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Components of the Bid Ask Spread of Shares Traded at the National Stock Exchange of India – Analysis of Select Industries

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Abstract

The components of the Bid Ask spread are calculated for a sample of 200 shares traded on the National Stock Exchange of India. These sample of shares belong to two sectors – the services sector and the manufacturing sector, each having 10 companies. The analysis was done for a period of three months from October 2014 to December 2014. The Madhavan Richardson and Roomans model was used in the study. It was found that the Adverse Selection Cost and the Order Processing Cost are almost similar for the two sectors. No particular distinction has been made between the two sectors. These costs exhibit a " U" shaped patters over the period for the two sectors. Inventory costs are not given importance for limit order market like the National Stock Exchange of India

Keywords: *Adverse Selection Cost, Order Processing Cost, Liquidity*

I. Introduction

Liquidity is defined as the ability to buy and sell shares at whatever time the investor wants to and with minimal changes in the buying and selling prices. It reflects the financial health of a market. Bid Ask Spread is one of the important measures of liquidity. It is also an indicator of the financial stability of the stock markets. It arises as the compensation for various costs involved when trading in securities. These costs are classified as Order Processing Costs, Inventory Holding Costs and Adverse Selection Costs.

Two categories of markets exist – the order driven market and the quote driven markets. Quote driven markets have a third party or the dealers who provide liquidity. But in case of the order driven markets, liquidity is provided by limit orders. The order processing cost arises when a transaction takes place. Processing of orders and execution of these orders results in cost to the investor which cannot be avoided and hence a part of total market prices.

While the order processing costs are fixed, the inventory holding costs is incurred when the investor is not clear about the order flow, both in terms of quantity and time of the order. This forces him to hold a portfolio, which is not optimal. He bears cost in holding suboptimal shares, which could have been invested in other avenues. This results in inventory holding costs. The inventory holding cost is expected to be minimal for an order driven market and

therefore not too important for order driven markets.

The adverse selection cost is one of the most researched and important component of the bid ask spread. Information based trading can create a huge difference in market prices. A few investors would receive information before the rest of them receive the same information. This leads to information asymmetry. Informed traders place orders according to the information they receive. This would cause adverse selection risk. This adverse selection risk is borne by market makers in the quote driven markets and limit order trades in the order driven markets (Handa and Schwartz, 1996).

As explained by various theories in financial markets, different investors receive information at different points in time and at various levels. Some traders are hence, better informed than the others. A better informed trader will buy when the stock is undervalued and sell when the stock is overvalued. Here, the liquidity providers loses, faces liquidity risk and hence, they seek for compensation. This type of costs arises in case of informational event and was first given by Bagehot (1971).

The order processing cost and the inventory holding costs are transitory in nature as it is not information driven. These costs cause the prices to mean revert or price changes to be negatively serially correlated. But the adverse selection cost is permanent in nature. The effect on prices does not revert in future. This is due to informational nature of the adverse selection costs.

Like some developed markets, the Indian stock exchanges do not have a dealer or market maker. In such cases, the bid ask spread must be estimated from trade prices. The trade prices can be obtained from the National Stock Exchange of India Ltd, on request. Trade prices consists of tick by tick transaction data and it is possible to calculate the bid ask spread from the trade prices.

The purpose of this paper is to examine the components of the bid ask spread in a limit order market. Existing theories on components of spread have focused on developed markets and on quote driven and dealer markers. However, the bid ask spread is not unique to the dealer markets. Cohen, Aier, Schwartz and Whitcomb (1981) establish the existence of bid ask spread in a limit order market when investors faces transaction costs of assessing information, monitoring markets and conveying orders to the markets. Glosten (1994) shows that the limit order market will have a positive bid ask spread arising from the possibility of trading on private information. However, empirical research on the components of the bid ask spread is limited in a limit order market like India.

I examine the components of bid ask spread, for shares traded at the National stock Exchange of India. The remainder of this paper is organized as follows. Section 2 brings out a brief literature on this subject. Section 3 describes the set up i.e. the market on which this research is carried out. Section 4 represents empirical results and Section 5 concludes.

IL Literature Review

Kyle (1985) was one of the forerunners in establishment of the components of spread. He argues that the presence of traders who possess superior knowledge of the value of a stock can impose adverse selection costs on liquidity traders and market makers. The theoretical contribution on the components of bid ask spread is immense. Roll's (1984) serial covariance of observed transaction prices was one of the first. The others who followed the serial

covariance properties were Choi, Salandro and Shastri (1984), George, Kaul and Nimelandran (1991), Stoll (1989), Lin (1992), Huang and Stoll (1994), Lin, Sanger and Booth(1995). Few other contributions based on the trade initiation indicator model included Glosten and Harris (1988), Madhavan and Smidt (1991).

A major contribution was made by Madhavan, Richardson and Roomans (1997) (henceforth MRR). The MRR model is more suitable for order driven markets. It is an extension of the Glosten and Milgrom (1985) model. In the MRR model, the inventory component is ignored. Instead, the model decomposes the spread into permanent component due to information (adverse selection) and transitory component. This approach has an attractive feature since it is believed that the inventory costs are of a less important concern for limit order trades.

III. Data and Methodology

The National Stock Exchange of India (henceforth NSE) was incorporated in 1992 and was recognized as a stock exchange in 1993. It is a completely order driven electronic market. NSE operates in different segments - Capital Market, wholesale Debt Market, Futures & Options and Currency.

Capital market segment offers a screen based trading system for equities, preference, shares, Exchange traded funds, retail government securities etc. The trading platform known as NEAT (National Exchange for Automated Trading) operates on a price/time priority basis.. The data was collected from NSE – Department of Economic Analysis and Policy (NSE – DEAP). On request, the NSE provides the required data for all trading activities. The average measure for each stock for each day is first calculated for the entire month. Thus a summary measure per security for the stock is obtained.

The actual spread, being the difference between the ask and bid prices is based on bid and ask quotes, which can be obtained from the Limit Order Book (LOB). The NSE collects snapshot of LOB at four different times of a trading day – at 11 AM, 12 Noon, 1 PM & 2 PM. Snapshot and trade data are used for this study. The LOB snapshot lists all the outstanding orders, identified as buy/sell orders. On the data obtained, the MRR model was used to estimate the components of the spread.

The sample consists of 200 shares that were traded on the NSE from October to December 2014. These 200 shares were selected from ten industries, each industry consisting of 20 companies, and belonging to two sectors – the Service Sector and the Manufacturing Sector. Shares with similar turnover and market capitalization (Average for three months) are taken for this study, as the comparison would be meaningful.

The MRR Model;

According to the MRR model, the price of a security at time t is given by P_t. Q_t is the buy-sell trade indicator variable for transaction prices. Q_t takes the value of 1 if it is a buyer initiated transaction and –1 if it is a seller initiated transaction. The change in transaction price is given as

$$\Delta P_t = \alpha (Q_t - \rho Q_{t-1}) + \beta (Q_t - Q_{t-1}) + \mu_t$$

The first term captures the effect of revision in belief, where $\alpha \geq 0$ measures the possible asymmetric information revealed by the trade at time t. The second term captures the effect

of bid ask bounce where $\beta \geq 0$ denotes the liquidity suppliers' cost per share for supplying liquidity.

The three parameters (α, β and ρ) governing the behavior of transaction prices and quotes in the equation can be estimated using generalized method of movements (GMM) which imposes very weak distribution assumptions. This is important because the error term includes the rounding errors due to discreteness of stock prices.

IV. Analysis of Data

Shares of 200 companies from ten industries are taken for analysis. These companies are classified are classified under two categories. The first category consists of the shares of services sector. The list includes (i) Banking (ii) Software, (iii) Media and Entertainment (iv) Tourism and Hospitality and (v) Financial Services (Non Banking). The second category in the classification includes five manufacturing sectors – (i) Heavy Electricals, (ii) Automobiles, (iii) Auto Ancillaries, (iv) Fast Moving Consumer Goods and (v) Textiles. These shares are divided into two categories and their performances are compared. Table 1 brings out the descriptive statistics. It is seen from the Table that the average market prices for the service sector is Rs. 370, having a median of 395 and a standard deviation of 283. The average market price per shares for the second category of shares, i.e. Manufacturing Sector is Rs. 645, with a median of Rs 648 and standard deviation of 384. The market value is Rs. 38.22 Crores and Rs. 83.41 Crores. The return volatility for these shares represents the variations in market prices. The return volatility is calculated for the trading prices of the past one year. The Return Volatility is 4.09 and 4.6 respectively. The implied spread for these shares is found to be 2.31 and 2.14 respectively. The percentage spread which is the ratio between the market prices and the implied spread are found to be 0.49 and 0.33 respectively.

Table 2 provides the cross – sectional mean estimates of the market variables for the ten half-an hour intraday intervals through the trading day. The trading day is divided into ten half-an-hour trading intervals. For the two categories, the number of shares traded, the market price per share, the market value and the return volatility are given. It can be seen that these values represents a U shape over the course of the trading day. The number of shares traded at the beginning of the day is low, decreases further during the trading day and increases at the end of the day. For the manufacturing sector, the market prices are highest during the second last intraday half hour interval. Return volatility exhibits a U pattern through the trading day. These values are lowest during the middle of the trading session. The return volatility is lowest in the middle half hour interval.

Table 3 summarizes the intraday patterns of the bid ask spread for shares belonging to the two categories. The average spread for shares belonging to the first category is 2.25. Spread is lowest during the post lunch session and highest during the second interval. It is seen that for the second category, the spread is lowest immediately during the post lunch session. The results of the percent spread are not in accordance with the Rupee Spread, as there are variations in the Market Price.

Table 4 presents the summary statistics on the individual parameter estimates for two categories of stocks. The summary also includes mean coefficient estimates, mean standard error, standard deviation of the estimates and the median estimates for the adverse selection

cost component (á), order processing cost (â), auto correlation of order flows (ñ), implied spread, given as 2(á + â) and the proportion of the adverse selection cost component. The adverse selection cost component, the order processing cost and the implied spread in percentage terms is calculated relative to the average prices over the sample period. Is seen that the Adverse Selection Cost Component, the Order Processing Cost component and the Implied Spread are almost similar for the two categories of shares.

Table 5 is an extension of Table 4, but the data is used for a ten half hour interval. It can be seen from Table 5 that the spread, the adverse selection cost component and the auto correlation of trade flow has the highest value during the post lunch session. Taking the Adverse Selection Cost Component, the values decline over the trading day reaches a lowest level during the mid day and increases during the last few sessions. Therefore spread and the components of spread exhibits a "U" shaped pattern.

V. Conclusion

This paper examines the components of the bid ask spread of 200 shares of ten companies belonging to the Services Sector and the Manufacturing sector. The shares of these companies are listed at the National Stock Exchange of India. Both the Adverse Selection Cost and the Order Processing Cost exhibits a "U" shaped pattern in the implied spread. The "U" shaped pattern is seen in most of the markets. (Example, Van Ness and Van Ness (1999), Madhavan, Richardson and Roomans (1997)). The findings also suggest that as the market prices increases, the spread and its components declines. The Adverse Selection cost component and the Order Processing Cost component are almost similar for these two sectors, which implies that there are not much differences between the two sectors. Investors' perception of these two sectors is the same.

VI. References

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Table 1. Descriptive Statistics

This Table presents the descriptive statistics for 200 shares listed in the NSE. The summary includes share price, market value, return volatility, calculated over last one year, average number of trades per day, average trade volume, trade size etc. The shares were selected from ten industries, five belonging to the Services Sector and five from the Manufacturing Sector.

Sector	*Services Sector*			*Manufacturing Sector*		
Particulars	*Mean*	*Median*	*SD*	*Mean*	*Median*	*SD*
MPS	370	395	283	645	648	384
Market Value (in crs)	38.22	36.34	1824	83.41	87.43	847
No. of Trades	6484	6981	1438	18324	18563	7432
No. of shares (Mean in Crs)	24.31	26.41	2743	33.92	37.52	2592
Trading Volume (Crs)	87.58	85.64	4325	132.82	131.81	4891
Return Volatility	4.09	4.28	1.92	4.6	5.88	4.15
Spread	2.31	2.92	2.65	2.14	2.93	3.1
% Spread	0.49	0.57	0.44	0.38	0.39	0.91

Table 2. Mean Estimates of Variances and Trading Activity Variables on 30- Minutes Intervals

This Table presents the cross sectional mean estimates of the variance of transaction price changes, average number of trades, average rupee volume and the trade sizes during the 30 minute intraday intervals. The results are presented in two panels, based on their nature of industry.

Services Sector

Particulars	*10-10.30*	*10.30-11*	*11-11.30*	*11.30-12*	*12-12.30*	*12.30-13*	*13-13.30*	*13.30-14*	*14-14.30*	*14.30-15*	*Mean*
MPS	374	374	375	367	359	363	363	362	365	374	376
No. of shares	24.52	24.83	24.77	24.65	23.81	23.99	23.84	23.72	24.66	24.56	24.33
Market Value	38.42	38.54	38.51	38.11	37.91	37.94	39.73	38.61	38.11	38.72	38.91
Return Volatility	4.2	4.43	3.61	4.1	4.4	3.97	3.96	3.86	3.85	4.14	4.06

Manufacturing Sector

Particulars	*10-10.30*	*10.30-11*	*11-11.30*	*11.30-12*	*12-12.30*	*12.30-13*	*13-13.30*	*13.30-14*	*14-14.30*	*14.30-15*	*Mean*
MPS	643	676	652	644	668	631	593	571	608	702	641.3
No. of shares (in '0000)	33.17	34.28	33.37	34.11	34.26	33.71	33.8	34.1	34.7	34.01	33.92
Market Value	59.78	51.34	52.21	59.76	57.35	59.18	60.01	54.3	54.5	54.2	56.25
Return Volatility	4.26	4.83	4.77	4.38	4.01	4.21	4.09	3.99	4.52	4.17	4.38

Table 3– Mean Rupee and Percent Spread by 30 Minutes Intraday Trading Intervals

This Table presents the cross sectional means estimates of the spread in rupee and percent terms, during a 30 minute intervals. The trading day is divided into intervals of 30 minutes over the trading day.

Services Sector

Particulars	*10-10.30*	*10.30-11*	*11-11.30*	*11.30-12*	*12-12.30*	*12.30-13*	*13-13.30*	*13.30-14*	*14-14.40*	*14.40-15*	*Mean*
Rupee Spread	2.22	2.68	2.18	2.15	2.24	2.25	2.4	2.2	2.09	2.1	2.25
Percent Spread	0.52	0.52	0.45	0.49	0.44	0.48	0.51	0.50	0.49	0.48	0.48

Manufacturing Sector

Particulars	10-10.30	10.30-11	11-11.30	11.30-12	12-12.30	12.30-13	13-13.30	13.30-14	14-14.40	14.40-15	Mean
Rupee Spread	2.62	2.54	2.62	2.18	2.11	2.14	1.8	1.9	2.04	2.11	2.20
Percent Spread	0.44	0.42	0.39	0.35	0.31	0.41	0.39	0.38	0.42	.038	.034

Table 4- GMM estimates of Spread

This Table presents the GMM model estimates of the parameters and the spread implied by the parameters for 200 shares on the NSE. The parameters are the adverse selection cost (á), the order processing cost (â), and the auto correlation of trade direction (ñ). The implied spread is given as 2(á+â). The proportion of the adverse selection in the implied spread is given as â. Shares are divided into two sectors based on their nature of industry. The results of these two parts are summarized below.

Services Sector

Particulars	*Mean*	*Median*	*SE*	*SD*
α	2.70	2.75	0.092	0.460
β	2.51	2.46	0.085	0.417
α(% of spread)	0.27	0.282	0.075	0.072
β(% of spread)	0.24	0.252	0.063	0.913
ρ	0.311	0.3111	0.0056	0.324
γ	0.487	0.5124	0.0226	0.213
Implied Spread	10.08	10.09	0.0892	1.928
Percentage of IS	0.501	0.476	0.0261	0.231

Manufacturing Sector

Particulars	*Mean*	*Median*	*SE*	*SD*
α	2.49	2.55	0.274	2.13
β	2.21	2.19	0.1514	1.56
α(% of spread)	0.269	0.252	0.086	4.232
β(% of spread)	0.240	0.281	0.0075	5.343
ρ	0.427	0.45	0.0152	0.929
γ	0.490	0.501	0.0512	0.912
Implied Spread	9.08	10.36	0.46	1.827
Percentage of IS	0.45	0.54	0.0169	0.11

Table 5 – GMM model Parameters and Implied Spread by for 30 Minute Intervals During the Trading Day.

This Table presents the cross sectional mean and the mean standard error (given in parenthesis) of the GMM model over the trading period. The day is divided into 10 30- minute intervals and for each interval, the adverse selection cost, the order processing cost, the auto correlation of trade flows and the implied spread are given. The companies are divided into two sectors based on their nature – as either Service Sector or as Manufacturing Sector.

Services Sector

Particulars	*10-10.30*	*10.30-11*	*11-11.30*	*11.30-12*	*12-12.30*	*12.30-13*	*13-13.30*	*13.30-14*	*14-14.30*	*14.30-15*
α (Rupees)	2.74	2.53	2.23	2.7	2.68	2.6	2.7	3.01	3.05	3.1
	(0.013)	(0.037)	(0.031)	(0.027)	(0.013)	(0.042)	(0.061)	(0.028)	(0.043)	(0.038)
β (Rupees)	2.21	2.34	2.16	2.38	2.19	2.21	2.35	2.39	2.41	2.39
	(0.042)	(0.042)	(0.021)	(0.032)	(0.033)	(0.041)	(0.051)	(0.032)	(0.047)	(0.058)
α (% of Spread)	0.27	0.26	0.22	0.26	0.25	0.25	0.267	0.277	0.282	0.278
	(0.008)	(0.007)	(0.005)	(0.005)	(0.003)	(0.003)	(0.007)	(0.063)	(0.007)	(0.010)
β (% of Spread)	0.22	0.24	0.22	0.234	0.203	0.212	0.232	0.22	0.22	0.217
	(0.005)	(0.004)	(0.005)	(0.007)	(0.011)	(0.043)	(0.041)	(0.009)	(0.017)	(0.062)
ρ	0.347	0.298	0.310	0.292	0.294	0.297	0.310	0.301	0.296	0.298
	(0.004)	(0.005)	(0.005)	(0.005)	(0.032)	(0.005)	(0.008)	(0.006)	(0.010)	(0.014)
γ	0.465	0.482	0.474	0.423	0.458	0.452	0.521	0.511	0.517	0.496
	(0.012)	(0.011)	(0.011)	(0.009)	(0.021)	(0.061)	(0.006)	(0.008)	(0.007)	(0.009)
Implied Spread	9.9	9.74	9.78	10.16	10.74	10.42	10.1	10.8	10.98	10.98
2(α + β)	(0.008)	(0.007)	(0.012)	(0.025)	(0.056)	(0.014)	(0.034)	(0.036)	(0.012)	(0.009)
IS (% of Price)	0.430	0.479	0.478	0.485	0.491	0.483	0.468	0.483	0.479	0.492
	(0.002)	(0.003)	(0.003)	(0.009)	(0.004)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)

Manufacturing Sector

Particulars	*10-10.30*	*10.30-11*	*11-11.30*	*11.30-12*	*12-12.30*	*12.30-13*	*13-13.30*	*13.30-14*	*14-14.30*	*14.30-15*
α	2.12	2.20	2.18	1.97	1.88	1.72	1.84	2.28	2.34	2.89
	(0.028)	(0.194)	(0.190)	(0.242)	(0.281)	(0.31)	(0.37)	(0.35)	(0.33)	(0.32)
β	2.34	2.34	2.38	2.28	2.29	2.22	2.22	2.72	2.128	2.24
	(0.186)	(0.191)	(0.191)	(0.192)	(0.180)	(0.091)	(0.097)	(0.112)	(0.183)	(0.128)
α (% of price)	0.119	0.097	0.099	0.099	0.102	0.097	0.109	0.092	0.091	0.091
	(.092)	(0.084)	(0.092)	(0.078)	(0.89)	(0.091)	(0.148)	(0.121)	(0.083)	(0.094)
β (% of price)	0.072	0.092	0.072	0.107	0.82	0.96	0.87	0.94	0.78	0.89
	(.0008	(0.007)	(0.008)	(0.009)	(0.010)	(0.005)	(0.008)	(0.007)	(0.078)	(0.008)
ρ	0.482	0.472	0.486	0.474	0.389	0.392	0.398	0.397	0.392	0.420
	(0.018)	(0.012)	(0.017)	(0.016)	(0.011)	(0.011)	(0.013)	(0.015)	(0.015)	(0.017)
γ	0.491	0.476	0.472	0.465	0.482	0.482	0.451	0.448	0.472	0.471
	(0.034)	(0.036)	(0.052)	(0.085)	(0.022)	(0.042)	(0.069)	(0.057)	(0.047)	(0.054)
IS 2(α + β)	8.92	9.08	9.12	8.72	8.32	8.05	4.92	8.18	10.14	9.24
	(0.421)	(0.392)	(0.447)	(0.241)	(0.853)	(0.421)	(0.511)	(0.508)	(0.516)	(0.582)
IS (% of Price)	0.412	0.431	0.420	0.424	0.426	0.428	0.424	0.421	0.424	0.395
	(0.021)	(0.021)	(0.011)	(0.018)	(0.014)	(0.018)	(0.014)	(0.021)	(0.018)	(0.026

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