Liquidity Premium at National Stock Exchange of India

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Abstract

This study endeavours to investigate the existence of liquidity premium at National Stock Exchange of India, with a sample of Nifty 500 stocks for a period ranging from 1st April 2000 to 31st March 2018, by employing four different proxies of liquidity i.e. Trading volume, Turnover rate, Relative Spread and Amihud Illiquidity Ratio. The empirical evidence indicated that as liquidity allied to portfolio reduces, return also expands to recompense investors for bearing liquidity risk validating the existence of a negative relationship between liquidity and expected stock returns at NSE. Among the various asset-pricing models employed in this study, Liquidity augmented Fama and French three-factor model turned out to be the best in explaining cross-sectional variations in portfolio returns of NSE stocks. Strong liquidity premium was observed such that illiquid stocks outperformed liquid stocks which has strong inference for investors and portfolio managers who continuously look for investment strategies that can help them beat the market.

Keywords: *Market Microstructure, Liquidity Premium, Stock Returns, Asset Pricing, National Stock Exchange*

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Introduction

The phrase "market microstructure" was first coined by Mark Garman (1976) in an article that talked about the relationship between the market makers and inventory cost. O'Hara (1995) describes market microstructure as "a study of the process and outcomes of exchanging assets under a specific set of rules". Market microstructure is a new area in finance which emerged as stock prices are not always equal to the true fundamental value reflecting all the available information because of the existence of market frictions. The basic foundation for the emergence of market microstructure delves into efficient markets, or in truth, its criticisms thereof. Fama (1970) proposed that efficient market trades at a price equal to the true or fair asset value reflecting all the accessible information and it is hard to beat the market. In an efficient market, it is presumed that traders have equal access to information without any frictions such that equilibrium price is attained representing expected values conditional on the set of information at time t. It can be described as follows:

$$E(P_{t+1}|\Omega_t) = [1 + E(r_{t+1}|\Omega_t)]P_t$$

where,
E is the expected value operator,

P_t & P_{t+1} is the price of an asset at time t and t + 1 respectively,

r_{t+1} is the one period percentage return $[(P_{t+1} - P_t)/P_t]$ &

Ω_t is the set of available information assumed to be "fully reflected" in the price at t.

As far as financial markets are concerned, this frictionless representation is a theoretical abstraction and nowhere close to reality. In the real-world, financial markets are more complicated as traders do not arrive on the market at the same time and therefore, market makers are at the risk of holding and handling inventories to serve the investors who expect immediacy. In a situation of market imbalance, investors who desire to sell now should reduce their ask price to pull buyers and ones who desire to buy now have to raise their bid to entice sellers. The notion of liquidity is precisely rooted from the disparity between the stock's bid prices and ask prices identified as the spread. On account of this, standard microstructure literature has developed inventory-based models (Garman (1976) and Ho & Stoll (1981)) that examined the position of market-makers as liquidity providers to explain how they set bid-ask spread to compensate them for holding inventory risk. The literature in the area of market microstructure highlights the importance of liquidity in market-making and proposes that besides being a source of cost, it can also be a source of risk for market participants.

"*Investors prefer to commit capital to liquid investments, which can be traded quickly and at low cost whenever the need arises. Investments with less liquidity must offer higher expected returns to attract investors. In equilibrium, the expected returns on capital assets are increasing functions of both risk and illiquidity*" (Amihud & Mendelson, 1991).

Liquidity is the market's ability to handle large orders from traders swiftly with least transaction cost and minimal influence on prices. Investors face liquidity risk at the time of transfer of ownership of their assets; thus, they should regard it as a significant element while evaluating their investment opportunities. Five aspects were recognised as the causes of stock illiquidity by Amihud, Mendelson & Pedersen (2005) – exogenous transaction costs, inventory risk, demand pressure, search frictions and asymmetric information. Such market dynamics make transactions expensive for investors which, in turn, influence the stock prices. Thus, liquidity is an important factor in the pricing of securities as investors demand compensation in the form of superior returns for holding illiquid stocks in their portfolio.

Amihud & Mendelson (1986) proposed "liquidity hypothesis" suggesting that traders require superior returns for investing in illiquid or less liquid stocks as

calculated by the bid-ask spread. However, most empirical research on the concerned issue mainly focused on the U.S. stock market with a few studies on other emerging markets, but none for the Indian stock market in isolation. Therefore, the key objectives of this research are: (1) to analyse the effect of liquidity on the pricing of securities and (2) to verify the presence of liquidity premium at the leading stock exchange of India i.e. NSE.

The National Stock Exchange of India Ltd. (NSE) was established in 1992 as India's first demutualised electronic exchange and was recognised by SEBI in April 1993. It began operations in the segment of Wholesale Debt Market (WDM) in June 1994, followed in November 1994 by segment on Capital Market (Equities) and Derivatives segment in June 2000. NSE was India's first exchange to set up a modern, fully-automated, screen-based electronic trading structure to provide easy trading facilities for investors across the country. For fiscal 2018, NSE had a leading market share of 87% in equity cash trading, 100% in equity derivatives trading, 53% in currency derivatives trading, 59% in interest rate derivatives trading and 67% in ETFs trading. NSE's flagship index, the Nifty 50 was introduced in 1996, is widely used by investors to take exposure to the market. NSE has a total market capitalization of approximately $2.3 trillion making it the world's 11th largest stock exchange as of January 2018 (World Federation of Exchanges).

Literature Review

The most influential work on this front owes to Amihud & Mendelson (1986), who theoretically modelled a marketplace where investors were rational with diverse holding periods and assets having distinctive relative spread. The resulting market features were: (a) market average return goes up with spread, (b) expected stock returns increase with spread, (c) high spread stocks are preferred by investors with longer holding periods (clientele effect) and (d) stock return and spread relationship is concave. They empirically examined the association between expected stock return and bid-ask spread for NYSE stocks over a period of 1961-1980 and found that stock return was a rising and concave function of the spread. Hence, liquidity is a significant factor in asset pricing and investors require compensation for the cost of illiquidity.

Constantinides (1986) provided a theoretical perspective on the capital market equilibrium with transaction costs by utilizing Merton's (1973) inter-temporal consumption and investment model to analyse the effect of the transaction cost. He formulated a two-asset inter-temporal portfolio selection model including proportional transaction costs and presented a numerical solution that quantifies the impact of transaction costs on this model. He established that equilibrium transaction costs only have second-order effect on stock returns and immense transaction costs are adjusted by investors by significantly dropping the quantity and frequency of trade. Hence, liquidity indeed has an influence on stock returns, but a second-order effect which is somewhat weak in magnitude.

Going forward, the research in this area flourished and many studies empirically investigated the relationship between liquidity and expected stock returns by using numerous proxies of liquidity such as bid-ask spread, turnover rate, trading volume, Amihud illiquidity ratio and others. Amihud & Mendelson (1989), Brennan & Subrahmanyam (1996), Eleswarapu (1997), Datar, Naik & Radcliffe (1998), Chalmers & Kadlec (1998), Chordia, Subrahmanyam & Anshuman (2001), Amihud (2002), Pastor & Stambaugh (2003), Liu (2006), Nguyen, Mishra & Ghosh (2007), Korajczyk & Sadka (2008), Hasbrouck (2009), Asparouhova, Bessembinder & Kalcheva (2010), Baradarannia & Peat (2013) and Kim & Na (2018) all examined the effect of liquidity on the pricing of securities in the U.S. equity market for NYSE, AMEX and NASDAQ stocks. Nevertheless, most of these papers supported Amihud & Mendelson's (1986) findings and evidenced that portfolios with high liquidity risk generate large return premium to compensate investors for investing in illiquid stocks.

While most of the studies in the literature have been conducted for the U.S. market, a few studies do exist

for other emerging markets. Marshall & Young (2003) examined Australian stock market; Wang & Cheng (2004), Wang & Kong (2010), Narayan & Zheng (2011) studied Shenzhen and Shanghai Stock Exchanges of China; Chang, Faff & Hwang (2010) studied Tokyo Stock Exchange; Li, Sun & Wang (2011) examined Japanese Stock Market; Florackis, Gregoriou & Kostakis (2011) explored London Stock Exchange; Lam & Tam (2011) examined Hong Kong Stock Exchange and Hoang & Phan (2019) pursued Ho Chi Minh Stock Exchange in Vietnam. Bekaert, Harvey & Lundblad (2007) studied 19 emerging markets including India; Amihud et. al. (2015) scrutinized 45 countries around the world including 19 emerging and 26 developed markets and Chiang & Zheng (2015) explored the G7 countries. All these studies elaborate on the concerned issue in different markets and evidence that liquidity is a significant factor in the pricing of securities across the globe in the international equity markets.

As evidenced by the foregoing scrutiny, most of the studies have been performed on U.S. market with only some studies on other emerging markets, but none for the Indian market in isolation. In the past, equity market anomalies have been documented in the Indian stock market such as size effect (Sehgal & Tripathi, 2005), value effect (Tripathi & Aggarwal, 2018), momentum effect (Sehgal & Jain, 2015), volatility effect in value and growth stocks (Joshipura & Peswani, 2018), effect of macroeconomic variables (Bhattacharjee & Das, 2020), earnings news effect (Mathur & Rastogi, 2017), but no study has analysed the effect of market microstructure variable so far. Therefore, this study seeks to explore the effect of liquidity risk on the pricing of securities in the Indian stock market.

Research Methodology

Data: The sample includes Nifty 500 stocks to represent NSE as this index has a broad spectrum of stocks belonging to 20 major industries of the economy and accounts for more than 90% market capitalisation of the exchange. Also, the data is easily available for these companies than for other companies that are not a part of this group. The sample period ranges from 1st April 2000 to 31st March 2017, not including data prior to 2000 essentially because of the major developments in the market structure of Indian stock market during that period and data before this period is sparsely available. The records for the analysis are mainly gathered from the CMIE Prowess and Thomson Reuters and official websites of NSE and RBI which are renowned sources for providing accurate and complete historical data. The dataset includes:

- Monthly closing adjusted share prices of NSE sample stocks have been utilised to estimate the stock returns. The monthly stock returns are computed using equation:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

where,

$R_{i,t}$ is the return on stock i in the month t

$P_{i,t}$ is the closing adjusted share price of stock i in month t

$P_{i,t-1}$ is the closing adjusted share price of stock i in month $t-1$.

- Monthly closing index values have been used to calculate monthly return on market portfolio (Nifty 500 index is taken as proxies of the exchanges).
- The cut-off implicit yield on 91 days Treasury Bills is considered as risk-free return (RBI website).
- To compute different liquidity proxies for the sample stocks, two frequencies of data have been used -
  - Daily Data: Bid price, ask price, mid-price, closing price, volume-weighted average price, trading volume (number of shares traded).
  - Monthly Data: Volume-weighted average price, trading volume (number of shares traded) and number of outstanding shares.
- For the estimation of size and value risk factors, the yearly (March-end) information on market capitalisation and P/BV ratio for all sample stocks have been taken.

It is important to specify that the complete data set was not available for all the 500 sample companies all through the sample span of 17 years; therefore, the effectual number of stocks employed in the study varies from 265 to 490 over the period.

Construction of Liquidity Proxies: According to Liu (2006), "Liquidity can be best described as the ability to trade large quantities quickly at low cost with little impact on price." Liquidity is a multidimensional concept, so we employ several liquidity proxies from the literature to capture different aspects of liquidity based on the data availability. Many measures of liquidity have been proposed but none of them have been superior to others. The present study comprehensively employs four liquidity measures:

1. *Trading Volume:* Brennan & Subrahmanyam (1995) identified trading volume as a significant measure of liquidity. For a particular stock, it is directly related to liquidity as large volume of trading signifies higher liquidity. For each stock, monthly trading volume is computed as the value of shares traded over a month.

$$\text{Rupees Trading Volume}_t^i = V_{i,t} * P_{i,t}$$

$V_{i,t}$ is trading volume (number of shares traded) for stock i in month t

$P_{i,t}$ is volume weighted average price for stock i in month t

2. *Turnover Rate:* It is another important measure of liquidity capturing trading frequency calculated as a proportion of number of shares traded to shares outstanding during a particular month. For a stock, turnover rate is positively related to liquidity implying greater the turnover rate, better the liquidity of an asset.

$$\text{Turnover Rate}_t^i = \frac{V_{i,t}}{\text{Shares}_{i,t}}$$

where,

$V_{i,t}$ is the total trading volume (number of shares traded)for stock i in month t

$\text{Shares}_{i,t}$ is the number of shares outstanding for stock i in month t

3. *Relative (Quoted) Spread:* Amihud & Mendelson (1986) put forward a direct measure of transaction cost defined as the ask price minus the bid price, divided by the mid prices. It gauges illiquidity implying that stocks with higher spread have lesser liquidity (illiquid). Daily relative/quoted spread for each stock is computed with the formula:

$$\text{Quoted Spread}_d^i = \frac{P_{i,d}^A - P_{i,d}^B}{(P_{i,d}^A + P_{i,d}^B)/2}$$

where,

$P_{i,d}^A$ is the ask price for stock i on day d

$P_{i,d}^B$ is the buy price for stock i on day d

4. *Amihud Illiquidity (ILLIQ) Ratio:* Amihud (2002) defined this price impact measure of liquidity as – "Daily price response associated with one dollar of trading volume." The core idea of ILLIQ ratio was that illiquid stocks have a lower capacity to absorb large trades – implying that stocks with high ILLIQ ratio are less liquid. Illiq ratio is computed as:

$$ILLIQ_t^i = \frac{1}{D_t^i} \sum_{d=1}^{D_t^i} \frac{|R_{td}^i|}{V_{td}^i}$$

where,

$|R_{td}^i|$ is the absolute return of stock i in day d of month t

V_{td}^i is the trading volume (in million rupees) for the stock i on day d of month t

D_t^i is the total trading days for stock i in month t

Construction of Liquidity-Sorted Portfolios: Liquidity sorted decile portfolios were created for all the liquidity proxies separately for each year throughout the sample span. To begin with, decile portfolios were created on the basis of trading volume for each year all through the sample period. Every year June end, we sort the stocks in descending order based on the average trading volume in the previous year (in order of liquidity from most to least liquid). After that, the sorted securities were divided into decile portfolios (P1 to P10) and then for the next twelve months $(\text{July of } Y_t \text{ to June of } Y_{t+1})$ equally-weighted monthly returns are estimated for these portfolios. Then, the excess portfolio return is computed by deducting the risk-free rate from the portfolio returns. P1 (liquid portfolio) includes 10% of the most liquid stocks, while P10 (illiquid portfolio) comprises 10% of the least liquid stocks. A portfolio P10-P1 is also constructed to assess the economic feasibility of liquidity-based trading strategy (buying P10 and short selling P1). Portfolios were continuously rebalanced all through the sample span in June end every year. This strategy is known as 12/12 strategy i.e. 12 months portfolio formation and 12 months portfolio holding period. For inclusion of a stock in portfolio formation process, it must be traded during the year. In the similar manner, liquidity-sorted decile portfolios were created for other three liquidity proxies viz. turnover, relative spread and ILLIQ ratio. However, for the formation of liquidity portfolios for relative spread and ILLIQ ratio (being direct measures of illiquidity) stocks were sorted in ascending order.

Notes:

- Portfolio formation starts from June 2000 and continues throughout the sample period for all the proxies of liquidity.
- It is important to mention that financial year in India is from 1st April to 31st March every year, but the formation of portfolios is performed in each year June end with the assumption that financial data is available to investors at the time of investment decision to evade look ahead-bias.

Construction of Risk Factors: The following risk factors have been employed in this study-

- *Market Factor:* Market Risk Premium $(R_{M_t} - R_{f_t})$ calculated by subtracting risk-free return (cut-off implicit yield on 91 days Treasury Bills) from the monthly return on market portfolio - Nifty 500 index is taken as the proxies of market portfolios of NSE.
- *Size and Value Factor:* Market capitalisation and P/B ratio are taken as proxies for the creation of size and value factors respectively. Every year June end, we sort the sample stocks into two size portfolios $(\text{Small (S) and Big (B)})$ on market capitalisation (50:50 split) and three value portfolios $(\text{Low (L), Medium (M) and High (H)})$ on the basis of P/B ratio on a 30:40:30 divide. Six portfolios were formed at the intersection of size and value - $(\text{S/L, S/M, S/H, B/L, B/M, and } B/H)$. Thereafter, for the next twelve months $(\text{July of } Y_t \text{ to June of } Y_{t+1})$, the equally-weighted average returns are estimated for these portfolios. Rebalancing of portfolios is done each year continuously throughout the sample period. Size Factor (SMB_t) is the excess returns on portfolios of small stocks over portfolios of big stocks, while Value Factor (LMH_t) is the excess return on diversified portfolios of low P/B (value) stocks over high P/B (growth) stocks.

$$SMB = \frac{(S/L + S/M + S/H)}{3} - \frac{(B/L + B/M + B/H))}{3}$$

$$LMH = \frac{(S/L + B/L)}{2} - \frac{(S/H + B/H)}{2}$$

- *Momentum Factor:* In June end each year, we sort the sample stocks into three momentum portfolios (Winners (W), Neutral (N) and Losers (L)) on 30:40:30 divide based on prior performance derived from past twelve months average excess returns. For the next 12 months $(\text{July of } Y_t \text{ to June of } Y_{t+1})$, equally-weighted average monthly returns are computed for these portfolios. Portfolios are rebalanced each year and it continues throughout the sample period. Momentum Factor(WML_t) is estimated as the amount of return on winner stocks portfolio (W) in excess of loser stocks portfolio (L) based on past year performance.

- *Liquidity Factor:* IMV_t is estimated for each of the liquidity measures: trading volume, turnover, quoted spread and ILLIQ ratio separately. In June end each year, we sort the sample stocks into three liquidity portfolios $(\text{Very Liquid (V)}, \text{Moderately Liquid (N)}$ and $\text{Illiquid (I)})$ on a 30:40:30 divide using each liquidity measure independently. Then for the next twelve months $(\text{July of } Y_t \text{ to June of } Y_{t+1})$, equally-weighted average monthly returns are computed for these three portfolios. Portfolios are rebalanced each year and it continues all through the sample period. Liquidity Factor (IMV_t) is the excess return on the portfolio of illiquid stocks (I) over very liquid stocks (V).

Measures of Performance Evaluation: Initially, various statistical measures like mean, standard deviation, skewness and kurtosis are employed to evaluate the performance of liquidity-sorted decile portfolios of NSE. Further, the following risk-adjusted ratios are also calculated for the decile portfolios to assess their investment appraisal.

S. No.	Ratio	Meaning	Formula
1	*Sharpe Ratio*	Relationship between the average excess portfolio return and the total risk of the portfolio.	$\frac{R_P - R_f}{\sigma_P}$
2	*Treynor Ratio*	Relationship between the portfolio return over the risk-free rate with its systematic risk indicated by portfolio beta (β_P)	$\frac{R_P - R_f}{\beta_P}$
3	*Information Ratio*	Estimated as the residual return of the portfolio divided by tracking error. Residual return is portfolio return minus benchmark index return and tracking error is residual return standard deviation.	$\frac{E[R_P - R_B]}{\sqrt{var[R_P - R_B]}}$

where, R_P is return of portfolio, R_f is risk − free rate, σ_P is standard deviation of portfolio, β_P is portfolio's beta (systematic risk) and R_B is index or benchmark return.

Regression Models: The well-documented models considered in this study are the Standard CAPM model of Sharpe (1964) and Lintner (1965), Fama & French three-factor model (1993) and Carhart's model (1997) to observe the reality of liquidity premium at NSE. OLS regressions are estimated for liquidity-sorted decile portfolios using the following factor models-

Standard CAPM

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \varepsilon_t$$

F&F 3-Factor Model

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \beta_{SMB}(SMB_t) + \beta_{LMH}(LMH_t) + \varepsilon_t$$

Carhart's Model

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \beta_{SMB}(SMB_t) + \beta_{LMH}(LMH_t) + \beta_{WML}(WML_t) + \varepsilon_t$$

where,

$R_{P_t} - R_{f_t}$ is portfolio excess return,

$\propto$ is the intercept,

$R_{M_t} - R_{f_t}$ is market excess return,

SMB_t, LMH_t & WML_t are size, value and momentum risk factors,

ε_t is a residual term *and*

$\beta_M, \beta_{SMB}, \beta_{LMH}$ & β_{WML} are the slope coefficients for market, size, value and momentum risk factors respectively.

To isolate the effect of liquidity risk on the pricing of securities, the above models are extended further by augmenting the liquidity (IMV) factor in the Standard CAPM model, F&F 3-factor model and Carhart's model.

Liquidity Augmented Standard CAPM

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \beta_{IMV}(IMV_t) + \varepsilon_t$$

Liquidity Augmented F&F 3-Factor Model

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \beta_{SMB}(SMB_t) + \beta_{LMH}(LMH_t) + \beta_{IMV}(IMV_t) + \varepsilon_t$$

Liquidity Augmented Carhart's Model

$$R_{P_t} - R_{f_t} = \propto + \beta_M \left(R_{M_t} - R_{f_t}\right) + \beta_{SMB}(SMB_t) + \beta_{LMH}(LMH_t) + \beta_{WML}(WML_t) + \beta_{IMV}(IMV_t) + \varepsilon_t$$

where,

$R_{P_t} - R_{f_t}$ is portfolio excess return,

$\propto$ is the intercept,

$R_{M_t} - R_{f_t}$ is market excess return,

SMB_t, LMH_t, WML_t & IMV_t are size, value, momentum and liquidity risk factors,

ε_t is a residual term and

$\beta_M, \beta_{SMB}, \beta_{LMH}, \beta_{WML}$ & β_{IMV} are the slope coefficients for market, size, value, momentum and liquidity risk factors respectively.

Time-series data generally shows both heteroskedasticity and autocorrelation, while the OLS methodology assumes that the errors terms are homoskedastic and serially uncorrelated. If it's not considered, it may produce statistically inefficient estimates which may give misleading inferences. In econometrics, the most popular estimator is Newey & West (1987): heteroskedasticity and autocorrelation-consistent estimator of variance-covariance matrix. Newey–West (1987) procedure is adopted to estimate all regression models employed in this study so that it mechanically corrects for any problem of heteroscedasticity and autocorrelation in the series.

Autoregressive Distributed Lag (ARDL) Model: We have employed ARDL model (Pesaran, Shin & Smith (2001)) to explore the reality of long-term co-integrating association between the variables. ARDL model is OLS regression where lags of the dependent variable as well as independent variables are included as regressors. Specifically, if Y_t is dependent variable and $X_t, \dots, X_k$ are k independent variables, ARDL $(\mathrm{p}, \mathrm{q}_1, \dots, \mathrm{q}_\mathrm{k})$ model is given by:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \delta_i Y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{k_j} \beta_{j,i} X_{j,t-i} + \epsilon_t$$

We have employed ARDL model to examine the long-term co-integrating relationship between portfolio returns and liquidity risk after involving for Fama & French three-factors into the model.

$$R_{P_t} - R_{f_t} = \propto + \sum_{i=1}^{p} \gamma_i \left(R_{P_t} - R_{f_t}\right)_{t-i} + \sum_{i=0}^{q} \beta_i \left(R_{M_t} - R_{f_t}\right)_{t-i} + \sum_{i=0}^{r} \theta_i (SMB)_{t-i} + \sum_{i=0}^{s} \delta_i (LMH)_{t-i} + \sum_{i=0}^{u} \varphi_i (IMV)_{t-i} + \varepsilon_t$$

where,

$(R_{P_t} - R_{f_t})$ is portfolio excess return,

$\propto$ is the intercept,

$\left(R_{M_t} - R_{f_t}\right)$ is market risk factor,

$\mathrm{SMB_t}$, $\mathrm{LMH_t}$ & $\mathrm{IMV_t}$ are size, value and liquidity risk factors, ε_t is a noise term and p, q, r, s & u are lag lengths of explanatory variables in the model

We have used the Akaike Information Criterion (AIC) for the selection of lag length in the ARDL model. This model can be applied to variables irrespective of the order of integration, whether I(0) or I(1) or combination of both. We perform unit root test on time series used in the model to check their order of integration as ARDL test renders invalid results if variables involved are I(2) or beyond. The ADF, PP and KPSS tests are the most widely used unit root tests to confirm stationarity and identify the level of integration in the data. Next, we assess the above equations and conduct F-bound test to verify the

existence of a long-run relationship between the variables involved in the model. In the ARDL bounds test, F-test or Wald test for the joint significance is performed by equating the coefficients of variables equal to zero. The Null hypothesis $H_0: \beta_i = \theta_i = \delta_i = \varphi_i = 0$ means that there is no co-integration. To decide on the null hypothesis, one has to consider the critical values given by Pesaran et al. (2001):

Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.45	3.52
5%	2.86	4.01
1%	3.74	5.06

In the ARDL bounds test, the estimated F-statistics value is compared with the two sets of critical values:

1) If the computed F-statistic > upper bound, then H_o of no co-integration can be rejected and there exists a long-term relationship between the variables regardless of the order of integration of the variables.
2) If the F-statistic < lower bound, then H_o cannot be rejected and the presence of co-integration is not significant.
3) Finally, if the estimated F-statistic falls in between the two critical bound values, then the test is indecisive and additional information is required before a conclusion can be made.

Empirical Results

Results of Performance Evaluation Measures

Performance evaluation of liquidity-sorted decile portfolios based on four different liquidity proxies is reported in Table 1. As a first confirmatory indication of liquidity risk being a significant factor affecting stock returns, it is noticed that the portfolios across all four liquidity proxies show an increasing trend in mean monthly excess return as we go from first portfolio P1 (liquid stocks) to last P10 (illiquid stocks). The mean monthly excess portfolio return ranges from 0.36% for P1 to 3.67% for P10 for trading volume sorted portfolios, from 1.16% for P1 to 2.10% for P10 for turnover sorted portfolios, from 0.60% for P1 to 3.32% for P10 for relative spread sorted portfolios, and from 0.59% for P1 to 3.12% for P10 for Amihud illiquidity sorted portfolios. It is to be noted that the average return of illiquid stocks portfolio (P10) is much higher than liquid stocks portfolio (P1). Illiquid stocks portfolio (P10) provides a superior return that is about two to three times of liquid stocks portfolio (P1). Long short liquidity-based trading strategy may be adopted by investors by going long on P10 and short on P1 to earn liquidity premium at BSE. It is visible that investors may earn an average monthly liquidity premium of 3.31%, 0.93%, 2.72% and 2.52% by following liquidity-based trading strategy derived from trading volume, turnover, relative spread and Amihud Illiquidity ratio respectively. A strong liquidity effect is observed such that when liquidity level of portfolio declines, the average excess portfolio return increases almost monotonically indicating that high risk related to illiquid stocks generates higher returns. The skewness and kurtosis values of portfolios indicate positive skewness (skewed to right) and leptokurtic distribution (fatter tails).

In harmony with the theory of finance, where risk return go together in tandem, high risk in less liquid stocks portfolio generates a high Sharpe ratio. Sharpe ratio of portfolios increases monotonically from P1 to P10 signifying that as risk increases due to a drop in the level of liquidity, returns also increase. Sharpe ratio of P10 (Illiquid stocks portfolio) is about three to four times that of P1 (liquid stocks portfolio). This further verifies the existence of strong liquidity premium and a negative liquidity and expected stock returns relationship at NSE. Similarly, Treynor ratio and information ratio also increase almost monotonically from P1 to P10 for all the proxies of liquidity indicating investors are rewarded with superior returns for holding a risky portfolio of less liquid stocks. This validates the presence of a strong liquidity effect at NSE; as liquidity risk in portfolio increases, returns also expand to recompense investors for holding lesser liquid stocks.

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Table 1: Performance Evaluation of Liquidity-Sorted Portfolios

Portfolios	P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L1: Trading Volume											
Mean	0.0036	0.0088	0.0110	0.0156	0.0157	0.0171	0.0226	0.0206	0.0243	0.0367	0.0331
t-stat.	0.556	1.431	1.760*	2.548**	2.493**	2.766***	3.725***	3.412***	4.020***	5.703***	6.453***
Std. Dev.	0.0908	0.0868	0.0886	0.0868	0.0890	0.0878	0.0858	0.0855	0.0859	0.0912	0.0603
Skewness	0.5144	0.2961	0.3490	0.3658	0.4863	0.4749	0.4345	0.4308	0.5954	0.5690	0.5028
Kurtosis	4.2229	4.0290	3.1182	3.8029	6.5247	5.2087	3.5612	3.5407	3.0313	2.4879	2.5135
Sharpe Ratio	0.0392	0.1009	0.1242	0.1797	0.1758	0.1951	0.2628	0.2406	0.2836	0.4023	0.5487
Treynor Ratio	0.0032	0.0082	0.0104	0.0150	0.0148	0.0170	0.0230	0.0215	0.0266	0.0391	-0.1798
Information Ratio	-0.0984	0.0449	0.0950	0.2161	0.2042	0.2186	0.3405	0.2829	0.3271	0.5025	0.1921
L2: Turnover Rate											
Mean	0.0116	0.0139	0.0142	0.0171	0.0175	0.0192	0.0170	0.0200	0.0227	0.0210	0.0093
t-stat.	1.431	2.051**	2.180**	2.934***	3.000***	3.364***	3.185***	3.506***	3.976***	3.757***	5.830***
Std. Dev.	0.9651	0.0960	0.0924	0.0828	0.0827	0.0807	0.0758	0.0807	0.0808	0.0791	0.0632
Skewness	0.5393	0.3251	0.4543	0.0802	0.4624	0.2841	0.0807	0.6811	0.4472	0.5091	-0.8943
Kurtosis	4.4507	3.1121	4.9295	2.5169	4.7825	5.1644	1.7144	4.0101	3.1834	2.8228	2.4996
Sharpe Ratio	0.1009	0.1447	0.1538	0.2070	0.2116	0.2373	0.2247	0.2473	0.2805	0.2650	0.1478
Treynor Ratio	0.0084	0.0119	0.0129	0.0172	0.0179	0.0204	0.0197	0.0223	0.0254	0.0247	-0.0177
Information Ratio	0.0751	0.1599	0.1645	0.2704	0.2638	0.2952	0.2384	0.2776	0.3317	0.2818	-0.0279
L3: Relative (Quoted) Spread											
Mean	0.0060	0.0086	0.0128	0.0152	0.0145	0.0181	0.0193	0.0250	0.0237	0.0332	0.0272
t-stat.	1.010	1.415	2.124**	2.434**	2.491**	2.807***	3.271***	4.057***	3.873***	5.091***	5.360***
Std. Dev.	0.0848	0.0857	0.0855	0.0885	0.0827	0.0916	0.0835	0.0874	0.0868	0.0925	0.0570
Skewness	0.2642	0.2116	0.2696	0.7635	-0.1215	0.4540	0.2919	0.3399	0.5543	0.4320	0.6871
Kurtosis	2.9671	2.9786	3.1906	7.1384	2.4327	4.9880	3.7613	2.5818	3.6562	2.1343	2.4187
Sharpe Ratio	0.0712	0.0998	0.1498	0.1717	0.1757	0.1980	0.2307	0.2862	0.2732	0.3591	0.4773
Treynor Ratio	0.0058	0.0082	0.0124	0.0145	0.0151	0.0169	0.0200	0.0259	0.0247	0.0346	-0.3147
Information Ratio	-0.0337	0.0379	0.1534	0.1916	0.1798	0.2428	0.2830	0.3605	0.3374	0.4444	0.1460
L4: Amihud Illiquidity Ratio											
Mean	0.0059	0.0096	0.0146	0.0147	0.0164	0.0177	0.0197	0.0217	0.0241	0.0312	0.0252
t-stat.	0.999	1.577	2.501**	2.290**	2.639***	2.792***	3.180***	3.483***	3.813***	4.805***	4.808***
Std. Dev.	0.0841	0.0867	0.0827	0.0908	0.0880	0.0898	0.0879	0.0885	0.0897	0.0919	0.0578
Skewness	0.3798	0.3876	0.1537	0.6187	0.3303	0.4041	0.5411	0.4794	0.3329	0.6083	0.6814
Kurtosis	3.5678	4.2612	3.4219	5.6938	4.2411	4.0869	5.0428	3.7784	2.1168	2.4122	2.2985
Sharpe Ratio	0.0704	0.1112	0.1764	0.1615	0.1861	0.1970	0.2243	0.2457	0.2689	0.3389	0.4370
Treynor Ratio	0.0056	0.0092	0.0146	0.0135	0.0156	0.0172	0.0196	0.0219	0.0250	0.0330	-0.2345
Information Ratio	-0.0400	0.0657	0.2041	0.1799	0.2254	0.2253	0.2724	0.3006	0.3148	0.4040	0.1242

Note: Statistical level of significance at 1%, 5% and 10% is indicated by ***, ** & * respectively.

Descriptive statistics of the independent risk factors involved in time series regression models are accounted in Table 2. Mean monthly excess return on market portfolio (Rm-Rf) is 0.72 per cent. The mean monthly SMB, LMH and WML are 1.46%, 1.43% and 0.46% respectively. The average monthly liquidity premium (IMV) derived from trading volume, turnover, relative spread & Amihud illiquidity ratio is 1.98%, 0.80%, 1.82% and 1.54% respectively. The skewness values exhibit that explanatory variables SMB, LMH, and IMV (derived from trading volume, relative spread and Amihud illiquidity ratio) are positively skewed while Rm-Rf, WML, and IMV (turnover) are negatively skewed. The kurtosis values are greater than zero for all the risk factors implying leptokurtic distribution (fatter tails).

Karl Pearson's coefficients of correlation between the risk factors employed in the study are given in Table 3. Size premium is highly correlated with liquidity premium derived from trading volume, relative spread and Amihud illiquidity. Further, there exists a high level of correlation among all the liquidity factors (IMV) derived from trading volume, turnover, relative spread and Amihud Illiquidity ratio indicating that they all substitute one another. All other correlation coefficients do not discover any extremely high correlation value that will lead to an issue of multicollinearity in asset pricing models.

Table 2: Descriptive Statistics of Risk Factors

Factors	Mean	t-stat.	Std. Dev.	Skewness	Kurtosis	Obs.
RM-RF	0.0072	1.362	0.0745	-0.1735	2.8503	201
SMB	0.0146	6.366***	0.0163	1.0423	3.6366	201
LMH	0.0143	4.299***	0.0241	1.4479	5.8909	201
WML	0.0046	1.584	0.0204	-0.7919	2.7519	201
IMV (Trading Volume)	0.0198	6.532***	0.0214	0.5450	1.9162	201
IMV (Turnover Rate)	0.0080	2.702***	0.0209	-0.4724	1.5780	201
IMV (Relative Spread)	0.0182	6.513***	0.0198	0.8290	2.7436	201
IMV (Amihud Illiquidity Ratio)	0.0154	5.196***	0.0210	0.9518	2.9846	201

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

Table 3: Correlation Matrix of Risk Factors

Factors	Rm- Rf	SMB	LMH	WML	IMV (Trading Volume)	IMV (Turnover)	IMV (Relative Spread)	IMV (Amihud Illiquidity)
Rm- Rf	1							
SMB	.142*	1						
LMH	.357**	.569**	1					
WML	.040	-.140*	-.267**	1				
IMV (Trading Volume)	-.248**	.707**	.289**	.000	1			
IMV (Turnover)	-.603**	.292**	-.078	.039	.752**	1		
IMV (Relative Spread)	-.147*	.696**	.261**	.093	.944**	.677**	1	
IMV (Amihud Illiquidity)	-.117	.702**	.348**	.069	.928**	.645**	.936**	1

Note: ** & * show correlation is significant at the level of 1% & 5% respectively (2-tailed).

Results of Regression Models

The return performance of portfolios derived from four different liquidity proxies is in harmony with the risk-return trade off, that is, the portfolio of illiquid stocks (P10) provides higher returns relative to the portfolio of most liquid stocks (P1). A meagre confirmation of liquidity premium at NSE may not be exciting for the investors who search for superior returns. A more important matter is to authenticate the reality of observed liquidity premium at NSE through asset pricing models. Tables 4, 5 and 6 present results of CAPM, Fama & French three-factor model and Carhart's model respectively for liquidity-sorted decile portfolios derived from trading volume, turnover, relative spread and Amihud illiquidity ratio.

Table 4 presents the outcomes of standard CAPM for liquidity-sorted decile portfolios of NSE. Value of intercept (α – a measure of abnormal returns) increases monotonically as we go from the portfolio of most liquid to least liquid stocks (P1 to P10) which signifies that as liquidity risk in portfolio increases, abnormal return also increases in order to compensate investors for investing in illiquid stocks. This implies a negative relationship between liquidity and expected stock returns at NSE. The illiquid stocks portfolio (P10) based on trading volume provide a significant abnormal return of 3.00% per month against the abnormal return of -0.45% per month for liquid stocks portfolio (P1). The monthly abnormal returns generated by illiquid stocks portfolio based on turnover rate, relative spread and Amihud illiquidity ratio are found to be 1.49%, 2.63% and 2.44% against liquid stocks portfolio of 0.18%, -0.15%, and -0.16% respectively. This shows that illiquid stocks outperform liquid stocks. The abnormal returns generated by long-short investment strategy i.e. P10-P1 based on trading volume, turnover, relative spread and Amihud illiquidity ratio are found to be 3.44%, 1.31%, 2.78%, and 2.60% respectively. Alpha values are positive and statistically significant across portfolios except for liquid stocks portfolio where it is negative (see the alpha values of P1 derived from trading volume, relative spread and Amihud illiquidity ratio are -0.0045, -0.0015 and -0.0016 respectively). These outcomes verify the existence of significant liquidity effect and establish a negative liquidity-stock return relationship at NSE. Mostly, the value of market beta " "β_m" is close to one and highly significant across portfolios. Market beta decreases as one moves from liquid to illiquid stocks portfolios (P1 to P10) indicating

that liquid stocks are more sensitive to market risk than illiquid stocks. A glance at the adjusted R^2 value provides evidence that the market risk is a significant factor to describe substantial part of variations in equity returns. It is necessary to point out that adj. R^2 value is less for illiquid stocks portfolios (e.g. on an average, it is 60.02% for P10 as against 83.80% for P1) signifying the larger unexplained variations in the portfolio returns of illiquid stocks. The adjusted R^2 value declines as we move from P1 to P10 indicating that as illiquidity increases, unexplained variations in portfolio returns also increase. These empirical outcomes prove the existence of strong liquidity effect at NSE where illiquid stocks outperformed liquid stocks portfolio.

It is clearly visible that market risk factor captures a large part of variations in stock returns at NSE, but not all. Large CAPM alphas may not imply the abnormal performance of portfolios; instead it may represent compensations for misplaced risk factors in the model. Therefore, we widen our analysis by employing well-known multifactor models i.e. Fama & French three-factor model and Carhart's model.

Table 5 provides the outcomes of Fama & French three-factor model for liquidity-sorted decile portfolios of NSE. With the insertion of size and value factors, results show that there has been a considerable improvement in adjusted R^2 values, especially for illiquid stocks portfolios (on an average, it is 83.39% for P10 as against 84.95% for P1). Alpha values reduce substantially and become insignificant for most of the portfolios except for illiquid stocks portfolios for which they are still significant. Market beta remains positive and significant throughout, but slightly decreases in magnitude. Overall, size and value factor coefficients are positive and significant across portfolios except size coefficient being negative for P1 (liquid stocks portfolio). Size coefficient (β_{SMB}) increases as one moves from portfolio P1 to P10 showing that illiquid stocks are likely to be more sensitive to size premium relative to liquid stocks. This may be because small stocks are generally less liquid in comparison to big stocks. And, there is only a marginal difference in value coefficients (β_{LMH}) across portfolios.

Fama & French three-factor model does elucidate a major part of variations in liquidity-sorted portfolio returns. Yet, illiquid stocks portfolios are still not entirely explained so we further move to Carhart's model by adding up an additional risk factor i.e. momentum factor. Table 6 reports the regression results of Carhart's model for liquidity-sorted decile portfolios of NSE. The results illustrate that there is no substantial improvement in adjusted R^2 values. Alpha values remain quite stable and are still significant for illiquid stocks portfolios. There is no apparent effect on market, size and value factors coefficient; overall they are still positive and highly significant across portfolios. Momentum factor coefficient (β_{WML}) is mostly insignificant except for liquid stocks portfolios for which it is significantly negative. This shows that momentum risk factor has no significant role in explaining stock returns at NSE.

Therefore, among various models employed so far, Fama & French three-factor model turned out to be the best in explaining variations in portfolio returns at NSE. However, a few portfolio returns are still not completely explained, so we further broaden our investigation to isolate the effect of liquidity by augmenting liquidity factor (IMV) in Standard CAPM, Fama & French three-factor model and Carhart's model. The regression results of liquidity augmented standard CAPM, liquidity augmented Fama & French three-factor model and liquidity augmented Carhart's model are presented in Tables 7, 8 and 9 respectively.

With the inclusion of liquidity risk factor in the asset pricing models, there has been a considerable improvement in adjusted R^2 values indicative of significant enhancement in explaining variability of portfolio returns by liquidity-adjusted models. This implies that liquidity augmented models can better explain variations in stock returns at NSE. Alpha values reduce and market, size and value factors coefficients continue to remain positive and significant across

portfolios. However, inclusion of liquidity as a risk factor into the pricing framework vanishes the trend observed in intercept, adjusted R^2, market beta and size coefficients. Momentum factor coefficients remain insignificant mostly in liquidity augmented Carhart's model except for liquid stocks portfolio (P1) where it is negative. The estimates of liquidity-augmented models reveal that on an average, six of the ten liquidity sorted portfolios betas are significant for the liquidity (IMV) factor. Clearly, the illiquid stocks portfolios have positive and highly significant IMV betas implying that investors get compensation for bearing liquidity risk of holding illiquid stocks; in contrast, the liquid stocks portfolios have significantly negative IMV betas implying that liquid stocks may give lower returns for a given risk. However, IMV betas are insignificant for portfolios representing moderate liquidity (i.e. P4, P5, P6, and P7).

A strong pattern of increasing slope coefficient of IMV factor is observed as we go from the portfolio of most to least liquid stocks (P1 to P10). In liquidity-augmented CAPM, coefficient of liquidity risk factor (β_{IMV}), varies from -0.39 for P1 to 2.16 for P10 for trading volume sorted portfolios, from -1.32 for P1 to 1.28 for P10 for turnover sorted portfolios, from -0.31 for P1 to 2.28 for P10 for relative spread sorted portfolios and from -0.24 for P1 to 2.19 for P10 for Amihud illiquidity sorted portfolios. However, in liquidity-augmented F&F 3-factor model, the magnitude of β_{IMV} reduces substantially (varies from -1.55 for P1 to 0.94 for P10 for trading volume sorted portfolios, from -2.17 for P1 to 0.57 for P10 for turnover sorted portfolios, from -1.05 for P1 to 1.30 for P10 for relative spread sorted portfolios and from -0.56 for P1 to 1.19 for P10 for Amihud illiquidity sorted portfolios). This may be because there is a high degree of correlation between SMB and IMV factors (specifically liquidity factor based on trading volume, relative spread and Amihud Illiquidity ratio). An element of liquidity effect on equity returns is subsumed by size factor, but still liquidity betas are statistically significant in liquidity augmented Fama & French three-factor model. This indicates that liquidity factor is an independent and significant factor in explaining variations in portfolio returns at NSE. But momentum factor has no significant effect on the magnitude of coefficients of liquidity factor. Overall, it suggests that liquidity has a significant role to explain return variations for NSE stocks irrespective of liquidity measure used.

We conclude that among various asset-pricing models employed in this research, Liquidity-augmented Fama & French three-factor model turned out to be best to explain variations in equity returns at NSE. A strong liquidity effect is observed at NSE where illiquid stocks outperformed liquid stocks' portfolio. The liquidity premium is discovered at NSE such that investors get reward in the form of superior returns for holding illiquid stocks in their portfolios.

Table 4: Results of Standard CAPM for Liquidity-Sorted Portfolios

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L1: Trading Volume												
Constant	$\propto$	-0.0045	0.0011	0.0034	0.0081	0.0081	0.0099	0.0155	0.0137	0.0178	0.0300	0.0344
	t-stat.	-1.7774*	0.4553	1.1957	2.9456***	2.7487***	3.0609***	4.8413***	4.0847***	4.8007***	7.2025***	8.2469***
Market	β_m	1.1222	1.0643	1.0598	1.0410	1.0583	1.0074	0.9796	0.9562	0.9154	0.9381	-0.1841
	t-stat.	33.3097***	31.5932***	27.7044***	28.1063***	26.867***	23.1897***	22.7757***	21.2249***	18.4343***	16.8327***	-3.292***
Adjusted R^2		0.8472	0.8329	0.7931	0.7978	0.7828	0.7285	0.7213	0.6921	0.6288	0.5854	0.0469
L2: Turnover Rate												
Constant	$\propto$	0.0018	0.0055	0.0063	0.0100	0.0105	0.0124	0.0109	0.0135	0.0163	0.0149	0.0131
	t-stat.	0.4758	1.9329*	2.1067**	3.8188***	3.7744***	4.3355***	3.804***	4.1963***	4.9774***	4.4006***	3.7335***
Market	β_m	1.3755	1.1704	1.1034	0.9955	0.9777	0.9386	0.8635	0.8952	0.8916	0.8476	-0.5279
	t-stat.	27.5741***	30.6505***	27.4996***	28.3118***	26.2256***	24.415***	22.5822***	20.6945***	20.3364***	18.6932***	-11.2124***
Adjusted R^2		0.7915	0.8243	0.7906	0.8001	0.7745	0.7485	0.7179	0.6812	0.6735	0.6353	0.3841
L3: Relative (Quoted) Spread												
Constant	$\propto$	-0.0015	0.0011	0.0054	0.0077	0.0076	0.0105	0.0124	0.0181	0.0168	0.0263	0.0278
	t-stat.	-0.6218	0.4272	2.065**	2.5934**	2.6231***	3.2804***	4.0783***	5.1484***	4.834***	6.3301***	6.9154***
Market	β_m	1.0477	1.0397	1.0367	1.0468	0.9646	1.0719	0.9636	0.9671	0.9623	0.9613	-0.0864
	t-stat.	33.298***	29.6668***	29.6035***	26.3311***	24.7866***	25.071***	23.6979***	20.5507***	20.6236***	17.2442***	-1.6039
Adjusted R^2		0.8471	0.8147	0.8140	0.7759	0.7541	0.7583	0.7370	0.6781	0.6797	0.5971	0.0078
L4: Amihud Illiquidity Ratio												
Constant	$\propto$	-0.0016	0.0021	0.0075	0.0069	0.0089	0.0103	0.0125	0.0146	0.0172	0.0244	0.0260
	t-stat.	-0.7346	0.8002	2.8829***	2.3537**	3.068***	3.111***	3.824***	4.2451***	4.5056***	5.797***	6.4006***
Market	β_m	1.0510	1.0483	0.9966	1.0857	1.0469	1.0299	1.0047	0.9933	0.9635	0.9434	-0.1076
	t-stat.	36.0217***	29.2909***	28.7736***	27.6705***	26.9897***	23.1796***	22.8844***	21.5176***	18.8005***	16.7263***	-1.9768**
Adjusted R^2		0.8664	0.8108	0.8052	0.7927	0.7844	0.7284	0.7233	0.6979	0.6380	0.5823	0.0143

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

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Table 5: Results of Fama & French Three-Factor Model for Liquidity-Sorted Portfolios

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L1: Trading Volume												
Constant	$\propto$	-0.0046	0.0000	-0.0034	0.0033	0.0003	-0.0019	0.0029	-0.0016	-0.0006	0.0091	0.0137
	t-stat.	-1.6851*	0.0096	-1.2641	1.1965	0.1101	-0.6676	1.0856	-0.6382	-0.2416	3.3561***	5.0378***
Market	β_m	1.0899	1.0045	0.9540	0.9560	0.9854	0.8937	0.8741	0.8521	0.7920	0.8217	-0.2682
	t-stat.	30.5404***	29.2938***	27.1755***	26.4329***	25.9582***	24.4167***	24.8675***	25.8967***	24.6497***	22.9595***	-7.4959***
Size	β_{SMB}	-0.3186	-0.4160	0.1607	0.0173	0.6871	1.0107	1.2575	1.7726	2.1409	2.6725	2.9912
	t-stat.	-1.7231*	-2.3414**	0.8833	0.0925	3.4934***	5.329***	6.9042***	10.3979***	12.8596***	14.4117***	16.1341***
Value	β_{LMH}	0.3654	0.6301	0.8724	0.7316	0.4453	0.7110	0.5729	0.4225	0.4900	0.2847	-0.0807
	t-stat.	2.7481***	4.9325***	6.6702***	5.4296***	3.1485***	5.2137***	4.3748***	3.4466***	4.0935***	2.1351**	-0.6052
Adjusted R^2		0.8513	0.8500	0.8490	0.8329	0.8252	0.8330	0.8387	0.8576	0.8653	0.8518	0.6619
L2: Turnover Rate												
Constant	$\propto$	-0.0050	-0.0001	-0.0019	0.0028	0.0016	0.0014	0.0003	0.0007	0.0023	0.0004	0.0055
	t-stat.	-1.3247	-0.0390	-0.6730	1.1421	0.6212	0.5653	0.1150	0.2502	0.8991	0.1572	1.5200
Market	β_m	1.2847	1.0920	1.0052	0.9067	0.8881	0.8419	0.7740	0.7995	0.7898	0.7383	-0.5464
	t-stat.	25.6225***	28.9661***	27.0632***	28.0427***	26.6169***	26.5994***	23.811***	22.5199***	23.1617***	21.0692***	-11.5469***
Size	β_{SMB}	0.3226	0.2292	0.5058	0.4183	0.7297	1.0572	1.0378	1.4018	1.5413	1.5589	1.2363
	t-stat.	1.2417	1.1736	2.6283***	2.4972**	4.2208***	6.4468***	6.162***	7.6211***	8.7235***	8.5865***	5.0425***
Value	β_{LMH}	0.6994	0.6171	0.7132	0.6562	0.5785	0.5515	0.4942	0.4502	0.4646	0.5249	-0.1745
	t-stat.	3.7444***	4.3937***	5.1542***	5.4473***	4.6539***	4.6771***	4.0808***	3.404***	3.657***	4.0209***	-0.9900
Adjusted R^2		0.8175	0.8516	0.8445	0.8535	0.8434	0.8522	0.8233	0.8139	0.8288	0.8112	0.4609

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L3: Relative (Quoted) Spread												
Constant	$\propto$	-0.0026	-0.0036	0.0009	0.0012	-0.0004	-0.0009	0.0010	0.0025	0.0003	0.0058	0.0084
	t-stat.	-1.0391	-1.3868	0.3643	0.4314	-0.1404	-0.3154	0.3802	0.9160	0.1243	2.0777**	3.1155***
Market	β_m	0.9971	0.9606	0.9445	0.9409	0.8734	0.9783	0.8679	0.8626	0.8606	0.8467	-0.1504
	t-stat.	30.7618***	28.0176***	28.4733***	25.3442***	24.0925***	26.2341***	25.2843***	24.3805***	26.4144***	23.0601***	-4.26***
Size	β_{SMB}	-0.3244	0.0564	-0.1287	0.1016	0.5408	1.1422	1.1252	1.8233	2.0216	2.6363	2.9607
	t-stat.	-1.9315*	0.3176	-0.7486	0.5279	2.879***	5.9115***	6.3265***	9.9458***	11.9752***	13.8573***	16.1882***
Value	β_{LMH}	0.5262	0.6692	0.8339	0.8900	0.6436	0.5016	0.5239	0.4119	0.3341	0.2797	-0.2465
	t-stat.	4.3572***	5.2387***	6.748***	6.435***	4.7654***	3.6102***	4.0968***	3.1245***	2.7524***	2.0445**	-1.8743*
Adjusted R^2		0.8593	0.8462	0.8554	0.8306	0.8151	0.8406	0.8376	0.8423	0.8646	0.8485	0.6306
L4: Amihud Illiquidity Ratio												
Constant	$\propto$	-0.0012	-0.0010	0.0034	0.0002	0.0008	-0.0019	-0.0010	0.0008	-0.0008	0.0037	0.0049
	t-stat.	-0.5108	-0.3978	1.3087	0.0830	0.2826	-0.6689	-0.3539	0.2924	-0.2748	1.2985	2.0158**
Market	β_m	1.0261	0.9559	0.9260	1.0024	0.9505	0.9201	0.9122	0.8792	0.8416	0.8265	-0.1997
	t-stat.	33.1977***	27.9954***	26.7521***	26.3074***	26.66***	24.4916***	25.7734***	23.5739***	23.3797***	22.1337***	-6.2617***
Size	β_{SMB}	-0.3345	-0.3749	0.0113	0.3709	0.5067	1.1341	1.5498	1.3830	2.0822	2.6452	2.9797
	t-stat.	-2.0888**	-2.1189**	0.0632	1.8788*	2.7428***	5.8261***	8.4508***	7.1567***	11.1644***	13.6723***	18.0352***
Value	β_{LMH}	0.3057	0.9018	0.6077	0.6209	0.6982	0.6442	0.3817	0.6136	0.4930	0.2972	-0.0085
	t-stat.	2.6544***	7.0896***	4.7121***	4.3739***	5.2569***	4.6026***	2.8943***	4.4158***	3.6762***	2.1365**	-0.0712
Adjusted R^2		0.8700	0.8507	0.8314	0.8305	0.8421	0.8317	0.8441	0.8291	0.8452	0.8413	0.7068

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

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Table 6: Results of Carhart's Model for Liquidity-Sorted Portfolios

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L1: Trading Volume												
Constant	$\propto$	-0.0024	0.0007	-0.0033	0.0040	0.0003	-0.0018	0.0025	-0.0019	-0.0011	0.0101	0.0124
	t-stat.	-0.9119	0.2686	-1.2148	1.4461	0.0959	-0.6322	0.9099	-0.7562	-0.4502	3.6659***	4.5722***
Market	β_m	1.1148	1.0123	0.9548	0.9643	0.9850	0.8945	0.8692	0.8483	0.7860	0.8323	-0.2825
	t-stat.	32.5314***	29.2644***	26.8153***	26.4384***	25.5804***	24.0924***	24.429***	25.4534***	24.2072***	23.1431***	-7.9198***
Size	β_{SMB}	-0.2961	-0.4089	0.1614	0.0249	0.6868	1.0114	1.2530	1.7693	2.1354	2.6821	2.9782
	t-stat.	-1.6865*	-2.3077**	0.8848	0.1334	3.4814***	5.3174***	6.8741***	10.3622***	12.8374***	14.5581***	16.2981***
Value	β_{LMH}	0.1988	0.5780	0.8669	0.6756	0.4481	0.7059	0.6057	0.4474	0.5300	0.2139	0.0150
	t-stat.	1.5186	4.3736***	6.372***	4.8475***	3.0454***	4.9764***	4.4552***	3.5135***	4.2724***	1.5564	0.1102
Momentum	β_{WML}	-0.5771	-0.1806	-0.0190	-0.1941	0.0095	-0.0175	0.1135	0.0864	0.1387	-0.2455	0.3316
	t-stat.	-4.7674***	-1.4778	-0.1514	-1.5067	0.0701	-0.1336	0.9032	0.7337	1.2093	-1.9323*	2.6319***
Adjusted R^2		0.8661	0.8509	0.8482	0.8339	0.8243	0.8321	0.8385	0.8573	0.8656	0.8538	0.6718
L2: Turnover Rate												
Constant	$\propto$	-0.0026	0.0008	-0.0020	0.0023	0.0020	0.0012	0.0007	0.0011	0.0019	0.0012	0.0038
	t-stat.	-0.7033	0.2655	-0.6851	0.9416	0.7933	0.4700	0.2925	0.4001	0.7361	0.4450	1.0659
Market	β_m	1.3120	1.1020	1.0044	0.9015	0.8934	0.8395	0.7791	0.8043	0.7853	0.7471	-0.5649
	t-stat.	26.6627***	29.0382***	26.6604***	27.5636***	26.4694***	26.1645***	23.6918***	22.3781***	22.7467***	-21.1661***	-11.9665***
Size	β_{SMB}	0.3474	0.2383	0.5051	0.4136	0.7345	1.0551	1.0424	1.4062	1.5372	1.5670	1.2195
	t-stat.	1.3781	1.2258	2.617***	2.4687**	4.2479***	6.4188***	6.188***	7.6375***	8.6913***	8.6653***	5.0429***
Value	β_{LMH}	0.5161	0.5500	0.7185	0.6910	0.5429	0.5674	0.4599	0.4181	0.4944	0.4655	-0.0506
	t-stat.	2.7448***	3.7932***	4.9917***	5.5295***	4.2096***	4.6288***	3.6607***	3.0445***	3.7476***	3.4515***	-0.2803
Momentum	β_{WML}	-0.6354	-0.2325	0.0183	0.1206	-0.1235	0.0552	-0.1187	-0.1114	0.1032	-0.2059	0.4295
	t-stat.	-3.6552***	-1.7342*	0.1378	1.0438	-1.0360	0.4873	-1.0218	-0.8774	0.8461	-1.6509	2.5757**

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
Adjusted R^2		0.8282	0.8531	0.8437	0.8536	0.8435	0.8516	0.8233	0.8137	0.8286	0.8129	0.4759
L3: Relative (Quoted) Spread												
Constant	$\propto$	-0.0005	-0.0021	0.0011	0.0018	-0.0005	-0.0007	0.0008	0.0018	0.0000	0.0063	0.0068
	t-stat.	-0.2179	-0.8016	0.4302	0.6181	-0.1794	-0.2436	0.3025	0.6714	-0.0145	2.2089**	2.5532**
Market	β_m	1.0203	0.9782	0.9466	0.9472	0.8720	0.9805	0.8658	0.8554	0.8567	0.8520	-0.1683
	t-stat.	32.8975***	28.9555***	28.1451***	25.2302***	23.7188***	25.9295***	24.8751***	23.941***	25.9621***	22.9266***	-4.8371***
Size	β_{SMB}	-0.3033	0.0724	-0.1268	0.1073	0.5396	1.1442	1.1233	1.8168	2.0181	2.6411	2.9444
	t-stat.	-1.9089*	0.4182	-0.7357	0.5577	2.8647***	5.9066***	6.2999***	9.9254***	11.9379***	13.873***	16.5165***
Value	β_{LMH}	0.3704	0.5513	0.8198	0.8478	0.6525	0.4870	0.5383	0.4601	0.3604	0.2442	-0.1262
	t-stat.	3.126***	4.271***	6.3796***	5.9112***	4.6448***	3.3709***	4.0479***	3.3701***	2.8583***	1.7202*	-0.9491
Momentum	β_{WML}	-0.5396	-0.4085	-0.0490	-0.1461	0.0307	-0.0504	0.0498	0.1670	0.0910	-0.1228	0.4168
	t-stat.	-4.925***	-3.4229***	-0.4124	-1.1015	0.2366	-0.3775	0.4048	1.3234	0.7805	-0.9353	3.3906***
Adjusted R^2		0.8742	0.8542	0.8548	0.8308	0.8142	0.8399	0.8369	0.8429	0.8644	0.8484	0.6493
L4: Amihud Illiquidity Ratio												
Constant	$\propto$	0.0005	0.0004	0.0047	0.0002	0.0005	-0.0021	-0.0011	0.0004	-0.0018	0.0048	0.0042
	t-stat.	0.2363	0.1537	1.7674*	0.0744	0.1914	-0.7086	-0.4153	0.1508	-0.6564	1.6651*	1.7192*
Market	β_m	1.0459	0.9721	0.9398	1.0022	0.9478	0.9184	0.9101	0.8747	0.8296	0.8387	-0.2073
	t-stat.	34.9265***	28.7745***	27.231***	25.9289***	26.224***	24.1055***	25.3595***	23.1575***	22.9953***	22.399***	-6.4474***
Size	β_{SMB}	-0.3166	-0.3601	0.0238	0.3707	0.5042	1.1325	1.5479	1.3789	2.0714	2.6563	2.9729
	t-stat.	-2.0637**	-2.0808**	0.1347	1.8723*	2.7233***	5.8026***	8.4191***	7.126***	11.2079***	13.8484***	18.0514***
Value	β_{LMH}	0.1731	0.7930	0.5154	0.6225	0.7163	0.6556	0.3958	0.6436	0.5734	0.2156	0.0425
	t-stat.	1.5129	6.1433***	3.9088***	4.2154***	5.1878***	4.5038***	2.8862***	4.4595***	4.1598***	1.5069	0.3456
Momentum	β_{WML}	-0.4593	-0.3772	-0.3197	0.0055	0.0628	0.0395	0.0489	0.1040	0.2785	-0.2829	0.1764
	t-stat.	-4.3422***	-3.1604***	-2.6222***	0.0402	0.4917	0.2938	0.3855	0.7797	2.1853**	-2.1389**	1.5537
Adjusted R^2		0.8808	0.8572	0.8363	0.8297	0.8415	0.8309	0.8434	0.8287	0.8481	0.8441	0.7089

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

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Table 7: Results of Liquidity Augmented Standard CAPM for Liquidity-Sorted Portfolios

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L1: Trading Volume												
Constant	$\propto$	-0.0004	0.0040	0.0012	0.0064	0.0022	0.0004	0.0044	-0.0012	-0.0011	0.0075	0.0079
	t-stat.	-0.1341	1.4313	0.3927	2.0798**	0.7115	0.1345	1.3940	-0.4022	-0.3744	2.509**	3.9271***
Market	β_m	1.0940	1.0448	1.0746	1.0529	1.0984	1.0725	1.0563	1.0586	1.0450	1.0922	-0.0019
	t-stat.	32.2605***	30.3652***	27.3075***	27.5796***	28.0843***	26.2266***	27.3145***	29.2368***	29.4373***	29.4985***	-0.0750
Liquidity	β_{IMV}	-0.3956	-0.2735	0.2088	0.1665	0.5626	0.9144	1.0788	1.4383	1.8199	2.1654	2.5611
	t-stat.	-3.3514***	-2.2833**	1.5242	1.2530	4.1323***	6.4238***	8.0135***	11.4123***	14.7281***	16.8023***	29.6518***
Adjusted R^2		0.8546	0.8364	0.7944	0.7983	0.7990	0.7742	0.7885	0.8133	0.8220	0.8282	0.8239
L2: Turnover Rate												
Constant	$\propto$	0.0087	0.0090	0.0075	0.0101	0.0101	0.0103	0.0079	0.0080	0.0091	0.0082	-0.0005
	t-stat.	2.447**	3.1433***	2.3976**	3.6512***	3.4649***	3.4636***	2.718***	2.5565**	3.0571***	2.583**	-0.2775
Market	β_m	1.1507	1.0558	1.0644	0.9943	0.9902	1.0090	0.9592	1.0772	1.1262	1.0660	-0.0848
	t-stat.	20.2484***	22.9241***	21.1934***	22.4972***	21.1438***	21.1967***	20.5339***	21.5579***	23.6268***	20.9645***	-3.0432***
Liquidity	β_{IMV}	-1.3269	-0.6764	-0.2304	-0.0073	0.0741	0.4156	0.5654	1.0742	1.3851	1.2894	2.6162
	t-stat.	-6.557***	-4.1247***	-1.2884	-0.0465	0.4442	2.452**	3.3993***	6.0374***	8.1611***	7.1217***	26.3809***
Adjusted R^2		0.8279	0.8374	0.7913	0.7991	0.7736	0.7546	0.7321	0.7294	0.7545	0.7082	0.8629
L3: Relative (Quoted) Spread												
Constant	$\propto$	0.0015	0.0019	0.0044	0.0047	0.0017	0.0018	0.0025	0.0024	0.0003	0.0049	0.0034
	t-stat.	0.5831	0.6565	1.5314	1.4520	0.5638	0.5679	0.8572	0.8101	0.1111	1.6407	1.7506*
Market	β_m	1.0354	1.0364	1.0407	1.0591	0.9890	1.1078	1.0045	1.0325	1.0311	1.0506	0.0152
	t-stat.	33.0507***	29.2087***	29.365***	26.5795***	26.2939***	27.9083***	27.8109***	28.9608***	30.7189***	28.8932***	0.6427
Liquidity	β_{IMV}	-0.3148	-0.0840	0.1019	0.3154	0.6267	0.9186	1.0486	1.6746	1.7609	2.2858	2.6006
	t-stat.	-2.675***	-0.6300	0.7657	2.1073**	4.4356***	6.1608***	7.7282***	12.5037***	13.9652***	16.7345***	29.283***
Adjusted R^2		0.8517	0.8141	0.8136	0.7797	0.7752	0.7962	0.7970	0.8192	0.8378	0.8323	0.8129
L4: Amihud Illiquidity Ratio												
Constant	$\propto$	0.0004	0.0028	0.0074	0.0034	0.0039	0.0021	0.0029	0.0025	0.0018	0.0069	0.0066
	t-stat.	0.1540	0.9878	2.6799***	1.1030	1.3385	0.6526	0.9898	0.9131	0.6649	2.4296**	3.3596***
Market	β_m	1.0429	1.0455	0.9967	1.1003	1.0675	1.0642	1.0447	1.0434	1.0277	1.0160	-0.0268
	t-stat.	35.9174***	28.9714***	28.5074***	28.5074***	28.7648***	26.8091***	28.1924***	29.6257***	30.2502***	28.2829***	-1.0887
Liquidity	β_{IMV}	-0.2459	-0.0866	0.0030	0.4425	0.6220	1.0396	1.2106	1.5192	1.9429	2.1996	2.4455
	t-stat.	-2.3928**	-0.6783	0.0246	3.2395***	4.7362***	7.3995***	9.2312***	12.1882***	16.1597***	17.301***	28.0341***
Adjusted R^2		0.8695	0.8103	0.8043	0.8021	0.8053	0.7861	0.8055	0.8265	0.8431	0.8328	0.8006

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

Table 8: Results of Liquidity Augmented Fama & French Three-Factor Model for Liquidity-Sorted Portfolios

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L1: Trading Volume												
Constant	$\propto$	-0.0007	0.0031	-0.0001	0.0052	0.0015	-0.0008	0.0034	-0.0020	-0.0021	0.0068	0.0076
	t-stat.	-0.2985	1.2303	-0.0302	1.9045*	0.5219	-0.2652	1.2243	-0.7668	-0.8379	2.5265**	3.7765***
Market	β_m	0.9386	0.8837	0.8235	0.8782	0.9372	0.8500	0.8559	0.8669	0.8505	0.9131	-0.0256
	t-stat.	23.9623***	22.6703***	20.8151***	20.4156***	20.4171***	19.1859***	19.9934***	21.6263***	22.0953***	21.6775***	-0.8179
Size	β_{SMB}	1.5598	1.0833	1.7810	0.9825	1.2860	1.5535	1.4834	1.5885	1.4143	1.5385	-0.0213
	t-stat.	4.8242***	3.3667***	5.4539***	2.7671***	3.394***	4.2479***	4.198***	4.8008***	4.4512***	4.4252***	-0.0825
Value	β_{LMH}	0.2077	0.5043	0.7364	0.6506	0.3950	0.6654	0.5540	0.4380	0.5510	0.3799	0.1722
	t-stat.	1.6998*	4.147***	5.9668***	4.848***	2.7588***	4.8147***	4.148***	3.5023***	4.5886***	2.8912***	1.7647*
Liquidity	β_{IMV}	-1.5575	-1.2431	-1.3435	-0.8003	-0.4965	-0.4501	-0.1874	0.1527	0.6024	0.9403	2.4978
	t-stat.	-6.7824***	-5.4397***	-5.7926***	-3.1733***	-1.845*	-1.7327*	-0.7465	0.6498	2.6695***	3.8078***	13.6227***
Adjusted R^2		0.8790	0.8690	0.8704	0.8402	0.8273	0.8346	0.8383	0.8572	0.8694	0.8613	0.8255
L2: Turnover Rate												
Constant	$\propto$	-0.0012	0.0021	-0.0004	0.0037	0.0025	0.0019	0.0004	0.0000	0.0010	-0.0006	0.0006
	t-stat.	-0.4126	0.8190	-0.1515	1.5120	1.0170	0.7705	0.1506	-0.0185	0.4201	-0.2280	0.3399
Market	β_m	0.9012	0.8745	0.8560	0.8220	0.7932	0.7926	0.7649	0.8719	0.9186	0.8394	-0.0618
	t-stat.	17.9964***	20.2853***	18.7011***	19.8963***	18.6915***	19.2785***	17.9626***	19.0273***	21.6958***	18.8527***	-1.9997**
Size	β_{SMB}	1.5513	0.9262	0.9841	0.6897	1.0337	1.2151	1.0669	1.1698	1.1286	1.2348	-0.3165
	t-stat.	6.9313***	4.8074***	4.8108***	3.7357***	5.4504***	6.6135***	5.6062***	5.7126***	5.9645***	6.2054***	-2.2904**
Value	β_{LMH}	0.5019	0.5050	0.6364	0.6125	0.5296	0.5261	0.4895	0.4875	0.5309	0.5770	0.0751
	t-stat.	3.4925***	4.0826***	4.8449***	5.1667***	4.3493***	4.4595***	4.006***	3.7077***	4.37***	4.5161***	0.8466
Liquidity	β_{IMV}	-2.1716	-1.2318	-0.8453	-0.4797	-0.5373	-0.2791	-0.0514	0.4101	0.7294	0.5729	2.7445
	t-stat.	-11.8891***	-7.8343***	-5.0633***	-3.1833***	-3.4715***	-1.8614*	-0.3309	2.4535**	4.7234***	3.5278***	24.3367***
Adjusted R^2		0.8934	0.8864	0.8618	0.8600	0.8517	0.8540	0.8225	0.8185	0.8455	0.8216	0.8653

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Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L3: Relative (Quoted) Spread												
Constant	$\propto$	-0.0001	-0.0004	0.0020	0.0021	-0.0004	-0.0004	0.0004	0.0003	-0.0017	0.0027	0.0028
	t-stat.	-0.0338	-0.1699	0.7986	0.7153	-0.1524	-0.1318	0.1468	0.1036	-0.7057	1.0362	1.4658
Market	β_m	0.9381	0.8844	0.9178	0.9209	0.8744	0.9661	0.8822	0.9147	0.9088	0.9195	-0.0186
	t-stat.	28.8539***	26.634***	26.1725***	23.3092***	22.5449***	24.2617***	24.0979***	25.1823***	27.1776***	25.2929***	-0.7019
Size	β_{SMB}	0.8813	1.6139	0.4149	0.5088	0.5199	1.3912	0.8331	0.7588	1.0376	1.1491	0.2678
	t-stat.	3.1409***	5.6315***	1.3707	1.4922	1.5531	4.0481***	2.6367***	2.4203**	3.5956***	3.6625***	1.1734
Value	β_{LMH}	0.3534	0.4461	0.7560	0.8317	0.6466	0.4659	0.5658	0.5644	0.4751	0.4928	0.1393
	t-stat.	2.9884***	3.6927***	5.9264***	5.7867***	4.583***	3.2164***	4.2485***	4.2714***	3.9058***	3.7262***	1.4483
Liquidity	β_{IMV}	-1.0577	-1.3663	-0.4768	-0.3573	0.0183	-0.2184	0.2563	0.9339	0.8632	1.3047	2.3624
	t-stat.	-5.1975***	-6.5734***	-2.1722**	-1.4447	0.0755	-0.8762	1.1184	4.1075***	4.1242***	5.7334***	14.2697***
Adjusted R^2		0.8757	0.8734	0.8581	0.8315	0.8141	0.8405	0.8378	0.8541	0.8748	0.8696	0.8179
L4: Amihud Illiquidity Ratio												
Constant	$\propto$	-0.0010	-0.0008	0.0037	0.0003	0.0008	-0.0019	-0.0010	0.0005	-0.0011	0.0033	0.0043
	t-stat.	-0.4463	-0.3101	1.4927	0.1112	0.2902	-0.6719	-0.3661	0.1781	-0.4534	1.2576	2.3391**
Market	β_m	0.9915	0.9038	0.8683	0.9861	0.9459	0.9229	0.9192	0.9508	0.9183	0.8991	-0.0924
	t-stat.	30.6998***	25.8706***	24.7439***	24.2739***	24.8096***	22.9658***	24.2943***	25.6199***	26.1219***	24.2554***	-3.5396***
Size	β_{SMB}	0.3128	0.5981	1.0912	0.6751	0.5918	1.0823	1.4194	0.0456	0.6478	1.2869	0.9741
	t-stat.	1.1913	2.1058**	3.8251***	2.044**	1.9091*	3.3128***	4.6144***	0.1510	2.2667**	4.27***	4.5917***
Value	β_{LMH}	0.2677	0.8447	0.5443	0.6031	0.6932	0.6472	0.3893	0.6921	0.5773	0.3770	0.1093
	t-stat.	2.3594**	6.8835***	4.4158***	4.2262***	5.1765***	4.5855***	2.9294***	5.3098***	4.6748***	2.8954***	1.1929
Liquidity	β_{IMV}	-0.5696	-0.8561	-0.9502	-0.2676	-0.0749	0.0456	0.1147	1.1768	1.2621	1.1952	1.7648
	t-stat.	-3.0739***	-4.2712***	-4.7197***	-1.1482	-0.3423	0.1976	0.5283	5.5269***	6.2574***	5.6194***	11.788***
Adjusted R^2		0.8753	0.8627	0.8478	0.8308	0.8414	0.8309	0.8435	0.8514	0.8703	0.8626	0.8276

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

Table 9: Results of Liquidity Augmented Carhart's Model for Liquidity-Sorted Portfolios

Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
L1: Trading Volume												
Constant	$\propto$	0.0003	0.0031	-0.0005	0.0055	0.0013	-0.0009	0.0030	-0.0021	-0.0022	0.0078	0.0076
	t-stat.	0.1052	1.2384	-0.1954	1.976**	0.4499	-0.3015	1.0818	-0.8292	-0.8957	2.9385***	3.7324***
Market	β_m	0.9762	0.8856	0.8078	0.8873	0.9298	0.8459	0.8421	0.8602	0.8445	0.9500	-0.0262
	t-stat.	24.6299***	21.7963***	19.687***	19.8143***	19.4479***	18.3219***	18.9333***	20.6059***	21.0634***	22.1812***	-0.8029
Size	β_{SMB}	1.3243	1.0716	1.8793	0.9260	1.3327	1.5794	1.5703	1.6303	1.4522	1.3067	-0.0176
	t-stat.	4.1135***	3.2471***	5.6383***	2.5459**	3.4319***	4.2114***	4.3465***	4.8077***	4.4591***	3.7561***	-0.0663
Value	β_{LMH}	0.1130	0.4996	0.7759	0.6278	0.4138	0.6759	0.5889	0.4548	0.5662	0.2867	0.1737
	t-stat.	0.9262	3.9939***	6.1416***	4.554***	2.8116***	4.7546***	4.3004***	3.5382***	4.5871***	2.1742**	1.7303*
Momentum	β_{WML}	-0.4012	-0.0198	0.1675	-0.0963	0.0797	0.0441	0.1480	0.0713	0.0645	-0.3948	0.0064
	t-stat.	-3.4587***	-0.1666	1.3946	-0.7348	0.5694	0.3267	1.1368	0.5835	0.5499	-3.1499***	0.0667
Liquidity	β_{IMV}	-1.3493	-1.2328	-1.4305	-0.7503	-0.5379	-0.4730	-0.2642	0.1157	0.5689	1.1453	2.4945
	t-stat.	-5.8295***	-5.1959***	-5.9694***	-2.8692***	-1.9266*	-1.7542*	-1.0171	0.4746	2.4298**	4.579***	13.1027***
Adjusted R^2		0.8854	0.8683	0.8710	0.8399	0.8267	0.8339	0.8385	0.8567	0.8689	0.8673	0.8246
L2: Turnover Rate												
Constant	$\propto$	0.0002	0.0024	-0.0008	0.0030	0.0027	0.0015	0.0008	0.0005	0.0010	0.0004	0.0002
	t-stat.	0.0603	0.9390	-0.2950	1.2472	1.0911	0.6354	0.3060	0.1852	0.3828	0.1354	0.0974
Market	β_m	0.9327	0.8821	0.8470	0.8081	0.7983	0.7857	0.7739	0.8844	0.9168	0.8609	-0.0717
	t-stat.	18.5633***	19.985***	18.081***	19.1908***	18.3558***	18.6623***	17.7639***	18.896***	21.1152***	19.0985***	-2.2751**
Size	β_{SMB}	1.5219	0.9191	0.9925	0.7027	1.0289	1.2216	1.0585	1.1581	1.1302	1.2147	-0.3072
	t-stat.	6.9269***	4.7616***	4.8447***	3.816***	5.4103***	6.635***	5.5557***	5.6585***	5.9525***	6.1619***	-2.228**
Value	β_{LMH}	0.3929	0.4786	0.6675	0.6607	0.5120	0.5500	0.4583	0.4441	0.5370	0.5024	0.1095
	t-stat.	2.6979***	3.7407***	4.915***	5.4122***	4.0612***	4.5065***	3.6285***	3.2731***	4.2667***	3.8449***	1.1978
Momentum	β_{WML}	-0.4027	-0.0976	0.1149	0.1779	-0.0652	0.0882	-0.1155	-0.1605	0.0226	-0.2757	0.1270
	t-stat.	-2.9653***	-0.8181	0.9074	1.5628	-0.5546	0.7753	-0.9810	-1.2691	0.1921	-2.2624**	1.4904
Liquidity	β_{IMV}	-2.0919	-1.2125	-0.8680	-0.5149	-0.5244	-0.2966	-0.0285	0.4418	0.7249	0.6274	2.7193
	t-stat.	-11.549***	-7.6197***	-5.1397***	-3.3915***	-3.3447***	-1.954*	-0.1816	2.6184***	4.6311***	3.8609***	23.9211***
Adjusted R^2		0.8975	0.8862	0.8617	0.8610	0.8512	0.8537	0.8225	0.8191	0.8448	0.8253	0.8661
L3: Relative (Quoted) Spread												
Constant	$\propto$	0.0008	0.0000	0.0019	0.0022	-0.0005	-0.0004	0.0004	0.0003	-0.0015	0.0037	0.0029

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Portfolios		P1 (Liquid)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (Illiquid)	P10-P1
	t-stat.	0.3334	-0.0172	0.7498	0.7777	-0.1755	-0.1235	0.1452	0.1150	-0.6225	1.4239	1.5047
Market	β_m	0.9692	0.8979	0.9139	0.9281	0.8719	0.9669	0.8822	0.9159	0.9158	0.9542	-0.0150
	t-stat.	29.3927***	26.0365***	24.977***	22.5286***	21.5407***	23.264***	23.0873***	24.1596***	26.274***	25.8741***	-0.5434
Size	β_{SMB}	0.6003	1.4923	0.4508	0.4442	0.5426	1.3842	0.8334	0.7479	0.9745	0.8359	0.2356
	t-stat.	2.1016**	4.996***	1.4222	1.2448	1.5477	3.8449***	2.5179**	2.2774**	3.2278***	2.6166***	0.9858
Value	β_{LMH}	0.2845	0.4163	0.7648	0.8158	0.6522	0.4642	0.5659	0.5617	0.4596	0.4159	0.1314
	t-stat.	2.4318**	3.402***	5.8916***	5.5815***	4.5413***	3.1478***	4.1739***	4.1761***	3.7166***	3.1789***	1.3427
Momentum	β_{WML}	-0.3858	-0.1668	0.0493	-0.0887	0.0313	-0.0096	0.0004	-0.0149	-0.0866	-0.4301	-0.0443
	t-stat.	-3.3928***	-1.4027	0.3907	-0.6245	0.2239	-0.0668	0.0032	-0.1139	-0.7208	-3.3817***	-0.4652
Liquidity	β_{IMV}	-0.7980	-1.2540	-0.5100	-0.2976	-0.0027	-0.2120	0.2560	0.9439	0.9216	1.5942	2.3922
	t-stat.	-3.7546***	-5.6419***	-2.1627**	-1.1206	-0.0103	-0.7912	1.0394	3.8631***	4.1022***	6.7073***	13.4526***
Adjusted R^2		0.8821	0.8740	0.8575	0.8310	0.8132	0.8396	0.8369	0.8533	0.8745	0.8762	0.8172
L4: Amihud Illiquidity Ratio												
Constant	$\propto$	0.0004	0.0001	0.0042	0.0001	0.0005	-0.0020	-0.0011	0.0010	-0.0012	0.0055	0.0051
	t-stat.	0.1673	0.0213	1.6702*	0.0243	0.1686	-0.7022	-0.3971	0.3885	-0.4741	2.1629**	2.7414***
Market	β_m	1.0227	0.9221	0.8795	0.9806	0.9388	0.9201	0.9169	0.9635	0.9167	0.9475	-0.0752
	t-stat.	31.2909***	25.5309***	24.1148***	23.1604***	23.6378***	21.9609***	23.2418***	24.9874***	25.0069***	25.9247***	-2.802***
Size	β_{SMB}	0.0592	0.4494	0.9996	0.7202	0.6498	1.1047	1.4381	-0.0574	0.6612	0.8940	0.8347
	t-stat.	0.2229	1.5304	3.371***	2.0922**	2.0126**	3.2431***	4.4841***	-0.1832	2.2187**	3.0087***	3.8254***
Value	β_{LMH}	0.1707	0.7878	0.5092	0.6203	0.7154	0.6558	0.3965	0.6527	0.5824	0.2268	0.0561
	t-stat.	1.4995	6.262***	4.008***	4.2058***	5.1715***	4.4933***	2.885***	4.86***	4.5607***	1.7813*	0.5996
Momentum	β_{WML}	-0.3906	-0.2291	-0.1412	0.0694	0.0894	0.0344	0.0288	-0.1587	0.0205	-0.6053	-0.2147
	t-stat.	-3.4713***	-1.8425*	-1.1245	0.4761	0.6539	0.2388	0.2120	-1.1955	0.1628	-4.8103***	-2.3229**
Liquidity	β_{IMV}	-0.3331	-0.7174	-0.8647	-0.3097	-0.1290	0.0247	0.0973	1.2729	1.2497	1.5617	1.8948
	t-stat.	-1.728*	-3.3682***	-4.0202***	-1.2402	-0.5509	0.0999	0.4180	5.5983***	5.7811***	7.2462***	11.971***
Adjusted R^2		0.8820	0.8644	0.8480	0.8301	0.8409	0.8300	0.8428	0.8517	0.8697	0.8766	0.8314

Note: Statistical level of significance at 1%, 5% & 10% is indicated by ***, ** & * respectively.

Results of ARDL Model

We have employed ARDL model that specifies a relationship between portfolio returns and liquidity risk together with Fama & French three factors. To consider the existence of long-term co-integration relationship, F-test statistic given by ARDL bound test is computed. ARDL model is tested for corner portfolios i.e. P1 and P2 indicating liquid stocks portfolios; P9 and P10 representing illiquid stocks portfolios. First, to verify the validity of ARDL model, the traditional methods of unit root testing ADF, PP and KPSS tests are applied. For all the variables, results of ADF and PP tests do not accept the null hypothesis of non-stationarity at level implying that they are stationary and I(0). The KPSS test confirms the result as it does not reject the null hypothesis of stationarity.

Optimum ARDL model including the lags of dependent variable i.e. portfolio returns and independent variables i.e. market, size, value and liquidity risk factor is selected with minimum AIC. ARDL model outcomes are detailed in Table 10. It is essential to point out that the lags of independent variables are mostly zero indicating that previous months' risk has no information to explain variations in stock returns at NSE. Notably, portfolio returns of illiquid stocks i.e. P9 and P10 are positively related to liquidity risk factor signifying that investors demand extra return for investing in less liquid stocks, while returns on portfolios P1 and P2 are negatively related to liquidity risk factor suggesting that liquid stocks may provide lesser returns for a given amount of risk.

ARDL bound test calculated F-statistic values are above the upper bounds critical value at the 1% significance level. This means that the null hypothesis of no co-integrating long term relationship is rejected and hence, the existence of a long-term correlation between the variables involved in the specified ARDL model is confirmed. On the whole, there exists a long-term co-integrating relationship between portfolio returns and liquidity risk together with market, size and value risk factors at NSE.

L1: Trading Volume				
	P1	P2	P9	P10
ARDL Model	(1,0,0,0,0)	(2,0,0,0,0)	(1,0,0,0,0)	(1,0,0,0,0)
C	-0.0006	0.0032	-0.0025	0.0045*
P(-1)	0.0546**	0.0340	0.0125	0.0835***
P(-2)		0.0392		
Rm-Rf	0.9230***	0.8726***	0.8520***	0.8903***
SMB	1.6265***	1.2251***	1.4537***	1.7320***
LMH	0.2171*	0.5018***	0.5439****	0.3754***
IMV	-1.6381***	-1.3922***	0.5653**	0.7161***
Adj. R^2	0.8799	0.8759	0.8701	0.8677
ARDL Bounds Test				
F-Statistics	31.9521	17.9382	31.1638	26.0022
L2: Turnover				
	P1	P2	P9	P10
ARDL Model	(1,0,0,0,0)	(1,0,0,0,0)	(1,0,0,0,0)	(1,0,0,0,0)
C	-0.0018	0.0014	0.0002	-0.0019
P(-1)	0.0335	0.0585**	0.0564*	0.0666**
Rm-Rf	0.8972***	0.8580***	0.9033***	0.8266***
SMB	1.5676***	0.9129***	1.1141***	1.2432***
LMH	0.4931***	0.5174***	0.5318***	0.5726***
IMV	-2.2224***	-1.2865***	0.6623***	0.4959***
Adj. R^2	0.8953	0.8888	0.8472	0.8275
ARDL Bounds Test				
F-Statistics	34.5335	31.3792	25.4715	27.1447

L3: Quoted Spread				
	P1	P2	P9	P10
ARDL Model	(1,0,0,0,0)	(1,0,0,0,0)	(1,0,0,0,0)	(1,0,0,0,0)
C	-0.0001	-0.0006	-0.0025	0.0014
P(-1)	0.0476*	0.0462*	0.0515**	0.0563**
Rm-Rf	0.9311***	0.8784***	0.9016***	0.9097***
SMB	0.9343***	1.6866***	1.1254***	1.2623***
LMH	0.3537***	0.4369***	0.4613***	0.4859***
IMV	-1.1296***	-1.4534***	0.7497***	1.1506***
Adj. R^2	0.8765	0.8745	0.8762	0.8725
ARDL Bounds Test				
F-Statistics	33.5273	33.6575	27.9440	25.6663
L4: Amihud Illiquidity Ratio				
	P1	P2	P9	P10
ARDL Model	(2,0,0,0,0)	(1,0,0,0,0)	(1,0,0,0,0)	(1,0,0,0,0)
C	-0.0009	-0.0012	-0.0016	0.0015
P(-1)	0.0162	0.0344	0.0158	0.0595**
P(-2)	-0.0428*			
Rm-Rf	0.9979***	0.9047***	0.9197***	0.8965***
SMB	0.2693	0.6003**	0.6503**	1.3012***
LMH	0.2584**	0.8464***	0.5746***	0.3942***
IMV	-0.5270***	-0.8717***	1.2478***	1.1311***
Adj. R^2	0.8765	0.8639	0.8698	0.8667
ARDL Bounds Test				
F-Statistics	22.1168	35.1881	35.6942	39.2858

Conclusion

This study investigates the effect of liquidity on the pricing of securities at NSE with a sample of Nifty 500 stocks for a time span from 1st April, 2000 to 31st March, 2017 by employing four alternate liquidity proxies, namely trading volume, turnover rate, relative spread and Amihud Illiquidity ratio to strengthen the robustness of results.

In harmony with Amihud & Mendelson (1986), we have found the presence of strong liquidity premium and a significantly negative relationship between liquidity and expected stock returns at NSE. It is evidenced that investors are recompensed with extra returns for being exposed to liquidity risk. Among the various pricing models employed, liquidity augmented Fama & French three-factor model turned out to be the best in explaining variation in stock returns at NSE. The results of ARDL bound test confirms the presence of long-term co-integrating relationship between stock returns and liquidity risk together with market, size and value risk factors. Therefore, we conclude that the liquidity risk is significantly priced at NSE such that illiquid stocks outperformed liquid stocks' portfolio and the strength of results are proved using four alternative proxies of liquidity.

Applicability and Generalizability

Liquidity premium is observed in the Indian stock market where investors are compensated with superior returns for including less liquid or illiquid stocks in their portfolio. The findings of the study can be generalised to the equity market of other emerging economies that are congruent to the Indian stock market. The research has significant strategic inferences and is of pertinent use for companies, regulators and policymakers, stock analysts and the entire investment community. Investors and analysts may adopt a liquidity-based investment strategy that may provide extra risk-adjusted returns instead of relying only on fundamental and technical portfolio management analysis. Companies should enhance the liquidity of assets and increase transparency in their operations with better information availability to reduce their cost of capital. Companies can go for voluntary disclosures, even if they were not mandatory, publish forecasts and other data and provide ratings for their assets for improving liquidity to lessen the yield. The study illustrates the significance of microstructure and policies designed to enhance liquidity of securities and the market as a whole. Market regulators need to introduce strict norms and rules to facilitate a well-organized competitive market environment for exchange of securities. Proper designing of trading system, efficient execution of transactions, fair competition among market participants, enforcing rules that equalize disclosure to investors, bring transparency in companies' operations and restrict trading on insider information can boost liquidity and thereby promote investment and economic growth in the country.

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