Business & Economic Review: Vol. 13, No.2 2021 pp. 57-86
DOI: dx.doi.org/10.22547/BER/13.2.3

Liquidity and Cross-Sectional Variation in Stock Returns: An Emerging Market Study

Sana Tauseef[1]

Abstract

The study investigates the existence of liquidity premiums and the relationship between liquidity and equity returns in Pakistan. We estimate stock liquidity using three different measures: stock turnover, illiquidity cost following Amihud (2002), and liquidity beta following Pastor and Stambaugh (2003). For the non-financial firms listed on Pakistan Stock Exchange, we conduct asset pricing tests including liquidity factor in addition to the well-known factors of market, size, book-to-market and momentum. We report significant market, size, BM, momentum, and liquidity premiums in Pakistan's equity market. Further, the relationship between liquidity factor and stock returns is not consistent for the different liquidity measures used. We document a positive relationship between stock turnover and returns; however, a negative relationship between liquidity and returns is confirmed using the Amihud illiquidity cost and Pastor and Stambaugh liquidity beta.

Keywords: *Liquidity, stock returns, asset pricing models, Pakistan Stock Exchange, emerging market*

1. Introduction

The well-known asset pricing models including the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model, and the Carhart Four-Factor Model explain significant cross-sectional variations in stock returns by using factors such as market risk, firm size, book-to-market (BM) ratio, and momentum (Sharpe, 1964; Lintner, 1965; Fama & French, 1992; Carhart, 1997). Literature documents that stock returns in the emerging markets can also be explained by the same risk factors (Akdeniz, Altay-Salih, & Aydogan, 2000; Al-Mwalla, 2012; Bundoo, 2008; Rouwenhorst, 1999; Serra, 2002). However, in addition to these four more recognized factors, the liquidity factor particularly interests investors in emerging equity markets. The emerging markets are characterized by fewer listed securities, a smaller investor base, and more informational inefficiencies; therefore, stock returns in these markets are likely to be more influenced by the liquidity factor (Bekaert, Harvey & Lundblad, 2007).

1 Assistant Professor, Institute of Business Administration (IBA), Karachi. Email: sasghar@iba.edu.pk

ARTICLE HISTORY

01 Mar, 2021 Submission Received	23 Mar, 2021 First Review
27 Apr, 2021 Second Review	10 Jun, 2021 Accepted

This study examines the existence of liquidity premium and focuses on the role of liquidity in explaining cross-sectional variation in Pakistan's emerging stock market. The study is motivated by various factors. First, Pakistan's financial market has become increasingly attractive to local and foreign investors after the decision by the MSCI to upgrade the Pakistan Stock Exchange (PSX) from the frontier market to emerging markets in June 2016. As more local and foreign investors are now attracted to invest in Pakistan's equity, these investors would be interested in understanding how the various risk factors are priced in the market.

Second, the evidence on asset pricing from Pakistan's market remains limited and unclear. To date, only few studies (Haque & Sarwar, 2013; Iqbal & Azher, 2014; Mirza & Shahid, 2008; Rahman & Mohsin, 2012; Shah & Shah, 2015; Tauseef & Nishat, 2018) have used Pakistan's stock data to examine the cross-sectional variations in stock returns. Of these, Rahman and Mohsin, Shah and Shah (2015) and Tauseef and Nishat (2018) have examined the momentum effect for Pakistan's stock returns in isolation and did not consider the market risk, firm size, and BM ratio. Mirza and Shahid (2008) explained the cross-sectional variation of Pakistan's stocks using a sample of 81 firms over the five-year period from 2003 to 2007 which was an overall bullish period for Pakistan's stock market. The study was conducted in a single market state making the results non-generalizable. On the contrary, Haque and Sarwar (2013) used a comparatively longer sample period (from 1998 to 2009) and a larger sample of 394 firms, but they provided their analysis based on individual stock returns instead of portfolio returns. Iqbal and Azher (2014) used the data over the period from October 1992 to June 2008 and included a fourth explanatory factor, value-at-risk (VaR). The findings reported by the three studies are contradictory. Iqbal and Azher (2014) and Mirza and Shahid (2008) confirmed the existence of the size and value premiums for Pakistan's stocks; however, Haque and Sarwar (2013) found equity returns in Pakistan to be better explained by the CAPM model. Further, Iqbal and Azher (2014) reported that VaR is stronger in explaining equity returns than the market, size, and BM factors. These inconsistent findings may have resulted due to different sample periods and methodologies employed in previous studies. This makes it important to cross-check the results with an extended and more recent sample period and using a standard methodology. Thus, we re-examine the factors that explain the cross-sectional variations in stock returns and compare the validity of various asset pricing models with extended data from PSX.

Finally, Pakistan's equity market being characterized by small number of investors, high volatility and less transparency is a typical emerging market. Further, liquidity level of PSX is low that leads to less synchronicity in prices and low market size (Kanasro, Jalbani & Junejo, 2009). Considering the illiquidity risk involved in trading on PSX,

it is important to assess the existence of liquidity premiums and the relationship between liquidity factor and equity returns. Hence, we examine the impact of liquidity on stock returns in Pakistan. Sadaqat and Butt (2017) and Saeed and Hassan (2018) provide evidence of relationship between liquidity and stock returns in Pakistan. Our study differs from these existing studies in several ways. Sadaqat and Butt (2017) estimated single measure of market illiquidity as the ratio of monthly zero returns over total trading days in a month, whereas Saeed and Hassan (2018) used five different measures to gauge liquidity in one sector of Pakistan's market. We perform a more comprehensive analysis by using three different liquidity measures for return analysis of all stocks on PSX. Literature suggests that liquidity, both on a firm-specific level and the aggregate level, has an effect on stock returns. Hence, we use two liquidity measures, stock turnover and Amihud illiquidity cost, which consider liquidity as a firm-specific characteristic, and a third liquidity measure, the Pastor and Stambaugh liquidity beta, which measures liquidity as a systematic factor. Moreover, none of the existing studies examined the role of liquidity factor in context of multi-factor asset pricing model. We construct the liquidity factor in line with the traditional size, BM and momentum factors using each of three liquidity measures, and examine if liquidity explains the cross-sectional variation in stock returns through employing a five-factor asset pricing model.

Rest of the paper is organized as follows. Section 2 provides review of literature, section 3 explains data and methodology, section 4 discusses the results and section 5 concludes.

2. Literature Review

2.1. Cross-sectional variation in stock returns

The presence of anomalies in the financial markets is indicative of the market inefficiency. These anomalies attract the attention of the investment professionals since these anomalies can be used as the basis of investment strategy to earn superior returns. There is mounting empirical evidence that multiple risk factors across stocks are correlated with stock returns. These risk factors, including the market factor, firms' fundamental factors, technical factors, and macroeconomic factors, either individually or jointly, help explain a significant portion of cross-sectional variations in stock returns. Because of investors' risk aversion, the classic theory of asset pricing suggests that investors should be compensated for the risk; this makes the expected returns on stocks an increasing function of the risk factors.

Sharpe (1964) and Lintner (1965) presented a single-factor asset pricing model, Capital Asset Pricing Model (CAPM) that hypothesized market risk (called beta) to

be the only factor explaining stock returns. However, the empirical tests performed during 1970s rejected the single-factor model (Blume & Friend, 1973; Friend, Westerfield & Granito, 1978), after which firm's fundamental factors appeared significant in explaining the stock returns. Though a number of fundamental variables are used in literature, two of these (firm size and BM) gained special attention. Negative relationship between firm size and stock returns (Banz, 1981) and the positive relationship between BM and stock returns (Stattman, 1980) became popular with the influential work of Fama and French (1992). The Fama-French (FF) model used the two variables, size and BM, along with market risk factor to explain cross-sectional variation in stock returns. The study concluded that the two fundamental factors capture the effect of fundamental variables and fully explain the cross-section of average stock returns. FF three-factor model was then tested widely across various markets and time periods and proved to be valid in most cases (Drew & Veeraraghavan, 2002; Drew, Naughton & Veeraraghavan, 2003; Fama & French, 1995; Walkshausl & Lobe, 2014)

In 1993, Jegadeesh and Titman presented the momentum anomaly which suggests that the stocks which perform better in past continue to outperform in future period and the stocks which underperform in past continue to underperform in future. Based on this persistent price behavior, a momentum trading strategy can be used. The strategy involves buying stocks with good past performance and selling stock with poor past performance. The momentum factor was added as the fourth factor in the FF three-factor model by Carhart (1997) and the revised model was found to be superior compared to three-factor model in explaining the stock returns.

2.2. Liquidity and stock returns

Liquidity is the ability of investors to buy or sell stocks in large quantities at low cost and without substantially affecting prices. Because liquidity is not directly observable, different liquidity proxies have been used in the literature, such as bid-ask spread, trading volume, turnover ratio, price impact, and price reversal (Amihud & Mendelson, 1986; Datar, Naik & Radcliffe, 1998; Pastor & Stambaugh, 2003; Chordia, Huh & Subrahmanyam, 2007). Furthermore, some studies regard liquidity as a firm-specific characteristic, but others treat it as a systematic risk factor. The different liquidity measures capture different dimensions of liquidity; therefore, the findings using these different measures are mixed. However, the majority of the studies that have related liquidity and stock returns have established a negative relationship between the two, and this implies that the illiquid stocks compensate investors by offering higher returns (for example, Brennan & Subrahmanyam, 1996; Bekaert et al., 2007).

Amihud and Mendelson (1986) in their seminal work introduced illiquidity as an asset's characteristic that is priced in the market. They proposed that the bid-ask

spread proxies for the illiquidity risk because the stocks of the firms with incomplete public information are thinly traded and carry a higher bid-ask spread. They found a positive correlation between the stocks' the bid-ask spread and returns and proposed that investors require a compensation for bearing the illiquidity. Hence, the expected returns are an increasing function of the stocks' illiquidity costs. The Amihud and Mendelson (1986) related propositions on the positive relation between stock returns and illiquidity completely negated the findings previously proposed by James and Edmister (1983) that reported inexistence of liquidity premiums.

Since the seminal work, the theory has been tested in many studies and using different liquidity measures. Brennan and Subrahmanyam (1996), for example, used the intraday transactions data, including the bid-ask quotations, transaction timings, prices, and quantities, to calculate the fixed (unrelated to order size) and variable (dependent on order size) components of transaction costs, Datar et al. (1998) used stock turnover as a measure of liquidity, and Amihud (2002) employed illiquidity cost computed as the ratio of the absolute return of a stock to its dollar volume.

The link between a single stock's liquidity and aggregate market liquidity has also been studied in literature. Pastor and Stambaugh (2003) constructed a liquidity measure that captures the return reversal associated with a given order flow. Their study documented that the volume shocks showed a reversal effect and the illiquid stocks experienced a larger expected return reversal. Moreover, using this liquidity measure for individual stocks, they calculated aggregate systematic liquidity and reported that the stocks whose returns are more sensitive to the changes in aggregate liquidity earned higher returns. Uddin (2009) observed that the stock's liquidity is dependent on and hence should be considered together with the market-wide liquidity. An infrequently traded stock can be called illiquid during a period of high market liquidity, but it cannot be called illiquid during the period when the overall market is illiquid. The liquidity risk and, therefore, the liquidity premium increases more than proportionately as the stock becomes more illiquid. Based on this observation, Uddin suggested a relative liquidity measure, which was computed as the ratio of a stock's turnover volume to the average market turnover volume and was found to be negatively linked to the stock's excess return.

Since there are numerous measures of liquidity used in literature, it is important to check if these measures are related and capture the correct effect. Korajczyk and Sadka (2008) found that there is commonality across stocks for each measure of liquidity used in the literature and that these common factors are correlated across different measures of liquidity. Their study reported that the significant pricing results documented in the literature using different measures of liquidity appear to be consistent with an underlying common liquidity factor. Similarly, Goyenko, Holden,

and Trzcinka (2009) compared the different proxies for liquidity used in the literature to determine if these proxies actually measure liquidity. Their study found a close association between many of the liquidity measures and actual transactions costs, and they concluded that the literature had generally not been flawed in the assumption that liquidity proxies measure liquidity.

2.3. Empirical evidence from Pakistan

Evidence on cross-sectional variation in returns from Pakistan's market is limited and inconclusive. Iqbal and Azher (2014) and Mirza and Shahid (2008) confirmed the existence of the size and value premiums on PSX and concluded that the three-factor FF model performs adequately for Pakistan's stocks. On the contrary, Haque and Sarwar (2013) documented that the failure of FF model in explaining equity returns.

Relating to the liquidity factor, the first evidence for Pakistan's market was documented by Amihud, Hameed, Kang and Zhang (2012) who examined the pricing of illiquidity in equity markets globally and included Pakistan as one of the nineteen emerging countries in the sample. The impact of liquidity on stock performance in Pakistan has been confirmed recently by Sadaqat and Butt (2017) and Saeed and Hassan (2018). For example, Sadaqat and Butt (2017) employed liquidity-augmented CAPM and justified that the higher returns resulting from size and volatility related anomalies in Pakistan compensate the investors against exposure to the higher levels of market and liquidity risk factors. Similarly, Saeed and Hassan (2018) provided evidence of a bi-directional linkage between liquidity and stock returns from oil and gas sector of Pakistan. However, these studies used different liquidity measures and did not analyze liquidity factor in context of multi-factor asset pricing model. Hence, this study is an attempt to explain the variability of stock returns in Pakistan through testing and comparing the validity of the CAPM, the Fama-French Three-Factor Model, and the Carhart Four-Factor Model and through performing the cross-sectional analysis including liquidity factor.

3. Data and Methodology

This study uses stock data for non-financial firms listed on PSX over the period from January 2000 to December 2015. The selected study period is a post-reform period when the financial system, including the equity market of Pakistan, was strong and diversified. Moreover, the study period is justified based on the availability of financial data during this time period. The analysis is performed on the complete period which includes both expansionary and recessionary market states. Our sample consists of all firms with available data on stock prices, trading volume, book values and market capitalization values. We excluded the firms with negative book equity

and thin trading (when the firm's stock didn't trade on at least 50 percent of the days for each year (July of year *t* to June of the year *t+1*)). Based on these criteria, 132 non-financial firms were selected to be included in the sample. KSE-100 Index is used in this study as the proxy for a market portfolio. And six-month Treasury bill rate was used as the proxy for the risk-free return.

Data are obtained from multiple sources. The total return prices of the stocks are taken from the Bloomberg database. The data on stocks' market capitalization and firms' book equity values are taken from the State Bank of Pakistan, and the missing values are filled in from the Pakistan Stock Exchange. The daily trading volume and KSE-100 index series are taken from the Pakistan Stock Exchange, and the monthly time series of the 6-month Treasury bill rates is taken from the State Bank of Pakistan.

To compute the factor premiums and run regression models, we sorted the sample stocks into portfolios based on size, book-to-market (BM), and momentum and liquidity factors. Firm size for stock was measured by taking the natural log of its market capitalization, BM was calculated by dividing stock's book equity value by its market equity value (market capitalization) and momentum was estimated as the average of past twelve monthly returns. We used three different measures of liquidity:

a. Stock turnover. Following Datar et al. (1998), the stock turnover for each firm *i* at the end of each month *t* was calculated as the ratio of traded shares to the outstanding shares (Equation 1):

$$LIQ_{i,t} = \frac{MeanVOL_{i,t}}{NOSH_{i,t}} \qquad \text{(Equation 1)}$$

Where Mean $VOL_{i,t}$ is the mean trading volume of stock *i* for month *t* calculated as the average trading volume of shares for three months, *t, t-1* and *t-2* and $NOSH_{i,t}$ is the number of shares outstanding for stock *i* at the end of month *t*. Dividing the trading volume by number of shares outstanding in calculation of stock turnover eliminates the size bias from the measure.

b. Amihud Illiquidity Cost. Following Amihud (2002), illiquidity cost for each firm i at the end of each day *d* was calculated as the ratio of absolute stock return to its dollar trading volume (Equation 2):

$$ILLIQ_{i,d} = \frac{|R_{i,d}|}{VOLD_{i,d}} \qquad \text{(Equation 2)}$$

Where $R_{i,d}$ is the return on stock *i* for day *d* and $VOLD_{i,d}$ is the respective daily volume in dollars. The ratio gives the absolute (percentage) daily price change per dollar of daily trading volume and shows the price response to the order flow. Monthly illiquidity measure, $ILLQ_{i,t}$, for month *t* is calculated by taking an average of overIL-$LIQ_{i,d}$ the number of days in month *t* Equation 3):

$$ILLQ_{i,t} = \frac{\sum_d ILLIQ_{i,d}}{N_{i,t}} \quad \text{(Equation 3)}$$

Where $N_{i,t}$ is the number of trading days for stock *i* in month *t*. The ratio is calculated for the stocks that have been traded on at least five days in a month.

c. Pastor and Stambaugh Liquidity Beta. Following Pastor and Stambaugh (2003), liquidity for stock *i* in month *t* was estimated as the ordinary least squares estimate $\gamma_{i,t}$ of in the following regression (Equation 4):

$$r^e_{i,d+1,t} = \theta + \phi_{i,t} r_{i,d,t} + \gamma_{i,t} sign\left(r^e_{i,d,t}\right).VOLD_{i,d,t} + \in_{i,d+1,t} \quad \text{(Equation 4)}$$

Where $r_{i,d,t}$ is the return on stock *i* for day *d* in month *t*, $r^e_{i,d,t}$ is the excess return on stock *i* for day *d* in month *t* calculated as $r_{i,d,t} - r_{m,d,t}$ where $r_{m,d,t}$ is the return on KSE-100 Index for day *d* in month *t*, $VOLD_{i,d,t}$ and is the dollar volume for stock *i* for day *d* in month *t*. Liquidity is calculated for a stock *i* in month *t* only if there are at least 10 observations of that stock in that month. The measure captures the temporary impact of trading volume on stock price and can be viewed as liquidity cost. For less liquid stocks, the return reversal for a given dollar volume is expected to be higher; hence $\gamma_{i,t}$ is expected to be more negative. To construct the measure of market liquidity in month *t*, an equally weighted average of the liquidity measure of individual stocks in month *t* was taken. To remove the impact of outliers while averaging, we used a 95 percent winsorization. Further, since the overall size of the stock market had risen substantially over the sample period (total market value of the stocks included in sample was PKR 137.06 billion at the beginning of the sample period, and it stood at PKR 2.43 trillion at the end of the sample period), the aggregate measure was scaled using the factor m_t/m_1 where m_t refers to the total dollar value of stocks included in the sample at the end of month *t* and m_1 refers to the total dollar value of stocks included in the sample at the end of the first month of the sample period (January 2001). The innovation to aggregate liquidity was then constructed as the time series residuals from the following autoregressive model (Equation 5):

$$\Delta\hat{\gamma}_t = \alpha + b\Delta\hat{\gamma}_{t-1} + c\left(\frac{m_t}{m_1}\right)\hat{\gamma}_{t-1} + d\sigma_{m,t} + \mu_t \quad \text{(Equation 5)}$$

Where $\Delta\hat{\gamma}_t = \left(\frac{m_t}{m_1}\right)\frac{1}{N}\sum_{i=1}^{N}(\hat{\gamma}_{i,t} - \hat{\gamma}_{i,t-1})$ and $\sigma_{m,t}$ is the measure of market volatility for month *t* calculated as the standard deviation of daily market indices during the month. Liquidity beta for each stock, β_i^L, was obtained by regressing the stock returns on this residual series. The liquidity beta captures the stocks' co-movement with the aggregate market liquidity.

The factor returns were calculated using two different approaches. The first approach involved creating the factor premiums on the basis of a single risk dimension and reflects the premium offered by the stocks for that specific risk factor only. The

stocks were sorted into quintiles (one-dimensional portfolios) based on each risk factor and the difference between the excess returns for portfolios with highest and lowest risk factors was taken. The second approach for computing the factor returns used the sequentially sorted portfolios and computed the premium for one factor while controlling for other factors. The stocks were first sorted on basis of their size in two portfolios, small and large. Each of these portfolios was then sorted based on their book-to-market (high or low) resulting in a total of four portfolios, Each of these four portfolios was then sorted into two portfolios based on their momentum (winner or loser). Finally, the stocks in each of the resulting eight portfolios were sorted in two portfolios (liquid and illiquid) based on their liquidity, resulting in a total of sixteen portfolios.

Liquidity-based sorting was performed thrice based on each liquidity measure; hence, the 16 sequential portfolios were formed for each of the three liquidity measures. The description of these sixteen portfolios is given in Table 1. To calculate the factor return, the difference between the average return of the eight portfolios high in that risk factor and the average return of the eight portfolios low in that risk factor was taken.

To test the validity of various asset pricing models in Pakistan, we estimate the following regressions for the portfolios sorted on the basis of size, BM, and one-year momentum factors (Equations 6, 7, 8, and 9):

Single-factor model: $ER_{p_i,t} = \alpha + \beta MKT_t + \varepsilon_{p_i}$ (Equation 6)

Three-factor model: $ER_{p_i,t} = \alpha + \beta MKT_t + \gamma SMB_t + \theta HML_t + \varepsilon_{p_i}$ (Equation 7)

Four-factor model: $ER_{p_i,t} = \alpha + \beta MKT_t + \gamma SMB_t + \theta HML_t + \delta WML_T + \varepsilon_{p_i}$ (Equation 8)

Five-factor model: $ER_{p_i,t} = \alpha + \beta MKT_t + \gamma SMB_t + \theta HML_t + \delta WML_T + \rho IML_t + \varepsilon_{p_i}$ (Equation 9)

Where$ER_{pi,t}$ is the excess return of portfolio *i* for month *t*, SMB_t, HML_t, WML_t, IML_t and are size, BM, momentum, and liquidity factor returns, respectively for month *t*.

Table 1: Description of Sequential Portfolios

Portfolio Name	Portfolio Definition
IBLL	Big stocks with low BM, low prior return,, and low liquidity
LBLL	Big stocks with low BM, low prior return,, and high liquidity

IBLW	Big stocks with low BM, high prior return,, and low liquidity
LBLW	Big stocks with low BM, high prior return, and high liquidity
IBHL	Big stocks with high BM, low prior return, and low liquidity
LBHL	Big stocks with high BM, low prior return, and high liquidity
IBHW	Big stocks with high BM, high prior return, and low liquidity
LBHW	Big stocks with high BM, high prior return, and high liquidity
ISLL	Small stocks with low BM, low prior return, and low liquidity
LSLL	Small stocks with low BM, low prior return, and high liquidity
ISLW	Small stocks with low BM, high prior return, and low liquidity
LSLW	Small stocks with low BM, high prior return, and high liquidity
ISHL	Small stocks with high BM, low prior return, and low liquidity
LSHL	Small stocks with high BM, low prior return, and high liquidity
ISHW	Small stocks with high BM, high prior return, and low liquidity
LSHW	Small stocks with high BM, high prior return, and high liquidity

Note: To construct the portfolios, we sorted stocks into two size-based portfolios, big and small. Each of these was then sorted into BM-based portfolios, high and low. Each of resulting four portfolios was then sorted into two momentum-based portfolios, winner and loser. Each of these eight portfolios was then sorted into two liquidity-based portfolios, resulting in a total of sixteen portfolios.

4. Empirical Results and Analysis

4.1. Properties of liquidity-sorted portfolios

Descriptive statistics presented for the liquidity-sorted portfolios in Table 2 show that there is a huge dispersion in liquidity across the sample stocks. The average stock turnover ratio for the most liquid portfolio is 72.55 percent, which is around 450 times larger than the average turnover ratio for the least liquid portfolio. Similarly, the illiquidity cost goes up to 0.25 percent for the illiquid stocks and drops to zero for the liquid stocks, and the average liquidity beta stands at 2.48 for the liquidity-sensitive portfolio as opposed to -2.34 for the portfolio on the other extreme.

Though the three liquidity measures used in the study capture different dimensions of liquidity, most of the relationships that can be deciphered between the four factors of market risk, size, and BM, and the liquidity measures remain the same regardless of the specific liquidity measure used. The most liquid portfolios have the highest market risk and are comprised of big stocks with low BM. High market risk implies that the liquid portfolio must earn a high return; however, big size and low BM justifies a low return on this portfolio and thus makes the relationship between

liquidity and average return less clear. While the average returns are highest for the portfolios with the highest liquidity cost and liquidity beta, the portfolio with the lowest turnover ratio earns the lowest return among the five turnover-based sorted portfolios.

A comparison of the size of the most illiquid portfolios constructed using different liquidity measures shows that the average size of the firms in the portfolio with the lowest turnover ratio is not as small as the average size of illiquid firms sorted on the basis of illiquidity cost or liquidity betas. This causes the size effect and size premium to be less prominent in the turnover-based illiquid portfolio, which might be a reason for its low return. Further, among all portfolios, least liquid portfolio based on Amihud measure clubs stocks with lowest size and highest BM and generates the highest excess return (3.8 percent) whereas the most liquid stock clubs stocks with biggest size and lowest BM indicating strongest size and BM effects when sorting is based on Amihud measure. While this pattern cannot be taken as a signal of which measure of liquidity is more accurate, it does show that there are substantial differences in the liquidity measures used, and this can lead to different conclusions regarding the significance of liquidity risk in asset pricing in our further analysis.

Table 2: Properties of Liquidity-Sorted Portfolios

Portfolio	Liquidity	Excess Return	Beta	Size (Millions PKR)	BM
Panel A: Average Stock Turnover Ratio					
LIQ-1	0.002	0.015	0.283	802.053	2.074
LIQ-2	0.007	0.019	0.463	617.885	2.121
LIQ-3	0.019	0.024	0.519	522.058	2.281
LIQ-4	0.049	0.028	0.696	692.793	2.554
LIQ-5	0.726	0.028	1.017	2107.308	1.682
Panel B: Amihud Illiquidity Cost					
LIQ-1	0.251	0.038	0.475	109.868	4.272
LIQ-2	0.005	0.019	0.448	360.808	2.315
LIQ-3	0.001	0.018	0.472	669.389	1.819
LIQ-4	0.000	0.021	0.649	1848.489	1.271
LIQ-5	0.000	0.017	0.930	7900.393	0.977
Panel C: Pastor and Stambaugh Liquidity Beta					
LIQ-1	2.484	0.028	0.555	430.458	2.744

LIQ-2	0.811	0.025	0.618	853.327	2.197
LIQ-3	0.064	0.018	0.564	1005.017	1.757
LIQ-4	-0.678	0.019	0.585	1384.381	1.689
LIQ-5	-2.340	0.023	0.660	786.230	2.276

Note: Sample stocks were sorted into five portfolios based on each liquidity measure. LIQ-1 comprises of twenty percent stocks with lowest liquidity and LIQ-5 comprises of twenty percent stocks with highest liquidity.

4.2. Validity of single-, three-, and four-factor models

Results of the single-factor model (CAPM) run on one-dimensional and sequentially-sorted portfolios are presented in Table 3. Looking at the coefficients, the exposure of biggest size portfolios (SIZE-5) is highest (0.822) to market risk in comparison to other size-based portfolios. Similarly, most liquid portfolio (LIQ-5) is most sensitive among liquidity-based portfolios to the market risk. The significant slope coefficients for all the portfolios support the existence of a market-risk premium for stock returns in Pakistan. On average, market risk is able to explain around 37.07 percent of variations in returns of one-dimensional portfolios and around 16.40 percent of variations in returns of sequentially sorted portfolios.

Tables 4 and 5 report the results of the three- and four-factor models, respectively. The size, BM and momentum premiums are significant for most of the portfolios, and this confirms that the investors in Pakistan's equity are rewarded for these factors. Looking at the coefficients for the liquidity-based portfolios from these tables, less liquid portfolio is less sensitive to market whereas more exposed to size, BM and momentum factors. The overall performance of the multi-factor models is adequate with the mean adjusted R-square for one-dimensional portfolios increasing drastically to 62.18 percent in three-factor model and 63.87 percent for four-factor model.

Despite the fact that the size, BM and momentum factors are significant for many of the portfolios in our study and the explanatory power of the model improves significantly by the addition of the size and BM factors, the market risk remained the most important factor explaining the stock returns. The finding is contrary to the one reported by Fama and French (1992), but the literature provides evidence of similar findings for other emerging markets, for example, Eraslan (2013) and Firozjaee and Jelodar (2010).

4.3. Aggregate liquidity analysis

To examine the role of the potential confounding impact of liquidity in explaining stock returns, we use three different liquidity measures. The three measures capture

Table 3: Single-Factor Market Model

	Panel A: One-Dimensional Portfolios				Panel B: Sequential Portfolios		
Portfolio	Coefficient	p-value	Adjusted R-square	Portfolio	Coefficient	p-value	Adjusted R-square
SIZE-1	0.483	0.000	0.112	IBLL	0.362	0.000	0.166
SIZE-2	0.429	0.000	0.212	LBLL	0.804	0.000	0.441
SIZE-3	0.488	0.000	0.320	IBLW	0.297	0.000	0.111
SIZE-4	0.648	0.000	0.536	LBLW	0.761	0.000	0.384
SIZE-5	0.822	0.000	0.779	IBHL	0.463	0.000	0.151
BM-1	0.581	0.000	0.565	LBHL	0.862	0.000	0.429
BM-2	0.638	0.000	0.561	IBHW	0.287	0.000	0.088
BM-3	0.597	0.000	0.421	LBHW	0.807	0.000	0.366
BM-4	0.478	0.000	0.212	ISLL	0.155	0.029	0.022
BM-5	0.516	0.000	0.158	LSLL	0.495	0.000	0.161
MMT-1	0.604	0.000	0.330	ISLW	0.132	0.099	0.010
MMT-2	0.518	0.000	0.326	LSLW	0.483	0.000	0.176
MMT-3	0.590	0.000	0.444	ISHL	0.228	0.048	0.017
MMT-4	0.580	0.000	0.451	LSHL	0.449	0.000	0.077
MMT-5	0.518	0.000	0.292	ISHW	0.335	0.001	0.060
LIQ-1	0.223	0.000	0.079	LSHW	0.443	0.000	0.085
LIQ-2	0.339	0.000	0.144				
LIQ-3	0.482	0.000	0.265				
LIQ-4	0.718	0.000	0.432				
LIQ-5	1.042	0.000	0.700				

Note: Turnover rate is used to sort the stocks on basis of liquidity. The table reports the estimated results of Equation 6.

different dimensions of liquidity; therefore, the first question posed relates to whether the trends in these measures are consistent over the study period. To assess this, we construct the measure of aggregate liquidity in each month over the study period as an equally weighted average of the respective liquidity measure of individual stocks taken after excluding the stocks with the calculated liquidity in the extreme 2.5 percent in each month. We plot the aggregate liquidity over the study period in Figure 1. Panel A of the figure shows the average stock turnover for the sample firms. The market experienced frequent high jumps in liquidity over the period from June 2003 till March

2005 and the high liquidity during this period is consistent with the high returns of the market. There was another severe downward spike in liquidity during 2008 when the financial crisis hit the economies around the globe. Similar trend in liquidity for the crisis period are found using the other two measures. There is a big jump in this liquidity cost (Panel B) and several severe downward spikes in Pastor and Stambaugh's price reversal measure (Panel C) for the period following the financial crisis.

The calculated correlation between the market return and the liquidity measures are not as strong as those reported in the literature; nevertheless, these correlations do take the expected signs. Stock turnover ratio is positively related to the change in market return (with a correlation of 0.10), and the change in Pastor and Stambaugh aggregate liquidity is positively associated with the change in market return (with a correlation of 0.05); whereas the change in Amihud illiquidity cost is negatively associated with the change in market return (a correlation of -0.04). These correlations suggest that the trends in the market returns and three liquidity measures appear to show consistency.

Table 4: Three-Factor Model

	Market		Size		BM		Adjusted R-square
	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	
Panel A: One-Dimensional Portfolios							
SIZE-1	0.809	0.000	0.950	0.000	0.061	0.249	0.904
SIZE-2	0.533	0.000	0.262	0.000	0.236	0.001	0.582
SIZE-3	0.569	0.000	0.247	0.000	-0.028	0.724	0.427
SIZE-4	0.717	0.000	0.209	0.000	-0.032	0.637	0.603
SIZE-5	0.810	0.000	-0.050	0.272	0.060	0.249	0.778
BM-1	0.667	0.000	0.320	0.000	-0.341	0.000	0.656
BM-2	0.688	0.000	0.160	0.006	-0.054	0.410	0.590
BM-3	0.712	0.000	0.360	0.000	-0.098	0.170	0.582
BM-4	0.631	0.000	0.415	0.000	0.192	0.006	0.682
BM-5	0.670	0.000	0.300	0.000	0.659	0.000	0.875
MMT-1	0.742	0.000	0.378	0.000	0.158	0.025	0.687
MMT-2	0.625	0.000	0.289	0.000	0.141	0.033	0.630
MMT-3	0.650	0.000	0.158	0.010	0.110	0.119	0.560
MMT-4	0.682	0.000	0.301	0.000	0.005	0.934	0.647

MMT-5	0.662	0.000	0.434	0.000	-0.044	0.556	0.576
LIQ-1	0.326	0.000	0.282	0.000	0.115	0.096	0.444
LIQ-2	0.468	0.000	0.380	0.000	-0.003	0.974	0.436
LIQ-3	0.603	0.000	0.344	0.000	0.077	0.297	0.558
LIQ-4	0.848	0.000	0.368	0.000	0.079	0.289	0.674
LIQ-5	1.116	0.000	0.198	0.002	0.098	0.168	0.774
Panel B: Sequential Portfolios							
IBLL	0.347	0.000	-0.060	0.584	-0.032	0.790	0.161
LBLL	0.719	0.000	-0.298	0.015	0.049	0.718	0.459
IBLW	0.334	0.000	0k2.139	0.217	0.012	0.922	0.114
LBLW	0.743	0.000	-0.079	0.551	-0.051	0.728	0.380
IBHL	0.360	0.000	-0.222	0.113	0.693	0.000	0.238
LBHL	0.761	0.000	-0.284	0.035	0.382	0.011	0.446
IBHW	0.308	0.000	0.137	0.250	0.292	0.027	0.148
LBHW	0.774	0.000	-0.075	0.604	0.217	0.178	0.366
ISLL	0.392	0.000	0.761	0.000	-0.449	0.000	0.218
LSLL	0.700	0.000	0.674	0.000	-0.319	0.046	0.252
ISLW	0.396	0.000	0.869	0.000	-0.395	0.006	0.221
LSLW	0.673	0.000	0.634	0.000	-0.252	0.088	0.272
ISHL	0.418	0.000	0.849	0.000	0.772	0.000	0.392
LSHL	0.663	0.000	0.865	0.000	0.441	0.025	0.320
ISHW	0.570	0.000	0.947	0.000	0.464	0.002	0.471
LSHW	0.720	0.000	1.083	0.000	0.395	0.018	0.453

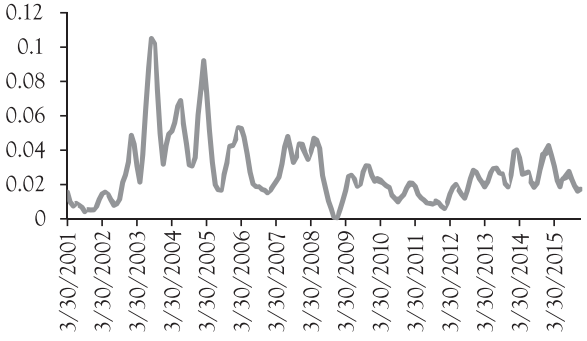
Note: Turnover rate is used to sort the stocks on basis of liquidity. The table reports the estimated results of Equation 7.

Table 5: Four-factor market model

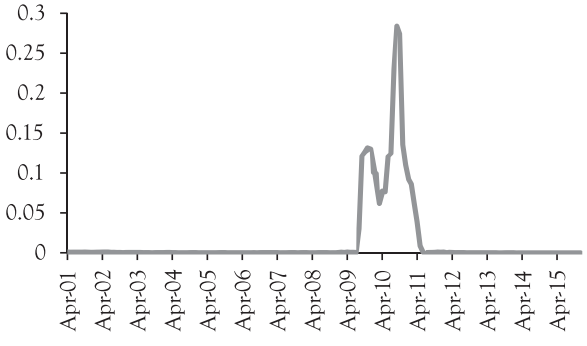
	Market		**Size**		**BM**		**Momentum**		**Adjusted R-square**
	Co-efficient	**p-value**	**Co-efficient**	**p-value**	**Co-efficient**	**p-value**	**Co-efficient**	**p-value**	
Panel A: One-Dimensional Portfolios									
SIZE-1	0.809	0.000	0.950	0.000	0.061	0.256	0.000	0.998	0.903
SIZE-2	0.547	0.000	0.252	0.000	0.271	0.000	0.171	0.003	0.601
SIZE-3	0.579	0.000	0.240	0.000	-0.002	0.977	0.125	0.046	0.437
SIZE-4	0.721	0.000	0.207	0.000	-0.023	0.731	0.041	0.448	0.602

SIZE-5	0.810	0.000	-0.050	0.274	0.060	0.260	0.020	0.998	0.777
BM-1	0.669	0.000	0.319	0.000	-0.337	0.000	0.020	0.649	0.654
BM-2	0.686	0.000	0.161	0.005	-0.060	0.370	-0.028	0.593	0.588
BM-3	0.720	0.000	0.354	0.000	-0.077	0.281	0.102	0.074	0.587
BM-4	0.640	0.000	0.409	0.000	0.212	0.003	0.102	0.068	0.686
BM-5	0.670	0.000	0.320	0.000	0.663	0.001	0.020	0.649	0.874
MMT-1	0.705	0.000	0.404	0.000	0.064	0.249	-0.467	0.000	0.811
MMT-2	0.629	0.000	0.286	0.000	0.152	0.023	0.054	0.308	0.630
MMT-3	0.650	0.000	0.158	0.011	0.110	0.125	-0.001	0.991	0.557
MMT-4	0.690	0.000	0.295	0.000	0.024	0.693	0.095	0.054	0.653
MMT-5	0.710	0.000	0.400	0.000	0.060	0.250	0.533	0.000	0.772
LIQ-1	0.335	0.000	0.276	0.000	0.137	0.047	0.113	0.041	0.454
LIQ-2	0.484	0.000	0.369	0.000	0.037	0.634	0.197	0.002	0.464
LIQ-3	0.604	0.000	0.343	0.000	0.080	0.290	0.012	0.840	0.555
LIQ-4	0.844	0.000	0.371	0.000	0.069	0.361	-0.050	0.411	0.674
LIQ-5	1.111	0.000	0.201	0.001	0.087	0.228	-0.057	0.325	0.774
Panel B: Sequential Portfolios									
IBLL	0.346	0.000	-0.025	0.817	-0.086	0.488	-0.306	0.043	0.176
LBLL	0.719	0.000	-0.286	0.021	0.030	0.828	-0.107	0.526	0.457
IBLW	0.335	0.000	0.105	0.353	0.065	0.608	0.303	0.051	0.128
LBLW	0.744	0.000	-0.133	0.311	0.033	0.822	0.482	0.008	0.402
IBHL	0.359	0.000	-0.194	0.172	0.649	0.000	-0.252	0.194	0.241
LBHL	0.761	0.000	-0.301	0.027	0.408	0.008	0.151	0.416	0.445
IBHW	0.309	0.000	0.090	0.449	0.365	0.006	0.418	0.011	0.175
LBHW	0.776	0.000	-0.158	0.265	0.344	0.031	0.730	0.000	0.411
ISLL	0.392	0.000	0.787	0.000	-0.489	0.000	-0.227	0.149	0.223
LSLL	0.700	0.000	0.695	0.000	-0.352	0.032	-0.186	0.352	0.251
ISLW	0.398	0.000	0.806	0.000	-0.297	0.036	0.564	0.001	0.264
LSLW	0.675	0.000	0.562	0.000	-0.141	0.332	0.638	0.000	0.319
ISHL	0.417	0.000	0.890	0.000	0.710	0.000	-0.356	0.114	0.397
LSHL	0.661	0.000	0.920	0.000	0.355	0.074	-0.491	0.044	0.332
ISHW	0.572	0.000	0.876	0.000	0.573	0.000	0.623	0.000	0.505
LSHW	0.722	0.000	0.991	0.000	0.538	0.001	0.820	0.000	0.500

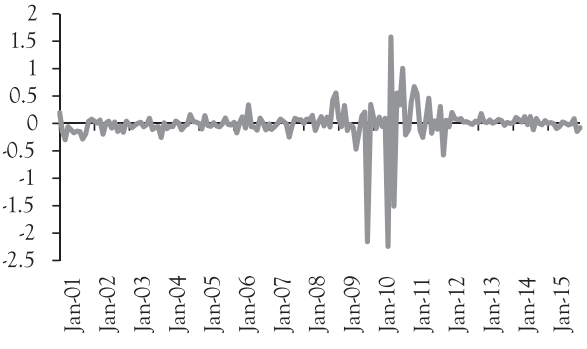
Note: Turnover rate is used to sort the stocks on basis of liquidity. The table reports the estimated results of Equation 8.



Panel A: Average stock turnover for sample firms



Panel B: Aggregate liquidity using the Amihud (2002) liquidity measure



Panel C: Aggregate liquidity using Pastor and Stambaugh's (2003) liquidity measure

Figure 1: Aggregate Liquidity over Study Period

4.4. Cross-sectional evidence on liquidity

To see the impact of liquidity on stocks returns, we estimated multiple-factor model (Equation 9), which included liquidity as a factor additional to the market, size, BM, and momentum factors. The regression was performed using each measure of liquidity: stock turnover, Amihud illiquidity cost, and Pastor and Stambaugh liquidity beta, and the results are presented in Tables 6, 7 and 8, respectively. The slope coefficient for

liquidity factor is significant for many portfolios, regardless of the liquidity measure used; thus, suggesting that liquidity is an important factor explaining cross-sectional variation of stocks. Interestingly, the coefficients of other factors were impacted with the inclusion of liquidity in the model. For the model with liquidity proxied by turnover ratio, the coefficients of the market factor reduced for some of the portfolios, suggesting that the liquidity as measured by turnover partly explains the cross-sectional market effect. The effect of the BM factor reduced with the addition of the liquidity factor proxied by Amihud illiquidity cost. The BM coefficients for some of the portfolios, which were significant in the four-factor model, turned insignificant with the addition of liquidity in the model. However, the traditional factors of market, size, BM and momentum do remain significant for many portfolios with an addition of liquidity facto implying that liquidity factor based on any of the three measures does not capture the impact of any traditional factor completely.

The slope coefficients reported for the turnover-based liquidity factor (Table 6) are negative which suggests that the strategy of investing in most liquid stocks provides superior performance. These results are in contrast to the negative relationship between turnover and returns documented by a number of studies (e.g., Brennan & Subrahmanyam, 1996; Datar et al., 1998); however, these findings are not unique. The positive relationship between the stock turnover and average returns is consistent with the evidence presented by Chordia et al. (2007). They argued that with the presence of positive feedback investors in the market, high positive returns in a period may trigger trading activity in the following period; this results in a positive relationship between returns and turnover and persistence in stock returns. Similarly, Brown, Crocker & Foerster (2009) claimed that the trading-volume-based measures can reflect other effects and for relatively liquid stocks, which are also big in size, the momentum and information content effects of trading volume measures are more prominent than the liquidity effect; this results in a positive relationship between trading volume and stock returns.

Due to the unavailability of data for non-surviving firms in Pakistan, our sample consists of the firms that existed for the complete sample period, and this might have biased our sample towards bigger size and higher liquidity. To extract the possible momentum effect, we regressed the portfolio returns on the previous periods' returns and ran the single-factor liquidity model using the residuals of that regression. The sign and the significance of the estimated coefficients remain the same, and, hence, we concluded that the turnover-based premiums are not caused by the momentum effect. However, we did not check for other potential effects of turnover, like information content, that might have influenced the liquidity measure.

The slope coefficients in the multiple-factor regression for the Amihud illiquidity

cost-based liquidity factor are positive for most portfolios (Table 7) suggesting that the strategy of investing in most illiquid stocks provides superior performance; thus, this confirms the well-established negative relationship between liquidity and stock returns. Stock returns are an increasing function of the illiquidity, and this liquidity premium represents a rational response by the market to the existence of the price reaction to a dollar of volume trading. Results of regression model using Pastor and Stambaugh liquidity betas (Table 8) suggest that the stocks which are more sensitive to the shocks in aggregate market liquidity earn higher returns. As cautioned by Pastor and Stambaugh (2003) that pricing based on liquidity betas might not be a result of pure liquidity effects, we checked the relationship between liquidity betas and other liquidity measures by calculating the correlation between the individual stock's liquidity betas and the other two liquidity measures over the sample period and averaged these correlations across the sample firms. The correlation between the liquidity beta and turnover rate was found to be -0.023, suggesting that the firms with high sensitivity to market liquidity are less liquid as measured by the trading volume. For the liquidity betas and Amihud illiquidity cost, the correlation was found to be 0.024, indicating that the firms with high sensitivity to market liquidity are less liquid as measured by the price impact of order flow. The signs of the correlation coefficients signify that liquidity betas for our sample reflect the liquidity effect, but the correlation values are small and not significant.

4.5. Robustness Analysis

It can be argued that our findings are sample-specific because the results are based on a short period and a small number of companies. However, although, relative to the studies of developed markets, our study period is short, the study used data that was available as far back in history as possible. We also perform certain robustness checks. First, due to the small number of stocks in the sample, we divided the sample stocks into quintiles and allocated approximately twenty percent of the stocks to each one-dimensional portfolio. However, in the literature, the arbitrage returns are mostly computed based on decile portfolios, and this implies that the high-risk portfolio in the literature has more risk concentration than the high-risk portfolio in this study. To make the portfolio construction consistent with the literature, we performed a separate analysis by using the decile portfolios with an allocation of approximately ten percent to the highest and lowest risk portfolios. Second, our study period includes various bullish and bearish trends, and we conducted the analysis using the entire data period without attempting to compare the factor returns for different market conditions. However, there was an unusual bear market period in 2008, when the floor rule was imposed in Pakistan's equity market, and this paralyzed the market for a few months. We performed all the analysis separately after excluding that period.

Table 6: Five-Factor Model (with stock turnover ratio as liquidity measure)

	Market		Size		BM		Momentum		Liquidity		Adjusted R-square
	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	
Panel A: One-Dimensional Portfolios											
SIZE-1	0.721	0.000	0.958	0.000	0.066	0.207	0.019	0.651	-0.113	0.010	0.906
SIZE-2	0.617	0.000	0.245	0.000	0.266	0.000	0.156	0.007	0.091	0.118	0.605
SIZE-3	0.556	0.000	0.242	0.000	-0.001	0.993	0.130	0.041	-0.031	0.634	0.434
SIZE-4	0.681	0.000	0.211	0.000	-0.021	0.761	0.050	0.366	-0.052	0.356	0.602
SIZE-5	0.721	0.000	-0.042	0.355	0.066	0.207	0.019	0.651	-0.113	0.010	0.784
BM-1	0.665	0.000	0.319	0.000	-0.337	0.000	0.021	0.644	-0.004	0.930	0.652
BM-2	0.536	0.000	0.176	0.002	-0.050	0.437	0.005	0.930	-0.194	0.000	0.617
BM-3	0.667	0.000	0.359	0.000	-0.074	0.303	0.114	0.050	-0.068	0.246	0.588
BM-4	0.638	0.000	0.409	0.000	0.212	0.003	0.103	0.072	-0.002	0.975	0.684
BM-5	0.665	0.000	0.319	0.000	0.663	0.000	0.021	0.644	-0.004	0.930	0.873
MMT-1	0.669	0.000	0.407	0.000	0.066	0.233	-0.459	0.000	-0.046	0.308	0.811
MMT-2	0.640	0.000	0.285	0.000	0.152	0.024	0.052	0.338	0.014	0.798	0.628
MMT-3	0.581	0.000	0.165	0.008	0.114	0.109	0.014	0.802	-0.089	0.128	0.561
MMT-4	0.610	0.000	0.303	0.000	0.030	0.629	0.113	0.024	-0.103	0.041	0.659
MMT-5	0.669	0.000	0.407	0.000	0.066	0.233	0.541	0.000	-0.046	0.308	0.772
LIQ-1	0.703	0.000	0.241	0.000	0.113	0.032	0.032	0.447	0.474	0.000	0.680
LIQ-2	0.545	0.000	0.363	0.000	0.033	0.671	0.184	0.004	0.079	0.217	0.466

LIQ-3	0.526	0.000	0.350	0.000	0.085	0.258	0.029	0.632	-0.100	0.106	0.559
LIQ-4	0.688	0.000	0.386	0.000	0.079	0.282	-0.016	0.791	-0.201	0.001	0.692
LIQ-5	0.703	0.000	0.241	0.000	0.113	0.032	0.032	0.447	-0.526	0.000	0.879
Panel B: Sequential Portfolios											
IBLL	0.266	0.000	-0.126	0.243	-0.014	0.917	-0.431	0.005	-0.144	0.192	0.228
LBLL	0.404	0.000	-0.409	0.000	0.249	0.031	-0.472	0.000	-0.771	0.000	0.691
IBLW	0.295	0.000	-0.154	0.170	0.375	0.006	0.364	0.021	0.115	0.312	0.165
LBLW	0.338	0.000	-0.180	0.082	0.174	0.166	0.258	0.074	-1.070	0.000	0.642
IBHL	0.300	0.001	-0.478	0.000	1.086	0.000	-0.445	0.017	0.055	0.684	0.350
LBHL	0.352	0.000	-0.401	0.000	0.763	0.000	-0.143	0.319	-1.047	0.000	0.690
IBHW	0.194	0.011	-0.302	0.007	0.854	0.000	0.549	0.001	0.004	0.968	0.291
LBHW	0.362	0.000	-0.339	0.006	0.710	0.000	0.567	0.001	-0.980	0.000	0.580
ISLL	0.320	0.000	0.722	0.000	-0.374	0.010	-0.359	0.032	-0.042	0.731	0.190
LSLL	0.310	0.001	0.770	0.000	-0.183	0.245	-0.411	0.024	-1.026	0.000	0.424
ISLW	0.324	0.000	0.524	0.000	-0.090	0.568	0.716	0.000	0.103	0.435	0.232
LSLW	0.255	0.002	0.465	0.000	0.061	0.668	0.582	0.001	-1.003	0.000	0.456
ISHL	0.354	0.000	0.751	0.000	1.376	0.000	-0.772	0.000	0.106	0.449	0.588
LSHL	0.206	0.046	0.782	0.000	1.294	0.000	-0.719	0.001	-0.968	0.000	0.531
ISHW	0.458	0.000	0.675	0.000	0.984	0.000	0.625	0.000	-0.036	0.764	0.594
LSHW	0.285	0.001	0.923	0.000	1.129	0.000	0.586	0.001	-0.971	0.000	0.646

Note: Turnover rate is used to sort the stocks on basis of liquidity. The table reports the estimated results of Equation 9.

Table 7: Five-Factor Model (with Amihud illiquidity cost as liquidity measure)

	Market		Size		BM		Momentum		Liquidity		Adjusted R-square
	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	
Panel A: One-Dimensional Portfolios											
SIZE-1	0.799	0.000	0.815	0.000	0.061	0.544	-0.020	0.823	0.096	0.522	0.879
SIZE-2	0.453	0.000	0.231	0.095	0.376	0.003	0.043	0.689	-0.048	0.788	0.593
SIZE-3	0.445	0.000	0.300	0.083	-0.049	0.742	0.025	0.850	-0.059	0.789	0.278
SIZE-4	0.597	0.000	0.283	0.047	-0.042	0.734	-0.001	0.993	-0.126	0.488	0.524
SIZE-5	0.799	0.000	-0.185	0.111	0.061	0.544	-0.020	0.823	0.096	0.522	0.754
BM-1	0.589	0.000	0.386	0.001	-0.293	0.003	-0.081	0.335	-0.130	0.347	0.700
BM-2	0.550	0.000	0.197	0.145	0.002	0.989	-0.177	0.097	-0.165	0.346	0.549
BM-3	0.539	0.000	0.220	0.052	-0.154	0.120	-0.079	0.371	0.059	0.686	0.562
BM-4	0.575	0.000	0.238	0.071	0.184	0.110	-0.015	0.882	0.248	0.145	0.683
BM-5	0.589	0.000	0.386	0.001	0.707	0.000	-0.081	0.335	-0.130	0.347	0.876
MMT-1	0.657	0.000	0.317	0.004	0.086	0.352	-0.589	0.000	0.086	0.532	0.810
MMT-2	0.567	0.002	0.687	0.039	-0.102	0.433	0.036	0.759	-0.465	0.227	0.532
MMT-3	0.316	0.036	0.482	0.010	-0.022	0.928	-0.314	0.133	0.018	0.939	0.796
MMT-4	0.581	0.000	0.298	0.164	0.235	0.133	-0.102	0.322	-0.202	0.377	0.659
MMT-5	0.657	0.000	0.317	0.004	0.086	0.352	0.411	0.000	0.086	0.532	0.750
LIQ-1	0.763	0.000	0.376	0.000	0.013	0.875	-0.030	0.689	-0.524	0.000	0.856
LIQ-2	0.473	0.000	0.023	0.881	0.052	0.696	-0.195	0.106	0.046	0.815	0.351

LIQ-3	0.431	0.000	0.424	0.002	0.151	0.194	-0.085	0.413	-0.213	0.217	0.546
LIQ-4	0.387	0.000	0.226	0.060	0.242	0.023	-0.100	0.287	0.072	0.638	0.629
LIQ-5	0.763	0.000	0.376	0.000	0.013	0.875	-0.030	0.689	0.476	0.000	0.873
Panel B: Sequential Portfolios											
IBLL	0.773	0.000	-0.063	0.424	0.021	0.796	-0.338	0.001	0.178	0.089	0.725
LBLL	0.547	0.000	-0.098	0.345	-0.186	0.083	-0.392	0.003	-0.427	0.002	0.378
IBLW	0.821	0.000	0.143	0.140	-0.031	0.759	0.088	0.473	0.436	0.001	0.649
LBLW	0.469	0.000	-0.141	0.177	0.154	0.156	0.404	0.003	-0.616	0.000	0.318
IBHL	0.754	0.000	-0.313	0.006	0.773	0.000	-0.567	0.000	0.303	0.045	0.673
LBHL	0.646	0.000	-0.256	0.044	0.627	0.000	-0.211	0.189	-0.581	0.001	0.460
IBHW	0.837	0.000	-0.154	0.201	0.540	0.000	0.358	0.020	0.185	0.246	0.592
LBHW	0.439	0.000	-0.074	0.478	0.503	0.000	0.603	0.000	-0.290	0.037	0.387
ISLL	0.636	0.000	0.803	0.000	-0.447	0.000	-0.485	0.000	0.363	0.009	0.457
LSLL	0.732	0.000	0.966	0.000	-0.506	0.000	-0.554	0.002	-0.579	0.002	0.413
ISLW	0.549	0.000	0.593	0.000	0.063	0.621	0.377	0.016	0.367	0.024	0.342
LSLW	0.759	0.000	0.840	0.000	-0.666	0.000	0.846	0.000	-0.532	0.002	0.461
ISHL	0.441	0.000	1.008	0.000	0.858	0.000	-0.119	0.461	0.770	0.000	0.597
LSHL	0.757	0.000	0.995	0.000	1.262	0.000	-1.390	0.000	-0.839	0.000	0.761
ISHW	0.475	0.000	1.027	0.000	0.624	0.000	0.630	0.000	0.587	0.000	0.577
LSHW	0.937	0.000	0.810	0.000	1.214	0.000	0.640	0.000	-0.947	0.000	0.757

Note: Amihud illiquidity cost is used to sort the stocks on basis of liquidity. The table reports the estimated results of Equation 9.

Table 8: Five-Factor Model (with Pastor and Stambaugh Beta as liquidity measure)

	Market		Size		BM		Momentum		Liquidity		Adjusted R-square
	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	Co-efficient	p-value	
Panel A: One-Dimensional Portfolios											
Small	0.816	0.000	0.958	0.000	0.066	0.217	0.011	0.801	-0.064	0.212	0.903
Size-2	0.539	0.000	0.250	0.000	0.260	0.000	0.162	0.006	0.063	0.356	0.598
Size-3	0.592	0.000	0.260	0.000	0.002	0.975	0.148	0.023	-0.110	0.140	0.444
Size-4	0.723	0.000	0.211	0.000	-0.023	0.731	0.044	0.439	-0.020	0.752	0.600
Large	0.816	0.000	-0.042	0.369	0.066	0.217	0.011	0.801	-0.064	0.212	0.778
Low-BM	0.671	0.000	0.323	0.000	-0.337	0.000	0.015	0.745	-0.026	0.620	0.653
BM-2	0.688	0.000	0.160	0.006	-0.055	0.405	-0.010	0.862	-0.001	0.982	0.585
BM-3	0.735	0.000	0.379	0.000	-0.074	0.299	0.102	0.084	-0.147	0.031	0.595
BM-4	0.633	0.000	0.402	0.000	0.208	0.003	0.120	0.039	0.078	0.239	0.689
High-BM	0.671	0.000	0.323	0.000	0.663	0.000	0.015	0.745	-0.026	0.620	0.873
Loser	0.709	0.000	0.391	0.000	0.081	0.149	-0.473	0.000	-0.031	0.567	0.805
MMT-2	0.640	0.000	0.302	0.000	0.158	0.018	0.067	0.226	-0.099	0.117	0.634
MMT-3	0.622	0.000	0.378	0.007	-0.052	0.688	0.190	0.305	-0.093	0.522	0.567
MMT-4	0.708	0.000	0.301	0.000	0.058	0.421	0.103	0.063	-0.166	0.013	0.656
Winner	0.709	0.000	0.391	0.000	0.081	0.149	0.527	0.000	-0.031	0.567	0.761
Illiquid	0.685	0.000	0.369	0.000	0.109	0.063	0.099	0.042	-0.447	0.000	0.709
Liq-2	0.678	0.000	0.274	0.000	-0.022	0.738	0.016	0.780	-0.063	0.329	0.582

Liq-3	0.665	0.000	0.271	0.000	0.066	0.273	-0.063	0.208	-0.204	0.000	0.657
Liq-4	0.684	0.000	0.293	0.000	0.153	0.024	0.085	0.129	0.026	0.687	0.653
Liquid	0.685	0.000	0.369	0.000	0.109	0.063	0.099	0.042	0.553	0.000	0.799
Panel B: Sequential Portfolios											
IBLL	0.606	0.000	0.007	0.926	-0.055	0.534	-0.347	0.002	0.082	0.483	0.549
LBLL	0.684	0.000	-0.100	0.310	-0.099	0.367	-0.370	0.007	-0.129	0.376	0.523
IBLW	0.612	0.000	0.058	0.473	0.102	0.256	0.263	0.018	0.037	0.754	0.518
LBLW	0.656	0.000	-0.029	0.760	0.008	0.937	0.275	0.033	-0.371	0.008	0.493
IBHL	0.718	0.000	-0.244	0.022	0.861	0.000	-0.231	0.115	0.440	0.006	0.619
LBHL	0.647	0.000	-0.270	0.027	0.532	0.000	-0.496	0.003	-0.780	0.000	0.524
IBHW	0.641	0.000	-0.105	0.329	0.496	0.000	0.445	0.003	0.483	0.003	0.489
LBHW	0.622	0.000	-0.079	0.413	0.567	0.000	0.496	0.000	-0.292	0.044	0.535
ISLL	0.667	0.000	0.888	0.000	-0.400	0.002	-0.524	0.001	0.611	0.000	0.400
LSLL	0.674	0.000	0.957	0.000	-0.529	0.000	-0.528	0.001	-0.441	0.011	0.419
ISLW	0.577	0.000	0.712	0.000	-0.186	0.116	0.437	0.003	0.397	0.012	0.378
LSLW	0.711	0.000	0.746	0.000	-0.429	0.002	0.830	0.000	-0.716	0.000	0.435
ISHL	0.614	0.000	0.927	0.000	1.015	0.000	-0.552	0.001	1.020	0.000	0.671
LSHL	0.575	0.000	1.073	0.000	1.087	0.000	-0.916	0.000	-1.332	0.000	0.724
ISHW	0.751	0.000	0.996	0.000	0.579	0.000	0.544	0.000	0.399	0.015	0.642
LSHW	0.617	0.000	0.940	0.000	1.275	0.000	0.746	0.000	-0.467	0.009	0.722

Note: Liquidity beta is used to sort the stocks on basis of liquidity. The table reports the estimated results of Equation 9.

Finally, to confirm that the results are not affected by the outliers, we performed the analysis after winsorized the data at 1 percent, 2.5 percent, and 5 percent. Our analysis using decide portfolios, excluding the unusual market period and based on winsorized data did not change and confirmed that our results and conclusions are not affected by any of these factors.

5. Conclusion

The study aims to investigate the association between liquidity and stock returns in an emerging market using data for non-financial listed firms of Pakistan. The study estimates stock liquidity using three different measures: stock turnover, illiquidity cost, and liquidity beta and performs asset pricing tests including liquidity factor in addition to the well-known factors of market, size, book-to-market and momentum. The findings suggest that factors related to cross-sectional variations in stock returns that are popular in the literature are also priced in Pakistan's emerging equity market. The study also confirms that liquidity explains the differences in the average returns across stocks in Pakistan; however, the relationship between liquidity and returns is different when diverse measures of liquidity are used. Stock turnover and returns were found to be positively related; however, a negative relationship between liquidity and returns was confirmed using the Amihud illiquidity cost and Pastor and Stambaugh liquidity beta.

Our analysis demonstrates the importance of the liquidity factor in the cross-sectional variation of stock returns, and our findings have clear and important implications for portfolio managers in Pakistan. The results suggest a possibility of earning high returns by appropriately selecting stocks based on positively priced risk factors. Moreover, investors do not necessarily have to trade in illiquid stocks to capture high yields as stocks with high turnovers offer higher returns. From an emerging market perspective, the study provides out-of-sample evidence on the validity of various asset pricing models; however, this study considered only five explanatory stock return factors over the period from 2001 to 2015. Further, our analysis ignores transaction costs and is based on sample stocks that survived over complete period. The investigation of other fundamental factors, the comparison of factor premiums in different markets, impact of transaction cost on investment strategies and the use of high frequency stock transaction data to construct the liquidity measure remain areas of future research.

References

Akdeniz, L., Altay-Salih, A., & Aydogan, K. (2000). A cross-section of expected stock returns on the Istanbul Stock Exchange. *Russian and East European Finance and Trade*, *36*(5), 6–26.

Al-Mwalla, M. (2012). Can book-to-market, size and momentum be extra risk factors that explain the

stock rate of return? Evidence from emerging market. *Journal of Finance, Accounting and Management, 3*(2), 42–57

Amihud, Y. (2002). Illiquidity and stock returns: Cross-section and time-series effects. *Journal of Financial Markets, 5*(1), 31–56.

Amihud, Y., Hameed, A., Kang, W., & Zhang, H. (2012). The illiquidity premium: International evidence. *Journal of Financial Economics, 117*(2), 350–368.

Amihud, Y., & Mendelson, H. (1986). Asset pricing and the bid-ask spread. *Journal of Financial Economics, 17*(2), 223–249.

Banz, R. W. (1981). The relationship between return and market value of common stocks. Journal of Financial Economics, 9(1), 3–18.

Bekaert, G., Harvey, C. R., & Lundblad, C. (2007). Liquidity and expected returns: Lessons from emerging markets. *The Review of Financial Studies, 20*(6), 1783–1831.

Blume, M., & Friend, I. (1973). A new look at the Capital Asset Pricing Model. *The Journal of Finance, 28*(1), 19–33.

Bundoo, S. K. (2008). An augmented Fama and French three-factor model: New evidence from an emerging stock market. *Applied Economics Letters, 15*(15), 1213–1218.

Brennan, M. J., & Subrahmanyam, A. (1996). Market microstructure and asset pricing: On the compensation for illiquidity in stock returns. *Journal of Financial Economics, 41*(3), 441–464.

Brown, J. H., Crocker, D. K., & Foerster, S. R. (2009). Trading volume and stock investments. *Financial Analysts Journal, 65*(2), 67–84.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of finance, 52*(1), 57-82.

Chordia, T., Huh, S., & Subrahmanyam, A. (2007). The cross-section of expected trading activity. *The Review of Financial Studies, 20*(3), 709–740.

Drew, M. E., Naughton, T., & Veeraraghavan, M. (2003). Firm size, book-to-market equity and security returns: Evidence from the Shanghai Stock Exchange. Australian Journal of Management, 28(2), 119–139.

Drew, M. E., & Veeraraghavan, M. (2002). A test of the Fama-French three-factor model in the Australian equity market. *Accounting, Accountability and Performance, 8*(1), 77–92.

Datar, V. T., Naik, N. Y., & Radcliffe, R. (1998). Liquidity and stock returns: An alternative test. *Journal of Financial Markets, 1*(2), 203–219.

Eraslan, V. (2013). Fama and French three-factor model: Evidence from the Istanbul Stock Exchange. *Business and Economics Research Journal, 4*(2), 11–22.

Fama, E. F., & French, K. R. (1992). The cross‐section of expected stock returns. *The Journal of Finance,*

47(2), 427–465.

Fama, E. F., & French, K. R. (1995). Size and book-to-market factors in earnings and returns. *The Journal of Finance, 50*(1), 131–155.

Firozjaee, M. R., & Jelodar, Z. S. (2010). Tests of the Fama and French three-factor model in Iran. *Iranian Economic Review, 15*(27), 117–132.

Friend, I., Westerfield, R., & Granito, M. (1978). New evidence on the Capital Asset Pricing Model. *The Journal of Finance, 33*(3), 903–917.

Goyenko, R. Y., Holden, C. W., & Trzcinka, C. A. (2009). Do liquidity measures measure liquidity? *Journal of Financial Economics*, *92*(2), 153–181.

Haque, A., & Sarwar, S. (2013). Effect of fundamental and stock market variables on equity return in Pakistan. *Science International, 25*(4), 981–987.

Iqbal, J., & Azher, S. (2014). Value-at-risk and expected stock returns: Evidence from Pakistan. *The Lahore Journal of Economics, 19*(2), 71–100.

James, C., & Edmister, R. O. (1983). The relation between common stock returns trading activity and market value. *The Journal of Finance, 38*(4), 1075–1086.

Kanasro, H. A., Jalbani, A. A., & Junejo, M. A. (2009). Stock Market Liquidity: A Case Study of Karachi Stock Exchange. *Pakistan Journal of Commerce and Social Sciences, 3*, 25-34.

Korajczyk, R. A., & Sadka, R. (2008). Pricing the commonality across alternative measures of liquidity. *Journal of Financial Economics*, *87*(1), 45–72.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The Review of Economics and Statistics, 47*(1), 13–37.

Mirza, N., & Shahid, S. (2008). Size and value premium in Karachi Stock Exchange. *The Lahore Journal of Economics, 13*(2), 1–26.

Pastor, L., & Stambaugh, R. F. (2003). Liquidity Risk and Expected Stock Returns. *Journal of Political Economy, 111*(3), 642-685.

Rahman, H., & Mohsin, H. M. (2012). Momentum effect: Empirical evidence from Karachi Stock Exchange. *The Pakistan Development Review, 51*(4), 449–462.

Rouwenhorst, K. G. (1999). Local return factors and turnover in emerging stock markets. *The Journal of Finance*, *54*(4), 1439–1464.

Sadaqat, M., & Butt, H. A. (2017). Role of Liquidity in Explaining Anomalous Returns: Evidence from Emerging Market. *Business & Economic Review, 9*(3), 1-35.

Saeed, S., & Hassan, A. (2018). Inter-Linkages between Liquidity and Stock Returns: An Empirical Investigation through Panel Cointegration. *Pakistan Journal of Commerce and Social Sciences, 12*(2), 617-637.

Serra, A. P. (2002). *The cross-sectional determinants of returns: Evidence from emerging markets' stocks*. (FEP Working Papers Series No. 120, pp. 1–37).

Shah, S. H. A., & Shah, A. (2015). Can momentum portfolios earn more in the Karachi Stock Exchange? *Pakistan Business Review, 17*(1), 80–98.

Sharpe, W. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance, 19*(3), 425–442.

Stattman, D. (1980). Book values and stock returns. The Chicago MBA: *A Journal of Selected Papers, 4*(1), 25–45.

Tauseef, S., & Nishat, M. (2018). Can investors benefit from momentum trading? Evidence from an emerging market. *Business Review, 13*(1), 21-36.

Uddin, H. (2009). Re-examination of stock liquidity risk with a relative measure. *Studies in Economics and Finance, 26*(1), 24–35.

Walkshausl, C., & Lobe, S. (2014). The alternative Three-Factor Model: An alternative beyond US markets? *European Financial Management, 20*(1), 33–70.