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Liquidity Risks and Asset Pricing: Evidence from Developed and Emerging Markets

*Sadia Saeed[1]**
Saif ul Mujahid Shah[2]
Saadullah Shah[3]

ABSTRACT

The study examines the liquidity adjusted capital asset pricing model in developed and emerging markets. Amihud measure is used to compute market liquidity. Innovations in Amihud ratio are generated through the autoregressive process to avoid autocorrelation in illiquidity data series. Decile portfolios based on illiquidity cost are formulated for each stock market. Liquidity adjusted betas are calculated at the portfolio level and then stocks as test assets have been used in the regression stage. Panel regression with fixed effect has been employed on LCAPM specifications for explaining the excess stock returns of developed and emerging markets during a period July 2005- June 2017. The findings of the study support that individual and aggregate liquidity risk price in stock markets except for Pakistan. The results of the study suggest that investors institutional or individual should consider liquidity risks for assessing the worth of assets.

JEL Classification: *G1,G10, G15*

Keywords: *Amihud ratio liquidity risks, Asset Pricing, Market liquidity and Stock market, emerging markets*

INTRODUCTION

Market microstructure reveals that two important determinants of asset pricing are market liquidity and price discovery (Wenjaun, 2017). Financial intermediaries including dealers and brokers organize the trade for buyers and sellers in a financial market. Besides this, the trading mechanism based upon implicit and explicit rules exists in each financial market (Hasbrouck, 2007). This trading mechanism defines the market structure that explains the behavior of investors including when, what, how and where trade is done. The origin of price formation and market liquidity is based upon this when, what, how and where. The trading of securities is badly affected due to inadequate liquidity in financial markets. Therefore, liquidity is considered an important factor in asset pricing (Paddrik & Tompaidis 2019).

Prices of securities instigate in markets and two important contributors for it are price discovery and market liquidity but traditionally asset pricing models neglect it. The model can exclude these features if pragmatic actions including anomalies, momentum easily explain the behavior of asset prices (del Mar Miralles-Quirós, Miralles-Quirós, & Oliveira, 2017). Practically, this does not happen therefore the implications of market microstructure are indispensable to be included in the valuation of assets (Wenjaun, 2017). The study limits its scope to one implication of market microstructure that is market liquidity. Goodhart (2008) refers to market liquidity as the ability of the market to trade financial securities in bulk

1-Department of Management Science National University of Modern Languages (NUML), Islamabad, Pakistan.
2-Department of Economics National University of Modern Languages (NUML), Islamabad, Pakistan.
3-Institute of Management Studies,University of Peshawar, Peshawar, Pakistan.
*Corresponding Author Email:sadiasaeed441@yahoo.com

quickly with minimal price impact. Liquidity becomes a liquidity risk when investors face difficulty in trading assets. This liquidity risk should be priced in returns if investors are exposed to it (Amer Al-Jaifi, Hussein Al-rassas & Ali AL-Qadasi, A. 2017; Corwin & Schultz, 2012; Leirvik, Fiskerstrand & Fjellvikås 2017.

The unified framework of liquidity is developed in the form of Liquidity adjusted capital asset pricing model (LCAPM) in 2005 by Acharya and Pedersen. LCAPM integrated liquidity risk individually and collectively for explaining the returns of assets. Commonality in liquidity, flight to liquidity risk and the depressed wealth effect of liquidity risk are the individual channels of liquidity risk whereas combined liquidity risk and systematic risk are liquidity risk at the aggregate level. LCAPM model has been tested empirically in developed markets such as the U.S and Australia (Kim & Lee 2014; Vu, Chai & Do, 2015). Returns in emerging markets are more and investors want to invest in emerging markets to get high returns. Therefore, there is a need to study the liquidity risks in emerging markets as well.

This study is beneficial for investors to know the impact of liquidity risks on excess returns in stock markets while designing portfolio strategies. This is the comparative study that analyzes different forms of liquidity risks individually and collectively in developed and emerging markets. This will help the investors to comprehend the liquidity situation of financial markets that lead to escalating domestic and foreign investment. Moreover, this study is also helpful for controlling authorities in designing a code of conduct for controlling liquidity shocks in financial markets.

The research article is comprised of six sections. First section illustrates the background, objective and significance of the study. In the second section theoretical framework of the study is formulated after discussing theoretical and empirical literature. Section three and four explain the data setting, methodology framework and econometric model of the study. Conclusion and practical implications of the study are discussed in the last section of the paper.

LITERATURE REVIEW

Traditionally various asset pricing models exist to explain the risk-return relationship. At first, Sharp (1964) developed the capital asset pricing model (CAPM) and explain the expected return of the asset using market risk. Over time extensions have been occurred in CAPM and CAPM with a three-factor model has been introduced by Fama and French (1993). They identified three risk factors book to market ratio, market risk and firm size in the valuation of assets. In 1973 Intertemporal CAPM (ICAPM) has been presented by Merton. According to ICAPM assets are valued in the context of changing wealth and investment opportunities. Roll and Ross (1984) studied the relationship between systematic factors and price and proposed the Arbitrage pricing theory (APT). APT incorporates macroeconomic factors as multiple risk factors in explaining asset returns. The basic assumption of CAPM and APT is frictionless market and transaction cost has no role in the trading of securities. These models assess the worth of assets based on the present value of future cash flows. If future cash flows of the securities are the same these securities should trade in the market at the same prices. Practically the prices of securities are different in the market it means various factors including illiquidity involve in this price differential. The future potential of trading of security makes liquidity an important factor in the valuation of assets (Bhattacharya, Bhattacharya, & Jha, 2020)

Amihud and Mendelson (1986) analyze the effect of liquidity on stock returns for the first time. Chordia, Roll and Subrahmanyam (2000) introduced another phenomenon of liquidity commonality in liquidity literature. There is a co-movement between market liquidity and stock liquidity. Investors receive a commonality premium in the required rate of return when they bear liquidity commonality risk. The factors involving asymmetric information, transaction cost, less transparent information and search costs that affect the demand and supply of stocks originate commonality in liquidity in stock markets (Kumar & Misra, 2019).

Pastor and Stambaugh (2003) introduced another liquidity risk channel flight to liquidity risk in liquidity literature. Flight to liquidity risk originates when illiquid assets are replaced with liquid assets. Investors are ready to pay a premium for liquid stocks because these stocks are easily liquidated in illiquid market conditions. Therefore, there is a negative association between expected equity returns and flight to liquidity risk. Acharya and Pederson (2005) developed a liquidity adjusted capital asset pricing model and proposed another liquidity risk at an individual level depressed wealth effect of liquidity risk. As the investor is ready to get a low return on the assets that remain liquid when the market return is down. So it has also a negative relationship with excess stock returns.

The liquidity adjusted capital asset pricing model has been empirically analyzed in the developed stock market including New Zealand, American and Australian stock markets (Chen, Chou & Yen, 2016; Kim & Lee, 2014; Vu et al., 2015). The results of the study demonstrate that liquidity risks at the individual and aggregate levels are priced in a developed stock market. The study observed a positive flight to liquidity in the U.S stock market and a negative depressed wealth effect of liquidity risk in Australian stock markets. Commonality liquidity risks are positively compensated in the developed markets. Foran, Hutchinson, & O'Sullivan, (2015) investigated asset pricing with liquidity risk using tick data for 12 years in the UK. The market structure in the UK is different relative to the U.S. The results of the study have revealed that the commonality of liquidity is positively priced in the UK. Vu et al., (2015) also found that commonality liquidity risk is one of the prominent liquidity risks in the stock market of Australia. Similarly, Silva and Machado (2020) have investigated that commonality liquidity premium is highly concentrated during the period of international financial crises in the Berzelian stock market.

Liquidity adjusted capital asset pricing model has been tested in the emerging market including India, Finnish stock market and Ghana stock market (Hirvonen, 2016; Hongxing and Duduchoge, 2017). The findings of the study demonstrate that liquidity risks are priced in the Finish stock market, the Indian stock market and the Ghana stock market. However, liquidity commonality risk is significant but negative in the Ghana stock market. In India, liquidity commonality risk is prominent and significantly positively priced in their securities. In contrast to these studies Butt (2015), reports that there is no significant relationship between liquidity risk and asset pricing in the Finnish stock market. Similarly, Rehman et al., (2020) also suggest that liquidity portfolio strategy does not contribute to asset pricing in the Pakistan stock exchange.

At the global level, Saad and Samet (2015) tested LCAPM and report that among liquidity risks depressed wealth effect of liquidity risk is prominent and significant. The contribution of the depressed wealth effect of liquidity risk towards total liquidity premium is 70% at the global level. The study is the extension of the above studies and empirically analyzes the

LCAPM model in Fama and French framework. It includes liquidity risks at an individual and aggregate level along with controlling factors including firm size and momentum.

Theoretical framework

Acharya and Pedersen (2005) developed a liquidity adjusted capital asset pricing model (LCAPM). In this model, two aspects of liquidity are included first liquidity as a cost and second liquidity as a risk. Liquidity risks are classified into six categories in this model. The first is market risk. It is similar to traditional CAPM beta with one difference; LCAPM market risk includes transaction cost whereas in CAPM transaction cost is not included in market risk. The second risk is liquidity commonality risk. It is the covariance between stock and market illiquidity. The relationship of commonality liquidity risk is positive with excess returns because investors receive commonality premium in those stocks whose illiquidity is influenced by market illiquidity. The third risk is Flight to liquidity risk in LCAPM. It is a covariance between stock return and market illiquidity. Flight to liquidity risk is negatively associated with excess returns because investors are willing to accept low returns on those stocks whose liquidity is not sensitive to market illiquidity. The fourth individual liquidity risk is the depressed wealth effect of liquidity risk. It is a covariance between stock illiquidity and market return. As investors are willing to pay a premium for those stocks that remain liquid in down market conditions. So there is a negative relationship between depressed wealth liquidity risk and excess returns.

Acharya and Pedersen (2005) also identified total liquidity risk and total systematic risk in LCAPM model. Total liquidity risk is the aggregate liquidity risk. It is the combination of all the individual liquidity risks including commonality in liquidity, flight to liquidity and the depressed wealth effect of liquidity risk. Total systematic risk is the combination of market risk and aggregate liquidity risk. Total systematic risk may be negatively priced in the stock market having constrained liquidity risk premium relative to market risk (Vu et al., 2015). The current study employs LCAPM model to know the impact of liquidity risks individually and collectively in developed and emerging markets from July 2005- June 2017.

Hypotheses of the study

The hypotheses of the study have been designed from the theoretical framework of the study.
H_1=The covariance of stock liquidity with market liquidity is positive in stock markets
H_2= The covariance between market illiquidity and stock returns is negative in stock markets.
H_3= The co-movement of market returns with stock liquidity is negative in stock markets
H_4= Aggregate liquidity risks are priced in stock markets.
H_5=Aggregate systematic risks are priced in stock markets.

Data and operational definitions of variables

The population of the study is comprised of financial and non-financial firms listed in stock markets. It is difficult to analyze all the firms listed in the stock market. The current study employs a Realized volatility sampling technique to obtain the sample of actively traded stocks in the stock market (Dunne et al 2011; Papavassiliou 2013). The sample of the study is comprised of non-financial firms that are continuously listed in the index based on market capitalization during the period 2005-2017. The study selects developed and emerging markets from Asia including Pakistan, India, Japan, China and Thailand. These markets are

selected based on common market design, maintenance of 100 stock indices and easy access to data. Prices and trading volume of non-financial firms in these stock markets have been collected from yahoo finance, ADVFN, Open door, Thomson Reuters, Business recorder and investing.com. The study follows the data screening procedure in line with Vu et al., (2015) and Foran et al., (2015). 15 valid observations of Amihud ratio are essential to calculate market liquidity. Stocks having 100 positive volume days are selected in the study. Non-financial firms having a negative book to market ratio or market capitalization are excluded from the sample. After data screening 50, 80, 53, 64 and 54 stocks are selected that remain listed in stock exchange indexes of Pakistan, India, China, Japan and Thailand stock markets during the sample period of 12 years.

Operational definition of variables of the study

independent variables

β_i^1 Market Beta)

Market beta is the covariance of stock returns and market returns with the variance of the market. The variance of the market includes illiquidity cost) $c_t^M - E_{t-1}(c_t^M)$. $\boldsymbol{\beta_i^1}$ is written as

$$\boldsymbol{\beta_i^1} = \frac{cov\left(r_t^i, r_t^M - E_{t-1}(r_t^M)\right)}{var(r_t^M - E_{t-1}(r_t^M) - [c_t^M - E_{t-1}(c_t^M)])} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

β_i^2 (Liquidity Commonality Beta)

Liquidity commonality beta is the covariance between stock illiquidity and market illiquidity. As investors are compensated for holding those stocks whose liquidity is influenced by market liquidity. Therefore excess stock returns have a positive association with commonality beta (Chordia et al 2001). Commonality beta is written as

$$\boldsymbol{\beta_i^2} = \frac{cov\left(c_t^i - E_{t-1}\left(c_t^i\right), c_t^M - E_{t-1}(c_t^M)\right)}{var(r_t^M - E_{t-1}(r_t^M) - [c_t^M - E_{t-1}(c_t^M)])} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

β_i^3 (Flight to Liquidity Beta)

Pastor and Stambaugh (2003) proposed the third covariance flight to liquidity in LCAPM model. It is the covariance between stock returns and market illiquidity. A negative association exists between a flight to liquidity beta and stock returns because low returns are received on those securities whose liquidity is not affected in illiquidity market situation. Flight to liquidity beta is mathematically expressed as

$$\beta_i^3 = \frac{cov\left(r_t^i, c_t^M - E_{t-1}(c_t^M)\right)}{var(r_t^M - E_{t-1}(r_t^M) - [c_t^M - E_{t-1}(c_t^M)])} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

β_i^4 (Depressed Wealth Beta)

Acharya and Pedersen (2005) identified the fourth liquidity beta named as depressed wealth beta. Depressed wealth beta represents the covariance between stock illiquidity and market return. The depressed wealth effect of liquidity risk is negatively related to excess returns. I Investors receive less return on liquid securities when the return of the stock market is poor. Depressed wealth beta is statistically represented as

$$\beta_i^4 = \frac{cov\left(c_t^i - E_{t-1}\left(c_t^i\right), r_t^M - E_{t-1}\left(r_t^M\right)\right)}{var\left(r_t^M - E_{t-1}\left(r_t^M\right) - \left[c_t^M - E_{t-1}\left(c_t^M\right)\right]\right)} \quad \ldots\ldots(4)$$

β_i^5 (AggregateLiquidityBeta)

It is the collective effects of three individual liquidity risks such as liquidity commonality beta, Flight to liquidity beta and depressed wealth beta. It is represented as

$$\beta_i^5 = \beta_i^2 - \beta_i^3 - \beta_i^4 \quad \ldots\ldots(5)$$

β_i^6 (Total Systematic Risk)

Aggregate Systematic risk is the combined effect of illiquidity risks and market risk. It is represented by β6. It is written below.

$$\beta_i^6 = \beta_i^1 + \beta_i^2 - \beta_i^3 - \beta_i^4 \quad \ldots\ldots(6)$$

Control Variable

The control variables included in the study are explained below

Firm Size

Firm size is the market value of outstanding shares of a firm. It is computed by taking the natural logarithm of market capitalization.

Firm Size = ln (Market capitalization) t

Momentum

The momentum of the firm is measured to predict the return of securities based on historical prices. It is calculated by taking the aggregate return of past consecutive 12 months with one month lag.

Momentum = $\sum R\ t_{12}\ Rt\text{-}_1$

Dependent variable

Stock return is the dependent variable for the research. It is computed by taking the natural logrithem of prices of stocks.

Rt = ln (Pt / Pt-1)

Rt = Return of the stock for a month t

Pt = Closing prices of the stock for the month t

Pt-1= Closing prices of the stock for previous month t-1

METHODOLOGY FRAMEWORK

The methodology of the study includes measurement of liquidity, fitting approach. Innovations in Amihud ratio, decile portfolio betas and panel regression with fixed effects after confirmation of Housman's test.

Measurement of liquidity

Amihud Measure (2002)

Odeegard (2018) Amihud measure is the best proxy to determine illiquidity. It determines the response in the price of securities when one Rupee volume of securities is traded. It is the ratio of stock return to Rupee volume. If the price impact with trading volume is high then the market is illiquid. Amihud illiquidity ratio is computed as

$$AM = | ER\ t | / PV\ t$$

ER t is the daily equity return
PV t is the daily trading volume

The monthly Amihud ratio is calculated in the study to analyze the data monthly.

Fitting approach

Augmented Dickey-Fuller test has been applied to test the stationarity of data. Amihud ratio is non-stationary whereas momentum, firm size, stock returns are stationary during July 2005-June 2017. In line with Lee (2011) and Vu et al., (2015) innovations in Amihud ratio is calculated to avoid auto-correlation.

Autoregressive process (ar2) for innovations in amihud ratio

Liquidity persists due to autocorrelation that makes the result biased. For unbiased result innovations in Amihud ratios are generated through the autoregressive process.

$$C_t^i = \alpha_0 + \alpha_1 C_{t-1}^i + \alpha_2 C_{t-2}^i + \ldots\ldots\ldots + \alpha_x C_{t-x}^i + \lambda_4 \mu_t^i$$

C_t^i = the Amihud ratio of stock i during the month t

x =Number of lags in the autoregressive process

μ_t^i = the residuals in Amihud ratio of stock i during a month t.

Innovations are residuals and are calculated by taking the difference between the observed value of Amihud ratio at time t and the optimal forecast of Amihud ratio based upon information available before two days.

Stock liquidity = $c_t^i - E_{t-1}(c_t^i)$

Residuals are generated in the study to solve the problem of autocorrelation and persistence of liquidity. These residuals are used in the study for further analysis rather than the absolute value of Amihud ratio.

Market liquidity

Market liquidity is measured by computing the sum of residuals of Amihud ratio of all non-financial firms that are continuously listed in the stock exchange index during 2005-2017 The same procedure is applied in each stock market to calculate their respective market liquidity. Market liquidity is specified below.

$$\text{Market liquidity} = \sum c_t^M - E_{t-1}(c_t^M)$$

Lcapm portfolio beta estimation

In line with Vu et al (2015) LCAPM betas are calculated at the portfolio level to mitigate the problem of noise. Decile portfolios are generated in the study by sorting stocks from lowest to highest liquidity level in the context of Amihud ratio. Decile portfolios for each country are designed. Each portfolio shows stocks of the same liquidity level. LCAPM portfolio betas are calculated according to the formulas presented in equations (1-6). 36 monthly observations have been used for the computation of LCAPM beta. As a result, the data for three years has been lost. Monthly data of nine years has been used for empirical analysis of the LCAPM model. At first, betas are calculated at the portfolio level and then assigned betas to individual stocks of a specific portfolio.

Panel regression with fixed effect

To avoid spurious results individual stocks as test assets are used in the regression stage. The main benefits of using individual stocks in regression are firstly abundant observations are available for employing regression. Secondly, potential information cannot be lost and the control in firm size is possible. After confirmation of the Housman test Panel, cross-sectional regression with fixed effects has been employed in the study instead of Fama Macbeth (1973) cross-sectional regression. In panel regression proposed by Petersen (2009) statistical biases can be avoided because it measures serial as well as cross-sectional correlation

Econometric model of the study

The study tests seven LCAPM specifications proposed by Vu et al (2015). These specifications are

$$r_{t+1}^i - r_{t+1}^f = \alpha_t + \lambda_1 \mu_t^i + \lambda_2 \beta_t^{1i} + \varphi_2 SIZE_t + \varphi_3 MOM_t \ldots (7)$$

$$r_{t+1}^i - r_{t+1}^f = \alpha_t + \lambda_1 \mu_t^i + \lambda_2 \beta_t^{1i} + \lambda_3 \beta_t^{2i} + \varphi_2 SIZE_t + \varphi_3 MOM_t \ldots (8)$$

$$r_{t+1}^i - r_{t+1}^f = \alpha_t + \lambda_1 \mu_t^i + \lambda_2 \beta_t^{1i} + \lambda_3 \beta_t^{3i} + \varphi_2 SIZE_t + \varphi_3 MOM_t \ldots (9)$$

$$r_{t+1}^i - r_{t+1}^f = \alpha_t + \lambda_1 \mu_t^i + \lambda_2 \beta_t^{1i} + \lambda_3 \beta_t^{4i} + \varphi_1 BM_t + \varphi_2 SIZE_t + \varphi_3 MOM_t \ldots (10)$$

$$r_{t+1}^i - r_{t+1}^f = \alpha_t + \lambda_1 \mu_t^i + \lambda_2 \beta_t^{1i} + \lambda_3 \beta_t^{5i} + \varphi_2 SIZE_t + \varphi_3 MOM_t \ldots (11)$$

$$r_{t+1}^i - r_{t+1}^f = \alpha_t + \lambda_1 \mu_t^i + \lambda_2 \beta_t^{1i} + \lambda_3 \beta_t^{6i} + \varphi_2 SIZE_t + \varphi_3 MOM_t \ldots (12)$$

$$r_{t+1}^i - r_{t+1}^f = \alpha_t + \lambda_1 \mu_t^i + \lambda_2 \beta_t^{1i} + \lambda_3 \beta_t^{2i} + \lambda_4 \beta_t^{3i} + \lambda_5 \beta_t^{4i} + \varphi_2 SIZE_t + \varphi_3 MOM_t \ldots (13)$$

where

$r_{t+1}^{i} - r_{t+1}^{f}$ = Excess return

r_{t+1}^{f} = Risk-free rate (Monthly T-bill rate is used as risk-free rate)

RESULTS AND DISCUSSION

Table 1 reports that average stock returns of emerging markets including, Pakistan, India, China and Thailand are high as compared to the developed stock market. The maximum return on the stock in Pakistan is 38%. It is the highest one among all the stock markets selected in the study. It means Pakistan is a highly volatile market. Amihud measure in all stock markets is positively skewed that indicates a frequent decline in liquidity in all stock markets. Leptokurtic distribution is observed that shows the probability of extreme values that exist in data.

Table 1:
Statistical Summary

Country Variables	Mean	Median	Max	Min	SD	Skewness	Kurtosis	No of observations
Pakistan								
Amihud Measure (AM)	1.4762	0.1134	9.699	0	9.615	9.4235	30.3689	6,000
Stock returns	0.0025	0.0061	0.3854	-0.448	0.1022	-0.5091	6.9339	6,000
India								
Amihud Measure (AM)	0.0034	0.0016	0.0305	0.0002	0.0053	3.1031	13.3346	9,600
Stock returns	0.0059	0.005	0.0509	-0.0325	0.0146	0.5117	5.0369	9,600
China								
Amihud Measure (AM)	0.3415	0.1125	7.398	0.0135	0.948	6.2619	44.3916	6000
Stock returns	0.0013	0.0031	0.0538	-0.0763	0.018	-0.761	5.9952	6000
Thialand								
Amihud Measure (AM)	0.197	0.0047	4.3777	0.0001	0.646	4.3442	22.9767	6000
Stock returns	0.0032	0.0041	0.06	-0.0473	0.0113	0.2899	10.3691	6,000
Japan								
Amihud Measure (AM)	0.4546	0.1706	7.555	0.0009	0.9178	4.8174	32.9464	7680
Stock returns	0.0008	0.0015	0.046	-0.1099	0.017	-2.1699	16.3849	7,680

Augmented Dickey-Fuller test has been applied to test the stationarity of data. Table 2 reports that stock returns, firm size, and momentum are stationary in each stock market but illiquidity measured through Amihud ratio is non-stationary. To avoid autocorrelations in illiquidity series innovations in Amihud ratio are measured in the study.

Table 2:
Augmented Dickey-Fuller Test for Stock Returns, Illiquidity series, Firm size and Momentum

Country	Variables	T-statistic	Probability
Pakistan	Stock Returns	4.042	0
	Amihud Ratio	0.099	0.921
	Firm sIze	-3.932	0
	Momentum	-4.23	0
India	Stock Returns	4.99	0
	Amihud Ratio	0.32	0.74
	Firm sIze	8.66	0
	Momentum	-2.8	0
China	Stock Returns	-2.33	0.022
	Amihud Ratio	-2.465	0.127
	Firm sIze	2.638	0.01
	Momentum	-2.465	0.016
Thailand	Stock Returns	-2.82	0.005
	Amihud Ratio	-0.868	0.387
	Firm sIze	4.042	0
	Momentum	-8.247	0
Japan	Stock Returns	2.89	0.04
	Amihud Ratio	1.24	0.273
	Firm sIze	5.63	0
	Momentum	3.049	0.003

Market Liquidity

Innovations in Amihud ratios are calculated through the autoregressive process. It is computed by taking the difference between the current value of the Amihud ratio and its optimal forecast with two-month lags. Market liquidity is the sum of innovations of the Amihud ratio of all the non- financial firms continuously listed during the sample period. Graphically, upward spikes in market liquidity indicate that liquidity risk exists in these stock markets. Liquidity spikes are continuous throughout the sample period in Japan, India and Japan as compared to China and Thailand.

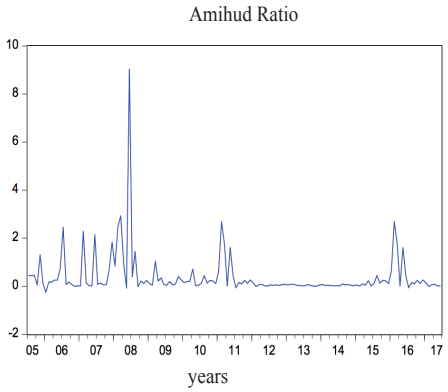

Figure 1: *Market liquidity of Pakistan*

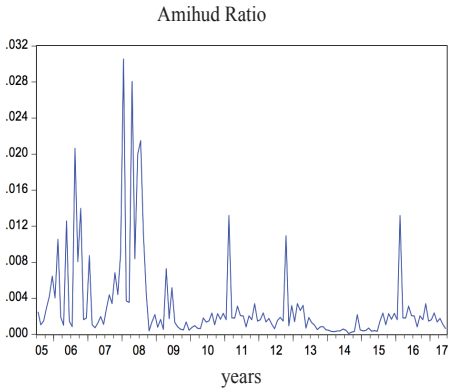

Figure 2: *market liquidity of India*

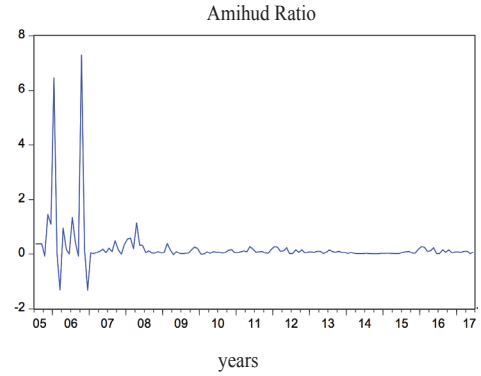

Figure 3: *Market liquidity of China*

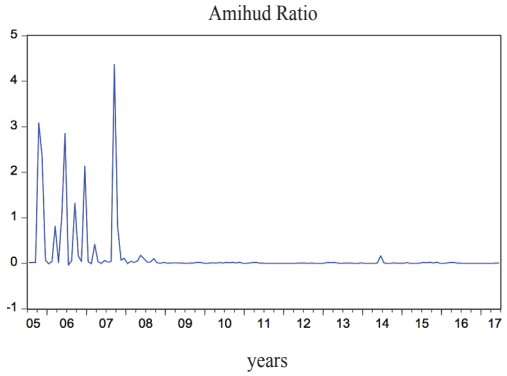

Figure 4: *Market liquidity of Thailand*

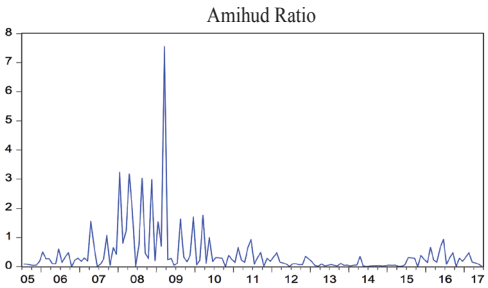

Figure 5: *Market liquidity of Japan*

Table 3 reports LCAPM betas in all stock markets. Liquidity commonality beta β2 are positive signs in stock markets. Negative liquidity commonality beta is also observed in the first, fourth and fifth portfolio in the Indian stock market. Similarly, flight to liquidity beta β 3 and depressed wealth beta β4 are also negative in the stock market except in India. India shows a positive flight to liquidity beta and mixed trend in the context of the depressed wealth effect of liquidity risk. The significance of these betas with excess return would support the implementation of liquidity adjusted capital asset pricing theory in developed and emerging stock markets.

Table 3:
Decile portfolios of LCAPM beta

Pakistan						
Portfolio	**β1**	**β2**	**β3**	**β4**	**β5**	**β6**
(Lowest) 1	0.03	0.0161	-0.0171	-0.0012	0.0344	0.0643
2	0.0389	0.0019	-0.0155	-0.0001	0.0174	0.0563
3	0.0279	0.0852	-0.0267	-0.0001	0.1119	0.1398
4	0.0391	0.2224	-0.0301	-0.0012	0.2538	0.2929
5	0.0389	0.0233	-0.0193	-0.0047	0.0473	0.0862
6	0.0455	0.0004	-0.0304	-0.0006	0.0314	0.0769
7	0.0392	0.0612	-0.0298	-0.002	0.093	0.1323
8	0.0454	0.0255	-0.022	-0.0023	0.0498	0.0952
9	0.044	0.2265	-0.0213	-0.0013	0.2491	0.2931
(Highest)10	0.0539	0.2303	-0.0274	-0.0106	0.2684	0.3222

India						
Portfolio	**β1**	**β2**	**β3**	**β4**	**β5**	**β6**
(Lowest) 1	0.0001	-0.015	0.0009	0.0002	-0.0161	-0.016
2	0.0004	0.0231	0.001	-0.0001	0.0222	0.0226
3	0.0001	0.0157	0.0004	-0.0001	0.0154	0.0155
4	0.0007	-0.006	-0.0006	-0.0002	-0.0052	-0.0045
5	0.0007	-0.0106	0.0002	-0.0008	-0.0101	-0.0094
6	0.0002	0.0285	-0.0012	-0.0002	0.03	0.0301
7	0.0008	0.0208	0.0003	-0.0002	0.0207	0.0215
8	0.0003	0.0212	-0.0076	-0.0052	0.0339	0.0342
9	0.0001	0.0172	-0.0004	0.0003	0.0174	0.0175
(Highest)10	0.0006	0.0723	0.0058	0.0034	0.063	0.0636
China						
Portfolio	**β1**	**β2**	**β3**	**β4**	**β5**	**β6**
(Lowest) 1	0.0135	0.5537	-0.021	-0.0466	0.6213	0.6348
2	0.0192	0.1599	-0.035	-0.0115	0.2064	0.2256
3	0.0208	0.3695	-0.0254	-0.0383	0.4332	0.454
4	0.0225	0.5649	-0.049	-0.0182	0.6322	0.6546
5	0.0165	0.4108	-0.0407	-0.0091	0.4605	0.477
6	0.0157	0.5943	-0.0421	-0.0367	0.6731	0.6889
7	0.0179	0.6253	-0.0341	-0.0208	0.6802	0.6981
8	0.0213	0.7236	-0.0386	-0.0443	0.8065	0.8277
9	0.0164	0.8981	-0.0219	-0.056	0.976	0.9925
(Highest)10	0.0196	0.8366	-0.0404	-0.0726	0.9496	0.9692
Thailand						
Portfolio	**β1**	**β2**	**β3**	**β4**	**β5**	**β6**
(Lowest) 1	0.2355	0.0872	-0.021	-0.0221	0.1302	0.3658
2	0.2751	0.0963	-0.0066	0.0026	0.1003	0.3754
3	0.2985	0.0905	-0.0428	-0.0184	0.1516	0.4502
4	0.3364	0.0987	-0.0741	-0.0019	0.1747	0.5111
5	0.2442	0.131	0.0134	-0.0002	0.1179	0.362
6	0.2396	0.0998	-0.0572	-0.0012	0.1582	0.3978
7	0.2749	0.1718	-0.0151	-0.0014	0.1883	0.4632
8	0.2882	0.186	-0.0653	0.046	0.2053	0.4935
9	0.2893	0.2469	-0.0166	0.0573	0.2062	0.4955
(Highest)10	0.3683	0.3452	0.0252	-0.2682	0.5882	0.9565
Japan						
Portfolio	**β1**	**β2**	**β3**	**β4**	**β5**	**β6**
(Lowest) 1	0.1115	0.1275	-0.0374	-0.013	0.1779	0.2894
2	0.1173	0.008	-0.0032	-0.0159	0.0272	0.1445
3	0.1071	0.0074	-0.0126	-0.0127	0.0327	0.1398
4	0.1352	0.0093	-0.0313	-0.0169	0.0576	0.1928
5	0.114	-0.0062	-0.0158	-0.0109	0.0205	0.1345
6	0.1055	0.0081	-0.0037	-0.0171	0.0289	0.1344
7	0.1073	0.018	-0.0043	-0.0224	0.0447	0.152
8	0.117	0.1609	-0.0099	-0.0132	0.184	0.301
9	0.4128	1.079	-0.086	-0.2732	1.4381	1.8509
(Highest)10	0.4679	1.1141	-0.0957	-0.3274	1.5372	2.0051

Table 4:
Empirical Analysis of LCAPM in stock markets.

Panel regression with fixed effects has been employed to examine the seven LCAPM specifications after confirmation of Housman's test.

In Pakistan Individual liquidity risk channels comprising of flight to liquidity β3, commonality in liquidity β2 and the depressed wealth effect of liquidity risk β4 are not statistically significant. It means there is no contribution of individual liquidity risks in explaining the returns of the Pakistan stock market. As far as the combined effect of liquidity and aggregate systematic risks are considered. These are statistically significant at a 10% significance level. Moreover, firm size is positive but significant indicating firm size anomaly does not exist in the Pakistan stock market.

Table 4.2 reports that liquidity commonality beta β2 is positive and significant at a 1% significance level that demonstrates liquidity commonality premium exists in the Indian stock market. Similarly, Flight to liquidity beta β3and depressed wealth beta β4 are also significant at 1% significance level but with opposite signs. Hirvonen (2016) also found the positive impact of flight to liquidity risk on excess returns. It means the result of the study shows some deviation from Liquidity adjusted capital asset pricing theory. The effect of momentum is also weak in the Indian stock market.

Another contrasting result concerning LCAPM theory is also observed in the stock market of China. Table 4.3 indicates the significance of all individual liquidity risks such as a flight to liquidity beta β3, commonality beta β2 and the depressed wealth effect of liquidity beta β4 but with opposite signs. Liquidity commonality beta is negative but significant in the Ghana stock market (Hongzing & Duduchoge 2017). According to Kumar and Misra (2018) expected illiquidity exists in emerging markets that lead to an increase in the returns of liquid assets. Therefore flight to liquidity and the depressed wealth effect of liquidity risk are positive in emerging markets as compared to the developed market. The negative significant coefficients of aggregate liquidity risk β5 at a 1% significance level indicate that constraint liquidity premium exists in the financial market of China.

Table 4.4 reports that liquidity commonality beta β2, depressed wealth liquidity beta β4 and flight to liquidity risk β4 are statistically significant at a 1% significance level with expected signs. The findings of the study support that LCAPM is applied to explain the excess returns of stocks in the Thailand stock market.

Similarly, Table 4.5 also shows the significance of individual and aggregate liquidity risk with expected signs in a developed market. It means LCAPM theory contributes to explaining the stock returns of Japan. Vu et al (2015) also found the same result in the developed market of Australia.

Table 4.1:
Results of Liquidity Adjusted Capital Asset Pricing Model in Pakistan

	Models						
Variable	1	2	3	4	5	6	7
Constant	-0.917***	-0.912***	-0.996***	-0.914***	-1.00***	-0.955***	-0.728***
	(-4.08)	(-3.94)	(-3.46)	(-3.08)	(-3.44)	(-4.04)	(-2.42)
E_c	-0.251***	-0.251***	-0.254***	-0.251***	-0.255***	-0.252***	-0.232***
	(-4.87)	(-4.86)	(-4.87)	(-4.78)	(-4.87)	(-4.90)	(-4.42)
β1	-0.043*	-0.055	-0.027	-0.044	-0.042*		-0.371***
	(-1.75)	(-0.40)	(-0.62)	(-1.06)	(-1.67)		(-2.23)
β2		-0.076					-3.076***
		(-0.09)					(-2.40)
β3			0.101				5.868***
			(-0.44)				(-3.47)
β4				-0.044			-5.626***
				(-0.02)			(-3.42)
β5					-0.111*		
					(-1.88)		
β6						-0.043*	
						(-1.79)	
Firm Size	0.038***	0.038***	0.042***	0.038***	0.043***	0.040***	0.043***
	(4.13)	(4.11)	(3.48)	(3.09)	(3.32)	(4.08)	(3.19)
Momentum	-0.036***	-0.036***	-0.036***	-0.035***	-0.036***	-0.036***	-0.026***
	(-3.19)	(-3.18)	(-3.22)	(-3.15)	(-3.23)	(-3.22)	(-2.24)
F-statistics	4.42	4.10	4.11	4.10	4.11	4.43	4.39
F–statistics(p)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted R2	0.05	0.05	0.05	0.05	0.05	0.05	0.07

E_c (liquidity level), β1(market risk) β2 (Commonality beta) β3(Flight to liquidity beta) β4 (Depressed wealth beta) β5 (Aggregate liquidity beta) β6 (Systematic risk).
*indicate 10% level of significance, ** indicate 5% level of significance and *** indicate 1% level of significance.

Table 4.2:
Results of Liquidity Adjusted Capital Asset Pricing Model in India

	Models						
Variable	1	2	3	4	5	6	7
Constant	0.126**	0.037***	0.365***	0.374***	0.007**	-0.202***	0.244***
	(2.31)	(2.65)	(4.90)	(4.93)	(2.12)	(-4.30)	(2.74)
E_c	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001**	-0.001***
	(-2.58)	(-2.86)	(-3.17)	(-3.23)	(-2.77)	(-2.48)	(-3.38)
β1	0.315***	0.332***	0.464***	0.481***	0.311***		0.502***
	(5.48)	(5.86)	(7.11)	(7.17)	(5.48)		(5.64)
β2		0.125***					0.100***
		(4.83)					(3.33)
β3			0.186***				-0.174
			(4.61)				(-1.09)
β4				0.180***			0.183
				(4.63)			(1.27)
β5					0.122***		
					(4.43)		
β6						0.124***	
						(4.43)	
Firm Size	-0.005**	-0.006***	-0.014***	-0.014***	-0.005**	0.003**	-0.013***
	(-2.39)	(-2.98)	(-4.94)	(-4.98)	(-2.38)	(2.15)	(-4.26)
Momentum	0.003	-0.018	-0.008	-0.010	-0.016	-0.019	-0.027*
	(0.26)	(-1.37)	(-0.68)	(-0.78)	(-1.20)	(-1.45)	(-1.90)
F-statistics	3.30	4.83	4.67	4.68	4.55	2.49	4.84
F-statistics(p)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted R2	0.06	0.07	0.07	0.07	0.06	0.05	0.08

E_c (liquidity level), β1(market risk) β2 (Commonality beta) β3(Flight to liquidity beta β4 (Depressed wealth beta) β5 (Aggregate liquidity beta) β6 (Systematic risk).
*indicate 10% level of significance, ** indicate 5% level of significance and *** indicate 1% level of significance.

Table 4.3:
Results of Liquidity Adjusted Capital Asset Pricing Model in China.

	Models						
Constant	-0.182***	-0.159**	-0.174***	-0.187***	-0.136**	-0.007**	-0.204***
	-2.75)	(-2.40)	(-2.63)	(-2.83)	(-2.07)	(-2.11)	(-2.94)
E_c	-0.094***	-0.097***	-0.091***	-0.090***	-0.097***	-0.098***	-0.091***
	(-13.17)	(-13.52)	(-12.61)	(-12.44)	(-13.74)	(-13.73)	(-12.78)
β1	0.236***	0.108*	0.448***	0.446***	0.197***		0.176*
	(4.08)	(1.68)	(4.53)	(5.10)	(3.42)		(1.65)
β2		-0.024***					-0.044***
		(-2.86)					(-4.81)
β3			0.098***				-0.461**
			(2.64)				(-2.40)
β4				0.091***			0.506***
				(3.19)			(3.43)
β5					-0.046***		
					(-4.97)		
β6						-0.045***	
						(-4.81)	
Firm Size	0.008***	0.008***	0.007***	0.008***	0.008***	0.002	0.010***
	(2.80)	(2.81)	(2.67)	(2.87)	(2.81)	(0.95)	(3.62)
Momentum	-0.069***	-0.060***	-0.076***	-0.079***	-0.060***	-0.047***	-0.074***
	(-6.45)	(-5.43)	(-6.92)	(-7.12)	(-5.67)	(-4.56)	(-6.66)
F-statistics	19.37	18.75	18.63	18.94	20.36	20.04	19.11
F- statistics(p)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted R2	0.24	0.25	0.26	0.26	0.27	0.26	0.28

E_c (liquidity level), β1(market risk) β2 (Commonality beta) β3(Flight to liquidity beta) β4 (Depressed wealth beta) β5 (Aggregate liquidity beta) β6 (Systematic risk).
*indicate 10% level of significance, ** indicate 5% level of significance and *** indicate 1% level of significance.

Table 4.4:
Results of Liquidity Adjusted Capital Asset Pricing Model in Thailand.

	Models						
Constant	-0.019***	-0.030**	-0.015**	-0.013**	-0.049**	-0.094**	-0.316***
	(-2.61)	(-1.98)	(-2.48)	(-2.40)	(-2.14)	(-2.53)	(-5.73)
E_c 0.003	0.001	0.002	0.002	0.002	-0.007	0.000	
	(0.12)	(0.06)	(0.08)	(0.08)	(0.11)	(-0.34)	(0.01)
β1 0.004**	0.029***	0.008***	0.007***	0.036*		0.313***	
	(2.05)	(3.70)	(3.35)	(2.95)	(1.74)		(6.19)
β2		0.020***					0.295***
		(3.27)					(6.05)
β3			-0.031***				0.010
			(-3.02)				(0.17)
β4				-0.025***			-0.509***
				(-2.28)			(-6.73)
β5					0.031**		
					(2.50)		
β6						0.029***	
						(2.94)	
Firm Size	0.001	0.001	0.001	0.001	0.001	0.003***	0.001
	0.71	0.43	0.55	0.48	0.70	3.33	1.07
Momentum	-0.080***	-0.081***	-0.080***	-0.079***	-0.083***	-0.080***	-0.103***
	-6.98	-7.04	-6.96	-6.90	-7.04	-6.86	-8.88
F-statistics	4.2	4.8	4.6	4.3	4.0	4.0	7.3
F-statistics(p)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted R2	0.06	0.06	0.07	0.07	0.06	0.07	0.12

E_c (liquidity level), β1(market risk) β2 (Commonality beta) β3(Flight to liquidity beta) β4 (Depressed wealth beta) β5 (Aggregate liquidity beta) β6 (Systematic risk).
indicate 10% level of significance, ** indicate 5% level of significance and * indicate 1% level of significance.*

Table 4.5:
Results of Liquidity Adjusted Capital Asset Pricing Model in Japan.

	Models						
Constant	-0.048**	0.231***	-0.045**	0.010**	0.226***	0.308***	0.561***
	(-2.10)	(4.09)	(-2.02)	(2.22)	(4.09)	(5.49)	(8.69)
E_c0.076***	0.081***	0.078***	0.080***	0.086***	0.092***	0.108***	
	(6.08)	(6.76)	(6.18)	(6.49)	(7.12)	(7.42)	(9.21)
β1 0.011***	0.017***	0.004	0.009	0.007**		0.050***	
	(4.51)	(6.96)	(0.74)	(1.56)	(2.08)		(5.18)
β2		0.031***					0.061***
		(7.50)					(10.80)
β3			-0.031				-0.311***
			(-1.17)				(-9.24)
β4				-0.028***			-0.014*
				(-3.86)			(-1.73)
β5					0.025***		
					(7.73)		
β6						0.016***	
						(5.21)	
Firm Size	0.002	-0.009***	0.002	0.001	-0.008***	-0.011***	-0.021***
	(1.09)	(-4.15)	1.01	(-0.25)	(-4.15)	(-5.54)	(-8.79)
Momentum	-0.046***	-0.039***	-0.046***	-0.051***	-0.044***	-0.018	-0.031***
	(-3.51)	(-3.05)	(-3.49)	(-3.89)	(-3.05)	(-1.40)	(-2.56)
F-statistics	6.08	10.10	5.75	6.82	10.37	6.65	15.21
F –statistics(p)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted R2	0.08	0.14	0.08	0.10	0.15	0.09	0.23

E_c (liquidity level), β1(market risk) β2 (Commonality beta) β3 (Flight to liquidity beta) β4 (Depressed wealth beta) β5 (Aggregate liquidity beta) β6 (Systematic risk).
*indicate 10% level of significance, ** indicates 5% level of significance and *** indicate 1% level of significance.

CONCLUSION AND EMPIRICAL FINDINGS OF THE STUDY

The findings of the study conclude that individual level of liquidity risks comprising liquidity commonality, flight to liquidity risk and the depressed wealth effect of liquidity risk exists in emerging and developed stock markets except Pakistan. In addition to that aggregate systematic risk and combined liquidity risk are also priced in these stock markets. The results of the study support that the Liquidity adjusted capital asset pricing model contributes to explaining the excess stock returns in all stock markets except Pakistan. The illiquidity risk premium exists in these stock markets that enable the investors to select the stocks from these stock markets while formulating their portfolios. Liquidity behavior of financial markets enables the controlling authorities to control negative illiquid shocks that cause too much deviation in stock prices from their fundamental value.

Institutional and individual investors at the global level may invest in Japan, India and Thailand in the long run. As liquidity commonality premium exists in these stock markets so investors are positively compensated when they hold illiquid securities. Similarly, flight to liquidity risk and the depressed wealth effect of liquidity risk are priced in the stock markets of Japan and Thailand. Investors may invest in these markets because hedging positions in poor conditions of markets are available. Contrasting results concerning liquidity adjusted

capital asset pricing theory are also observed in the stock markets of India and China. The individual's liquidity risk channels such as liquidity commonality risk, flight to liquidity risk and depressed wealth effect of liquidity risk show association with excess returns but contrast to theory. Liquidity beta is negatively significant and flight to liquidity risk and the depressed wealth effect of liquidity risk are positively significant. The positive significant coefficients of flight to liquidity beta and depressed wealth effect beta in India and China stock markets leave room for future study. The future study should be conducted to know the reasons of different behavior of liquidity risk in emerging markets as compared to the developed market.

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