	0.80	36.04	0.0004	2454.05
21	COLGATE	1.16	0.87	20.46	0.0004	2171.66
22	M&M	1.23	0.98	51.95	0.0010	1358.50
23	HDFCBANK	1.24	0.89	29.85	0.0002	5682.72
24	CASTROL	1.25	0.90	16.09	0.0006	2840.46
25	HDFC	1.25	0.79	35.61	0.0003	6830.40
26	RELPETRO	1.26	0.87	279.68	0.0009	23002.09
27	ICICI	1.28	0.92	48.69	0.0009	6645.87
28	SUNPHARMA	1.33	0.95	17.25	0.0012	2460.50
29	SILVERLINE	1.35	1.13	418.26	0.0102	639.08
30	STERLITE	1.36	0.99	41.24	0.0022	574.53
31	GERMANREM	1.37	1.01	21.58	0.0010	390.98
32	INDHOTEL	1.37	0.99	10.33	0.0003	1108.37
33	MADRASCEM	1.41	0.65	10.40	0.0002	511.59
34	SIEMENS	1.42	0.86	17.69	0.0006	748.96
35	SMITHKLPHA	1.44	0.97	5.97	0.0008	585.65

Quoted Half Spread (Ascending), BSE, April 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
36	ZEETELE	1.44	1.30	769.10	0.0115	4436.71
37	ESCORTS	1.45	0.99	8.27	0.0009	560.39
38	NIRMA	1.47	1.27	14.70	0.0011	3289.97
39	GLOBALTELE	1.52	1.48	1316.01	0.0150	740.88
40	ICICIBANK	1.53	1.14	25.43	0.0010	3440.64
41	EMERCK	1.59	0.95	4.51	0.0011	710.17
42	CORPBANK	1.59	1.10	6.84	0.0021	1403.53
43	DABUR	1.60	1.11	11.61	0.0005	1789.87
44	IDBI	1.64	0.89	3.70	0.0004	2882.54
45	ORIENTBANK	1.66	1.16	2.21	0.0004	754.30
46	WARTDIESEL	1.70	1.20	17.45	0.0023	91.83
47	P&G	1.72	1.15	5.93	0.0006	1209.01
48	EIHOTEL	1.80	1.06	2.06	0.0001	1125.15
49	THOMASCOOK	1.81	1.00	1.62	0.0010	300.56
50	SMITKLBECH	1.81	1.37	5.32	0.0003	1692.14
51	UNITEDPHOS	2.26	1.16	2.64	0.0009	109.84
52	GSFC	2.70	1.06	0.43	0.0008	155.10
53	VYSYABANK	3.19	3.52	0.23	0.0014	213.50
54	IFCI	3.48	2.67	0.45	0.0034	321.19
55	NAGARFERT	4.25	1.46	0.11	0.0004	308.78
	AVERAGE	1.42	1.02	294.34	0.0022	5542.95

Turnover is for the month

Market Capitalisation is at end of month

Quoted Half Spread (Ascending), BSE, July 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
1	WIPRO	0.53	0.56	1747.94	0.0039	30528.45
2	ITC	0.59	0.86	183.91	0.0010	18906.65
3	RELIANCE	0.62	1.16	961.16	0.0010	34270.35
4	INFOSYSTECH	0.68	1.95	3062.51	0.0019	24013.15
5	GLOBALTELE	0.69	0.74	754.46	0.0091	980.17
6	DRREDDY	0.80	1.15	329.27	0.0019	6152.33
7	L&T	0.81	0.99	254.06	0.0014	5304.98
8	NIIT	0.85	1.37	548.15	0.0107	1042.53
9	SBIN	0.88	1.09	88.76	0.0013	11399.38
10	HINDLEVER	0.91	1.15	372.05	0.0009	46624.61
11	SATYAMCOMP	0.93	1.10	1416.91	0.0040	4697.75
12	CIPLA	0.98	1.29	80.61	0.0013	6557.65
13	RANBAXY	1.05	1.10	245.16	0.0013	5772.04
14	ZEETELE	1.14	1.42	697.53	0.0056	3932.39
15	TISCO	1.23	1.19	194.80	0.0017	3659.02
16	SILVERLINE	1.41	1.09	57.92	0.0044	458.31
17	ICICIBANK	1.44	1.03	24.61	0.0065	2736.91
18	BSES	1.51	1.39	8.96	0.0011	2704.23
19	COLGATE	1.53	0.99	13.52	0.0043	2213.41
20	SUNPHARMA	1.64	0.76	12.43	0.0032	2571.32
21	GUJAMBCEM	1.67	1.42	9.01	0.0016	2676.04
22	HDFCBANK	1.68	1.24	24.74	0.0013	5330.78
23	MTNL	1.68	1.56	47.00	0.0022	7790.24
24	BAJAJAUTO	1.72	2.53	10.84	0.0061	2470.30
25	RELPETRO	1.72	2.56	63.72	0.0008	21807.59
26	CORPBANK	1.79	0.91	6.33	0.0173	1711.91
27	STERLITE	1.81	0.94	37.71	0.0039	557.74
28	GERMENREM	1.87	1.46	6.89	0.0112	370.27
29	GLAXO	1.94	1.14	13.63	0.0030	1750.20
30	TATATEA	1.95	1.62	16.02	0.0040	997.70
31	TELCO	2.07	2.07	34.57	0.0038	1775.10
32	HDFC	2.10	0.79	172.72	0.0012	7878.04
33	SMITKLBECH	2.15	1.09	3.92	0.0066	1857.09
34	SIEMENS	2.18	1.20	2.26	0.0207	691.29
35	IDBI	2.34	1.30	1.63	0.0023	2415.30

Quoted Half Spread (Ascending), BSE, July 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
36	NIRMA	2.41	1.07	3.24	0.0080	3143.59
37	SMITHKLPHA	2.43	0.93	0.46	0.0000	429.60
38	ICICI	2.50	2.10	7.61	0.0044	5217.12
39	M&M	2.53	2.75	11.25	0.0021	878.45
40	DABUR	2.56	1.90	2.90	0.0008	1725.21
41	CASTROL	2.57	1.26	4.13	0.0014	2691.03
42	WARTDIESEL	2.75	1.01	0.66	0.0048	80.90
43	THOMASCOOK	2.78	1.27	1.01	0.0138	387.21
44	INDHOTEL	2.93	0.99	5.41	0.0022	909.97
45	ESCORTS	3.00	1.27	0.59	0.0065	454.74
46	EIHOTEL	3.05	1.55	15.59	0.0021	1192.01
47	MADRASCEM	3.34	0.79	6.56	0.0027	519.70
48	ORIENTBANK	3.34	0.72	2.12	0.0008	685.12
49	UNITEDPHOS	3.49	1.27	0.37	0.0056	98.04
50	NAGARFERT	3.64	2.99	0.12	0.0000	256.00
51	P&G	3.91	0.41	1.33	0.0013	1159.22
52	IFCI	4.14	4.56	0.11	0.0000	230.66
53	EMERCK	4.33	2.08	1.94	0.0000	581.77
54	GSFC	4.49	0.60	0.28	0.0000	124.24
55	VYSYSBANK	4.92		0.09	0.0000	217.31
	AVERAGE	2.07	1.37	210.39	0.0038	5374.31

Turnover is for the month

Market Capitalisation is at end of month

Quoted Half Spread (Ascending), NSE, February 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
1	INFOSYSTCH	0.46	1.09	7297.81	0.0010	41289.37
2	ITC	0.50	1.05	2155.02	0.0011	19049.10
3	L&T	0.54	1.10	3069.78	0.0006	6490.76
4	RELIANCE	0.54	0.99	6780.01	0.0002	43636.08
5	WIPRO	0.54	1.06	4537.70	0.0011	59087.20
6	RANBAXY	0.57	1.10	634.75	0.0001	7986.36
7	SILVERLINE	0.59	1.33	3533.49	0.0036	1235.59
8	SIEMENS	0.60	0.93	67.01	0.0003	1043.07
9	TISCO	0.61	1.22	1625.95	0.0006	5687.72
10	SBIN	0.62	1.05	1626.62	0.0010	12920.66
11	SATYAMCOMP	0.63	1.33	12448.04	0.0020	9710.90
12	CIPLA	0.63	1.19	290.61	0.0003	6038.02
13	DRREDDY	0.64	1.29	219.47	0.0002	3516.45
14	NIIT	0.67	1.35	932.48	0.0009	4783.81
15	ZEETELE	0.69	1.49	7222.01	0.0027	6590.77
16	GLOBALTELE	0.70	1.51	7231.06	0.0038	1735.59
17	GLAXO	0.70	1.47	129.53	0.0010	2762.20
18	M&M	0.71	1.20	493.45	0.0011	1784.92
19	TATATEA	0.72	1.24	404.21	0.0016	1507.54
20	GUJAMBCEM	0.72	1.35	423.24	0.0010	2752.76
21	BSES	0.73	1.20	596.32	0.0010	3041.16
22	BAJAJAUTO	0.75	1.45	118.55	0.0006	3278.85
23	MADRASCEM	0.78	0.89	22.24	0.0003	598.21
24	HINDLEVER	0.80	1.14	1748.83	0.0011	50435.11
25	SUNPHARMA	0.80	1.10	35.72	0.0001	2757.25
26	TELCO	0.83	1.32	860.55	0.0015	2633.43
27	HDFC	0.84	1.33	165.58	0.0004	7069.42
28	COLGATE	0.87	1.63	76.39	0.0006	2466.23
29	CASTROL	0.87	1.63	59.01	0.0004	3366.70
30	RELPETRO	0.88	1.17	855.75	0.0003	27269.21
31	HDFCBANK	0.90	1.39	118.11	0.0006	6241.30
32	ICICI	0.90	1.39	302.63	0.0025	8407.11
33	EMERCK	0.92	0.84	24.34	0.0004	791.04
34	MTNL	0.95	1.37	1357.75	0.0008	9286.20
35	GERMANREM	0.95	1.06	29.25	0.0008	470.47

Quoted Half Spread (Ascending), NSE, February 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
36	ESCORTS	0.95	1.17	110.16	0.0012	723.77
37	P&G	0.97	1.89	19.96	0.0004	1488.43
38	SMITHKLPHA	1.01	1.08	45.56	0.0008	630.48
39	EIHOTEL	1.02	1.15	23.92	0.0007	1082.18
40	INDHOTEL	1.04	1.59	36.84	0.0013	1318.25
41	ICICIBANK	1.06	1.38	119.36	0.0028	3466.96
42	SMITKLBECH	1.06	2.08	13.78	0.0002	1751.47
43	STERLITIND	1.07	1.40	175.35	0.0020	837.85
44	NIRMA	1.08	1.11	50.56	0.0017	5642.12
45	DABUR	1.10	1.49	55.93	0.0008	2006.49
46	UNITEDPHOS	1.13	1.08	18.41	0.0011	174.88
47	IDBI	1.18	1.10	26.65	0.0101	2082.74
48	CORPBANK	1.19	1.46	43.83	0.0036	1539.60
49	THOMASCOOK	1.31	1.38	5.52	0.0005	387.11
50	ORIENTBANK	1.40	1.74	20.79	0.0004	811.55
51	VYSYABANK	1.63	1.51	6.06	0.0023	245.95
52	GSFC	1.83	1.71	2.19	0.0024	215.45
53	NAGARFERT	3.37	3.16	2.85	0.0016	392.00
54	IFCI	3.92	3.81	6.54	0.0039	435.23
	AVERAGE	0.97	1.38	1264.40	0.0014	7276.91

Turnover is for the month

Market Capitalisation is at end of month

Quoted Half Spread (Ascending), NSE, April 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
1	RELIANCE	0.58	1.02	2871.03	0.0022	36091.18
2	L&T	0.62	1.07	1011.94	0.0006	5445.62
3	ITC	0.65	0.99	570.15	0.0002	20595.22
4	SBIN	0.75	1.01	274.04	0.0005	11028.61
5	SATYAMCOMP	0.90	2.06	4936.90	0.0089	6066.67
6	HINDLEVER	0.91	1.05	26.41	0.0002	46197.42
7	BSES	0.94	1.18	47.91	0.0005	2669.20
8	GUJAMBCEM	0.98	1.31	89.75	0.0013	2525.45
9	TATATEA	0.98	1.24	94.83	0.0008	1201.70
10	RANBAXY	1.00	1.39	240.30	0.0027	5785.50
11	MTNL	1.01	1.22	273.29	0.0006	9415.35
12	CIPLA	1.05	1.43	185.73	0.0015	6887.22
13	INFOSYSTCH	1.08	1.80	3739.20	0.0065	24536.64
14	SILVERLINE	1.14	2.11	561.15	0.0097	580.16
15	HDFCBANK	1.15	1.38	463.83	0.0003	5605.13
16	GERMANREM	1.15	1.24	22.06	0.0010	373.66
17	NIIT	1.15	2.33	1116.77	0.0105	1459.40
18	GLAXO	1.16	1.36	27.78	0.0006	2208.99
19	RELPETRO	1.16	1.35	386.26	0.0009	22252.91
20	BAJAJAUTO	1.17	1.44	34.11	0.0005	2297.88
21	INDHOTEL	1.18	1.51	5.61	0.0003	1076.89
22	COLGATE	1.18	1.38	14.46	0.0004	2453.99
23	DRREDDY	1.20	1.52	183.11	0.0019	3540.47
24	SIEMENS	1.23	1.25	12.94	0.0006	637.17
25	SUNPHARMA	1.27	1.27	22.80	0.0011	2574.01
26	CASTROL	1.28	1.46	18.73	0.0006	3041.27
27	WIPRO	1.28	2.07	1674.51	0.0084	32937.26
28	M&M	1.34	1.42	41.97	0.0008	1494.89
29	TELCO	1.35	1.48	159.02	0.0011	1934.76
30	HDFC	1.35	1.26	39.12	0.0004	6837.14
31	SMITHKLPHA	1.42	1.47	4.14	0.0007	555.66
32	MADRASCEM	1.44	1.11	3.19	0.0003	511.70
33	EMERCK	1.49	1.20	3.95	0.0010	706.82
34	NIRMA	1.52	1.55	32.78	0.0013	3433.30
35	STERLITIND	1.52	1.57	34.49	0.0020	597.15

Quoted Half Spread (Ascending), NSE, April 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
36	ICICIBANK	1.53	1.67	79.54	0.0008	3498.19
37	GLOBALTELE	1.55	2.70	2218.23	0.0144	1403.29
38	ORIENTBANK	1.57	1.58	4.38	0.0004	757.64
39	ESCORTS	1.60	1.33	7.29	0.0008	555.83
40	ZEETELE	1.61	3.04	976.22	0.0114	4063.17
41	WARTSILA	1.62	1.44	11.19	0.0023	86.95
42	DABUR	1.64	1.71	11.94	0.0005	1976.54
43	P&G	1.67	1.86	4.04	0.0007	1281.87
44	SMITKLBECH	1.72	1.73	4.96	0.0004	1721.51
45	CORPBANK	1.75	1.71	7.34	0.0020	1425.60
46	THOMASCOOK	1.79	1.42	1.58	0.0009	289.48
47	EIHOTEL	1.84	1.24	3.92	0.0001	1144.78
48	UNITEDPHOS	1.88	1.59	2.25	0.0008	111.83
49	ORCHIDCHEM	2.39	1.78	0.97	0.0008	203.55
50	VYSYABANK	2.51	1.84	1.08	0.0009	218.74
51	GSFC	4.56	4.07	0.20	0.0009	150.82
52	NAGARFERT	5.87	5.73	0.40	0.0004	310.68
	AVERAGE	1.47	1.65	433.84	0.0021	5668.40

Turnover is for the month

Market Capitalisation is at end of month

Annexure 3A

Quoted Half Spread (Ascending), NSE, July 2001

Percent

No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
1	WIPRO	0.56	1.62	2700.22	0.0012	33547.59
2	ITC	0.68	0.59	302.24	0.0003	19454.04
3	INFOSYSTCH	0.73	0.70	4955.79	0.0016	24826.72
4	SATYAMCOMP	0.82	0.90	2438.84	0.0017	4637.89
5	SBIN	0.84	0.73	172.95	0.0003	10612.84
6	L&T.	0.88	0.66	387.37	0.0005	5305.20
7	GLOBALTELE	0.94	1.46	1743.33	0.0047	731.29
8	DRREDDY	1.04	0.86	401.09	0.0007	5337.08
9	RANBAXY	1.07	0.83	380.34	0.0007	6170.28
10	RELIANCE	1.08	1.03	1271.89	0.0006	33599.04
11	HINDLEVER	1.11	0.82	527.78	0.0004	48480.94
12	CIPLA	1.21	0.95	90.38	0.0004	6420.04
13	NIIT	1.21	1.28	1158.32	0.0049	645.44
14	TISCO	1.37	1.08	303.31	0.0013	3458.65
15	ZEETELE	1.51		821.88	0.0046	3495.98
16	GUJAMBCEM	1.55	1.14	10.28	0.0002	2659.34
17	SILVERLINE	1.60	1.76	113.50	0.0017	294.64
18	MTNL	1.67	1.23	76.19	0.0001	7528.50
19	COLGATE	1.70	1.14	11.92	0.0002	2230.96
20	TATATEA	1.71	1.20	22.97	0.0011	933.81
21	BSES	1.71	1.23	11.88	0.0002	2755.99
22	CORPBANK	1.76	1.43	17.77	0.0008	1680.60
23	RELPETRO	1.76	1.21	93.70	0.0002	19777.91
24	SUNPHARMA	1.79	1.37	26.42	0.0007	2799.78
25	ICICIBANK	1.81		39.43	0.0019	2775.42
26	HDFC	1.84	1.27	33.90	0.0002	8045.82
27	HDFCBANK	1.85	1.41	49.80	0.0003	5705.02
28	GERMANREM	1.87	1.56	11.70	0.0003	383.43
29	SIEMENS	1.93	2.00	9.93	0.0005	665.74
30	GLAXO	1.96	1.21	14.96	0.0006	1624.09
31	STERLITIND	1.98	1.74	14.82	0.0008	594.08
32	SMITKLBECH	2.04	1.77	5.73	0.0001	1987.44
33	CASTROL	2.06	1.66	7.41	0.0001	2615.19
34	BAJAJAUTO	2.07	1.53	16.03	0.0005	2556.91
35	TELCO	2.08	1.44	48.56	0.0021	1809.36

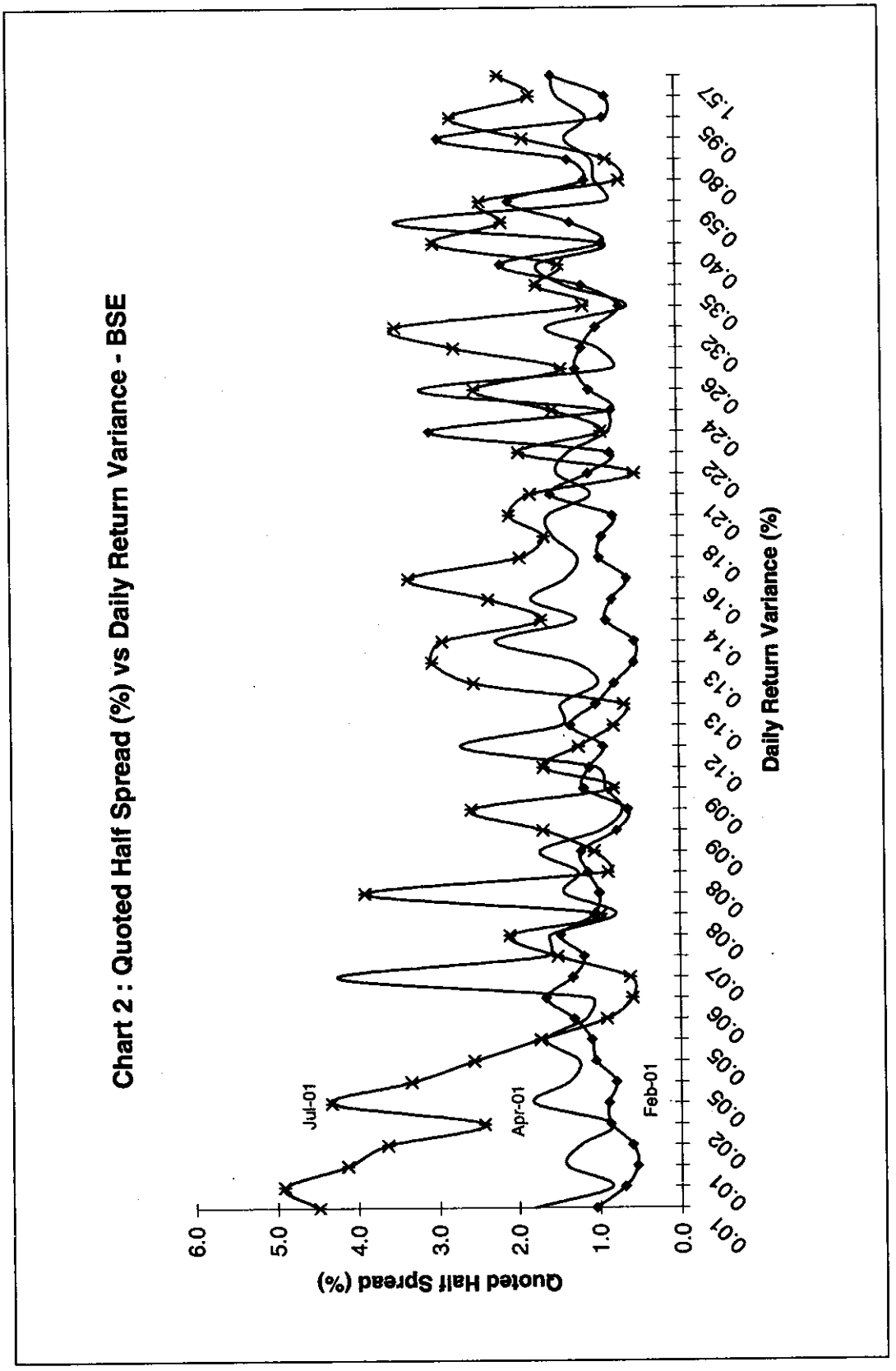
Quoted Half Spread (Ascending), NSE, July 2001

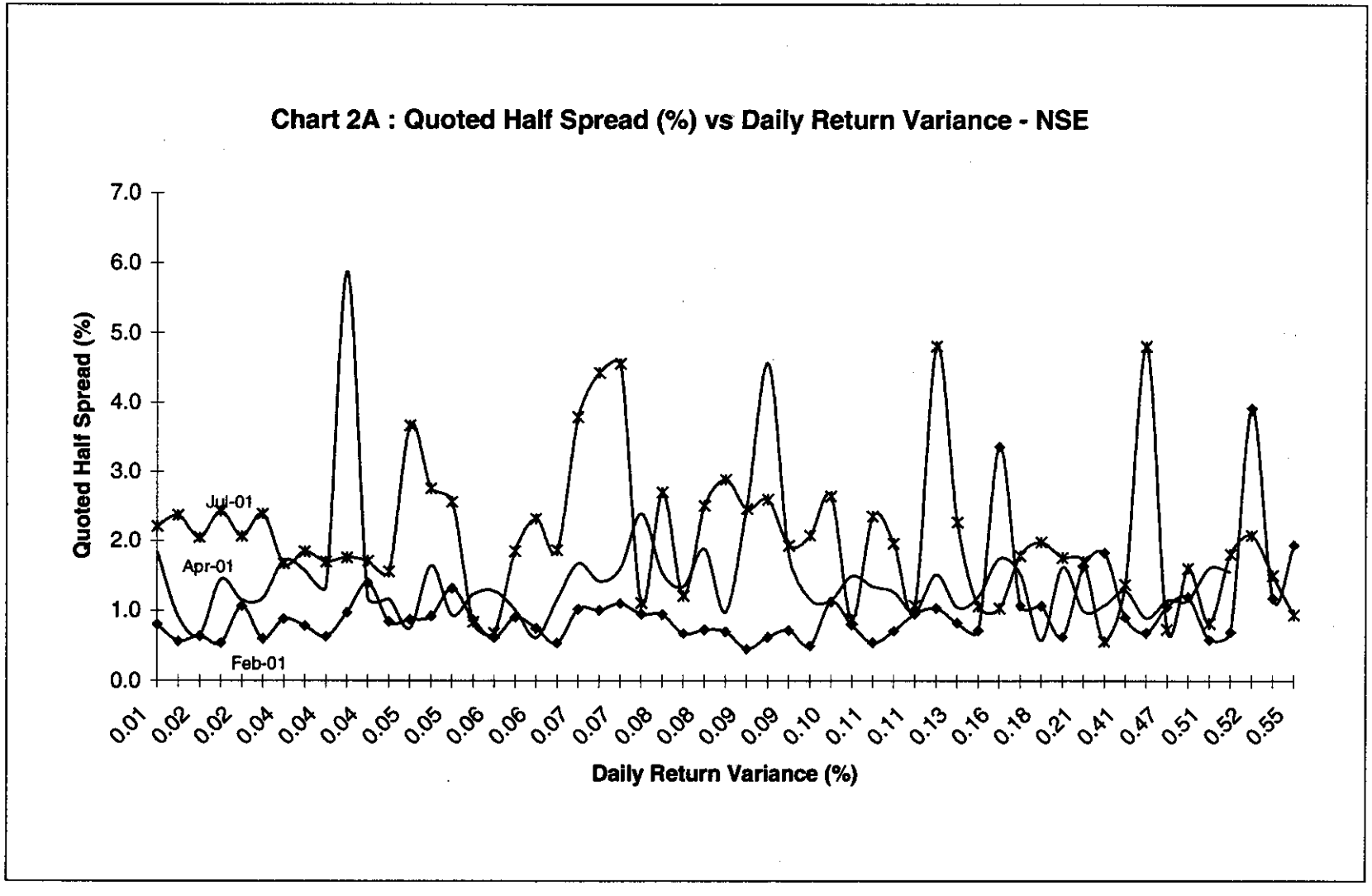
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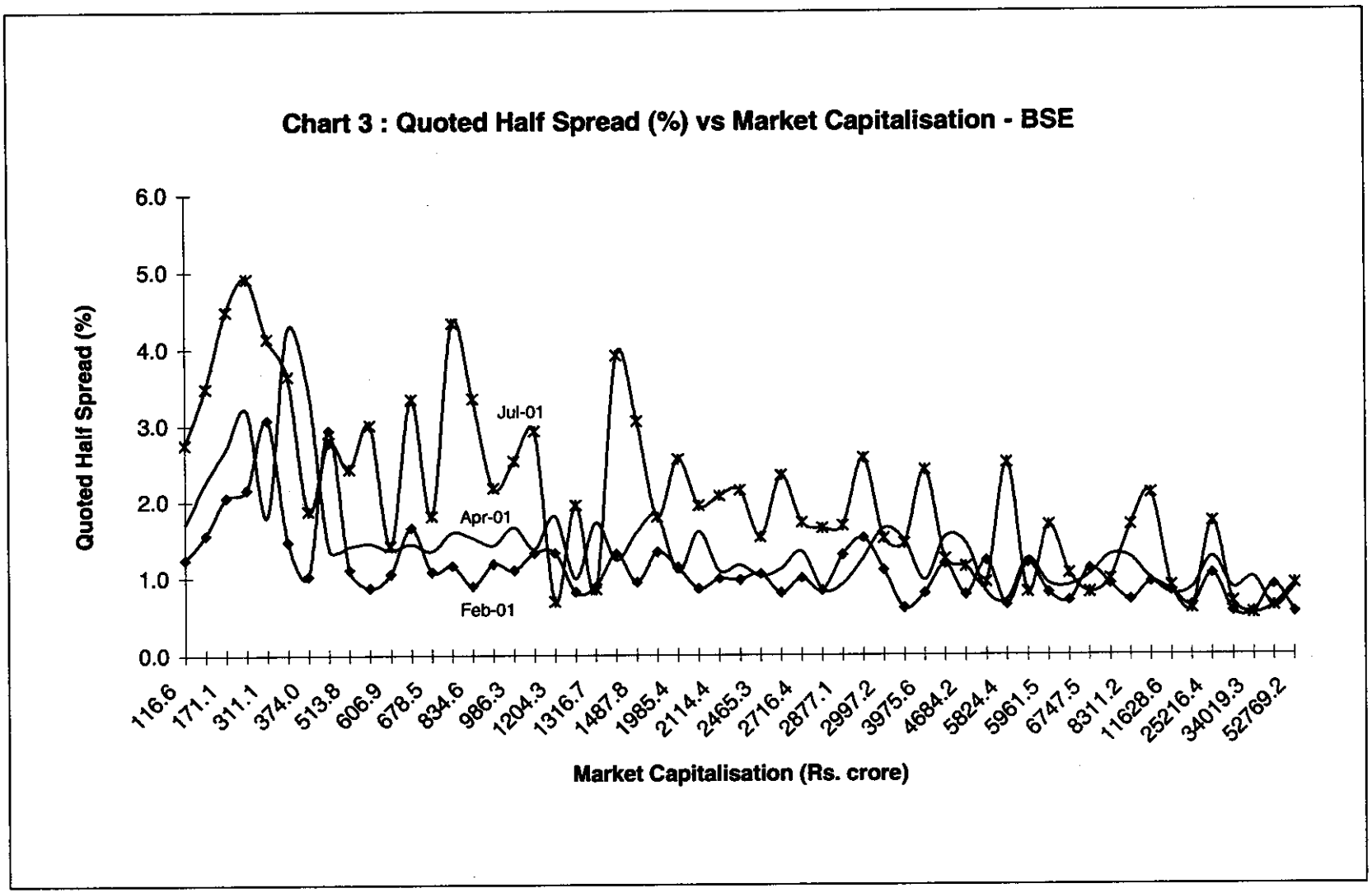
No	Company	Quoted	Effective	Turnover	Return Variance	Market Capitalisation
				Rs. Crore		Rs. Crore
36	NIRMA	2.21	1.54	4.73	0.0001	3041.15
37	ICICI	2.27		12.81	0.0007	4712.07
38	IDBI	2.31	2.28	2.75	0.0003	1308.92
39	SMITHKLPHA	2.36	1.48	0.85	0.0005	399.25
40	INDHOTEL	2.36	1.85	6.02	0.0001	899.81
41	ORIENTBANK	2.39	1.88	2.39	0.0001	691.22
42	DABUR	2.43	1.65	5.16	0.0001	1689.90
43	EIHOTEL	2.46	2.29	11.80	0.0005	1267.91
44	M&M	2.51		13.83	0.0005	756.84
45	P&G	2.57	2.03	2.43	0.0002	1157.77
46	THOMASCOOK	2.60	1.80	1.44	0.0005	403.23
47	ESCORTS	2.65	1.91	1.88	0.0005	405.22
48	WARTSILA	2.70	1.81	1.18	0.0004	76.42
49	ORCHIDCHEM	2.76	2.17	0.45	0.0002	203.13
50	MADRASCEM	2.89	2.54	2.59	0.0005	534.01
51	UNITEDPHOS	3.67	2.48	0.36	0.0002	95.91
52	EMERCK	3.79	2.38	4.85	0.0003	561.48
53	VYSYABANK	4.43	2.07	0.42	0.0004	236.65
54	NAGARFERT	4.55	2.77	0.26	0.0004	248.13
55	IFCI	4.81	3.19	0.32	0.0014	214.40
56	GSFC	4.81	3.06	0.14	0.0006	108.92
	AVERAGE	2.06	1.58	328.02	0.0008	5270.70

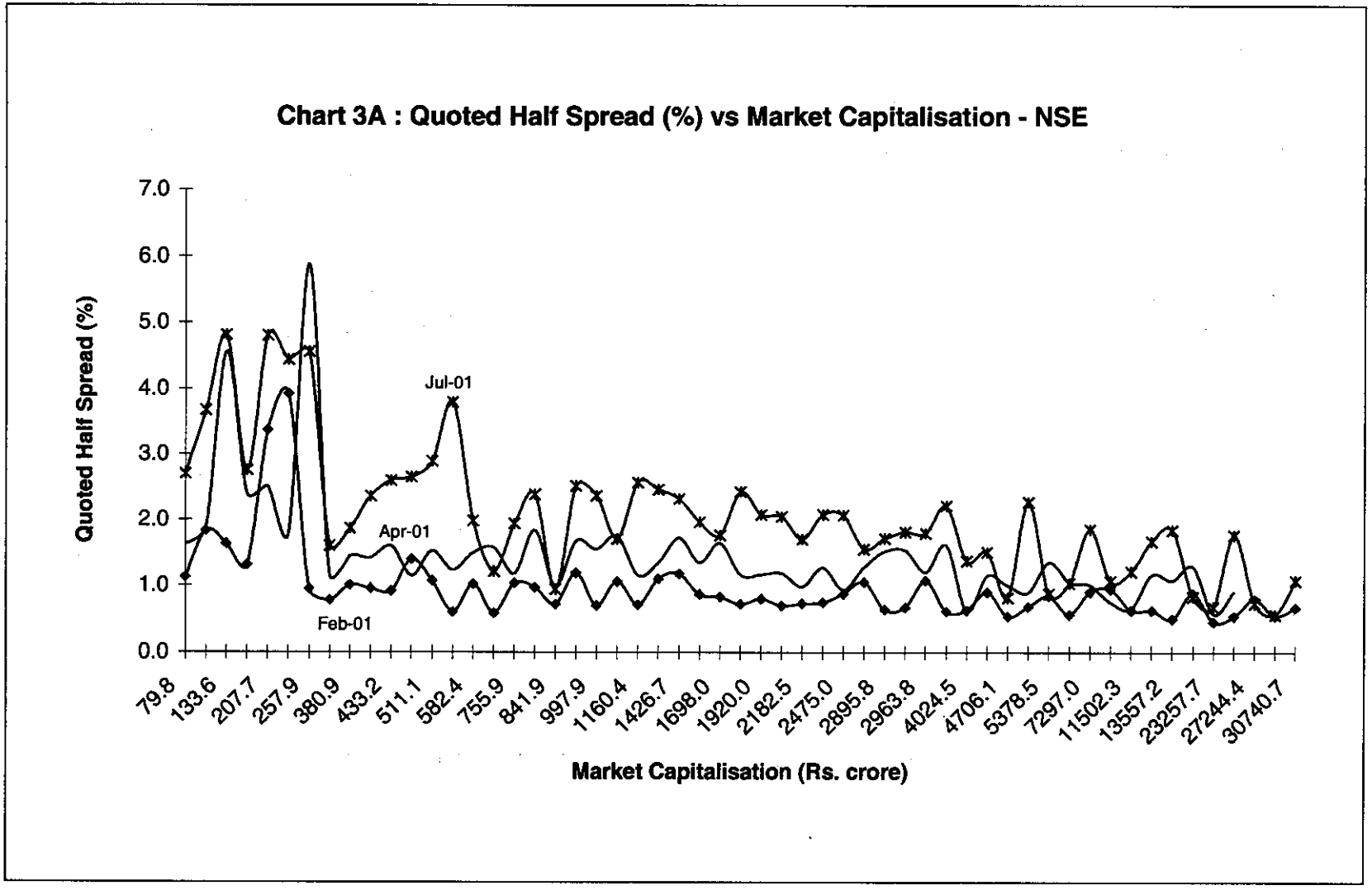
Turnover is for the month

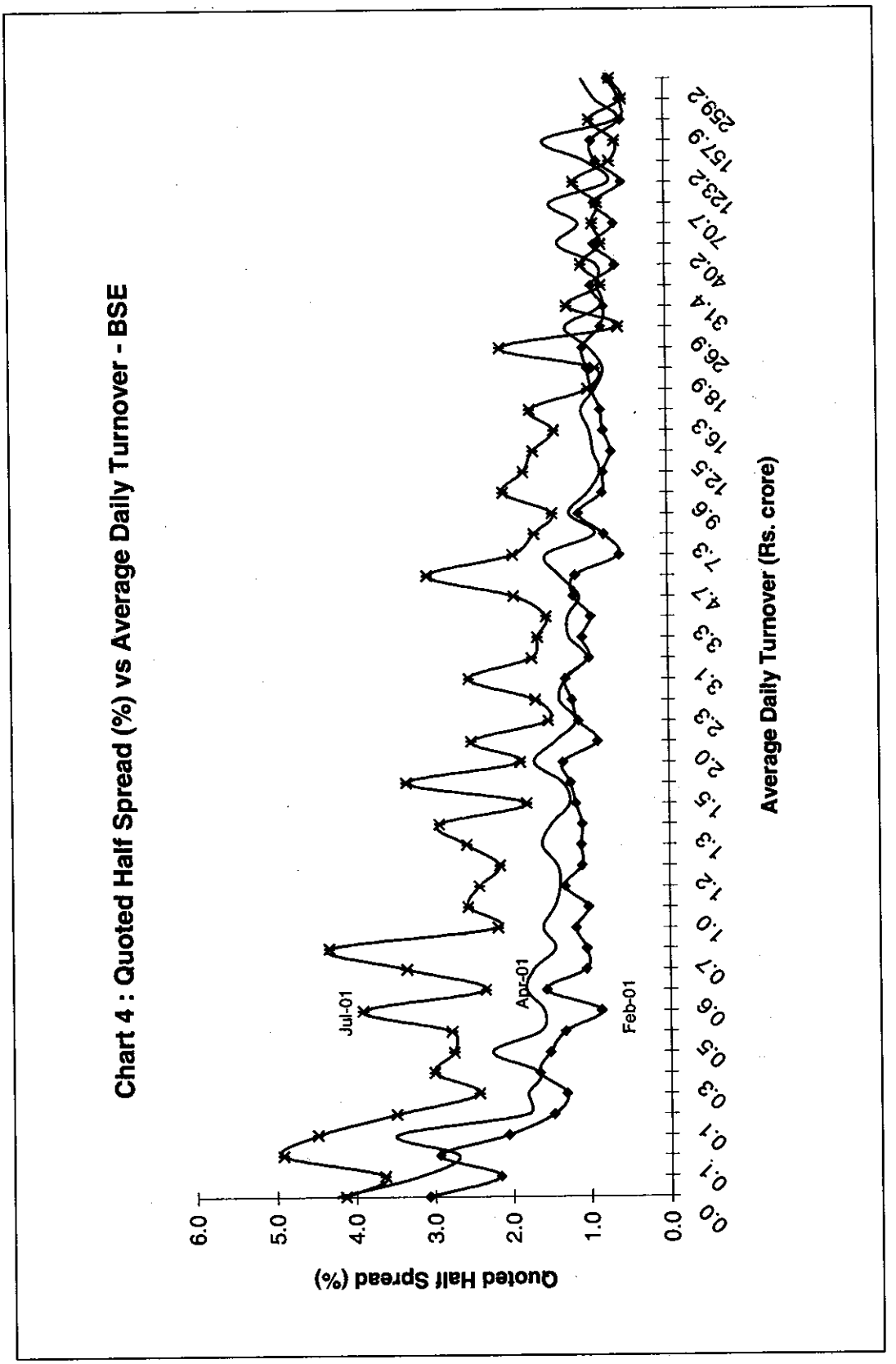
Market Capitalisation is at end of month

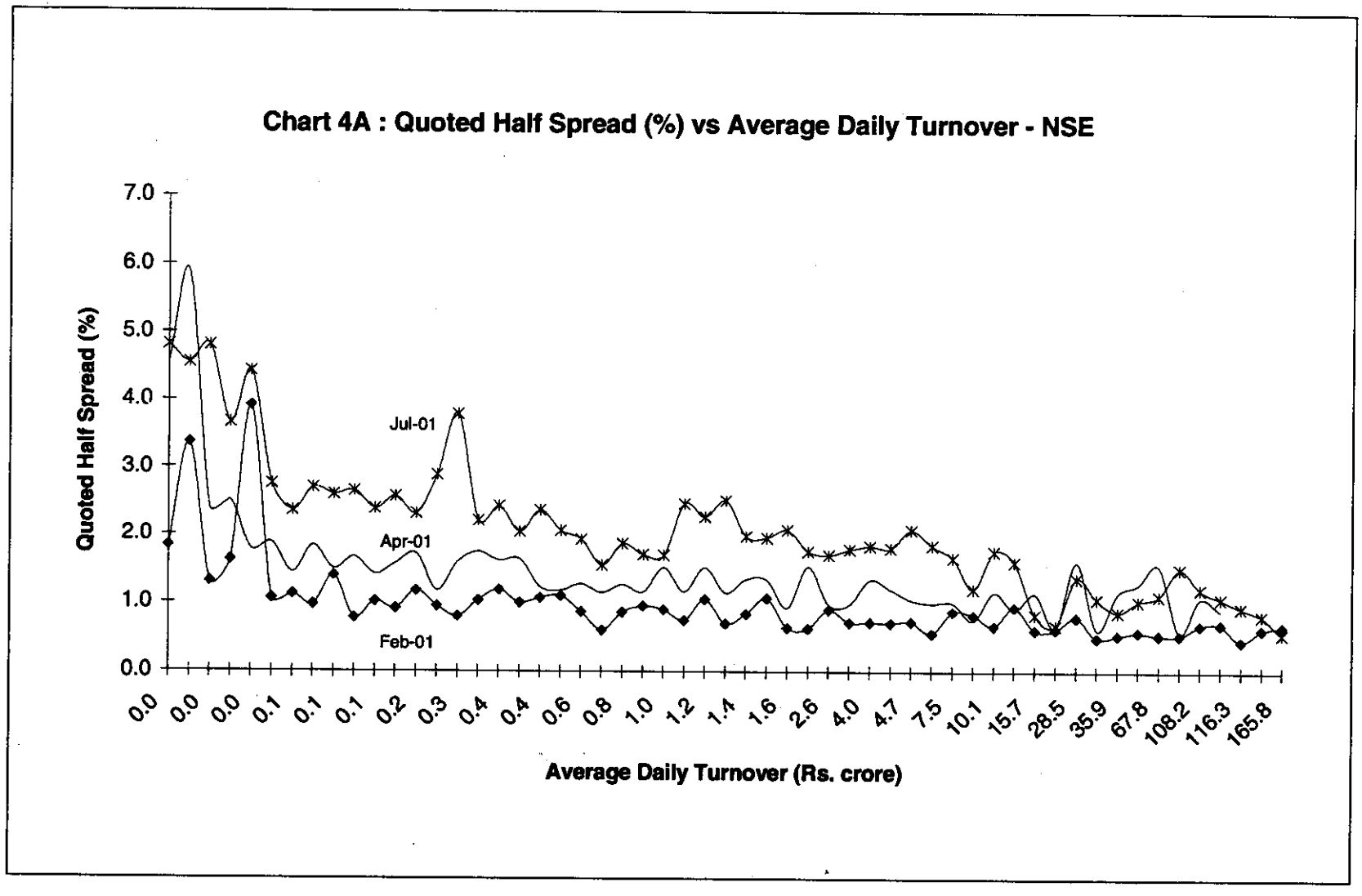

Chart 2 : Quoted Half Spread (%) vs Daily Return Variance - BSE
Quoted Half Spread (%)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jul-01
Apr-01
Feb-01
Daily Return Variance (%)
0.01
0.01
0.02
0.05
0.05
0.06
0.07
0.08
0.08
0.08
0.09
0.09
0.12
0.13
0.13
0.14
0.16
0.18
0.21
0.22
0.24
0.26
0.32
0.35
0.40
0.59
0.80
0.95
1.57


Chart 2A : Quoted Half Spread (%) vs Daily Return Variance - NSE
Quoted Half Spread (%)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jul-01
Apr-01
Feb-01
0.01
0.02
0.02
0.04
0.04
0.04
0.05
0.05
0.06
0.06
0.07
0.07
0.08
0.08
0.09
0.09
0.10
0.11
0.11
0.13
0.16
0.18
0.21
0.41
0.47
0.51
0.52
0.55
Daily Return Variance (%)


Chart 3 : Quoted Half Spread (%) vs Market Capitalisation - BSE
Quoted Half Spread (%)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jul-01
Apr-01
Feb-01
116.6
171.1
311.1
374.0
513.8
606.9
678.5
834.6
986.3
1204.3
1316.7
1487.8
1985.4
2114.4
2465.3
2716.4
2877.1
2997.2
3975.6
4684.2
5824.4
5961.5
6747.5
8311.2
11628.6
25216.4
34019.3
52769.2
Market Capitalisation (Rs. crore)


Chart 3A : Quoted Half Spread (%) vs Market Capitalisation - NSE
Quoted Half Spread (%)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jul-01
Apr-01
Feb-01
79.8
133.6
207.7
257.9
380.9
433.2
511.1
582.4
755.9
841.9
997.9
1160.4
1426.7
1698.0
1920.0
2182.5
2475.0
2895.8
2963.8
4024.5
4706.1
5378.5
7297.0
11502.3
13557.2
23257.7
27244.4
30740.7
Market Capitalisation (Rs. crore)


Chart 4 : Quoted Half Spread (%) vs Average Daily Turnover - BSE
Quoted Half Spread (%)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jul-01
Apr-01
Feb-01
0.0 0.1 0.1 0.3 0.5 0.6 0.7 1.0 1.2 1.3 1.5 2.0 2.3 3.1 3.3 4.7 7.3 9.6 12.5 16.3 18.9 26.9 31.4 40.2 70.7 123.2 157.9 259.2
Average Daily Turnover (Rs. crore)


Chart 4A : Quoted Half Spread (%) vs Average Daily Turnover - NSE
Quoted Half Spread (%)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jul-01
Apr-01
Feb-01
0.0 0.0 0.0 0.1 0.1 0.1 0.2 0.3 0.4 0.4 0.6 0.8 1.0 1.2 1.4 1.6 2.6 4.0 4.7 7.5 10.1 15.7 28.5 35.9 67.8 108.2 116.3 165.8
Average Daily Turnover (Rs. crore)

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