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Pricing of Liquidity Risk in Emerging Markets: Evidence from Greater China

Kuntonrat Davivongs[1] and Pantisa Pavabutr[2]

This paper used the liquidity adjusted capital asset pricing model of Acharya and Pedersen (2005) to examine the liquidity risk of stocks in two retail-based equity markets, China and Taiwan during the period of 1996-2008. We found that the proportion of liquidity risk overwhelms market risk, unlike the findings in US markets. As a pricing factor, the evidence indicated that systematic liquidity risk was more important than market risk in Taiwan. In China, cross-sectional differences in individual firm liquidity explained differences in returns.

JEL codes*:* G12, G15

Key Words: Asset Pricing, Liquidity Risk, Emerging Markets

1. Introduction

The diversity of liquidity features and their importance in asset pricing have been an active area of research. The main conclusions drawn from existing works are that there exists commonality in liquidity (Chordia et al., 2000, Huberman and Halka, 2001, Hasbrouck and Seppi, 2001) and that investors demand premium from illiquidity (Amihud and Mendelson, 1986, Brennan and Subrahmanyam, 1996, Datar et al., 1998, Amihud, 2002). What is less understood is the relative importance of market risk to liquidity risk. In an attempt to shed light on this issue, Acharya and Pedersen (2005) used an equilibrium model as a framework to measure possible channels of liquidity risk. Although the authors found their “Liquidity Adjusted Asset Pricing Model” provided a better fit than the standard capital asset pricing model, they found only weak evidence that liquidity risk was more important than market risk in U.S. data.

The result of U.S. stock market study may not be applied to emerging markets since these two markets differ in many aspects. Among others, liquidity is one of obvious factors. Comparing to developed stock markets, most of emerging stock markets are small and illiquid. Not only that there is small number of stock listed, but also there is small number of stock traded frequently. This study, therefore, investigated a relative importance as a pricing factor of liquidity risk to market risk in emerging stock markets using 1,355 sample firms between 1996 to 2008 from China and Taiwan. In 2010, China

[1] Corresponding author. Department of Finance, Faculty of Business Administration, Dhurakij Pundit University, 110/1-4 Prachachuen Rd., Laksi, Bangkok 10210, Thailand. Lecturer at Dhurakij Pundit University and a doctoral student in JDBA program, Thammasat University. *Email address:* kuntonrat@gmail.com

[2] Associate Professor of Finance. Thammasat Business School, Thammasat University, 2 Prachan Rd., Phra Borom Maha Ratchawang, Phra Nakhon, Bangkok 10200, Thailand. *Email address:* pantisa_p@yahoo.com

and Taiwan accounted for almost 50% of the market capitalization in Asian emerging markets. China was the most actively traded market, while Taiwan was ranked the fourth in Asian emerging markets (World Federation of Exchange, 2011). Despite common perception of China and Taiwan as diametric opposites, there are important parallels between their market structures and shared characteristics with smaller emerging markets in the region such that the study of these two markets are likely to have broader association. The common traits between these two markets are share class distinctions, retail dominated trading, relatively low free float, and heavy-handed involvement of the state (Cooper, 2007). While the degree of involvement of the state varies in East Asia, the emerging market segment of the region has markets that are predominated retail based (Pavabutr et al., 2009), and that there is share class separation, typically in term of domestic and foreign. In a study of thirty-one emerging markets, Lesmond (2005) had demonstrated, liquidity costs are higher in countries with weak legal enforcement.

Our research clarified the role of liquidity risk in terms of significance and channels in the following ways. First, market risk was insignificantly priced in both countries. Second, expected illiquidity was priced in China and Taiwan during the year of 2003-2008. Third, liquidity risks, in any form, were not priced in China. In Taiwan, investors required compensation for most types of liquidity risks, except for return sensitivity to market illiquidity. Consequently, we may say that as a pricing factor, systematic liquidity risk was more important than market risk in Taiwan. In China, cross-sectional differences in individual firm liquidity explained differences in return.

The next section provides a discussion of liquidity risk in related literature. The liquidity-adjusted asset pricing model is discussed in section 3. The details on sample data is in section 4. Section 5 explains the methodology used in the study and elaborates empirical results. Section 6 is conclusion.

2. Liquidity Risk in Related Literature

Commonality in liquidity refers to the co-movement in liquidity over time. Authors of pioneer papers on the issue conjectured various sources of commonality in liquidity. Chordia et al. (2000) suggested that commonality in liquidity occurred because macro conditions leading to general price swing and trading activity caused a correlated inventory, while Fujimoto (2004) and Brockman et al. (2009) suggested a co-variation in market makers' inventory carrying costs of asset. Similarly, Coughenour and Saad (2004) explained that constraints on capital and profit information of market makers caused a correlated liquidity of stock included in specialist portfolio. Moreover, illusion trades by noise traders (Huberman and Halka, 2001), common floor information (Sadd, 2006), news on revolution of new technology (Chordia et al., 2000), and similar trading styles, objectives, or strategy among investors (Brockman and Chung, 2006) caused trades to be correlated.

Regardless of the source of commonality, the temporal variability of liquidity of stock and market liquidity should be a key element in asset pricing. For instance, if a market's liquidity dries up but a stock continues to be relatively liquid, then investors must be willing to pay a higher price for that particular stock, thus lowering the required rate of return, *ceteris paribus*. Although some authors pointed out that cross-sectional variation in liquidity had impact on pricing (Amihud and Mendelson, 1986, Brennan and Subrahmanyam, 1996, Amihud, 2002), ample empirical evidence of liquidity commonality evoked the idea that liquidity should not totally be a firm-specific risk.

Lee (2011), Qin (2008), and Davivongs (2011) documented strong liquidity commonality in emerging markets. All authors found the prevalence of commonality within the same market, but commonality weakens when moving towards regional and global levels. In Davivongs (2011), commonality in liquidity was strongest in emerging Asian markets notably in China and Taiwan, while in Lee (2011) emerging markets required a larger premium on systematic liquidity risk. There are various reasons why liquidity commonality is strong in emerging markets. First, emerging markets are relatively small and thus foreign equity flow coordinated by world economic conditions can cause synchronized liquidity inflows and outflows across markets. This observation is applicable to Taiwan’s case, as the market does not separate distinct share class. Second, a number of stocks are illiquid. Third, in China’s case, retail investors have limited investment alternatives (Eun and Huang, 2007) and are chasing after too few stocks. These observations support the use of an asset pricing model that accommodates local systematic liquidity risk.

An empirical test on the importance of liquidity risk on asset price has increasingly been investigated, e.g., Pástor and Stambaugh (2003), Acharya and Pedersen (2005), Martínez et al. (2005), and Lee (2011). All of them, with the exception of Lee (2011), based their study on portfolio level. Lee (2011) studied asset pricing of liquidity risk at stock level; however, the liquidity betas were estimated at portfolio level—stocks belonging to the same portfolio had the same betas. They all reported significant pricing of liquidity risk. Pástor and Stambaugh (2003) showed that, based on US market data, stocks whose returns were more sensitive to market liquidity factor commanded higher required rate of return than stocks whose returns were less sensitive to the market liquidity factor. Martínez et al. (2005) found that the results depend on the choice of liquidity measures being used. For example, liquidity risk was priced in the Spanish market only when beta was measured relatively to illiquidity ratio, but it was not priced when liquidity beta was Pástor and Stambaugh factor or bid-ask spread return factor. By regressing expected risk premium against expected liquidity cost, market risk, and liquidity risks, Acharya and Pedersen (2005) showed that the expected return of a security increased in its expected illiquidity and its liquidity risk, and that illiquid securities also had high liquidity risk. However, their evidence that the total effect of the liquidity risk mattered over and above market risk and the level of liquidity was rather weak in US data. Lee (2011), by adopting the model of Acharya and Pedersen (2005) to investigate the pricing of liquidity risk of stocks in 50 countries, found that liquidity risk was significantly priced in only US and emerging markets, but not in the developed and overall world markets. For emerging market alone, the commonality in liquidity and liquidity sensitivity to market return were priced, but return sensitivity to market liquidity was not. Inconclusive evidence in literature on liquidity risk and asset pricing make it important to further observe whether liquidity risk is priced. In addition, the importance of liquidity risk relative to liquidity level and market risk is still not widely observed. Hence, it is worth to study the issue at stock level.

The well known pricing models that incorporate liquidity risk are the works of Pástor and Stambaugh (2003) and Acharya & Pedersen (2005). In the liquidity-adjusted capital asset pricing model of Acharya and Pedersen (2005), systematic risk was decomposed into the standard market beta, and three liquidity related betas: commonality in liquidity, return sensitivity to market liquidity, similar to Pástor and Stambaugh (2003) liquidity beta, and liquidity sensitivity to market return. We discuss the liquidity adjusted capital asset pricing model introduced by Acharya and Pedersen (2005) in the next section.

3. Liquidity-Adjusted Capital Asset Pricing Model

In an overlapping generations economy, risk-averse agents in Acharya and Pedersen (2005) trade securities whose liquidity varied randomly over time. Solving an expected utility maximization problem under wealth constraint, the liquidity adjusted asset pricing model (LCAPM) is a linear equilibrium in equation (1).

$$E_t\left(r_{i,t+1} - c_{i,t+1}\right) = r_f + \gamma_t \frac{cov_t(r_{i,t+1} - c_{i,t+1}, r_{M,t+1} - c_{M,t+1})}{var_t(r_{M,t+1} - c_{M,t+1})} \qquad (1)$$

Where $r_{i,t}$ is the gross return of stock i at time t
$c_{i,t}$ is the trading cost per price for stock i at time t
r_f is the gross risk free rate
$r_{M,t}$ is the gross market return at time t
$c_{M,t}$ is the market trading cost per price at time t
$\gamma_t = E_t(r_{M,t+1} - c_{M,t+1} - r_f)$ is the risk premium

By assuming constant conditional variances of innovations in illiquidity and returns or a constant risk premium, the unconditional LCAPM is derived as,

$$E_t\left(r_{i,t} - r_f\right) = E\left(c_{i,t}\right) + \lambda\beta_{1i} + \lambda\beta_{2i} - \lambda\beta_{3i} - \lambda\beta_{4i} \qquad (2)$$

Where $$\beta_{1i} = \frac{cov(r_{i,t}, r_{M,t} - E_{t-1}(r_{M,t}))}{var(r_{M,t} - E_{t-1}(r_{M,t}) - [c_{M,t} - E_{t-1}(c_{M,t})])} \qquad (3)$$

$$\beta_{2i} = \frac{cov(c_{i,t} - E_{t-1}(c_{i,t}), c_{M,t} - E_{t-1}(c_{M,t}))}{var(r_{M,t} - E_{t-1}(r_{M,t}) - [c_{M,t} - E_{t-1}(c_{M,t})])} \qquad (4)$$

$$\beta_{3i} = \frac{cov(r_{i,t}, c_{M,t} - E_{t-1}(c_{M,t}))}{var(r_{M,t} - E_{t-1}(r_{M,t}) - [c_{M,t} - E_{t-1}(c_{M,t})])} \qquad (5)$$

$$\beta_{4i} = \frac{cov(c_{i,t} - E_{t-1}(c_{i,t}), r_{M,t} - E_{t-1}(r_{M,t}))}{var(r_{M,t} - E_{t-1}(r_{M,t}) - [c_{M,t} - E_{t-1}(c_{M,t})])} \qquad (6)$$

Equivalently, the model states that the required excess return is the expected relative illiquidity cost plus risk premium times systematic risk that is covariance between net asset's return and net market return. Systematic risk in the LCAPM consists of the traditional market risk (β_{1i}) and additional three forms of liquidity risks: commonality in liquidity (β_{2i}), return sensitivity to market liquidity (β_{3i}), and liquidity sensitivity to market return (β_{4i}).

The model shows that each form of liquidity risks differently affects the expected return. β_{2i}, commonality in liquidity or the co-movement of stock liquidity with market liquidity, was positively related to the expected return because investors preferred holding stock whose liquidity negatively commoved with that of the market and were willing to pay a premium for that stock. Both β_{3i}, return sensitivity to market liquidity, and β_{4i}, liquidity sensitivity to market return, affected the expected return negatively. This was because investors were willing to accept lower expected return on stocks that yielded a high return in illiquid market and on stock that were liquid in a down market.

To examine the pricing effect of systematic risk, as well as to distinguish the pricing effect of liquidity risk to that of market risk, I followed Acharya and Pedersen (2005) and Lee (2011) by additionally defining a net liquidity beta as a linear combination of the three liquidity betas, and a net beta as a linear combination of all betas.

$$\beta_{5i} \equiv \beta_{2i} - \beta_{3i} - \beta_{4i} \qquad (7)$$

$$\beta_{6i} \equiv \beta_{1i} + \beta_{2i} - \beta_{3i} - \beta_{4i} \qquad (8)$$

4. Sample and Descriptive Statistics

Originally, daily price and trading data of all stocks listed in Shanghai Stock Exchange and Taiwan Stock Exchange during January 1, 1991 to December 31, 2008, as well as risk free rate for each country were collected from Thomson DataStream. The data was used to calculate daily stock return and Amihud's illiquidity ratio. Daily stock return is calculated as a log value of current closing price over past closing price, $\log(P_t/P_{t-1})$, and daily Amihud's illiquidity ratio is the ratio of absolute daily return to daily trading value in million of local currency. After replacing the extreme 5 percent observations on either side of daily return and illiquidity measure in both cross-sectional and time-series with their associated value at the 5 and 95 percentiles, monthly stock return and liquidity were calculated simply as an average daily value within the month. Monthly market return, as well as market liquidity measure, was simply an equally weighted average value of all stocks in the market. Finally, the months with less than 20 stocks and stocks with less than 36 months of data were excluded from this study. Therefore, based on the observations in China, the study period began from January 1993 for both countries, and the number of sample stocks was 1,355 stocks, 710 Chinese stocks and 645 Taiwanese stocks.

Table 1 shows market characteristics of each exchange. It clearly showed that size and trading activity in these two markets increased dramatically, especially in China. In

1996, there were only 46 actively traded stocks in China. By 2008, this number had grown to 709. At the same time, market capitalization grew from USD 38 billion to almost USD 1 trillion. The trading value grew 10 times from 1996 to 2008. The extraordinary increase in trading activity occurred during 2006-2008. Similar, in Taiwan 179 stocks in 1996 grew to 638 stocks in 2008. The market capitalization in 2008 was about three times greater than that in 1996. The trading value varied from one thousand to four billion. Most stocks were priced less than one U.S. dollar.

Table 1: Market Profile

The table presents market characteristics of China and Taiwan stock exchange in Panel A and B, respectively. N is the number of sample stocks in the market. It is a monthly average number of stocks traded each year. Market capitalization and trading value of the exchange is sum values of all sample stocks in the market. The value presented is monthly averaged over the year. Stock price is mean of monthly cross-sectional median. Price are expressed in USD, while market capitalization and trading value are in million of USD.

	Panel A: China				Panel B: Taiwan			
Year	N	Market Capitalization	Trading Value	Average Price	N	Market Capitalization	Trading Value	Average Price
1996	46	37,438.13	77.95	0.44	179	188,601.01	972.49	0.65
1997	125	75,400.88	263.58	0.56	198	281,174.74	2,515.35	0.81
1998	140	104,938.09	190.56	0.65	225	241,307.45	1,874.78	0.68
1999	178	131,576.55	283.22	0.75	268	278,193.04	2,310.34	0.51
2000	262	210,660.12	773.45	1.06	306	362,835.09	2,652.85	0.45
2001	314	293,468.80	464.11	1.15	345	250,201.36	1,495.51	0.27
2002	354	293,232.82	387.89	0.91	405	284,138.14	1,739.82	0.31
2003	398	300,015.83	468.01	0.74	465	304,444.25	1,815.83	0.36
2004	496	327,079.82	745.08	0.63	518	393,569.86	2,364.51	0.45
2005	553	266,299.33	708.83	0.44	568	430,144.87	1,999.75	0.43
2006	618	341,356.06	2,665.75	0.52	605	497,453.09	2,659.31	0.50
2007	689	1,053,323.97	13,282.78	1.36	626	623,331.59	3,792.39	0.70
2008	709	969,192.38	7,862.54	1.22	638	552,449.32	3,163.05	0.58

Because liquidity, of both a market and stock, was persistent, the unconditional LCAPM of Acharya and Pedersen (2005) focused on the innovation in liquidity when computing the liquidity betas as shown in Equations (3)-(6). To predict market and stock liquidity, The following AR(1) model were estimated.

$$ILLQ_{i,t} * P_{M,t-1} = a_0 + a_1\left(ILLQ_{i,t-1} * P_{M,t-1}\right) + u_t \quad (9)$$

Where $P_{M,t-1}$ is the ratio of the average capitalizations of the market in month *t-1* and of the market on January 1, 1993. This adjustment was recommended in Acharya and Pedersen (2005) to measure liquidity cost in dollar per dollar invested, instead of in percentage per dollar invested as original illiquidity measure. The same date of market index ($P_{M,t-1}$) was used to ensure that the innovation was measured only in liquidity, not changes in the index. The residual, u_t of the regression was interpreted as the illiquidity innovation. The same specification was also used to predict the market return, as well as the residual. The AR(1) model was selected instead of AR(2) as in Acharya and Pedersen (2005) as the cross-sectional mean of second order serial correlation in each country was statistically insignificant in explaining the concurrent period liquidity, while the first-order serial correlation was significantly high. Moreover, the AR(2) specification produced only slight improvement in the explanatory power. Finally, monthly return and liquidity betas as per equations (3) - (6) are computed using rolling 36-month historical observations. After finishing computation of betas, we have a series of each beta beginning from January 1996 to December 2008.

Table 2: Liquidity Measures and Liquidity Betas by Firm Size

This table reports for each size quintile the average value of return (R), variance of return ($\sigma^2(R)$), expected (E[Illq]) and unexpected (ε_{Illq}) illiquidity ratio estimated from AR(1) model, variance of unexpected adjusted illiquidity ratio ($\sigma^2(\varepsilon_{Illq})$), and all betas for stocks in each country. The variable is first cross-sectional average by month, then average over the sample period. Betas are rolling beta using the previous 36-month data in computation by equation (3)-(6). A net liquidity beta ($\beta^5_{i,t}$) is calculated as $\beta^2_{i,t} - \beta^3_{i,t} - \beta^4_{i,t}$, a net beta ($\beta^6_{i,t}$) is calculated as $\beta^1_{i,t} + \beta^2_{i,t} - \beta^3_{i,t} - \beta^4_{i,t}$. Size quintile is identified each month using stock market capitalization.

	Panel A: China					Panel B: Taiwan				
Size	Smallest	2	3	4	Largest	Smallest	2	3	4	Largest
N	11,649	11,725	11,711	11,725	11,772	12,773	12,824	12,830	12,824	12,893
R (%)	0.0109	0.0237	0.0175	0.0242	0.0244	-0.0226	-0.0224	-0.0117	0.0023	0.0062
σ^2(R)	0.2407	0.2242	0.2243	0.2173	0.2085	0.3340	0.2921	0.2824	0.2878	0.2541
E[Illq]	0.2024	0.1532	0.1204	0.0917	0.0566	0.0558	0.0208	0.0092	0.0047	0.0008
ε_{Illq}	0.0053	0.0004	-0.0023	-0.0026	-0.0035	0.0012	-0.0004	-0.0004	-0.0001	-0.0001
$\sigma^2(\varepsilon_{Illq})$	0.0104	0.0067	0.0046	0.0031	0.0014	0.0013	0.0003	0.0001	0.0001	0.0000
β^1	0.0254	0.0248	0.0253	0.0251	0.0241	0.2662	0.2636	0.2711	0.2736	0.2566
β^2	1.4015	1.1228	0.8776	0.6894	0.4249	1.2065	0.4492	0.2041	0.0962	0.0176
β^3	-0.0742	-0.0708	-0.0706	-0.0692	-0.0635	-0.1874	-0.1702	-0.16752	-0.1629	-0.1399
β^4	-0.1046	-0.0890	-0.0707	-0.0578	-0.0405	-0.4096	-0.1689	-0.0846	-0.0438	-0.0101
β^5	1.5804	1.28264	1.0190	0.8164	0.5288	1.8036	0.7883	0.4561	0.3028	0.1676
β^6	1.6058	1.3075	1.0443	0.8414	0.5529	2.0697	1.0519	0.7272	0.5766	0.4242

Table 2 presents the properties of stocks in various size quintiles identified by market capitalization. Comparing only the largest and the smallest quintiles, both panels in Table 2 contradicted to the expected pattern that higher return should relate to higher level of illiquidity and risk factors. The table showed however that stocks in the largest quintile yielded higher return (R) while return volatility (σ^2(R)), stock illiquidity (E[Illq] and ε_{Illq}), volatility of unexpected illiquidity ($\sigma^2(\varepsilon_{Illq})$), market risk ($\beta^1$) and liquidity risks ($\beta^2$, β^3 and β^4) were lower.

Table 3 presents the properties of stocks classified by sub-periods. The breaking point was identified based on the trend in market return in China since its stock exchange had shown a significant change during the sample period. The market return in China was at the minimum in 2003 before turning upward and was the beginning of the new cycle. Therefore, the first sub-period is from January 1996 to December 2002 and the second sub-period is from January 2003 to December 2008. The Table shows that the properties of stocks in both exchange varied across periods. The average return during the period of 1996 to 2002 was lower than the average return during the period of 2003 to 2008 in both countries. The volatility of return, however, showed the opposite pattern. Higher average illiquidity level and its volatility in the second sub-period indicated that price impact was greater and more volatile in the second period. Systematic risk varied across period, but the direction depended on the type of risk. Market risk (β^1) was higher in the first period, while commonality in liquidity (β^2) was greater in the second period, for both countries.

Table 3: Liquidity Measures and Liquidity Betas by Sub-Period

This table reports the average value over the sub-period of return (R), variance of return ($\sigma^2(R)$), expected (E[Illq]) and unexpected (ε_{Illq}) adjusted illiquidity ratio estimated from AR(1) model, variance of unexpected adjusted illiquidity ratio ($\sigma^2(\varepsilon_{Illq})$), and all betas for each country. Betas are rolling beta using the previous 36-month data in computation by equation (3)-(6). A net liquidity beta ($\beta^5_{i,t}$) is calculated as $\beta^2_{i,t} - \beta^3_{i,t} - \beta^4_{i,t}$, a net beta ($\beta^6_{i,t}$) is calculated as $\beta^1_{i,t} + \beta^2_{i,t} - \beta^3_{i,t} - \beta^4_{i,t}$. The first period is from the beginning of 1996 to the end of 2002, and the second period is from the beginning of 2003 to the end of 2008.

	Panel A: China		Panel B: Taiwan	
Period	1996-2002	2003-2008	1996-2002	2003-2008
N	17,025	41,557	23,114	41,030
R (%)	-0.0155	0.0385	-0.0244	0.0003
σ^2(R)	0.2063	0.1955	0.3183	0.2832
E[Illq]	0.1054	0.1571	0.0184	0.0219
ε_{Illq}	-0.0020	0.0057	0.0002	0.0003
$\sigma^2(\varepsilon_{Illq})$	0.0027	0.0091	0.0003	0.0004
β^1	0.0228	0.0033	0.3411	0.1031
β^2	0.9061	0.9709	0.2922	0.5771
β^3	-0.0756	-0.0328	-0.1621	-0.1742
β^4	-0.0792	-0.0333	-0.1352	-0.1565
β^5	1.0610	1.0371	0.5896	0.9078
β^6	1.0837	1.0404	0.9306	1.0109

The absolute value of return sensitivity to market illiquidity (β^3) and illiquidity sensitivity to market return (β^4) indicated that the effect of these risks was greater during the first period in China, but it was greater during the second period in Taiwan. Overall, systematic risk, as indicated by net liquidity beta (β^5), and net beta (β^6), was slightly greater in the second period in Taiwan, but was slightly greater in the first period in China.

5. Methodology and Empirical Results

To test whether liquidity risk was priced, as well as to examine its relative importance as pricing factor to market risk, in China and Taiwan, the regression model similar to the unconditional LCAPM as Equation (2) was cross-sectional estimated each month. In the model, stock expected risk premium was regressed against expected liquidity, and market and liquidity betas controlling for stock size that might affect stock risk premium as followed.

$$E(R_{i,t} - R^f_t) = \alpha_t + \theta_t E(C_{i,t}) + \gamma^1_t \beta^1_{i,t} + \gamma^2_t \beta^2_{i,t} - \gamma^3_t \beta^3_{i,t} - \gamma^4_t \beta^4_{i,t} \qquad (10)$$

Risk premium is the difference between stock monthly return and monthly risk-free rate. Monthly return was calculated as daily average of return within a month. A 6-month money market rate and a 6-month time deposit rate were proxy for risk-free rate in Taiwan and in China, respectively. Expected liquidity cost, $E(C_{i,t})$ was a forecasted value from AR(1) model. Each beta—market beta(β^1), liquidity commonality beta (β^2), return sensitivity to market liquidity (β^3), and liquidity sensitivity to market return (β^4) — was obtained by a rolling calculation using the previous 36 months of stock returns, and innovations of market return and liquidity, as well as the innovation of stock liquidity, as stated in equation (3) – (6). Net liquidity beta (β^5) was calculated as $\beta^2_{i,t} - \beta^3_{i,t} - \beta^4_{i,t}$ and net beta (β^6) was calculated as $\beta^1_{i,t} + \beta^2_{i,t} - \beta^3_{i,t} - \beta^4_{i,t}$. Stock size is a log value of market capitalization.

The monthly cross-sectional results estimated from equation (10) reported in the first column of Table 4 were averaged over each sub-periods. As stated before, the first period is from 1996 to 2002 and the second is from 2003 to 2008. In the second column presents the results estimated by running the risk premium against expected illiquidity $E(C_{i,t})$ and market beta (β^1). The third to sixth column present the results estimated by adding one at a time the liquidity betas—liquidity commonality (β^2), return sensitivity to market illiquidity (β^3), illiquidity sensitivity to market return (β^4), and net liquidity beta (β^5). The last column of each panel shows the estimated results of risk premium against expected illiquidity and net beta (β^6).

The Table 4 clearly showed variations in pricing effects across period. For China, Panel A of the Table, the coefficients estimated on market beta (β^1) were negatively and statistically insignificant in the first sub-period, while they were positive and statistically insignificant in the second-sub-period. Therefore, there was no strong evidence that market risk was priced in China. The expected illiquidity may have been more important as a pricing factor than market risk as its coefficients estimated showed consistent sign as expected and were statistically significant, particularly in the second sub-period. The liquidity risk, however, was not such an important pricing factor for Chinese stocks as expected illiquidity. The estimated coefficient on net liquidity beta had a negative sign and was statistically significant in the second sub-period, indicating that liquidity risk was not priced in China. Each type of liquidity risks led to the same conclusion. The sign of estimated coefficients on commonality in liquidity (β^2), on return sensitivity to market illiquidity (β^3), and on stock illiquidity sensitivity to market return (β^4) was inconsistent with the expected result. Moreover, they were statistically significant in the second sub-period.

For Taiwan, Panel B of the Table, the estimated coefficients on market beta (β^1) led to the similar conclusion to that of China that there was no strong evidence supporting that market risk was priced. The coefficients estimated on market beta (β^1) were insignificantly positive in the first sub-period, and were insignificantly, with inconclusive sign in the second sub-period. In contrast to China, evidence supported that both expected liquidity and liquidity risk were priced in Taiwan. Evidence strongly supported that expected illiquidity (E[Illq]) was priced during the second sub-period. The coefficients estimated on expected illiquidity (E[Illq]) were insignificant with inconclusive sign among specifications in the first sub-period, but they were significantly positive in the second period. Both commonality in liquidity (β^2) and stock illiquidity sensitivity to market return (β^4) were priced. The estimated coefficients on commonality in liquidity (β^2) were significantly positive, while the estimated coefficients on stock illiquidity sensitivity to market return (β^4) were significantly negative in both sub-periods, especially in the model that added either one in addition to expected illiquidity and market beta. For stock return sensitivity to market illiquidity (β^3), there was no strong

Table 4: Cross-Sectional Regressions by Sub-period

In this table, an expected risk premium is cross-sectional regressed against an expected liquidity measures (Amihud's illiquidity ratio), market beta, and liquidity betas. The regression: $E(RP_{i,t}) = \alpha_t + \theta_t E(C_{i,t}) + \gamma_t^1 \beta_{i,t}^1 + \gamma_t^2 \beta_{i,t}^2 - \gamma_t^3 \beta_{i,t}^3 - \gamma_t^4 \beta_{i,t}^4$, and its modifications are estimated monthly. Risk premium is difference between return on stock and on risk-free rate which is a 6 month money market rate for Taiwan and is a 6-month time deposit rate for China. Expected liquidity cost, $E(C_{i,t})$ is a forecasted value from AR(1) model. Betas are rolling beta using the previous 36 months data in computation of equation (3)-(6). $\beta_{i,t}^5$ is a net liquidity beta, calculated as $\beta_{i,t}^2 - \beta_{i,t}^3 - \beta_{i,t}^4$, and $\beta_{i,t}^6$ is a net beta, calculated as $\beta_{i,t}^1 + \beta_{i,t}^2 - \beta_{i,t}^3 - \beta_{i,t}^4$. The controls variable is a log of market capitalization. In the Tables, the estimated results are averaged over each of two sub-periods. The first sub-period is from 1996 to 2002 and the second sub-period is from 2003 to 2008. The t-statistics are given in parentheses. ***, **, and * indicate significant at 1, 5, and 10 % level, respectively.

Panel A: China							
First sub-period from 1996 to 2002							
Model	1	2	3	4	5	6	7
Intercept	-0.0104*** (-11.65)	-0.0104*** (-11.67)	-0.0104*** (-11.36)	-0.0105*** (-12.09)	-0.0104*** (-11.63)	-0.0104*** (-11.47)	-0.0098*** (-10.49)
E[Illq]	0.0031 (1.23)	0.0028 (1.34)	0.0040 (1.62)	0.0027 (1.31)	0.0039* (1.76)	0.0041* (1.68)	0.0034 (1.27)
β^1	-0.0764 (-1.09)	-0.0579 (-1.41)	-0.0540 (-1.27)	-0.0693 (-1. 00)	-0.0557 (-1.31)	-0.0535 (-1.25)	
β^2	0.0000 (0.05)		-0.0001 (-0.46)				
β^3	-0.0016 (-0.23)			-0.0005 (-0.07)			
β^4	-0.0007 (-0.27)				0.0013 (0.37)		
β^5						-0.0001 (-0.56)	
β^6							0.0000 (-0.11)
LNMV	0.0000 (-0.47)	0.0000 (-0.48)	0.0000 (-0.70)	0.0000 (-0.27)	0.0000 (-0.62)	0.0000 (-0.69)	0.0000 (-0.63)
ADJRSQ	0.1546	0.0891	0.1006	0.1396	0.0966	0.1012	0.0789
Second sub-period from 2003 to 2008							
Intercept	-0.0093*** (-13.05)	-0.0095*** (-13.63)	-0.0093*** (-13.11)	-0.0095*** (-13.50)	-0.0094*** (-13.18)	-0.0093*** (-13.11)	-0.0085*** (-6.81)
E[Illq]	0.0028*** (3.87)	0.0007 (1.20)	0.0025*** (3.30)	0.0011** (2.13)	0.0025*** (3.43)	0.0026*** (3.37)	0.0024** (2.14)
β^1	0.2253 (1.05)	0.1387 (0.79)	0.1663 (0.94)	0.1988 (0.93)	0.1740 (0.98)	0.1699 (0.96)	
β^2	0.0001 (0.68)		-0.0003*** (-4.66)				
β^3	0.0120 (1.02)			0.0128 (1.10)			
β^4	0.0091** (2.63)				0.0087*** (4.76)		
β^5						-0.0003*** (-4.64)	
β^6							-0.0003*** (-4.28)
LNMV	0.0003*** (3.91)	0.0004*** (4.26)	0.0003*** (3.92)	0.0004*** (4.28)	0.0003*** (3.91)	0.0003*** (3.91)	0.0003** (2.49)
ADJRSQ	0.1734	0.1288	0.1333	0.1670	0.1327	0.1334	0.0717

supporting evidence that it was priced in Taiwan. The estimated coefficients were insignificantly positive during the first sub-period, and were insignificantly negative during the second sub-period. The estimated coefficient on net liquidity beta (β^5) confirmed that liquidity risk is a pricing factor in Taiwan, with strong evidence during the second sub-period. However, the insignificantly positive estimated coefficient on the net beta (β^6) in both sub-periods indicates that total effect of market- and liquidity risk is not priced.

Table 4: Cross-Sectional Regressions by Sub-period (Continue)

Panel B: Taiwan							
First sub-period from 1996 to 2002							
Model	1	2	3	4	5	6	7
Intercept	-0.0172***	-0.0172***	-0.0171***	-0.0170***	-0.0174***	-0.0172***	-0.0170***
	(-15.58)	(-15.52)	(-15.31)	(-15.87)	(-15.35)	(-15.27)	(-14.00)
E[Illq]	-0.0125	0.0067	-0.0048	0.0069	-0.0107	-0.0073	-0.0023
	(-1.24)	(0.88)	(-0.49)	(0.89)	(-1.04)	(-0.63)	(-0.18)
β^1	0.0007	0.0014	0.0014	0.0009	0.0015	0.0015	
	(0.25)	(0.47)	(0.46)	(0.31)	(0.50)	(0.48)	
β^2	0.0000		0.0009*				
	(-0.01)		(1.99)				
β^3	0.0014			0.0014			
	(0.39)			(0.37)			
β^4	-0.0011				-0.0008*		
	(-1.58)				(-1.77)		
β^5						0.0004	
						(1.38)	
β^6							0.0003
							(0.77)
LNMV	0.0002**	0.0002**	0.0002**	0.0002**	0.0002**	0.0002**	0.0002*
	(2.13)	(2.08)	(2.01)	(2.00)	(2.24)	(2.10)	(1.92)
ADJRSQ	0.2209	0.1444	0.1476	0.2162	0.1487	0.1546	0.0998
Second sub-period from 2003 to 2008							
Intercept	-0.0068***	-0.0067***	-0.0068***	-0.0067***	-0.0067***	-0.0068***	-0.0070***
	(-14.98)	(-14.86)	(-15.14)	(-14.77)	(-15.09)	(-15.21)	(-8.85)
E[Illq]	0.0069***	0.0126***	0.0077***	0.0120***	0.0092***	0.0081***	0.0103**
	(2.67)	(4.73)	(2.96)	(4.80)	(3.62)	(3.10)	(2.41)
β^1	-0.0031	0.0004	0.0002	-0.0036	0.0002	-0.0001	
	(-0.54)	(0.10)	(0.06)	(-0.63)	(0.06)	(-0.02)	
β^2	0.0003*		0.0002***				
	(1.74)		(2.97)				
β^3	-0.0017			-0.0020			
	(-0.64)			(-0.78)			
β^4	0.0001				-0.0006***		
	(0.27)				(-3.00)		
β^5						0.0002***	
						(2.72)	
β^6							0.0001
							(1.14)
LNMV	0.0002***	0.0002***	0.0002***	0.0002***	0.0002***	0.0002***	0.0002***
	(4.51)	(4.27)	(4.54)	(4.31)	(4.50)	(4.57)	(3.95)
ADJRSQ	0.1517	0.1145	0.1185	0.1477	0.1168	0.1187	0.0477

In sum, market risk has never been priced in both countries. Neither illiquidity level nor illiquidity risk was priced in China and Taiwan during the first sub-period, 1996-2002. During the second sub-period, the level of illiquidity was priced in both countries. Liquidity risks, in any form, were not priced in China. Though the beta coefficients estimated on commonality in liquidity, on illiquidity sensitivity to market return, and on net liquidity risk were statistically significant, all their liquidity signs are opposite to those expected. In Taiwan, only was return sensitivity to market illiquidity not priced. Other forms, e.g., commonality in liquidity, illiquidity sensitivity to market return, and net liquidity risk, were priced.

6. Conclusion

Liquidity level is well accepted as one of pricing factors. Should liquidity risk be priced depends on whether it is systematic risk. The existence of commonality in liquidity documented in previous studies, e.g. Chordia, Roll, and Subrahmanyam (2000), Huberman and Halka (2001), (2001), Brockman and Chung (2002), Fabre and Frino (2004), Galariotis and Giouvris (2007), Giouvris and Galariotis (2008), etc. indicated that liquidity risk is partly systematic risk.

This study, following the framework of Acharya and Pedersen (2005), investigated at stock level the relative importance of liquidity risk to liquidity level and market risk using 1,355 sample firms listed in Chinese and Taiwanese stock market. Monthly stock returns, expected liquidity, market beta, and all types of liquidity were gathered from 1996 to 2008, and Amihud's illiquidity ratio was used as a liquidity measure. By cross-sectional regressing expected risk premium against expected liquidity cost, market beta, and liquidity betas similar to Fama and MacBeth (1973), we found that the results varied accordingly to country, and time period. Unlike that reported in Acharya and Pedersen (2005) and Lee (2011), evidence indicated market risk was less important, as pricing factor, than expected liquidity and liquidity risk. Chinese and Taiwanese investors generally demanded positive premium for expected illiquidity. In addition, systematic liquidity risk was more notable in Taiwan, especially after the year 2003.

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