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# Intraday liquidity patterns in Indian stock market☆

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ABSTRACT

This paper is an empirical study of the intraday liquidity patterns on the National Stock Exchange (NSE) of India. Using trade and quotes data on stocks contained in the NIFTY index, we find that most of the volume and spread related to liquidity measures are U-shaped, similar to those found in a quote driven market. Such patterns also indicate a contradictory feature of concurrent high trading volume and wide spreads, a feature that is new to an order driven market such as the NSE. Additionally, this paper also measures marketwise liquidity by checking for commonality among liquidity measures. Empirical results show that there is only weak evidence of commonality, suggesting sensitivity to commonality need not be a priced risk.



## 1. Introduction

This study analyses the liquidity patterns in the Indian equity market, using intraday data from the National Stock Exchange (NSE). We use the 20 most traded stocks from National Stock Exchange's CNX NIFTY index. NIFTY is the main stock market index of NSE and tracks the price movements of 50 stocks that represent 21 sectors of the Indian economy and accounts for about 66% of the total free float market capitalisation of the stocks traded on NSE as on March 2012.[1] NSE is a pure order driven market which is characterized by the absence of any market maker, and where the market transactions are carried out anonymously through a centralized computer. With improvements in technology, many stock exchanges around the world are opting for such pure order driven markets with the fundamental objective of providing a liquid market that is crucial for price discovery.

Liquidity of a stock is generally defined as the ability to trade large volumes with minimal price impact, cost and delay. This definition may also be applied to measure the liquidity of a market as a whole. While this definition in itself is simple, a universally acceptable measure of such a liquidity continues to be elusive and results in the presence of diverse measures. Moreover, liquidity is measured differently for different segments of a financial market. There are varying measures of liquidity for monetary, foreign exchange, bond and equity markets. The frequency of the data used is also important for measuring liquidity. For example, studies looking at the determinants of stock market development rely on measures that can be applied to annual or quarterly data to draw inferences about stock market liquidity. In the study by Cherif and Gazdar

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[1] *Source*: http://www.nseindia.com/content/indices/ind_cnx_nifty.pdf.

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(2010) liquidity is measured as traded value ratio (ratio of turnover to GDP), whereas in Levine and Zervos (1998) it is measured as the turnover ratio (ratio of turnover to market capitalisation). However, these measures are of little use for studies that look at the evolution of liquidity for shorter spans of trading activity, say for example, within a day. Traded value, market capitalisation, GDP and turnover will all register only a negligible change within a day; hence, they will not be able to capture the true movement of liquidity. For measuring liquidity with data collected at higher frequencies such as at the intraday level, we need liquidity measures that can be applied to such data and that have sufficient variations to capture the changes in liquidity within a day. In this paper, we employ some such measures on intraday data that are popular in the literature with the aim of understanding the liquidity pattern of the Indian stock market.

According to Kyle (1985), a liquid market should have depth, tightness and resilience. More recent researchers have also added trading time to this list. Depth simply measures the ability of the market to accommodate large trade volumes; however, it has little impact on prices. Resilience is the degree to which prices recover from small trades. A market that bounces back from a price shock or can absorb a shock and restore the balance among orders quickly is a resilient market. Tightness denotes the cost incurred in a transaction, irrespective of market price. Bid-ask spread is an indicator of tightness, while a narrow spread indicates a liquid market. Clearly these three concepts are closely related, which makes their measurement difficult. This also implies the necessity to consider all three measures either individually or jointly to decide on the liquidity of individual stocks or a market.

Liquidity patterns of many markets with different designs have been analysed in the literature, with a preponderance of studies involving quote driven markets. Two widely prevalent market systems are quote driven markets and order driven markets, with these two systems differing in a number of ways. Quote driven markets, also called price driven markets, rely on the existence of a market maker, or several market makers, to buy and sell traded assets. In a pure order driven market, there are no market makers. Traders record their sell or buy orders in an order book maintained by the stock exchange and monitored by a centralized computer system. Typically, in order driven markets, there are limit order traders and market order traders. While it is generally believed that market order traders are demanders of liquidity while limit order traders are the suppliers, there is no unanimity in this. However, regardless of the market design, liquidity has been measured using some common proxies such as bid-ask spread, trading volume, or turnover.

The question is, why should we study the liquidity patterns? An understanding of the interday or intraday behaviour pattern of various liquidity proxies gives us an idea about the variations in the liquidity of corporate stocks and the costs involved in trading in such stocks (see Amihud, Mendelson, & Pedersen, 2005 for a survey on the role of liquidity in asset pricing). Market imperfections create intraday variations in liquidity. And such variations have implications for the timing of trades that aim at minimizing transaction and liquidity costs. For instance, Garvey and Wu (2007) conclude from the U-shaped intraday pattern of market volume and volatility that orders submitted at midday take significantly longer to execute than orders submitted around open and close. Given this, it would be beneficial for the traders to trade around open and close to minimize overall liquidity costs. Similarly, suppliers of immediacy would benefit from knowledge of the intraday spread pattern. The bid-ask spread is the price or the cost that a trader who wishes to trade immediately has to pay. From an administrative point of view, apart from enabling the various agents to discriminate among stock exchanges in terms of liquidity, such studies also help regulators to design an appropriate measure of liquidity for an efficient and transparent trading system. This is particularly true of emerging markets that are generally believed to be less transparent and have limited portfolio choices. However, with dramatic growths in emerging markets and steady capital market liberalisation, Bekaert, Harvey, and Lundblad (2007) find that liquidity may have even greater impact in such markets. They opine that asset pricing models that incorporate local liquidity risks perform much better than those that employ market risk factors in predicting future returns. From a theoretical point of view, empirical or stylized facts that emanate from such studies help us identify the factors that explain the intraday behaviour of the underlying market. For example, a U-shaped bid-ask pattern in a quote driven market seems to indicate the role of activity, risk, information and competition (see McInish & Wood, 1992). Among the emerging markets, Brockman and Chung (1998) find a U-shaped bid-ask spread curve for an order driven market such as the Hong Kong market, while Guo and Tian (2005) report an L-shaped bid-ask spread for the Chinese market, which is basically an order driven market, citing the call auction at the opening of the market and asymmetric information as possible determinants.

Though patterns of bid-ask spread and other related measures have led to the formulation of theoretical models explaining intraday behaviour, researchers have also looked for patterns in liquidity using volume- and time-related measures such as depth, turnover, order ratio, trading volume and flow ratio, which are functions of quantity or volume of shares. Employing these measures on different stock exchanges of the world, many studies have reported varying liquidity patterns, hinting at different market micro structure at work. For instance, in a study that investigated the liquidity pattern of the Hong Kong stock exchange, Brockman and Chung (1999) highlight the importance of using depth measures to measure liquidity. They find an inverted U-shaped patten and point out that systematic changes in depth may magnify or mitigate changes in spread. Similarly, Admati and Pfleiderer (1988) propose a theoretical model to explain some intraday trading pattern in the volume of shares traded by using trading volume to explain the U-shaped pattern of the average volume of shares traded.

Based on findings discussed above about the various liquidity measures, some theoretical models have been proposed to explain intraday trading in both quote and order driven markets. Founded on adverse selection, a particular strand of theoretical work points to asymmetric information as the reason for bid-ask spread in order driven markets, with Glosten (1994) study establishing a positive correlation between bid-ask spread and the level of informed trading. A second theory