

Closer View at the Stock Market Liquidity:

A Literature Review

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Abstract

Liquidity is said to be the lifeblood of stock markets. It has prominent implications for traders, regulators, stock exchanges and the listed firms. In recent years a huge amount of literature has emerged that deals with liquidity. This article classifies and organises the literature and provides a critical review of the frameworks currently available for modelling liquidity and its macroeconomic and firm specific drivers. Commonality and intraday behaviour of liquidity in various markets is discussed under the umbrella of market microstructures. Subsequently, liquidity risk as a factor in Asset pricing is analysed taking various models in to consideration. Finally, the study reviewed the impact of liquidity on corporate finance decisions viz. dividends, firm valuation, stock split, capital structure etc.

Key words: Liquidity, Determinants, Commonality, Asset Pricing, Corporate Finance

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1. Introduction

The ability to trade large volume of stocks with least price impact, cost and postponement is termed as Liquidity. As per O'Hara (2004), "*liquidity is hard to define, but easy to feel it*". Liquidity has multi-dimensional characteristics viz. Tightness, Immediacy, Depth, Breadth, and Resiliency. All of these characteristics cannot be captured in a single measure. Thus, a globally acceptable measure of liquidity which represents most of these characteristics continues to be an area of research.

Higher level of illiquidity poses the risk of higher losses for the investors along with higher gains in comparison to the liquid markets because of the price volatility. In illiquid markets, an investor is uncertain about executing a large transaction as it may cause significant price change resulting higher losses. Therefore, the stock market development is impeded as higher illiquidity lower down the capital inflows. Also, the firms can reduce cost of capital by increasing the liquidity of their respective stocks. Fund managers can design improve trading strategies if they a better understanding of the liquidity dynamics.

Common determinants or the concept of commonality is a phenomenon in which individual stock liquidity is at least partly determined by market- wide factors (Chordia *et al.*, 2003). High degree of commonality indicates high degree of systematic risk resulting in to higher liquidity premium for holding such assets (Fujimoto, 2003). Designing of diversified portfolios becomes difficult because of presence of commonality in liquidity (Domowitz and Wang, 2002). Regulators can improve market liquidity by changing the market designs. This can be achieved by empirically understanding common liquidity movements (Coughenour and Saad, 2004).

With the above brief introduction about liquidity importance in field of financial economics, the study has initiated extensive review of literature with primary focus on the concept liquidity measurement, intraday behaviour, determinants, commonality and its implications on asset pricing and corporate finance.

2. Liquidity Proxies and Characteristics

As per Keynes (1930), an asset is more liquid if it is immediately realized without loss. An investor may either insist on immediate execution at the current bid or ask price or wait to transact at a favorable price. The quoted ask (offer) price includes a premium for immediate buying, and the bid price similarly reflects a concession required for immediate sale. Thus, the spread between the bid and ask prices is a measure of illiquidity, which is the sum of the buying premium and the selling concession.

Baker (1996) concluded that there is no single unambiguous, theoretically correct or universally accepted definition of liquidity. Sarr and Lybek (2002) opine that there is no universally accepted measure to determine a market's degree of liquidity because of market specific factors and peculiarities.

A Liquid market has depth, tightness, and resilience dimensions (Kyle, 1985). Black (1971), Harris (1990) and O'Hara (1995) identified several other dimensions of liquidity viz. bid-ask spread also called width, number of tradable shares at bid and offer prices; and immediacy. As liquidity has multidimensional features, it is difficult to capture in single measure. So, there are various measures of liquidity. The results from different measures of liquidity can

point to different conclusions (Benic and Franic, 2008). Liquidity measures are captured at different frequency *viz.* High frequency (captured in minutes or seconds) and Low frequency (captured daily). Study of market microstructure requires liquidity to be computed at a high frequency in order to capture sufficient variations within a day.

Bernstein (1987) examined different measures of stock liquidity and concluded that liquidity and efficiency are not compatible to each other. A liquid market, on arrival of new information, keeps the noise and sudden price changes minimal. On other hand, in efficient markets prices moves fast as the new information arrives. So, more liquidity leads to less efficient market. Amihud and Mendelson (1986) lay emphasis on the direct relationship between liquidity and cost of capital. High liquid markets are attractive to investors because of the easy exit from firm's ownership. This in turn reduces the opportunity cost of capital significantly. Hui and Heubel (1984) hypothesizes that part of unsystematic risk represents liquidity of stock. They measure liquidity as the sensitivity of unsystematic risk to the changes in volume traded.

Saar and Lybek (2002) classified liquidity measures into four categories based on their ability to capture a particular characteristic. The measures are Transaction cost measures, volume-based (*breadth* and *depth*), equilibrium price based measures (*resiliency*) and market-impact measures (resiliency and speed of price discovery). Hui-Heubel liquidity ratio (1984) attempts to capture market breadth, which is related price impact of volume of trades. Market Efficiency Coefficient (MEC) is used as a price based measure which states that the price movements are more continuous in liquid markets, even if equilibrium prices are impacted by new information.

Among price impact proxies, Amihud (2002) captures the lack of liquidity by dividing daily return by daily dollar volume. This measure is called as *Illiquidity (ILLIQ)*, shows the price shock triggered by a unit of dollar volume. Trizinkaet *al.* (2009) conclude the Amihud measure does a better job than most other measures at capturing liquidity, and is robust to regime changes such as the change in minimum tick size to decimals. *Illiquidity (ILLIQ)* is estimated for every share using daily data and the impact of each share is weighted by its free float rate and market capitalisation. The "Amivest measure", introduced by Cooper *et al.* (1985), compares daily returns with daily volume measured in number of shares. The two measures *viz.* Amihud and Amivest, even if constructed in a similar way, differ in several aspects. For example, one uses dollar volume while the other uses share volume. Amihud measure represents illiquidity, while Amivest measure indicates liquidity. The limitation with Amihud measure is it does not incorporate days without trading, which in and of itself contains important information for illiquidity. Even if the Amivest measure does not suffer from this limitation, it does not include information from days with a zero return.

PS measure of liquidity, developed by Pastor and Stambaugh (2003), is obtained by regressing daily returns in excess of daily market index returns on signed daily dollar volume. High Frequency benchmarks are categorized as (1) Spread Benchmarks and (2) Price Impact Benchmarks. The difference between the ask quote and the bid quote at time "*t*" divided by the average of the two quotes is termed as quoted spread at that particular time. The quoted spread measures pre-trade transaction costs. Even if the quoted spread provides important information about transaction costs, it is not necessarily translated to actual transaction costs.

Actual transaction costs borne by investors are better measured by the effective spread. The effective spread is defined as the absolute value of the difference between the transaction price and the midpoint of the quotes prevailing at the time of the transaction, divided by the transaction price. The realized spread matches the price of a trade with its post-trade true value.

Hasbrouck (2009) estimates the slope of the price function as price impact measure. Five minute price impact introduced by Goyenko *et al.* (2009), captures the permanent price change over a 5-minute window subsequent to a trade. It measures the change in quote midpoints from the time of the trade to 5 minutes after the trade. Huang and Stoll (1996) calculate adverse selection costs by subtracting the realized spread from the effective spread.

Trzcinka *et al.* (2011) compares percent-cost and cost-per-volume liquidity proxies computed from daily stock data to liquidity benchmarks computed from intraday data. Trzcinka *et al.* (2011) find that a new measure called FHT by simplifying the LOT model. This proxy has a high correlation with spread related measures *viz.* percent price impact, percent effective spread, percent quoted spread, and percent realized spread. Also, this proxy captures the level of effective spread and quoted spread. However, it fails to capture the level of realized spread or price impact.

Mianbi and Langnan (2007) made an empirical comparison of the high frequency measures of liquidity and low frequency measures of liquidity using Pearson, Partial Pearson and Spearman correlations on component stocks of SH180. Hui-Heubel Liquidity ratio performs as the best measure.

Table 1. Summary of empirical studies on liquidity proxies

Author/s (Year)	Frequency	Dimension	Remarks
Cooper <i>et al.</i> (1985)	Low (D)	Price Impact	Amivest Measure of Liquidity
Chordia <i>et al.</i> (2000)	High (Min)	Transaction Cost	Difference between Bid and Ask Price
Datar (2000)	Low (D or M)	Price Impact	Coefficient of Elasticity of Trading
Amihud (2002)	Low (D)	Price Impact	Measures Illiquidity, No ZERO Trading days, Sensitivity associated with the trade of one rupee of trading volume
Pastor and Stambaugh (2003)	Low (D)	Price Impact	Extent to which the volume of stocks traded impacts stock prices
Uddin (2009)	Low (M)	Relative Measure	Stock cannot be illiquid if average market liquidity is low, Factors Systematic Liquidity Risk
Trzcinka <i>et al.</i> (2009)	Low (D), High (Min)	Comparative Analysis	Identify high quality proxies, Amihud (2002)- well measures price impact

Source: Compiled by authors from cited research articles. D stands for daily measurement, M stands for monthly measurement, Min stands for minute measurement of liquidity.

Appendix (I) at the end of the study summarises key low frequency liquidity proxies used by researchers.

3. Determinants of Liquidity

In order to understand liquidity in financial markets it is important to understand its determinants. Research in area of determinants is categorised in two types viz. Firm specific factors and Macroeconomic factors. Jacoby and Zheng (2010) studied the empirical relationship between ownership dispersion and market liquidity. The study found that higher ownership dispersion improves market liquidity. It is also found a positive relation between block holder ownership and quoted spread, effective spread, and the adverse selection component of effective spread. The relationship between ownership dispersion and market liquidity still exist even on small stocks listed on NYSE/AMEX.

Baber *et al.* (2012) studied the relationship between institutional investors, liquidity, and liquidity risk. They find that institutional ownership generally predicts larger stock liquidity.

Stocks with concentrated institutional ownership and especially hedge fund ownership tend to have low returns with high market illiquidity, suggesting that crowded trading strategies have a detrimental impact on returns when markets are less liquid.

Yaghoobnezhadet *et al.* (2011) studied of relationship between institutional ownership and stock liquidity on Tehran Stock Exchange. The presence of the institutional investors can affect stock liquidity in two ways *viz.* informational benefits and increase of liquidity due to the increase of price discovery resulted from the competition between institutional investors (effectiveness of the information).

Næs (2004) takes account of the relationship between market liquidity and company ownership on Norway stock exchange using a panel regression approach. The study reported owner concentration to be negatively related to spreads and information costs. No strong relationship can be documented between liquidity and institutional ownership.

Sharma (2005) studied ownership structure and stock liquidity on Indian stock market and found that the promoters' shareholding is not a statistically significant variable in explaining the determinants of liquidity in both Nifty stocks and Nifty junior stocks though it is contrary to the a priori relation proposed by the market microstructure literature. Keim and Blume (2012) provide evidence that institutional participation in the U.S. stock market explains the cross-sectional variation in stock market illiquidity.

Kim and Verrecchia (1994) studied the relationship between earnings announcements, trading volume and liquidity and found that earnings announcements increase the information asymmetry, which in turn leads to reduced liquidity in an imperfect market. Hendershott, Jones and Menkveld (2011) explained the empirical relationship between Algorithmic Trading (AT) and liquidity. Auto quoting on NYSE is used as an instrumental variable for AT. It reduces the trading costs, trading frictions, makes risk sharing more efficient, in-formativeness of the quotes increases and in turn it enhances liquidity.

Kumar *et al.* (2001) studied the impact of international listings like ADR and GDR on liquidity of Indian firm's underlying domestic shares. GDR listings are associated with enhanced liquidity while ADR listings (in most cases) are associated with reduced liquidity of the shares of domestic firm.

Chordia *et al.* (2001) studied the relationship among liquidity, trading activity, market return and interest rate of NYSE listed stocks. Liquidity and trading activity is influenced by market returns, its volatility, short-term and long-term interest rates. Macroeconomic news like GDP, unemployment rate also impact liquidity at the time of announcements.

Ding *et al.* (2013) empirically studied the relationship between Foreign Institutional Investors and Stock Market Liquidity on Shanghai and Shenzhen stock exchanges. The results indicated that with the increased participation of foreign institutions, stock market liquidity improves.

Chordia *et al.* (2005) reported modest predictive power of monetary policy for stock market liquidity. However, Goyenko and Ukhov (2009) gives strong evidence that monetary policy

predicts liquidity of the stocks listed on U.S. markets for the period 1962 to 2003. Söderberg (2008) provides mixed evidence by studying the influence of 14 macroeconomic variables on the market liquidity of three Scandinavian stock exchanges.

Table 2. Summary of empirical studies on liquidity determinants

Author/s (Year)	Market	Area	Remarks
Naes (2004)	Norway Exchange	Stock Firm Specific	Granger causality fails to explain relationship between market liquidity and company ownership
Soderberg (2008)	Scandinavian Stock Exchanges	Macroeconomic	Fourteen macroeconomic variables are taken as repressors against market liquidity
Agarwal (2009)	USA- AMEX	NYSE, Firm Specific	Institutional ownership (Granger) causes liquidity
Peter <i>et al.</i> (2011)	Euro Zone stock exchanges	Macroeconomic	Stock market liquidity is increased by Expansionary monetary policy
Ding <i>et al.</i> (2013)	China- SHE, SZE	Firm Specific	Relationship between Foreign Institutional Investors and Liquidity

Source: Compiled by authors from cited research articles

4. Market Microstructures

Market microstructures in stock markets have attracted much research attention in recent years. This importance is due to the existence of intraday regularities in stock market that contests the Efficient Markets Hypothesis. The researchers are now focusing on the causes generating this behaviour in order to analyze this anomaly.

The variations in stock liquidity along with the costs involved in trading can be better understood by studying the behavior pattern of various liquidity proxies (Amihud and Mendelson, 1980; Acharya and Pedersen, 2005). This helps various agents in selecting stock exchanges in terms of liquidity. Also, such studies also help the regulators particularly in emerging markets that believed to be less liquid in designing an efficient and transparent trading system. Bekaert, Campbell and Lundblad (2007) argued that with the capital market liberalization in emerging economies, liquidity may have greater impacts.

Köksal (2012) studies intraday patterns of various liquidity proxies on Istanbul Stock Exchange (ISE) using limit order book. It is reported that the spreads follow an L-shaped pattern whereas returns, number of trades and volume follow a U-shaped pattern. In addition, wide spreads are accompanied by low depths and *vice versa* indicating that traders use spreads and depths simultaneously to carry out their strategies.

Tissaoui (2012) investigates the intraday pattern of trading activity, liquidity and return volatility of the stocks listed on Tunisian Stock Exchange (TSE). The majority of these studies showed that the trading volume, return volatility and liquidity profile follow the U-shaped patterns. Krishnan and Mishra (2013) investigates intraday liquidity patterns of twenty stocks listed on National Stock Exchange (NSE). The study reported that many liquidity proxies have U-shaped pattern. This is in line with the studies done on other quote driven or hybrid markets.

Table 3. Summary of empirical studies on liquidity patterns

Author/s (Year)	Market		Remarks
Guo and Tian (2005)	Shanghai Exchange (SHE)	Stock	L-shaped pattern of bid ask spread
Köksal (2012)	Istanbul Stock Exchange (ISE)		L-shaped pattern of Spreads, U-shaped pattern of returns, number of trades and volume
Tissaoui (2012)	Tunisian Exchange (TSE)	Stock	Existence of seasonality in trading activity, U-shaped pattern of Trading volume and return volatility
Krishnan and Mishra (2013)	National Exchange (NSE)	Stock	Many liquidity proxies have U-shaped pattern.

Source: Compiled by authors from cited research articles

Empirical market microstructure research has shifted its focus from studying individual stock liquidity to examining commonality.

Commonality is defined as the co-movement between variations in individual stock liquidity and variations in market and industry wide liquidity. Chordia *et al.* (2000) empirically studied common underlying determinants of time series movements in liquidity, known as commonality. Their study uncovers that the inter-temporal changes in liquidity is supported by the theory of inventory risks and theory of asymmetric information. Trading volume causes variations in dealer inventory levels, which results in varying liquidity levels. Inventory carrying costs depends on interest rates, hence it also co-moves. Asymmetric information i.e. when few traders have more information than the rest also causes co variation in liquidity. The study attempts to find evidence that liquidity co-variation is much stronger for portfolios than individual stocks, a finding relevant for investment managers who turn over their holdings frequently. Fabre and Frino (2004) does not find support for commonality on ASX and argued that commonality in liquidity might be attributed to market designs.

Narayan *et al.* (2011) made insightful analyses of the commonality on two stock exchanges of China comprising of 82 million transactions. They examined four hypothesis related to commonality. First, market-wide liquidity is variable influences liquidity of individual stocks. This is confirmed by positive and statistically significant beta. Second, size of the firm is not

a determinant of commonality on Chinese stock exchanges. This is different from the existing literature which says size effects in commonality. Third, sector specific liquidity has a greater influence on liquidity of individual stocks in comparison to market-wide liquidity. Commonality is found stronger during bear period than bull period as investors are more concerned of macroeconomic news in comparison to firm performance. The study finds evidence in support of commonality in liquidity and a greater influence of industry-wide liquidity in explaining liquidity of individual stocks.

Pukthuanthong-Le and Visaltanachoti (2009) studied commonality of stocks listed on Stock Exchange of Thailand (SET) using eight years tick data. The study reported empirical evidence in favour of Market wide commonality across various liquidity proxies. Also, it is found that Industry wide commonality is stronger than Market wide commonality.

The implications of commonality in liquidity on investors are not fully understood. Anderson *et al.* (2013) investigate whether investors are compensated for taking on commonality risk in equity portfolios. This study reports economical and statistical significance of return premium for commonality risk in NYSE stocks. The commonality risk premium is robust to various measures of liquidity and estimating its systematic component.

Zheng and Zhang (2006) examines to the degree at which liquidity is driven by common underlying factors in China that has adopted an order-driven trading system. The study found the influences of size, industry, and up and down markets effects in determining common trend in liquidity.

Tayahet *al.* (2015) argued that for most of the emerging economies intraday data is not available. So, they studied commonality on Amman stock exchange employing daily liquidity measures. The study reported evidence of commonality across all size based portfolios for the proxies used except for price impact. Also, the study reported weak evidence of Industry-wide commonality which is in contrast with the previous studies.

5. Liquidity Risk and Returns

This section studies the linkage of stock liquidity, its variation and the associated returns. Amihud and Mendelson (1986) analyze the effect of bid ask spread or illiquidity on asset pricing. The focus of the study was to explore the area of market microstructure in order to determine asset returns. Their model predicts that higher spread assets yield higher expected returns, net of trading costs. Investors hold high spread assets for longer holding period because of the clientele effect.

Bali *et al.* (2013) revealed that stock market under-reacts to the stock level liquidity shocks on NYSE, AMEX and NASDAQ exchanges. Investor inattention and illiquidity both drive this under reaction. This study finds evidence on the mechanism of processing information about stock level liquidity shocks. They opined that limited investor attention and illiquidity prevents public information being incorporated in security prices. Bali *et al.* (2013) finds that immediate liquidity shocks have positive impact on contemporaneous stock returns. They examined double sorted portfolios using Fama-MacBeth regressions to confirm the significant relationship between future returns and liquidity shocks using large set of control

variables example level of illiquidity, systematic liquidity risk, size, book to market, price momentum etc.

Pastor and Stambaugh (2001) find evidence that market-wide liquidity is a key state variable for asset pricing on NYSE, AMEX and NASDAQ. Stock expected returns are cross-sectionally related to the sensitivities of the returns to fluctuations in aggregate liquidity.

Faff *et al.* (2010) analyzed the effect of liquidity on stock returns on Tokyo Stock Exchange (TSE). Negative association is reported between expected stock returns and liquidity measures even after factoring risk adjustments in place of raw returns. This study found that liquidity is priced during expansionary phase of business cycle but not significantly priced during contraction phase. This is inconsistent with the notion that liquidity is more important in bad time which is a kind of liquidity puzzle.

Narayan and Zheng (2011) investigated the impact of liquidity on returns on Shanghai Stock Exchange (SHSE) and the Shenzhen stock exchange (SZSE). Liquidity has negative impact on returns more strongly on SHSE in comparison to SZSE.

Uddin (2009) examines the relationship between relative measure of liquidity and returns on NYSE and AMEX using a relative measure of liquidity RML instead of absolute measure. RML links individual stock liquidity with market wide liquidity which more closely represents systematic liquidity risk. He argued that a stock cannot be illiquid just because it is not traded frequently if the average market liquidity as a whole is low. So, the study claims that RML is a better measure of liquidity.

Rubio *et al.* (2005) empirically studied the explanatory power of systematic liquidity on asset pricing on Spanish stock market. Based on 10 years dataset, the study cross sectionally regressed average returns regressed against betas computed relative to market wide liquidity risk factors. Market wide liquidity is a plausible factor to be included in asset pricing models but as per this study none of the liquidity factors seems to be priced in Spanish stock market.

Chordia *et al.* (2001) demonstrates the importance of trading activity related variables in the cross section of expected returns. Strong negative relationship is reported between both the level of liquidity, its volatility and expected returns using monthly data from NYSE and AMEX stock exchanges.

Petkova *et al.* (2011) investigates relationship between volatility of liquidity and expected returns employing liquidity proxy as given by Amihud (2002) on daily data derived from NYSE and AMEX stock exchanges. Positive and robust relationship is documented between volatility of liquidity and expected returns in regressions after controlling for various variables, systematic risk factors, and different sub periods.

Table 4. Summary of empirical studies on liquidity risk and returns

Author/s (Year)	Market	Remarks
Amihud (2002)	USA- AMEX	NYSE, Illiquidity Measure, Small Firms effect, Expected market illiquidity positively affects excess returns
Watanabe and Watanabe (2008)	USA- AMEX	NYSE, Dynamics of Liquidity Betas
Faff <i>et al.</i> (2010)	Japan- TSE	Negative relationship between liquidity proxies and returns, Impact of business cycles
Narayan and Zheng (2011)	China- SHSE, SHZE	Liquidity have negative effect on returns, Not robust across the three proxies
Petkova <i>et al.</i> (2011)	USA- AMEX	NYSE, Idiosyncratic liquidity risk also positively priced in stock returns
Fu <i>et al.</i> (2012)	USA- AMEX, NASDAQ	NYSE, Liquidity change predicts cross sectional stock returns

Source: Compiled by authors from cited research articles

6. Liquidity and Assets Pricing

Financial analysts consider liquidity as a driver in affecting price of the stocks while making investment portfolios (Amihud and Medelson, 1991). This section studies liquidity as a factor in asset pricing. Acharya and Pedersen (2005) propounded an asset pricing model incorporating economic significance of liquidity risk. The study finds that the liquidity-adjusted CAPM explains the data better than the standard CAPM. Further, weak evidence is reported about the importance of liquidity risk over market risk and the level of liquidity. This model fails to explain the book-to-market effect but it is a good fit for portfolios sorted by liquidity, liquidity variation, and size.

Vu *et al.* (2014) examines the pricing of liquidity risk on Australian market, using data from 1991-2010. They explored the impacts of various liquidity risk measures on stock returns using Liquidity-adjusted CAPM model developed by Acharya and Pedersen (2005). The study find strong evidence of co-movements (i) between individual stock illiquidity and market illiquidity, (ii) between stock returns and market illiquidity and (iii) between stock illiquidity and market returns. Overall, the net value of these liquidity co-movements is significantly priced in Australia.

Hagströmer *et al.* (2013) investigates the relation between illiquidity level, illiquidity risk, size, value and momentum anomalies for US stocks. In contrast to statistical factors both illiquidity level and illiquidity risk have a theoretical foundation in the liquidity adjusted capital asset pricing model (LCAPM). LCAPM outperforms the CAPM in terms of ability to explain risk premiums of size and value sorted test portfolios. The study finds a very strong

correlation between Fama-French size betas and illiquidity level betas (about 0.96) and a fairly strong correlation between Fama-French value betas and illiquidity risk betas (about 0.56) while Carhart's momentum beta has high negative correlation with betas both for illiquidity level and risk (-0.76 and -0.94 respectively). The premiums related to size can to large extent be explained as a compensation for illiquidity level.

Eleswarapu and Reinganum (1993) empirically investigate the seasonal behavior of the liquidity premium in asset pricing. Liquidity premium is reliably positive only during the month of January. However, for the non-January months, a positive liquidity premium is not detected. In contrast to Amihud and Mendelson (1986), the study shows evidence that the size effect is significant, even after controlling for spreads.

Hubers (2012) tested the relationship between asset prices and liquidity on London Stock Exchange (LSE) taking three models *viz.* CAPM, CAPM with a liquidity factor and; CAPM with a liquidity factor along with the Fama-French factors. The size and liquidity sorted portfolio returns are regressed against liquidity in each model. The study finds evidence regarding the relationship between liquidity and asset prices.

Table 5. Summary of empirical studies on liquidity and asset pricing

Author/s (Year)	Market	Model Tested	Remarks
Acharya and Pederson (2005)	USA- NYSE, AMEX	LCAPM	Liquidity adjusted CAPM factors Systematic liquidity risk (LCAPM)
Piesse and Hearn (2009)	African Markets	Augmented Fama CAPM by Sharpe (1964)	Size and liquidity are important valuation factors in large markets, Premium associated with size is large
Lam and Tam (2011)	Hong Kong Stock Market	Fama and French (1993) three-factor model	Liquidity is important variable in pricing returns, Momentum factor not priced
Faff <i>et al.</i> (2013)	Australia- ASX	Carhart four factor model	New proxy of liquidity is added as factor
Vu <i>et al.</i> (2014)	Australia- ASX	LCAPM	Pricing of Liquidity co-movements, Asymmetric response of investors in up and down markets

Source: Compiled by authors from cited research articles

7. Liquidity and Corporate Finance

One of the current issues in the market microstructure literature is whether liquidity affects firm value. Hansen and Sung Suk (2013) studied the relationship between Stock liquidity and the Firm value on Indonesian Stock Market. The study employees panel data regressions to show that more liquid firms have higher operating profits as measured by Tobin's Q, operating income-to-price ratio, leverage, operating income on assets etc. Huang *et al.* (2013) reports the positive impact of stock liquidity corporate valuation on a broad sample of 53 countries. The findings are robust to various stock liquidity measures, host of firm-specific control variables, and different sub periods. Stock liquidity promotes the informed trading, which in turn gives rise to an informative stock price.

Skjeltorp and Ødegaard (2015) investigated the reason of incurring the cost of improving stock liquidity by the firms. The reasons reported being that the firm is going to raise capital in the near future or they are planning to repurchase their own shares. As per the study, the firms which hire a market maker resulted in to significant reduction in liquidity risk and hence cost of capital.

Huyghebaert and Hulle (2004) investigated the role of institutional investors in corporate finance. They reported that institutional investors reduce information asymmetries between firms and (other) investors, which lead to enhanced liquidity of the firm's share. Guo and Zhou (2006) reported that liquidity is enhanced after a stock split which is attributed to reduction in information asymmetries due to disclosure of private information to the public.

Weston *et al.* (2005) recommends that firms can reduce the cost of raising capital by improving the market liquidity of their stock. Employing the large sample of firms, the study reports that the fees charged by the investment banking firms for FPO's are lower for the firms having liquid stock. Bundgaard and Ahm (2012) reported that secondary market liquidity is a key factor in predicting combined cost of issuing securities under Follow on Public Offers (FPO's). Firms with more liquid shares are able to issue fresh shares at reduced costs in comparison to the firms which have less liquid shares. The phenomenon closely falls in lines with the study of Amihud and Mendelson (1986) that illiquidity is priced in the market, making illiquid assets to trade at a discount. Therefore, greater market liquidity of the stocks is in greater interests of the firms.

Spindt *et al.* (2007) reported empirical relationship between dividend policy and liquidity of firm's share. Investors demand for cash dividends is higher in illiquid markets. Brockman *et al.* (2008) studied the impact of stock market liquidity on payout decisions of the firm of the stocks listed on NYSE. They empirically confirmed that higher market liquidity encourages the use of repurchases over dividends.

Lipsona and Mortal (2009) provide evidence that firms with more liquid shares have lower leverage and prefer equity financing when raising capital. Enhanced liquidity reduced the required return on equity and cost of capital. Therefore the firms make efforts in order to increase liquidity and hence equity in their capital structures. Jayaraman and Milbourn (2011)

find evidence that firms with greater stock liquidity rely more on equity based compensation and less on cash-based compensation as part of annual contracts. The study further reports that the firms with greater stock liquidity have reliance on stock prices in designing executive compensation.

Hillert and Obernberger (2015) studied the relationship between stock repurchases and liquidity on US markets. The study reports that smaller repurchases consume liquidity, whereas larger repurchases provide liquidity. Repurchases tend to provide liquidity if they contain more information. The results of the study are interpreted context of recent research in market microstructure on limit order markets which says that, informed traders do make use of limit orders and provide liquidity to the market.

8. Conclusion

‘Stock liquidity’ as a concept research was first initiated by Amihud in 1986. Since then, research has been going on in area of defining liquidity, designing measures to quantify liquidity, identifying determinants of liquidity and implications of liquidity on asset pricing, dividend policy, returns and market efficiency. This study has analyzed various literature related to the ongoing research in area of liquidity in stock markets. The literature can be categorized into studying the factors that drives liquidity and how liquidity factors in determining the returns, asset pricing and corporate finance decisions. The factor that drives liquidity primarily focuses on macroeconomic, firm-specific determinants and commonality in liquidity. On other hand liquidity plays a key role in impacting daily as well as intraday returns, asset pricing and key corporate decisions viz. dividends, stock splits, executive compensation etc. So, far most of the studies are focused on quote driven markets *e.g.* USA. Liquidity in stock markets as a research area have been bringing out quality research, however, the developing world lags behind the developed world which can have an impact on the policy by the security regulators.

The extensive review of literature draws the future scope of study in this key area. To capture various characteristics and dimensions of liquidity multiplicities of proxies have been designed by many researchers. These proxies have been measuring liquidity in different degree in different markets. Some liquidity proxies have been benchmarked using high frequency and order driven stock markets of developed countries. In emerging market economies low frequency proxies can be evaluated against bench marked proxies. Macroeconomic and firm-specific factors as determinants of liquidity in a cross-section of firms have been significantly explored in developed economics. Also, the well documented common determinants or commonality in liquidity may not be valid in emerging market economies. It is not fully understood why this phenomenon is observed. Identification of causes driving common trends of liquidity can be an important scope for further research in market microstructure. In emerging markets the complex relationship among liquidity, stock return and liquidity risk premium has not been tested in a wider way. Similarly, ownership structure and its impact on liquidity and implication of liquidity on cost of equity, dividend policy and market efficiency need to be explored in emerging market economies.

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Appendix (I). Summary of low frequency liquidity proxies

Reference	Proxy
Hui-Heubel liquidity ratio (1984)	$L_{hh} = \frac{[(P_{max} - P_{min})/P_{min}]}{[V/(S * \bar{P})]}$ <p>P_{max} is highest daily price over last 5 days, P_{min} is lowest daily price over last 5 days, V is the total dollar volume traded over last 5 days, S is the number of instruments outstanding and \bar{P} is average closing price of the instrument over a 5 day period.</p>
Datar (2000)	$CET = \frac{\% \text{ Change in Trading Volume}}{\% \text{ Change in Price}}$ <p>CET is Coefficient of Elasticity of trading.</p>
Hasbrouck and Schwartz (1988)	$MEC = \frac{\text{Long term price variability}}{\text{Short term price variability}}$
Measures used by Saar and Lybek (2002)	$S = (P_A - P_B)$ $S = \frac{(P_A - P_B)}{(P_A + P_B)/2}$ <p>Where P_A is the ask price and P_B is the bid price</p>
Measures used by Saar and Lybek (2002)	$V = \sum P_i \times Q_i$ <p>Where V is the dollar volume traded, P_i and Q_i are price and quantity of the ith trade during a specific period</p> $T_n = \frac{V}{(S \times P)}$ <p>Where S is the outstanding stock of the asset and P is the average price of i^{th} trades.</p>
Measures used by Saar and Lybek (2002)	$MEC = \frac{\text{Var}(R_t)}{(T * \text{Var}(r_t))}$ <p>$\text{Var}(R_t)$ = variance of the logarithm of long period returns, $\text{Var}(r_t)$ = variance of the logarithm of short period returns and T = number of short periods in each longer period</p>
Roll (1984)	$\text{Roll} = \begin{cases} 2\sqrt{-\text{Cov}(\Delta P_t, \Delta P_{t-1})} & \text{if } \text{cov}(\Delta P_t, \Delta P_{t-1}) < 0 \\ 0 & \text{if } \text{cov}(\Delta P_t, \Delta P_{t-1}) \geq 0 \end{cases}$
Holden (2009)	$\text{Extended Roll} = \begin{cases} \frac{2\sqrt{-\text{Cov}(\Delta P_t^*, \Delta P_{t+1}^*)}}{\bar{P}} & \text{if } \text{cov}(\Delta P_t^*, \Delta P_{t+1}^*) < 0, \\ 0 & \text{if } \text{cov}(\Delta P_t^*, \Delta P_{t+1}^*) > 0 \end{cases}$ <p>where the idiosyncratic adjusted price change $\Delta P_t^* = z_t \cdot P_{t-1}$ and z_t is the regression residual from the market model $a_{jt} - r_{ft} = \alpha + \beta(r_{mt} - r_{ft}) + z_t$.</p>
Goyenko, Holden, and	<p>LOT Y – split = $\alpha_2 - \alpha_1$ where everything is the same as LOT Mixed, except that region 0 is $R_{jt} = 0$, region 1 is $R_{jt} > 0$, and region 2 is $R_{jt} < 0$ and no</p>

Trzcinka (2009)	upper bound cap is imposed.
Lesmond, Ogden, and Trzcinka (1999)	$\text{Zeros} = \frac{\text{ZRD}}{\text{TD} + \text{NTD}}$ where ZRD is the number of zero return days, TD is number of trading days and NTD is number of No trade days in a given stock month.
Goyenko, Holden, and Trzcinka (2009)	$\text{Zeros2} = \frac{\# \text{ of positive volume days with Zero return}}{\text{TD} + \text{NTD}}$
Goyenko et al. (2009)	$5 \text{ minute price impact}_t = \begin{cases} 2 \times [\ln(m_{t+5}) - \ln(m_t)] & \text{if the } t^{\text{th}} \text{ is a buy} \\ 2 \times [\ln(m_t) - \ln(m_{t+5})] & \text{if the } t^{\text{th}} \text{ is a sell} \end{cases}$ <p>In the above specification, m_t and m_{t+5} are the quote midpoints at t and five minutes after t, respectively.</p>
Hasbrouck (2009)	It is measured as the coefficient λ in the following regression model: $r_n = \lambda \left[\sum_t \text{sign}(\text{volume}_{tn}) \sqrt{ \text{volume}_{tn} } \right] + u_n$ <p>Where r_n is the return over the n^{th} five-minute interval, volume_{tn} is the dollar volume of the t^{th} trade during the n^{th} interval, and $\text{sign}(\cdot)$ takes the value of +1 if the t^{th} transaction is a buy and -1 if it is a sell. u_n is the disturbance term</p>
Trzcinka et al. (2011)	$\text{FHT} \equiv S = 2\sigma N^{-1} \left(\frac{1+z}{2} \right)$ <p>Where S is the round-trip, percent transaction cost.</p>
Amihud (2002)	$\text{Amihud} = \text{Average} \left(\frac{ r_t }{\text{Volume}_t} \right)$ <p>Where r_t is the stock return on day t and Volume_t is the currency value of volume on day t in units of local currency.</p>
Goyenko, Holden, and Trzcinka (2009)	$\text{Extended Amihud Proxy}_i = \frac{\text{Percent Cost Proxy}_i}{\text{Average Daily Current Volume}_i}$
Pastor and Stambaugh (2002)	<p>Pastor and Stambaugh = Γ, from the regression: $r_{t+1}^e = \theta + \phi r_t + \Gamma \text{sign}(r_t^e) (\text{volume}_t) + \varepsilon_t$, where r_t^e is the stock's excess return above the CRSP VWMR on day t, θ is the intercept, ϕ and Γ regression coefficients, and ε_t is the error term.</p>
Copper (1985)	$\text{Amivest} = \text{Average} \left(\frac{\text{Volume}_t}{ r_t } \right)$

Source: Compiled by authors from cited research articles