The Role of Liquidity Risk in Asset Pricing: Evidence from Sri Lanka

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Abstract

Securities liquidity varies over time, which leads to equity return volatility. It implies that the liquidity in the capital markets is a significant source of risk. Therefore, liquidity risk in securities is difficult to diversify and contributes to the systemic market risk. This study aims to analyze the relationship between securities returns and liquidity risk while taking into account the time-varying characteristics of illiquidity on the Colombo Stock Exchange from 2015-2019 and taking into account the effect of liquidity level, using the Generalized Method of Movements (GMM) framework model to assess the persistence of illiquidity securities contributions of the updated version of the Amihud illiquidity (Amihud, 1986) proxy to represent across time market illiquidity and to research the time-series relationship between liquidity and returns. The pricing of liquidity risk and its implications for expected returns are empirically tested using the conditional liquidity adjusted capital asset pricing model (LCAPM), where stock returns are cross-sectionally dependent on market risk and three additional betas ($\beta^1, \beta^2, \beta^3$) that capture different aspects of illiquidity and its risk. The findings reveal some support for the conditional capital asset pricing model (CAPM), but results are not robust to alternative specifications and estimation techniques. The total effect of liquidity risk is 0.11%, and illiquidity is 2.5% per year. Illiquidity premium depends on the expected transaction cost at the end of the holding period for investors' 2.5%. This makes the overall illiquidity premium of 2.61%. These estimates and the overall importance of liquidity level and liquidity risk depend on the model implied restrictions of a constant market risk premium and a fixed transaction cost. However, LCAPM has constructed conditionally; it can relax these model-implied constraints and estimate different liquidity risk premiums while also allowing transaction costs to be a free parameter. The overall liquidity risk characterized by liquidity betas with a single market risk premium is relatively small and barely significant in the restricted model. Using this unrestricted model, find that the overall illiquidity premium corresponds to 2.61%. The empirical results shed light on these channels' toal and relative economic significance and provide evidence of flight to liquidity.

Keywords: Capital Asset Pricing Model, Liquidity Risk, Liquidity beta, Generalize Method of Movement, Sri Lanka

INTRODUCTION

The literature on finance highlights the importance of liquidity in both dimensions: a function and a separate factor in pricing. Liquidity is the extent to which an asset or commodity can be exchanged on the market without changing the asset values or how easily an asset can be turned into cash without losing its value. In economics, liquidity risk is known as security-return exposure to aggregate market liquidity (Pástor and Stambaugh, 2003). While evaluating security returns and asset prices, investors should understand both the liquidity level and liquidity risk. Agencies (2016) emphasizes the significance of distinguishing between the liquidity level and liquidity risk. Securities liquidity varies over time, leading to equity return volatility, which means that liquidity in financial markets is a significant risk source. Empirical studies, such as Hasbrouck and Seppi (2001), Chordia, Sarkar, and Subrahmanyam (2005), and Huberman and Halka (2001) identified common liquidity and liquidity risk that affects the entire market.

As a result, securities liquidity risk is difficult to diversify and adds to the market's systemic risk. Traditional asset pricing models, such as CAPM-which model compensation for investor-taken un-diversifiable risk, fail to integrate investor-borne liquidity risk. Therefore, additional asset pricing models may be developed by adding components to compensate for illiquidity and liquidity risk in the market. The literature on market microstructure investigating the relationship between liquidity and asset returns is comprehensive. From the initial asset-specific works of Amihud and Mendelson, (1986) to subsequent market-wide research Pastor, (2003); Acharya, V. V., & Pedersen, (2005); Amihud *et al.*, (2012), previous studies analyze liquidity as a stock attribute and an aggregate risk factor. Despite the numerous financial crises and market volatility, market illiquidity remains of great interest to investors and researchers alike. In the CSE, the persistence of illiquidity shocks on the market and the effects of those shocks on liquidity risk pricing remains mostly unexplored.

The purpose of this study is to examine the relationship between security returns and liquidity risk while taking into account the time-varying characteristic of illiquidity in the CSE. Thus, the researcher contributed to the existing literature in the following ways. First, a modified version of the Amihud (2002) illiquidity proxy represented the illiquidity overtime on the market. Second, it studies the relationship between liquidity and security returns in the time series. This will demonstrate whether liquidity shocks impact securities returns or not and the notion of flight to liquidity. Thirdly, Acharya, and Pedersen (2005) liquidity-adjusted CAPM was used where stock returns rely sectionally on market risk and three additional risk betas, capturing different aspects of illiquidity and its risk.

LITERATURE REVIEW

It is estimated in the literature that the level of liquidity is priced. Acharya, V. V., & Pedersen (2005)found that the liquidity risk was positively priced using the Amihud liquidity measure and the liquidity-based asset pricing model. Amihud & Mendelson, (1986) were the first to examine the relationship between liquidity, asset prices, how this is interlinked with investors holding period, and found that investors trading more often would prefer to hold assets with lower transaction costs. Brennan et al. (1998) examine the relationship between the illiquidity premium and returns while measuring the alternative liquidity proxy that measures price impact and market depth. Jones (2001) finds evidence that the expected returns are the same when the spread is large. While using the turnover ratio as a measure of liquidity, he finds that a high turnover ratio leads to lower returns on stocks. Using daily data Hasbrouck & Seppi, (2001b) get mixed results. He finds that the relationship between returns and liquidity varies considerably in scope and direction. Hur, Chung, and Liu, (2018) studies a proposed liquidity premium (or discount) measure recently proposed. cross-sectional stock returns but excess time-series returns on portfolios extracted from a common measurement of liquidity. Their study suggests that a better understanding of liquidity risk improves market trading effectively. Kumar & Misra, (2019), reported results, provide evidence that liquidity risk factors play a role in explaining the cross-return in India. Common liquidity and co-movement between individual stock illiquidity and the market return is a dominant systematic risk factor. The idiosyncratic risk factor is the variance between the individual stock returns and the associated stock liquidity. The overall impact stated indicates that the sum of all liquidity risk factors is positive and essential across all model specifications. And their findings suggest that liquidity is part of systemic and idiosyncratic risk. Tazojeva & Supervisor (2019) study a model that takes into account liquidity risk at OSE. The conventional model of asset pricing has been modified to reflect the cost of illiquidity and reflects risk over time. They find that investors are interested in the return of securities and liquidity, particularly in the downstream market. They are also willing to trade off the performance of these assets in favour of liquidity at a time when liquidity is drying up. Investors' returns are positively influenced by this liquidity and increase the covariance between the illiquidity of securities and the broad illiquidity of the market.

METHODOLOGY

The data set used consists of daily data of share prices from 2015 to 2019 and includes a sample of 50 securities. The data set includes information on the return on the market and firms, market capitalization, turnover, and the risk-free rate. Only ordinary shares are included in the selection, and these are adjusted for dividends. There are several liquidity measures and proxies; this study uses the illiquidity factor of Amihud, (2002). The Amihud illiquidity measure (ALM) is a measure of illiquidity because it measures the price impact of trading in percentage, a higher outcome hints at a higher level of illiquidity. The formula for the ALM is presented as follows,

$$\boldsymbol{ILLIQ_t^i = \frac{1}{Days_t^i}\sum_{d=1}^{Days_t^i}\frac{R_{td}^i}{V_{td}^i}} \quad \textbf{(1)}$$

The researcher derives and an unconditional version to estimate the liquidity adjusted capital asset pricing model (LCAPM). For example, under the presumption of independence overtime of the costs of dividends and illiquidity, and unconditional result obtains. Nevertheless, empirically the illiquidity is persistent. Therefore, the researcher relies on the premise that developments in illiquidity and returns are continuously conditional covariances. This assumption yields the unconditional result that,

$$\boldsymbol{E(r_t^p - r_t^f)} = \mathrm{E}(\boldsymbol{C_t^p}) + \boldsymbol{\lambda\beta^{1p}} + \boldsymbol{\lambda\beta^{2p}} - \boldsymbol{\lambda\beta^{3p}} - \boldsymbol{\lambda\beta^{4p}} \quad (2)$$

β^{1p} - covariance between the return of a security and the market return.
β^{2p} - covariance between asset's illiquidity of a stock and the market illiquidity.
β^{3p} - covariance between a security's return and market liquidity.
β^{4p} - covariance between a security's illiquidity and the market return.

Portfolio Construction

The data set used consists of daily data of share prices from 2015 to 2019 and includes a sample of 50 securities. Firstly, at the beginning of each year, build 10 illiquidity portfolios based on daily illiquidity calculations using daily return and volume data from previous years. Portfolios are used in the asset pricing models that are tested in this thesis. The primary test is defined in terms of equally-weighted returns and illiquidity for the portfolio of markets.

Liquidity Adjusted Capital Asset Pricing Model

We are designing a dynamic conditional LCAPM to calculate the impact of persistence in liquidity, where betas are dependent on the market state and returns. Because financial market time series have unstable variances and covariances, the conditional LCAPM allows us to examine the relationship between liquidity risks and asset prices varying over the sample period. With this in mind, the LCAPM model can be written as:

$$\boldsymbol{E(r_t^p - r_t^f)} = \mathrm{E}(\boldsymbol{C_t^p}) + \boldsymbol{\lambda\beta^{1p}} + \boldsymbol{\lambda\beta^{2p}} - \boldsymbol{\lambda\beta^{3p}} - \boldsymbol{\lambda\beta^{4p}} \quad \textbf{(3)}$$

Where,

$$\beta^{1p} = \frac{cov\left(r_t^i, r_t^M - E_{t-1}(r_t^M)\right)}{var((r_t^M - E_{t-1}(r_t^M) - [c_t^M - E_{t-1}(c_t^M)])} \text{ .... (4)}$$

$$\beta^{2p} = \frac{cov\left((c_t^i - E_{t-1}(c_t^i), c_t^M - E_{t-1}(c_t^M)\right)}{var((r_t^M - E_{t-1}(r_t^M) - [c_t^M - E_{t-1}(c_t^M)])} \text{ .... (5)}$$

$$\beta^{3p} = \frac{cov\left((r_t^i, c_t^M - E_{t-1}(c_t^M)\right)}{var((r_t^M - E_{t-1}(r_t^M) - [c_t^M - E_{t-1}(c_t^M)])} \text{ .... (6)}$$

$$\beta^{4p} = \frac{cov\left((c_t^i - E_{t-1}(c_t^i), r_t^M - E_{t-1}(r_t^M)\right)}{var((r_t^M - E_{t-1}(r_t^M) - [c_t^M - E_{t-1}(c_t^M)])} \text{ .... (7)}$$

Sources: Acharya, V. V., & Pedersen, L. H. (2005) 'Asset Pricing with Liquidity Risk', Asset pricing with liquidity risk journal of Financial Economics

Empirical estimation

We need a couple of assumptions and model constraints to research the relationship between liquidity risk and anticipated returns. We test this relationship using the General Methods of Moments (GMM) method to apply a cross-sectional analysis of our portfolios. Running GMM offers similar estimates to the standard cross-sectional Fama, Eugene F.; MacBeth, (1973) or pooled OLS regression, but GMM also facilitates serial correlation and takes pre-estimation betas into account. (Cochrane, 2001) presents the application of GMM in the pricing of empirical properties. We first set a limit that the beta risk premium is the same, defined as:

$$\beta^{net.p} = \beta^{1p} + \beta^{2p} - \beta^{3p} - \beta^{4p} \text{ .... (8)}$$

Which makes liquidity adjusted CAPM:

$$E\left(r_t^p - r_t^f\right) = \alpha + k\mathrm{E}(C_t^p) + \beta^{net.p} \text{ .... (9)}$$

Where allow a non-zero intercept, α even though (Acharya and Pedersen, 2005) claim that this intercept should be zero.

RESULTS AND DISCUSSION

Summary Statistics

This table includes the descriptive statistical data on Sri Lanka grouped by ten portfolios based on an Amihud liquidity measure (2002). The source of the data is the World Bank Group's Database and Stock Exchanges. The daily price, market value, volume, and return index from 01 January 2015 to 31 December 2019 are included in the data collection for each company. The sample contains common return and volume stocks only within one year. Betas from LCAPM one to four represent Acharya and Pedersen's LCAPM regional betas (2005). Beta One is the market beta used in the original CAPM model and beta two to four are illiquid betas based on the covariance between normalized illiquidity portfolio and normalized illiquidity, the portfolio return covariance and normalized illiquidity market covariance and the covariance between normalized Illiquidity portfolio and a return on markets. $E(C^p)$ indicates the average value of the normalized illiquidity measurement of Amihud. The standard average deviation from this measurement is defined as $\sigma(\Delta C^p)$, the average excess return portfolio is referred to as, $E(r^{e,p})$, and its standard deviation is $\sigma(r^p)$. All data in the currency value are expressed in Bn. For presentation purposes, beta is multiple with 100.

Table 1: Summary Statistic – Properties of illiquidity portfolios

P	β^{1p} (.100)	β^{2p} (.100)	β^{3p} (.100)	β^{4p} (.100)	$\beta^{Net.p}$ (.100)	$E(C^p)$ (%)	$\sigma(\Delta C^p)$ (%)	$E(r^{e,p})$ (%)	$\sigma(r^p)$ (%)	trn (%)	Size (Bn)	BM
1	50.03	0.62	-0.24	-0.05	50.95	0.54	0.55	-0.15	1.73	3.24	73.82	0.99
2	40.25	0.07	-0.26	-0.24	40.82	0.68	1.10	0.04	1.77	2.80	41.91	0.44
3	88.04	0.02	-0.36	-0.26	88.68	0.78	0.74	-0.27	1.88	1.71	30.51	1.48
4	85.72	0.09	-0.52	-0.24	86.57	1.02	0.79	-0.60	2.03	1.47	26.40	1.21
5	74.02	0.02	-0.54	-0.43	75.01	1.27	1.18	-0.11	2.24	1.48	22.26	0.92
6	69.52	0.84	-0.67	-0.59	71.62	1.48	2.40	-0.16	2.88	0.20	16.38	2.03
7	81.94	0.29	-1.18	-0.44	83.86	1.75	1.98	-0.16	3.38	0.60	15.25	0.93
8	44.49	0.06	-1.45	-0.68	46.68	1.95	2.09	-0.12	3.69	0.38	8.44	1.22
9	82.12	0.74	-1.48	-0.82	85.16	2.02	2.29	-0.43	4.19	5.68	7.86	0.83
10	57.14	1.51	-1.78	-0.95	61.38	2.11	2.12	-0.22	4.81	2.44	6.15	1.08

Looking at the market beta, β^{1p} denotes the covariance between the return of a security and the market return. The market beta has a positive value linear with the required return of security and has positive with the liquidity stocks, and its value is significant. And also, liquidity betas, β^{2p} have different values in illiquidity, while β^{3p} start- off with a small negative value and the sign of β^{3p} varies from small negative values to large negative values in portfolios of each security and has an obscure pattern in the test portfolios. And also, there are no positive values these all testing portfolios β^{3p} value got negative values. If the researcher interprets β^{3p} in an economic sense, the investors expect returns of the stocks in the liquid companies to remain stable in times of illiquidity in the market. Said differently, negative values of β^{3p} for portfolio 1 to 10 means that the returns of the portfolios react too much to market illiquidity, i.e., high sensitivity of returns to market liquidity. The liquid stock (portfolio 10) seems to have a higher sensitivity of returns to market illiquidity. This is interesting on its own, but since the most illiquid portfolios are not supported in terms of statistical significance should be careful in this consideration. And also, β^{4p} is negative for all liquid securities, though this value is small and has an obscure pattern. β^{4p} seems to be increasing slowly between portfolio 1 and 10. And these portfolios are most sensitive to market returns.

Correlation:

A natural step is to establish a relationship between the various liquidity beta before assessing the liquidity and return relationship. They are in proportion to their correlations with their respective property and volatility in the way they construct liquidity betas, $\beta^{2p}, \beta^{3p}$and β^{4p}. The table 2 shows that more liquid stocks tend to have lower returns, although, for the most liquid portfolio, volatility tends to be the lowest.

The Correlation Coefficient Between Betas for Illiquidity Sorted Portfolio:

The correlated Betas, β^{2p}, β^{3p} and β^{4p} for ten equal-weighted portfolios have been shown in the below table. Betas are estimated based on illiquidity innovations and returns. The market portfolio is also equal-weighted for returns and illiquidity. For each year, the correlations are formed and then averaged over the sample period. The results are based on monthly data covering the period from January 2015 to December 2019.

Table 2: Correlation coefficient between betas for illiquidity sorted portfolio

	$\boldsymbol{\beta^{1p}}$	$\boldsymbol{\beta^{2p}}$	$\boldsymbol{\beta^{3p}}$	$\boldsymbol{\beta^{4p}}$
$\boldsymbol{\beta^{1p}}$	1.000			
$\boldsymbol{\beta^{2p}}$	-0.128	1.000		
$\boldsymbol{\beta^{3p}}$	0.012	-0.549	1.000	
$\boldsymbol{\beta^{4p}}$	-0.001	-0.620	0.913	1.000

In these results, the correlation between β^{1p} and β^{2p}, β^{1p} and β^{3p} and $\beta^{1p}$and β^{4p} has a small correlation coefficient, which indicates that there is no relationship between variables. One of the reasons for achieving the much smaller collinearity for individual stocks may be a larger estimation error. And this low collinearity between these betas is worrying when attempting to determine their return results. Nevertheless, this collinearity among the rest of the betas has been largely increased. The correlation strength between β^{2p} and β^{3p} is about -0.549 and $\beta^{2p}$and β^{4p} is about -0.629.

The relationship between these variables is negative, which indicate that, β^{2p} and β^{3p} and β^{2p} and β^{4p} increase, strength decreases. However, β^{3p} and β^{4p} the relationship is getting positive value, which is 0.913, which indicates that between these variables have a positive relationship, and strength is increasing.

The Correlation Coefficient Between Betas for Individual Stocks:

This table reports correlation of betas $\beta^{1p}, \beta^{2p}, \beta^{3p}$ and β^{4p} for individual shares listed in CSE. The correlations are computed annually for all eligible stocks in a year and then average over the sample period. The four betas are computed for each stock using all monthly returns and illiquidity covering the period from January 2015 to December 2019.

Table 3: Correlation coefficient between betas for individual stocks

	$\boldsymbol{\beta^{1p}}$	$\boldsymbol{\beta^{2p}}$	$\boldsymbol{\beta^{3p}}$	$\boldsymbol{\beta^{4p}}$
$\boldsymbol{\beta^{1p}}$	1.000			
$\boldsymbol{\beta^{2p}}$	-0.150	1.000		
$\boldsymbol{\beta^{3p}}$	0.265	-0.284	1.000	
$\boldsymbol{\beta^{4p}}$	0.759	-0.074	0.132	1.000

In these results, the correlation between β^{1p} and β^{2p}, β^{1p} and β^{3p} has a small correlation coefficient, which indicates that there is a small relationship between variables. Then β^{1p} and β^{4p} has a significant correlation coefficient and the mean of the relationship is strong. However, β^{1p} and β^{3p}, β^{1p} and β^{4p} have a positive relationship. The correlation between β^{2p} and β^{3p} is about -0.284 and β^{2p} and β^{4p} is about -0.074. The relationship between these variables is negative, which indicate that, β^{2p} and β^{3p} and β^{2p} and β^{4p} has a small relationship, strength decreases. However, β^{3p} and β^{4p} the relationship is getting positive value, which is 0.132, which indicates that between these variables have a positive relationship, and strength is not much higher.

Empirical Estimation:

To study the relationship between liquidity risk and expected returns, a few assumptions are needed, and some model constraints are set. To test this relation using the General Method of Moments (GMM) framework by carrying out a cross-sectional regression of portfolios. Running GMM generates similar estimates as the traditional cross-sectional regression Fama & Macbeth (1993) or using pooled OLS, but GMM also enables serial correlation and takes into account the pre-estimation of betas. The application of GMM in empirical asset pricing is provided in Cochrane (2001).

According to that firstly, set a constraint that the risk premium for the betas is the same, defined as,

$$\boldsymbol{\beta^{net.p} = \beta^{1p} + \beta^{2p} - \beta^{3p} - \beta^{4p}} \ldots\ldots \textbf{(10)}$$

Which makes liquidity adjusted CAPM:

$$\boldsymbol{E\left(r_t^p - r_t^f\right) = \alpha + kE\left(c_t^p\right) + \beta^{net.p}} \ldots\ldots \textbf{(11)}$$

Where the researcher allows a non-zero intercept, α, even though Acharya & Pedersen (2005) claim that this intercept should zero.

Asset Pricing with Liquidity Risk:

The liquidity adjusted capital asset pricing model results are present in this section. This begins by analyzing the primary test, which is sorted by illiquidity, and then moves on to evaluate portfolios sorted by volatility and size, as well as checking the robustness of weighted method and control for size and momentum.

Illiquidity Sorted Portfolios:

Table 4: Asset Pricing: Model Testing for Illiquidity Sorted Portfolios

	Constant	$E(c^p)$	β^{1p}	β^{2p}	β^{3p}	β^{4p}	$\beta^{net.p}$	R^2
1	-0.201*** (-2.774)	0.025 (-)					0.250** (1.270)	0.122 (0.115)
2	-0.123 (-1.155)	-0.01 (-0.534)					0.702 (0.853)	0.225 (0.223)
3	-0.144** (-2.201)		0.164 (0.155)					0.123 (0.121)
4	-0.203*** (-2.279)	0.025 (-)	0.520 (0.138)				0.717* (1.184)	0.223 (0.222)
5	0.148* (1.182)	0.04 (0.128)	-0.260 (-0.482)				0.382** (1.192)	0.308 (0.307)
6	0.175** (2.232)		-0.375 (-0.106)				0.548** (1.142)	0.210 (0.208)
7	0.122* (1.175)	0.025 (-)	0.207 (0.165)	0.079 (0.105)	-0.805* (-1.121)	-0.349* (-1.724)		0.381 (0.379)
8	-1.325* (-1.191)	0.017 (0.947)	0.274 (0.198)	0.026 (0.217)	-0.694* (-1.182)	-0.161* (-1.120)		0.441 (0.439)

****p<0.01, **<0.05, *p<0.1*

For certain configurations, the average holding period k for illiquidity sorted portfolios is calibrated to 0.025. This implies that it takes 1/0.025 ≅ 40 months for all stocks to be turned over once, which corresponds to investors holding, and this value is obtaining by the averaging turnover of test portfolios.

To start testing the LCAPM with only one risk premium, λ^M, where the risk factor is the net beta, $\beta^{net.p}$. The result for this specification is reported in Equation (Above mention) in Table 4. This sees that researcher get a large and significant value of risk premium λ^M, while the constant α is also significant at 5% and 1%.

To isolate the effect of liquidity risk, β^{2p}, β^{3p} *and* β^{4p}over traditional market risk, β^{1p}, and liquidity level, $E(c^p)$, consider the following model,

$$\boldsymbol{E\left(r_t^p - r_t^f\right) = \alpha + kE\left(c_t^p\right) + \lambda^1\beta^{1p} + \lambda\beta^{net.p}} \text{……………………………………………… } \mathbf{(12)}$$

This relation is estimated with k at its calibrated value. In this specification, $\beta^{net.p}$ is still significant (at 5% and 1%), but β^{1p} seem to produce relatively small values while being significant. Equation (2), (5) and (8) produce quite different results when allowing k to be free parameter and $\beta^{net.p}$ has different in value, while getting a small positive value of β^{1p} and small increased value of $E(c^p)$. In equation (6) set k = 0, which leads to support for $\beta^{net.p}$. It is also worthy of note that the negative value of β^{1p} in equation (5) and (6) does not mean a negative risk premium λ^M in the market. Since it has included β^{1p} as a part of $\beta^{net.p}$, simply need to add the coefficient of $\beta^{net.p}$ to get the correct value.

For instance, in Equation (5) in Table 4 means that,

$$E\left(r_t^p - r_t^f\right) = 0.148 + 0.04E\left(c_t^p\right) - 0.260\beta^{1p} + 0.382\beta^{net.p}$$

$$E\left(r_t^p - r_t^f\right) = 0.148 + 0.04E\left(c_t^p\right) + 0.122\beta^{1p} + 0.382(\beta^{2p} - \beta^{3p} - \beta^{4p})$$

To test the full model in which the researcher allows the betas to have different risk premiums and λ and a fixed k, and run the unrestricted model obtained in Equation 7. Equation 8 runs the same model with k as a free value. Here is the generalized relation,

$$E\left(r_t^p - r_t^f\right) = \alpha + kE\left(c_t^p\right) + \lambda^1\beta^{1p} + \lambda^2\beta^{2p} + \lambda^3\beta^{3p} + \lambda^4\beta^{4p}$$

If there is no model restriction, $\lambda^1 = \lambda^2 = -\lambda^3 = -\lambda^4$. Also, see that all beats produce moderate results, both significant and insignificant, except for the average illiquidity portfolio,$E\left(c_t^p\right)$. Since there is a significant collinearity problem, however, this evidence should be interpreted with caution. Eventually, it wants to emphasize that the intercept α fluctuates between being significant and insignificant of some specification, while the model implies a zero-constant value.

Then, the economic significance of the results and the overall liquidity risk are probably more important to research. The annual market risk premium should be measured to show the size of the results, λ^M, and the market risk premium for different liquidity betas (i.e. $\lambda^1, \lambda^2, \lambda^3, \lambda^4$) required to hold illiquid stocks. This calculates by the market risk premium product and the difference in empirical literature between liquidity risk for most liquid and least portfolio.

The different annualized expected returns between portfolio 1 and 10 that can be attributed to a difference in β^{2p}. Hence using the calibrate value k and the common market risk premium,λ^M, of 0.250 from Equation (1) get the following results, the commonality of portfolio illiquidity and market illiquidity is,

$\lambda^M\left(\beta_2^{p10} - \beta_2^{p1}\right)12$ =0.026%

Similarly, the effect of β^{3p}, the sensitivity of returns to market illiquidity, on yearly returns is,

-$\lambda^M\left(\beta_3^{p10} - \beta_3^{p1}\right)12$ =0.05%

And similarly, the effect of β^{4p}, the sensitivity of portfolio illiquidity to the overall market return is,

-$\lambda^M\left(\beta_4^{p10} - \beta_4^{p1}\right)12$ =0.03%

Which makes the overall effect of liquidity risk of 0.11% per year.

The difference in annualized expected returns between portfolio 1 and 10 that can be attributed to a difference in the expected illiquidity, $E\left(c_t^p\right)$, It is 2.5%, using the calibrate coefficient. The overall effect of expected illiquidity and liquidity risk is 2.61% per year.

In the restricted model, the overall liquidity risk defined as the liquidity beta with a signal market risk premium is relatively low and barely significant. This could be linked to choosing a small trading platform to look at. The overall risk value for liquidity is quite comparable with Pastor and Stambaugh's (2003) findings. Similarly, Acharya and Pedersen (2005) found that their primary illiquidity sorted model was value-weighted portfolios and the market, and found that their liquidity risk had become insignificant.

Although managing the single market risk premium for liquidity betas like this, using different risk premiums does not yield much higher performance. With the unrestricted model, different risk premiums are allowed and significant β^{3p} and β^{4p}, are obtained, while the rest of the betas are insignificant. The statistical insignificance of liquidity betas can also be attributed to the upper and lower limits of the sampled stocks.

Asset Pricing: Model Testing for Illiquidity Sorted Portfolios and Volatility of Illiquidity Sorted Portfolios:

This table reports the estimated coefficient of a cross-sectional regression for illiquidity sorted portfolios. Portfolios are formed using monthly returns and illiquidity innovations from 2015 to 2019. Testing portfolios are equal-weighted, and the market portfolio is reported to equal-weighted as well. To test the liquidity adjusted model consider the relation such as

$$E\left(r_t^p - r_t^f\right) = \alpha + kE\left(c_t^p\right) + \lambda^1\beta^{1p} + \lambda^2\beta^{2p} + \lambda^3\beta^{3p} + \lambda^4\beta^{4p} + \lambda\beta^{net.p}$$

Where, $\beta^{net.p} = \beta^{1p} + \beta^{2p} - \beta^{3p} - \beta^{4p}$. In equation (1), (4), (7) set the holding period (average of monthly turnover) k as a fixed parameter, while Equation (2), (5), (8) lets it be free. The t-statistic, reported in the parentheses, is estimated using the GMM framework into account the pre-estimation of the betas. The R^2 is obtained in single cross-sectional regression, and the adjusted R^2 is reported in parentheses.

The Volatility of Illiquidity Sorted Portfolios:

Table 5: Asset Pricing: Model Testing for Volatility of Illiquidity Sorted Portfolios

	Constant	$E(c^p)$	β^{1p}	β^{2p}	β^{3p}	β^{4p}	$\beta^{net.p}$	R^2
1	0.137** (1.813)	0.025 (-)					-0.145* (-1.581)	0.110 (0.108)
2	0.105 (1.243)	0.06 (0.46)					-0.576 (-0.573)	0.236 (0.234)
3	0.105 (1.391)		-0.924 (-1.060)					0.116 (0.112)
4	0.142** (1.916)	0.025 (-)	0.479 (1.183)				-0.583 (-1.443)	0.207 (0.205)
5	0.101 (1.217)	0.03 (0.18)	0.259 (0.665)				-0.292 (-0.734)	0.314 (0.313)
6	0.132** (1.714)		-0.497 (-1.276)				-0.572 (-0.778)	0.194 (0.193)
7	-0.602 (-0.736)	0.025 (-)	-0.512 (-0.486)	-0.765** (-2.35)	-0.358 (-0.284)	0.590 (1.394)		0.360 (0.359)
8	-0.854 (-0.938)	0.35 (1.08)	-0.263 (-0.251)	0.558 (0.127)	-0.541 (-0.04)	0.486 (0.923)		0.452 (0.450)

****p<0.01, **<0.05, *p<0.1*

Sorted stocks on σ (Illiquidity) do not produce any better results than previously predicted. This can be seen from Table 5, the majority of the market premium estimates provide moderate negative values, some of which are insignificant, based on the experience of equation (6), where hold k = 0. Holding period k tends to be of strong significance when the researcher allows it to be a free parameter. In Equation (5) and Equation (8) get values that correspond closely to their calibrated values without equation (2). In both cases, the insignificant values of β^{3p} and β^{4p} are given with moderate values. Looking at β^{2p}Those betas are moderately significant in equation (7) compared to equation (8). This, therefore, provides further evidence of the sensitivity of portfolio illiquidity to market returns. While the overall liquidity risk does not seem to matter above and beyond the level of liquidity or market risk, β^{4p} the contribution to annual returns here corresponds to 0.590. The overall liquidity risk is not substantially different from zero.

Illiquidity Sorted Portfolios; Robustness of The Weighted Method:

To order to verify the robustness of the weighting portfolios, the organization wants to test various requirements and portfolios. Test the value-weighted portfolios and the equal-weighted market in Table 6 and test the equal-weighted portfolios and the value-weighted market in Table 7. In this review, this specification is treated as a robustness check, whereas Acharya and Pedersen (2005) use it as a primary test model. From Equation (1), see that $\beta^{net.p}$ is a 5% borderline significant and interestingly gets a negative value.

Asset Pricing; Model Testing for The Robustness of The Weighting Method:

(value-weighted portfolios and equal-weighted market and equal-weighted portfolios and value-weighted market)

This table reports the estimated coefficient of a cross-sectional regression for illiquidity sorted portfolios. Portfolios are formed using monthly returns and illiquidity innovations from 2015 to 2019. Testing portfolios are value-weighted, and the market portfolio is reported equal-weighted. To test the liquidity adjusted model consider the relation such as,

$$E\left(r_t^p - r_t^f\right) = \alpha + kE\left(c_t^p\right) + \lambda^1\beta^{1p} + \lambda^2\beta^{2p} + \lambda^3\beta^{3p} + \lambda^4\beta^{4p} + \lambda\beta^{net.p}$$

Where, $\beta^{net.p} = \beta^{1p} + \beta^{2p} - \beta^{3p} - \beta^{4p}$. In equation (1), (4), (7) set the holding period (average of monthly turnover) k as a fixed parameter, while Equation (2), (5), (8) lets it be free. The t-statistics, reported in the parentheses, are estimated, taking into account the pre-estimation of betas using the GMM framework. The R^2 is obtained in single cross-sectional regression, and the adjusted R^2 is reported in parentheses.

Table 6: Asset Pricing: Model Testing Value Weighted Portfolios, Equal Weighted Market

	Constant	$E(c^p)$		β^{1p}	β^{2p}	β^{3p}	β^{4p}	$\beta^{net.p}$	R^2
1	0.350 (1.272)	0.025 (-)						-1.938** (-1.203)	0.486 (0.486)
2	0.213 (0.785)	-0.029 (-0.83)						-1.635** (-2.033)	0.246 (0.209)
3	0.583 (0.718)			-0.891 (-1.198)					0.450 (0.450)
4	0.363 (0.268)	0.025 (-)		0.811 (0.998)				-0.471 (-0.633)	0.395 (0.390)
5	0.301 (0.825)	-0.022 (-0.021)		0.655 (1.450)				-0.056 (-0.140)	0.225 (0.223)
6	0.105 (0.269)			0.512 (0.824)				-0.241 (-0.271)	0.400 (0.400)
7	0.996 (1.115)	0.025 (-)		-0.333 (-0.913)	-0.369 (-1.287)	-0.132 (-0.633)	0.143 (0.397)		0.364 (0.360)
8	1.782** (2.848)	-0.067 (-0.330)		-0.160 (-0.447)	0.588 (1.140)	-0.053 (-0.060)	0.105 (1.120)		0.245 (0.240)

****p<0.01, **<0.05, *p<0.1*

Table 7: Asset Pricing: Model Testing Equal Weighted Portfolios, Value Weighted Market

	Constant	$E(c^p)$	β^{1p}	β^{2p}	β^{3p}	β^{4p}	$\beta^{net.p}$	R^2
1	0.381 (0.882)	0.025 (-)					-0.516 (-0.915)	0.139 (0.135)
2	0.289 (0.737)	-0.053 (-0.063)					-0.621** (-1.435)	0.119 (0.110)
3	0.530 (1.203)		-0.852 (-0.855)					0.212 (0.210)
4	0.511 (0.730)	0.025 (-)	0.951 (0.571)				-0.422 (-0.667)	0.198 (0.198)
5	0.134 (0.379)	-0.039 (-0.041)	0.345 (0.531)				-0.039** (-1.814)	0.229 (0.223)

6	0.590 (0.772)		0.716 (1.214)				-0.096 (-1.120)	0.246 (0.240)
7	0.300 (0.350)	0.025 (-)	-0.024 (-0.764)	-0.981* (-1.953)	-0.093** (-1.612)	0.490 (0.284)		0.233 (0.231)
8	1.092** (1.567)	-0.14 (-0.452)	-0.275 (-0.024)	0.355 (0.014)	-0.101 (-0.730)	0.259 (0.232)		0.155 (0.152)

****p<0.01, **<0.05, *p<0.1*

First, $\beta^{net.p}$ is borderline significant at a 5% level in equation (1) of Table 6, but insignificant at this level in Table 7. In particular, $\beta^{net.p}$Is significant in equation (2) of Table 11, and all of the equation (2) and (5) in Table 6, the liquidity adjusted CAPM has a little bit higher R-square than the standard CAPM. In particular, with value-weighted portfolios in Table 6, the standard CAPM has an R-square of 45%, whereas the liquidity adjusted CAPM has an R-square of 48.6%. There is additional evidence that liquidity risk is more important than liquidity and market risk. However, in Table 7, it does not happen.

The traditional β^{1p} is also negative, though insignificant, in most of the cases. A similar conclusion is drawn from examining the expected illiquidity. Also, the intercept seems to be non-zero and significant in some cases.

In Table 7, test for equal-weighted portfolios and value-weighted market. This sees that with value-weighted market produces significant results for the risk premium in equation (2) and (5). However, the researcher gets insignificant values of expected illiquidity when it allows k to be a free parameter in all cases. The constant and holding periods seem to have opposite effects when control for holding period k. It can be seen that holding k fixed not leads to significant results for $E\left(c_t^p\right)$And also by relaxing this constraint not leads to gives plausible results for the intercept being significantly different than fixed results. Lastly, β^{1p} show fairly promising results in equation (7) and (8). The rest of the variables seem to have little relevance at standard levels.

Size Sorted Portfolios:

Small stocks are typically illiquid and have higher liquidity risk. Due to this, it is essential to test further if stock sorting by size can improve liquidity risk and returns. Table 8 reports where the re-estimate model sorted on the size. In any event, the market risk premium does not tend to generate any significant value except equation (1) and (2). The coefficient of $\beta^{net.p}$ seem to be negative in all of the Equations. Although controlling the impact of liquidity on traditional β^{1p}, it should be noted that the size sorting stock gives a value that corresponds closely to the actual value β^{1p}, which has been reported empirically. Next, the effect of expected illiquidity $E\left(c_t^p\right)$ seem to be insignificantly different from zero only when k = 0. Sorting stocks by size do not give any support for any of liquidity betas at 5% or 10% for β^{4p}.

Asset Pricing; Model Testing for Size And B/M-By-Size Sorted Portfolios:

This table tell table number reports the estimated coefficient of a cross-sectional regression for illiquidity sorted portfolios. Portfolios are formed using monthly returns and illiquidity innovations from 2015 to 2019. Testing portfolios are value-weighted, and B/M-by-size portfolios. To test the liquidity adjusted model consider the relation such as

$$E\left(r_t^p - r_t^f\right) = \alpha + kE\left(c_t^p\right) + \lambda^1\beta^{1p} + \lambda^2\beta^{2p} + \lambda^3\beta^{3p} + \lambda^4\beta^{4p} + \lambda\beta^{net.p}$$

Where, $\beta^{net.p} = \beta^{1p} + \beta^{2p} - \beta^{3p} - \beta^{4p}$. In equation (1), (4), (7) set the holding period (average of monthly turnover) k as a fixed parameter, while Equation (2), (5), (8) lets it be free. The t-statistic, reported in the parentheses, is estimated using the GMM framework into account the pre-estimation of the betas. The R^2 is obtained in single cross-sectional regression, and the adjusted R^2 is reported in parentheses.

Table 8: Asset Pricing: Model Testing for Size Portfolios

	Constant	$E(c^p)$	β^{1p}	β^{2p}	β^{3p}	β^{4p}	$\beta^{net.p}$	R^2
1	-0.013** (-5.39)	0.027 (-)					-0.412** (-2.270)	0.433 (0.409)
2	0.264 (1.841)	0.042 (0.951)					-0.370** (-2.275)	0.425 (0.400)
3	0.411 (0.511)		-0.579** (-1.541)					0.386 (0.360)
4	-0.113 (-0.613)	0.027 (-)	0.430 (0.432)				-0.482 (-0.504)	0.137 (0.100)
5	0.123 (0.326)	0.027 (0.658)	0.677 (0.762)				-0.177 (-0.913)	0.229 (0.170)
6	0.402 (0.810)		0.852** (2.031)				-0.452 (-0.729)	0.379 (0.332)
7	-0.555 (-2.924)	0.027 (-)	-0.568 (-0.05)	-0.000 (-0.412)	0.170 (0.064)	0.037 (0.601)		0.487 (0.426)
8	0.191 (0.309)	0.242 (0.401)	-1.502 (-0.13)	-0.000 (0.265)	-0.718 (-0.283)	0.317 (0.019)		0.350 (0.349)

****p<0.01, **<0.05, *p<0.1*

Table 9: Asset Pricing: Model Testing B/M-by-Size Properties

	Constant	$E(c^p)$	β^{1p}	β^{2p}	β^{3p}	β^{4p}	$\beta^{net.p}$	R^2
1	-0.200 (-0.260)	0.025 (-)					0.285 (0.817)	0.223 (0.220)
2	-0.201 (-0.286)	0.016** (1.245)					0.281 (0.377)	0.215 (0.211)
3	-0.120 (-1.224)		0.691 (1.452)					0.208 (0.200)
4	-0.321 (-0.331)	0.025 (-)	0.689 (0.913)				-0.870 (-1.115)	0.197 (0.186)

5	-0.457 (-0.561)	0.026** (1.874)	0.600 (0.825)				-0.593 (-0.680)	0.402 (0.396)
6	-0.554 (-0.715)		-0.250 (-0.368)				0.884 (1.461)	0.278 (0.273)
7	-0.400 (-0.911)	0.025 (-)	0.361 (0.497)	0.124 (0.638)	-0.090 (-0.457)	-0.046** (-2.614)		0.345 (0.341)
8	-0.288 (0.451)	0.017** (2.321)	0.372 (0.514)	0.189 (0.236)	-0.076 (-0.431)	-0.047** (-2.647)		0.418 (0.409)

****p<0.01, **<0.05, *p<0.1*

Small-sized stocks are illiquid and also have high liquid risk. Table 8 shows that cross-sectional regression has coefficients that are fairly different in values and significance. The coefficient of $\beta^{net.p}$ is estimated to be positive and the liquidity adjusted CAPM still has a higher than R^2 the standard CAPM. It can be seen that holding k fixed not leads to significant results for $E\left(c_t^p\right)$And also by relaxing this constraint not leads to gives plausible results for the intercept being significantly different than fixed results in Table 8. However, this result has been changed in Table 9. Because holding k free leads to significant results for $E\left(c_t^p\right)$In Table 9. In equation (2), (5) and (8) are significant at 5% level of the $E\left(c_t^p\right)$.

Table 9, Equation (3) recover the well-known result that CAPM does not relatively poorly for B/M-by-size portfolios (adjusted R^2 = 20%) since market beta is relatively "flat" across these portfolios. The liquidity adjusted CAPM in Equation (1) provides a moderate improvement in the fit (adjusted R^2 = 22%). Nevertheless, it should be noted that the unconstrained specification might be "overfitted" in the sense that some of the calculated risk premia give an incorrect sign and are all insignificant. The negative coefficient on $\beta^{net.p}$ in equation (5) suggests that the model is mis specified for these portfolios.

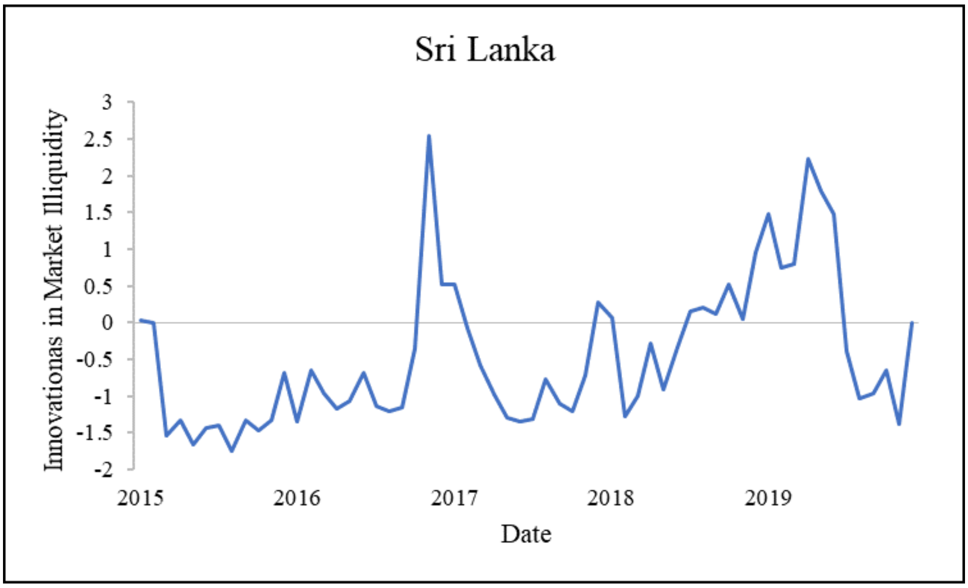

Figure 1: Standardized innovations in market illiquidity from 2015-2019

CONCLUSION

This research has the following conclusion based on existing methods and knowledge of the liquidity characteristics. Firstly, it shows that the persistent liquidity level exists all over the world. It is important for market participants and analysts because it means that liquidity characteristics are equivalent, and the same base models and methods of valuations can be used in investments and analytical literature. Second, according to this calculation, the liquidity risk is not positively priced over the 2015-2019 observation period. This finding is important for market participants; the relationship between return and liquidity risk should be well understood and implied in every investment strategy. Third, this shows that the liquidity level is not a priced characteristic in the LCAPM. This is also observable from the summary statistics where no obvious liquidity risk premium is observable. The traditional asset pricing model has been adjusted to reflect the cost of illiquidity and its respective risk over time. There is some evidence that shows that liquidity risk is priced and some support for the liquidity adjusted CAPM. The annualized risk of Sri Lanka is 0.11%. According to that, overall liquidity risk is the above countries belongs to 2.96%. This model provided a simple framework when studying the impact of liquidity and expected returns of assets, with the limited stocks available on the stock exchanges and with such small market compared to the one covered by Acharya and Pedersen (2005) and have made several adjustments. And also, use the conditional version of the LCAPM and use different restrictions for the sample.

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