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MARKET MICROSTRUCTURE OF STOCK MARKETS: A REVIEW OF LITERATURE

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ABSTRACT

Last few decades have seen a drastic spree of developments in the way capital markets operated. Across the globe, markets have moved from floor-based open outcry system to electronic platforms, from call auctions to continuous trading, from periodic settlements to rolling settlements, from simple financial products to exotic products like derivatives, ETFs, etc. The price adjustment time has decreased to milliseconds, tick size has reduced, volume of trades has skyrocketed and gone beyond humanly control and computations, a wide array of investors participate in markets today and all these, inter alia, have increased the complexities of capital markets. Technology is changing the relationship among investors, brokers and dealers and the facility through which they interact. All these have made the understanding of intricacies of capital markets all the more important for every stakeholder. Adequate knowledge of price discovery process, market architecture and design, information disclosure and dissemination, behavior of market makers and determination of bid-ask spread, etc will be significant to frame trading protocols, formulate trading strategies, enhancing transparency and liquidity in the markets. Though there has been enough research into the microstructure of stock markets of developed nations, the developing nations have been unable to attract attention from the academia and researchers. This paper aims to study the conceptual framework of market microstructure in the light of literature available from past studies. This shall also provide a ground work for future empirical research.

KEYWORDS

Market microstructure, Stock market, Market architecture, Efficient Market Hypothesis [EMH], Asset pricing.

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INTRODUCTION

The term "market microstructure" was first coined by "Mark Garman" (1976) in an article titled the same. Garman talked about the existence of market makers and inventory costs. We will shortly see how it became an umbrella term for study of structure of markets.

In common parlance, market microstructure means the study of trading mechanisms involved in the exchange of assets. Maureen 'O Hara (1995) defines market microstructure as the "the study of the process and outcomes of exchanging assets under a specific set of rules." As per the Efficient Market Hypothesis [EMH], in the presence of rational investors who have free and equal access to all the available information, the share prices will at all levels and at all the times reflect all available information. Such a market is regarded as an efficient market. But, do we really witness fully efficient markets? As per studies [Tripathi and Aggarwal (2009)], Indian markets are not even weak form efficient.

The basic tenet of market microstructure theory is that the asset prices may not reflect full information and thus trade away from their true intrinsic value. This happens due to the presence of frictions like transaction costs, asymmetric information, etc. in the market. Demsetz (1968) defines friction as the price of immediacy. Stoll (1978) in a paper "Friction" described study of friction as the study of how markets operate. Therefore, the study of market structure acquired a distinct identity as a field of study in finance. One of the applications of market microstructure theory is to question or test the market efficiency. Microstructure study deals with issues of market design and trading mechanisms, price formation and price discovery, transaction costs, information and disclosure, and market maker and investor behavior. All these aspects influence the efficiency, liquidity and volatility in the market.

The first few studies came from Garman (1976), Demsetz(1968), Bagehot, (pseudonym for Treynor) (1971). Later as the field acquired importance, enriching literature flowed in from Maureen O'Hara and Easley, Hans Stoll, Ananth Madhavan, Avanidhar Subramanyam, Amihud and Mendelson, Joel Hasbrouck, Biais, Glosten, Milgrom and Spatt, among others.

CONCEPTUAL FRAMEWORK OF MARKET MICROSTRUCTURE

According to Naes and Skjeltorp (2006), themes in market microstructure can be classified as:

- Actual transaction process
- Effects of market microstructure on transaction process
- Transaction process's implications on economic decisions

The study of microstructure of a capital market spans across the following (Madhavan 2000):

1. Price formation and price discovery, including both static issues such as the determinants of trading costs, bid-ask spread and dynamic issues such the process by which prices comes to impound information over time.
2. Market structure and design issues, including the relation between price formation and trading protocols. Essentially, this topic focuses on how different rules affect the black box and hence liquidity and market quality.
3. Information and disclosure, especially market transparency, i.e., the ability of market participants to observe information about the trading process. This topic deals with how revealing the operating methods of capital market affects the behavior of traders and their strategies.
4. Informational issues arising from the interface of market microstructure with other areas of finance including corporate finance, asset pricing, and international finance. It will allow deeper investigations of traditional issues such as IPO under pricing as well as opening up new avenues for research.

TABLE: 1 CONCEPTUAL FRAMEWORK OF MARKET MICROSTRUCTURE

1. Price formation and discovery	<ul style="list-style-type: none"> • Asset pricing and information • Market makers and transaction costs • Liquidity and pricing
2. Market structure and design issues	<ul style="list-style-type: none"> • Market type • Trading systems • Orders • Prices • Trading priority rules • Trading protocols • Consolidation and fragmentation • Non-synchronous trading • High frequency trading • Algorithm trading
3. Information and disclosure	<ul style="list-style-type: none"> • Knowledge of prices, quotes, volumes, order flows, identity of market participants, etc • Insider trading • Asymmetric information and bid-ask spread
4. Interface with other areas of finance	<ul style="list-style-type: none"> • Bid-ask spread and cost of capital for firms • Comparisons of international stock markets for fund raising or investment

We shall now do a detailed study of above broad areas of market microstructure.

I. PRICE DISCOVERY AND PRICE FORMATION

The term “price discovery” is used to describe the process through which new information is incorporated in security prices. Price discovery process is crucial for any market. The opening prices face a long non-trading period and thus have to inculcate all the unabsorbed information which flowed overnight. On the other hand, closing prices are very significant for traders because they are used for closing day’s position and doing mark-to-market settlements. Closing prices also act as an estimating base for next day’s opening price.

The traditional Walrasian model of price discovery focused on finding a single market clearing price. But, somehow it ignored issue of inter temporal aggregation of demand and supply and here we had the beginning of market microstructure as an area of research. **Garman (1976)** addressed the aggregation issues through market maker’s role and transaction costs.

O’ Hara (2003) says liquidity provision and price discovery are two most important functions of markets. Asset prices evolve in market, based on the nature of participants. On the basis of information possessed, traders are classified into – informed and uninformed or noise traders. Prices are a reflection of information related to the asset. Information is revealed to the market through the trading activities of informed traders. (**Barclay and Warner (1993)**) To utilize their informational advantage to the fullest, informed traders use medium and small trade orders rather than large trades to reduce their market impact.

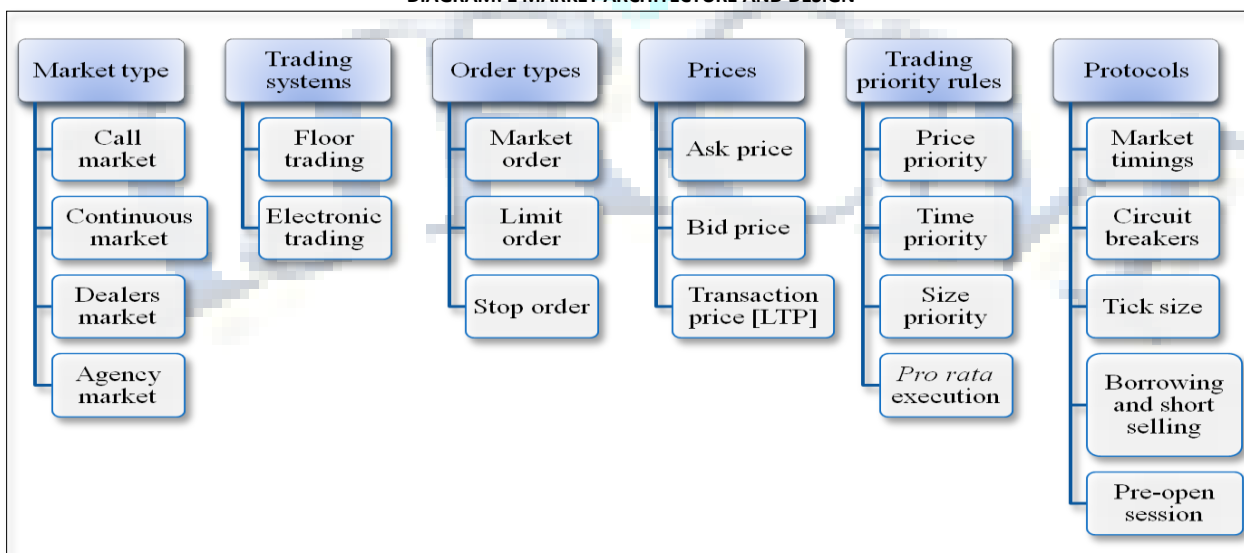
Amihud and Mendelson (1986) empirically showed an increase in the value of stocks of the companies which were moved to a more liquid trading environment, i.e., from call to continuous markets. Benefits from enhanced liquidity reduced the spread which in turn led to a rise in their stock prices. **Amihud and Mendelson (1997)** - an event study on Tel Aviv Stock Exchange and **Muscarella and Piwowar (2001)** results from the Paris bourse support the initial study. This shows that there is a direct link between the market microstructure and firm’s value. These studies justify the liquidity enhancement measures as an objective of stock exchanges and they being high on the regulators’ reform agenda.

Barclay and Hendershott (2008) discovered the effect of trading and non-trading mechanisms on price discovery using the 1999 data from NASDAQ when pre-open trading was introduced on NASDAQ. As the NASDAQ pre-open trading volume increased during the 1990s the noisiness of the opening price declined over time, suggesting that pre-open trading improved the efficiency of the opening price.

II. MARKET ARCHITECTURE AND DESIGN

A sea of changes in regulation and technology used by stock exchanges has created the need to better understand the impact of trading protocols and regulations on the trading process. In the last few decades, research fraternity and academia have been quick enough to come up with contemporary studies which have enriched the market microstructure literature. Market architecture can be studied under following heads:

DIAGRAM: 1 MARKET ARCHITECTURE AND DESIGN



PERIODIC VERSUS CONTINUOUS MARKET

Amihud and Mendelson (1987) conducted an empirical study to analyze the effect of trading mechanisms on security returns. They used NYSE stocks and compared the open-to-open returns to close-to-close returns. Opening prices were determined much like the clearing house trading procedure. Closing prices were, on the other hand, determined by trading with the market makers and thus represented dealership market procedures. The results found a significant effect of trading procedures on the returns earned. Secondly, open-to-open returns were having a greater variance and were more fat-tailed than the close-to-close returns. So, traders faced greater return variance at the opening than at the close. This depicts the effect of difference in trading mechanisms only because the other factors were controlled. Carole Comerton-Forde (1999) also arrived at similar results. Adoption of call auction at the open improved the market's pricing efficiency and more so for the illiquid stocks.

Amihud and Mendelson (1997) list the issues related to call auction method like - the traders have to put orders without knowing an indicative clearing price and even after placing an order they can't make any adjustment once the price is discovered, making them reluctant to place large orders, both to minimize their price impact and also to reduce the uncertainty involved.

Literature review, overall, considers periodic markets as more efficient in information aggregation and price discovery and thus useful in uncertain situations like open, close, and reopen after a trading halt. But, continuous markets overcome the various limitations of call markets like long pauses, no option for order modification on real time basis and more uncertainty due to delays and inventory risks.

FLOOR-BASED VERSUS SCREEN-BASED ELECTRONIC TRADING

On a more realistic note, adoption of screen-based electronic trading is more a result of huge trading volumes becoming unmanageable for human hands, and less of an informational efficiency enhancement step. Ultimate decisions regarding market structure and design are decided by marketplace specific factors rather than a general rule that succeeded elsewhere in enhancing market performance.

Pankaj K. Jain (2005) has done an extensive research covering 120 countries. He has analyzed the impact of electronic trading on market efficiency. Using international CAPM and dividend growth models, he obtained a positive short term return from the stocks which were moved from floor to electronic platform. Also, these firms faced a decline in their cost of equity due to reduced premium on shares after enhanced liquidity. So, electronic markets improve the liquidity, informativeness, and valuation of listed stocks, all of which help reduce the cost of equity.

Chang, Hsu, Huang and Rhee (1998) examined the effect of trading methods on Taiwan stock market liquidity and volatility. The results showed that price volatility on continuous market was twice that on the call markets. They also found that call markets were more efficient in reducing volatility for heavily traded stocks than for thinly traded stocks. This result was contrary to general belief. Also, price discovery was found to be more efficient in call markets. So, according to them, continuous markets not necessarily eliminate errors in price discovery process.

ORDER SIZE

Joel Hasbrouck (1988) empirically examined the relation between trades and quote changes to ascertain inventory and information costs. He found strong positive impact of trades on quote changes for all stocks. This shows the information impact of trades. A persistent order size impact was found for high volume stocks. This showed that large orders carry more information than small trades.

TRADING RULES

Cumming, Johan and Li (2011) studied the effect of trading rules on stock market liquidity for 42 exchanges across the world using the explicitness and preciseness of the trading rules laid down regarding market manipulation, insider trading and broker-agent conflicts. The results showed that the trading rules have a significant impact on the liquidity of a market. Also, the study brought about a greater significance of market manipulation, insider trading rules, etc for liquidity than the broker agency conflict guidelines. The reasoning put forth is that the former has a direct and endogenous impact whereas the latter are extraneous and subject to clarification by government, CFA institute, etc. the authors conclude that trading rules are a source of information in explaining the differences in the markets. They inferred a close relation between the Volume Manipulation Rules Index and trading velocity, the Price Manipulation Rules Index and volatility, and the Insider Trading Rules Index and bid-ask spreads.

TICK SIZE

Harris (1991) has shown the adverse effects of tick size. When the tick size is small, it is easier for the traders to revise quotes and move to next price. This lets them trade by using fewer limit orders. As we know that limit orders are the liquidity providers in a continuous market, fewer limit orders will dampen the liquidity in the market. Secondly, a mandated tick size will promote arbitrarily large spreads being charged by the dealers.

TRADING VOLUME AND PRICE VOLATILITY

Stoll and Whaley (1990) talked about the effect of market structure on price volatility using all common stocks listed on NYSE during 1982-86. They found the variance ratio (or F-statistic) of open-to-open returns to close-to-close returns was greater than one for all stocks. The authors attributed this higher price volatility on open to the private information revealed in trading. Second finding was a negative serial correlation between overnight returns and daytime returns meaning that prices tend to reverse on opening. There was also an evidence of greater spread, if measured on opening returns than on close-to-close returns, which has been justified by the higher tendency of price reversal on open than on close. Thirdly, day time volatility was found to be greater than overnight volatility due to presence of more public information during day as opposed to night. Finally, relation between price reversal and trading volumes was found to be significant. Opening prices are more likely to change the price change sign of the preceding day, if volume on preceding day was above normal and opening volumes are below normal. High volume are associated with price continuations i.e., a higher than normal volume will lead to a perpetuation of price change direction.

III. INFORMATION

Information is a central concept in market microstructure studies. All other components like price discovery, liquidity and market architecture are a manifestation of information in one form or another. In fact, literature has sub-classified market microstructure from an informational perspective only.

O' Hara (1995) defines transparency as the ability of participants to observe information regarding prices, quotes, order flows, identity and motives of traders, etc. Different markets have different disclosure norms which influences the level of transparency and price discovery process. For e.g. delayed reporting of large trades.

Pre trade transparency refers to the wide dissemination of current bid and ask quotations, depths, and possibly also information about limit orders away from the best prices, as well as other pertinent trade related information such as the existence of large order imbalances.

Post trade transparency refers to the public and timely transmission of information on past trades, including execution time, volume, price, and possibly information about buyer and seller identifications.

A related debate is the floor versus electronic trading mechanism. Under floor trading, a trader can see other trader's limit order only if it is the best quote. Whereas, in limit order book built in electronic trading interface provides information about orders (five best quotes) away from the best quote. Thus adoption of electronic trading improves transparency levels.

ASYMMETRIC INFORMATION MODELS

Most of the popular asset pricing models till date were based on the assumption of symmetric information with all the stakeholders. However, events like insider trading and price rigging have shattered the myth of equal access to information by all. Accordingly, modern economists have also incorporated this in the pricing models.

Asymmetric information models solve the problem of an uninformed dealer trading with informed traders and thus incurring losses. So, when a dealer receives a large order he perceives it to be originating from an informed trader and thus revises his bid-ask quotes in the light of information supplied by the inflowing order. Various asymmetric information models of bid-ask spread have been developed.

Baghot (1971) says that a market maker is faced by two types of traders – liquidity motivated or uninformed traders and informed traders or insiders. He says that the dealer wins over former but loses to the latter. And this trade-off determines his bid-ask spread. So, he says that spread arises due to non-symmetry of information.

Glosten and milgrom (1984) showed how a dealer revises his quotes in the light of order execution prices due to a lurking threat of insider trading on the other side of the contract. After fulfilling a sell (buy) order, a dealer revises his quotes downward (upward) due to a probability of insider trading.

Easley and O' Hara (1987) also studied the impact of information on price-trade size relationship. They showed how the behavior of informed trader, their order flows, etc influence the pricing behavior of the market makers due to a probability of an adverse selection losses incurring to them. It has been discussed in detail in next section.

INFORMATION DISCLOSURE, MARKET TRANSPARENCY AND LIQUIDITY

There is a growing consensus that increased transparency leads to better price discovery. However, too much disclosure will also discourage informed traders from trading and thereby reduce liquidity in the markets. Thus, some disclosure is better than no disclosure but absolute information sharing will eliminate the information advantage. So, we can conclude that informed traders will prefer anonymous system rather than the non-anonymous systems.

But we also witness a study which says disclosure enhances liquidity by reducing transaction costs. **Admati and Pfleiderer (1991)** gave us a model which shows that traders who disclose their order size in advance of trade execution face lower transaction costs because market believes that such traders are uninformed and have genuine intentions of trading. Forster and George (1992) framed a model where increased disclosure related to direction and motivation of trades leads to reduction in trading costs. Conceptually, trading costs are the costs of adverse selection which may happen because some traders have private information.

Easley, Kiefer, O' Hara and Paperman (1996) investigated a set of NYSE stocks to determine if spread differences across active and infrequently traded stocks can be explained by information based trading. They found that chances of information-based trading are low for high volume stocks. The authors propounded – Inventory or liquidity effect, Market power and Information-based reasons.

Easley and O' Hara (1987) developed a model to show the effect of information on price-trade size relationship. According to the authors, large trade orders carry an information perspective which influences the price process. As there is a higher probability that the large order is coming from an informed trader, the market maker will also change his pricing strategy to minimize the adverse selection losses. This explains why block trades are executed at unfavorable prices. Also, the sequence of block trades contains more information than a single block order.

SPEED OF INFORMATION ADJUSTMENT IN STOCK PRICES

Another interesting aspect is the speed with which the information gets assimilated in the stock prices in a market. EMH says that efficient stock markets are those in which any new information is almost instantaneously reflected in the share prices. So, the speed of adjustment of prices to new information will determine the efficiency of the markets. **Prasanna and Menon (2013)** computed the speed of information adjustment in Indian stock indices during 2005 to 2010 period using four alternative speed estimators viz., the AR (1) model, the ARMA (1, 1) model, the ARMA (1, X) model, and the cross-covariance estimator. They observed an increase in the speed coefficients during 2005-09 period, including the global financial crisis duration. However, the speed coefficients declined for bank index, Bankex. This clearly reflects the sectoral impact of the financial crisis on Indian stock market. Such an increase in market indices shows the improved efficiency of Indian stock markets in the wake of reforms initiated in the last decade or so.

IV. LIQUIDITY

Liquidity refers to the ease with which an asset can be converted into cash without any significant loss of value. It can be measured either by the time taken to trade an asset or the cost born to immediately trade the asset.

Market microstructure pays more attention to the cost of immediacy than the time for immediate execution of trade. So most of the theoretical and empirical studies focus on measuring the cost of immediacy and its influence on trade volume, market efficiency, asset pricing, etc. Immediacy cost can be explicit costs like brokerages, commission, transaction tax, etc or implicit costs like bid-ask spread, rounding off of prices, market impact costs, etc.

Kyle (1985) describes liquidity under three aspects of transaction costs:

- Tightness** - refers to the cost of turning over a position in a short period of time. In the continuous auction equilibrium, the market is infinitely tight because it is costless to turn over a position very quickly.
- Depth** - refers to the ability of the market to absorb quantities without having a large effect on price. In the continuous auction equilibrium, the depth of the market is constant.
- Resiliency** - refers to the speed with which prices tend to converge towards their fundamental values. Resiliency also measures the rate at which prices bounce back from an uninformative shock. In both call and continuous market, the resiliency of prices is determined by the trading of the insider.

MARKET MAKING AND TRANSACTION COSTS

Liquidity is an inter-temporal concept in terms of market microstructure. Buy and sell orders may not arrive in the market at the same time. So, it may even hamper price discovery process. Here enters the role of intermediaries in the market. The dealers or market makers are always ready to take the other side of the transaction and this provides liquidity to the investors. However, the dealers need to be compensated for bearing the inventory risk and for this they charge a bid-ask spread. This liquidity based spread becomes a transaction cost for the traders/ investors (O' Hara 2003). Hara proposes that asset prices are influenced by the transactions costs of liquidity and the risks of price discovery.

INVENTORY CONTROL MODELS

The Dealer's model by Garman (1976) provided a base to all the inventory control models due to its inherent fallacy. The dealer model says that dealers will set one market clearing price where demand equates supply. But, the dealer will quickly run into bankruptcy due to random buy and supply order flows because he maintained a static price. However, the reality doesn't support this. It means that dealers revise their bid-ask quotes in light of inventory imbalances created due to trading. Such price adjustments are aimed at controlling inventory levels near the optimal levels. **Stoll (1978)** explained that dealers have a preferred inventory level and whenever their realized inventory deviates from that level, they buy/sell inventory and also adjust their bid-ask quotes. This is the dynamic price-inventory adjustment model. **Amihud and Mendelson (1980)** in their study showed that bid-ask prices are dependent on the inventory positions of the dealer or market maker. They predict that inventories revert back to the desired inventory position after bid-ask adjustments are made by the dealer.

Moving beyond bid-ask spread as the measure of liquidity, **Brennan and Subrahmanyam (1996)** used a different measure of illiquidity to study the relation between illiquidity and stock returns. They have used the transactions data from stock market and adjusted it for risk using Fama-French three factor model. They have covered both variable and fixed cost component of transaction cost and thus shed more light on adverse selection as a cause of illiquidity and higher transaction costs. Their results show a significant relation between illiquidity and stock returns.

TRADING RULES AND LIQUIDITY

Cumming, Johan and Li (2011), as discussed in an earlier section, showed that the trading rules have a significant impact on the liquidity of a market. Also, the study brought about a greater significance of market manipulation, insider trading rules, etc for liquidity than the broker agency conflict guidelines.

▪ SIGNIFICANCE OF MARKET MICROSTRUCTURE

Naes and Skjeltorp (2006) in a paper titled "Is the market microstructure of stock markets important?" touched upon the concept, important themes and relevance of market microstructure as a field of finance. They reiterate the fact that microstructure study challenges the age old efficient markets assumption in the theoretical construct of all financial models. Microstructure focuses on the two most significant functions of markets, namely, price discovery and liquidity. So, all other functions flow from - how prices reveal the information available and the information risk arising due to asymmetric information. It states that even if all the investors in a market are rational, asymmetry of information will cause prices to deviate from their true values.

As already stated in earlier sections, the structure of financial markets is changing these days. So, the very base of all concepts in finance is bound to undergo change and their conclusions can go haywire if not molded into current context. So from academic, research and policy perspective; study of microstructure of stock markets is all the more important. We have to look for its repercussions on portfolio decisions of investors, both in short term and long term. Recent trends like non-synchronous trading, high frequency trading, changing circuit breakers, etc need to be dug deeper and broader across markets, nations and products. Also, there is a need to develop new empirical methods to measure liquidity, transparency and informational risk, etc.

▪ APPLICATION TO OTHER AREAS OF FINANCE

Market microstructure has important learning and implications for other areas of finance like corporate finance, personal finance and international finance. **Amihud and Mendelson (1986)** studied the relationship between bid-ask spread and stock returns. It was observed that higher spread stocks shall yield higher returns to compensate the investor for higher transaction costs. It was so because risk can be diversified away but the cost of illiquidity cannot be diversified.

It also gave an important result for portfolio decisions. It said that low liquidity in the markets for a particular asset means a higher spread on it. This creates a need for a longer investment horizon to spread the high spread thinly across the holding period. Therefore, less liquid assets like real estate and small firms' shares will be held for longer periods. This means short term investors will prefer low spread stocks.

Amihud and Mendelson (1986) also empirically showed an increase in the value of stocks of the companies which moved to a more liquid trading environment. Benefits from enhanced liquidity reduced the spread which in turn led to a rise in their stock prices. This has an important implication in corporate finance because a higher value of firm's shares means a lower cost of capital and a greater total value for the firm. This way microstructure study is relevant for investment management and corporate finance too.

Lastly, with growing globalization and inter-country investments in fray, microstructure of global markets is also of interest to practitioners. So, market microstructure is not an isolated field of study, it is well-integrated with other areas too. Comparative studies across nations can help investors take global investment decisions and help regulators formulate reform policies and operating guidelines. Stock exchanges can also make necessary improvements in the trading mechanisms to enhance the market efficiency.

▪ MARKET MICROSTRUCTURE RESEARCH IN INDIAN CONTEXT

Market microstructure of capital markets has not been the cynosure of Indian researchers. However, off late it has picked up pace as a distinguished field of research. Most of microstructure studies have originated in the west, even those having Indian or developing markets as the sample. But, this also is a result of western markets maturing earlier than ours. So, now with a spurt in the stock market reforms, wide spread penetration of stock market investing habit (though still lower as compared to advanced nations) and the emerging nature of Indian markets make in-depth study and analysis of our markets a hot topic of research in finance. Some of the prominent studies reviewed by the author are given below.

A SEBI initiated project came out with a paper "Trade execution cost of equity shares in India" by **M.T. Raju, Kiran Kirande and Shikha Taneja (2002)**. It measured quoted and effective bid-ask spread and also studied its relation with market microstructure. Indian stock markets follow electronic limit order book. Spreads were found to be highest on opening time and gradually declined to their minimum near the day's end. Spread were seen to have an inverse relation with the trading volumes and market capitalization whereas a positive relation with volatility and number of trades. Overall, it was concluded that spreads depend upon market structure. The study also gives a brief overview of stock market design in India.

NSE India Limited has been supporting research initiatives. One such **NSE working paper 128**, titled "understanding the microstructure of Indian markets" has thrown light upon the microstructure of Indian financial markets. The authors have measured the spread for all NSE stocks using limit order books and Roll estimator. Absolute spreads were found to be rising with price and return volatility and declining with market capitalization, trading volume and number of trades. A U-shaped pattern for intra-day spread has been observed.

Nilanjana Ghosh (2009) provides a comment on status of market microstructure issues being highly neglected in India from both policy perspective and research purpose. It also talks about various landmark studies conducted in the past and already discussed in this paper. He particularly talks in context of Indian commodity markets, however the same holds true for our financial markets as a whole. Future researchers can take some motivation and insight from his article.

An interesting aspect is the speed with which the information gets assimilated in the stock prices in a market. EMH says that efficient stock markets are those in which any new information is almost instantaneously reflected in the share prices. As discussed earlier, Prasanna and Menon (2013) computed the speed of information adjustment in Indian stock indices during 2005 to 2010 period.

Acharya and Gaikwad (2014) conducted an event study to observe the effect of introduction of call auctions in pre-open session. Call auctions in pre-open session were introduced by SEBI on BSE and NSE on 18th October 2010. They conducted a study on a sample of 100 stocks, 50 on NIFTY and 50 on NIFTY JUNIOR over a period of 16 months (8 months each in pre call and post call period). Results show that there has been no significant improvement in price discovery process. One contrast being witnessed from Indian literature is that we introduced call auctions for highly liquid large stocks which are in market index, BSE SENSEX and NSE NIFTY, whereas other nations in the past have introduced them for infrequently traded stocks. Past literature also found call auctions more efficient for infrequently traded stocks. So there exists scope for further empirical testing in this area. Secondly, the sample size is too small as compared to whole exchange. A more inclusive introduction of call auctions on an exchange may bring about the desired results.

Various other studies have also been done on Indian markets but they are either too few in numbers or are concentrating on limited issues like call versus continuous markets, estimation of spread, informed trading or efficiency of electronic markets. There is a need to conduct more extensive studies and also study the integrated effect of various variables on stock market efficiency, price discovery, transparency and liquidity.

CONCLUSION

Market microstructure research has been severely neglected, especially in Indian context, despite its high significance for policy makers, investors, exchanges and corporate. No proper policy for regulation and development of markets can be devised without in-depth knowledge and understanding of market structure, investor behavior, and their interplay. Moreover, in Indian context, where we are trying to attract more and more investment into our capital markets and increase its soundness and depth, it is highly unlikely that we will succeed in big way unless some long due and warranted steps are taken to enhance investor protection, hassle-free trading and smooth settlement, etc

The four tenets of microstructure touched upon in this paper provide the author and readers with a ground work to delve into empirical studies. Literature review spanning over decades and nations provide useful insights. Price discovery and liquidity functions of the markets have been quite well-researched. Secondly, asymmetric information models have been successful in explaining informed trading and bid-ask spreads. However, market architecture debates have been restricted largely to call versus continuous markets and alternative order mechanisms. There is a lot of scope for diving into trading protocols, priority rules of trade execution, non-synchronous trading, high frequency trading, algorithm trading, etc. High frequency data availability will facilitate study of non-synchronicity and its effects more elaborately, even for individual stocks.

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