JOURNAL
OF EUROPEAN ECONOMY
Vol. 11. Special issue – 2012
Publication of Ternopil National Economic University

Kuntonrat DAVIVONGS,
Pantisa PAVABUTR

PRICING OF LIQUIDITY RISK IN EMERGING MARKETS: EVIDENCE FROM GREATER CHINA

Abstract

This paper uses the liquidity adjusted capital asset pricing model of Acharya and Pederson (2005) to examine the liquidity risk of stocks in two retail-based equity markets, China and Taiwan. We find that the proportion of liquidity risk overwhelms market risk, unlike the findings in US markets. As a pricing factor, the evidence indicates that systematic liquidity risk is more important than market risk in Taiwan. In China, cross-sectional differences in individual firm liquidity explain differences in returns.

Key words:

Asset Pricing, Liquidity Risk, Emerging Markets.

JEL: G12, G15.

Davivongs Kuntonrat, Lecturer, Department of Finance, Faculty of Business Administration, University of Dhurakij Pundit University, Laksi, Bangkok, Thailand.
Pavabutr Pantisa, Associate Professor of Finance, Thammasat Business School, Thammasat University, Bangkok, Thailand.

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 work is 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 Pederson (2005) uses an equilibrium model as a framework to measure possible channels of liquidity risk. Although the authors find their «Liquidity Adjusted Asset Pricing Model» provides a better fit than the standard capital asset pricing model, they find weak evidence that liquidity risk is more important than market risk in US data.

This study investigates market risk and liquidity risk using 1,355 sample firms between 1996 to 2008 from China and Taiwan. 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. In 2010, China and Taiwan account for almost 50% of the market capitalization in Asian emerging markets. China is the most actively traded market, while Taiwan is ranked the fourth in Asian emerging markets (World Federation of Exchange, 2011). 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) has demonstrated, liquidity costs are higher in countries with weak legal enforcement.

Our research clarifies the role of liquidity risk in terms of significance and channels in the following ways. First, market risk is insignificantly priced in both countries. Second, expected illiquidity is priced in China and Taiwan during the year of 2003–2008. Third, liquidity risks, in any form, are not priced in China. In Taiwan, investors require 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 is more important than market risk in Taiwan. In China, cross-sectional differences in individual firm liquidity explain 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 conjecture various sources of commonality in liquidity. Chordia et al. (2000) suggest that commonality in liquidity occurs because macro conditions leading to general price swing and trading activity causes a correlated inventory, while Fujimoto (2004) and Brockman et al. (2009) suggest a co-variation in market makers' inventory carrying costs of asset. Similarly, Coughenour and Saad (2004) explain that constraints on capital and profit information of market makers cause 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) cause 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 point out that cross-sectional variation in liquidity has impact on pricing (Amihud and Mendelson, 1986, Brennan and Subrahmanyam, 1996, Amihud, 2002), ample empirical evidence of liquidity commonality evokes the idea that liquidity should not totally be a firm-specific risk.

Lee (2011), Qin (2008), and Davivongs (2010) document strong liquidity commonality in emerging markets. All authors find the prevalence of commonality within the same market, but commonality weakens when moving towards regional and global levels. In Davivongs (2010), commonality in liquidity is strongest in emerging Asian markets notably in China and Taiwan, while in Lee (2011) emerging markets require 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.

The empirical test on the importance of liquidity risk on asset price has increasingly been investigated, for example, Pástor and Stambaugh (2003), Acharya and Pederson (2005), Martínez et al. (2005), and Lee (2011). All of them, but Lee (2011), base their study on portfolio level. Lee (2011) studies asset pricing of liquidity risk at stock level, however, the liquidity betas are estimated at portfolio level–stocks belonging to the same portfolio have the same betas. All report significantly priced of liquidity risk. Pástor and Stambaugh (2003) show based on US market data that stocks whose returns are more sensitive to market liquidity factor command higher required rate of return than stocks whose returns are less sensitive to market liquidity factor. Martínez et al. (2005) find that the results depend on the choice of liquidity measures being used. Liquidity risk is priced in the Spanish market only when beta is measured relatively to illiquidity ratio, but it is not priced when liquidity beta is 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 Pederson (2005) show that the expected return of a security increases in its expected illiquidity and its liquidity risk, and that illiquid securities also have high liquidity risk. However, their evidence that the total effect of the liquidity risk matters over and above market risk and the level of liquidity is rather weak in US data. Lee (2011), by adopting the model of Acharya and Pederson (2005) to investigate the pricing of liquidity risk of stocks in 50 countries, finds that liquidity risk is 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 are priced, but return sensitivity to market liquidity is not. Inconclusive evidence in literature on liquidity risk and asset pricing make it important to be further observed 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.

The well known pricing models that incorporate liquidity risk are the works of Pástor and Stambaugh (2003) and Acharya & Pederson (2005). In the liquidity-adjusted capital asset pricing model of Acharya and Pederson (2005), systematic risk is 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 Pederson (2005) in the next section.

3. Liquidity-Adjusted Capital Asset Pricing Model

In an overlapping generations economy, risk-averse agents in Acharya and Pederson (2005) trade securities whose liquidity varies 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).

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

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,

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

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

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

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

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

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, is positively related to the expected return because investors prefer holding stock whose liquidity negatively commoves with that of the market and willing to pay a premium for that stock. Both β_{3i}, return sensitivity to market liquidity, and β_{4i}, liquidity sensitivity to market return, affect the expected return negatively. This is because investors are willing to accept lower expected return on stock that yields a high return in illiquid market and on stock that is liquid in 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 follow Acharya and Pederson (2005) and Lee (2011) by additionally define a net liquidity beta as a linear combination of the three liquidity betas, and a net beta as a linear combination of all betas.

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

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

4. Sample and Descriptive Statistics

Our sample consists of 1,355 actively traded stocks listed in Shanghai Stock Exchange and Taiwan Stock Exchange. The actively traded stocks are defined as stocks traded at least in 35% of market trading days a year on average. Table 1 shows market characteristics of each exchange. It clearly shows that size and trading activity in these two markets are increasing dramatically, especially in China. In 1996, there are only 46 actively traded stocks in China. By 2008, this number has grown to 709. At the same time, market capitalization grows from USD 38 billion to almost USD 1 trillion. The trading value grows 10 times from 1996 to 2008. The extraordinary increased trading activity occurs during 2006–2008. Similar, in Taiwan 179 stocks in 1996 have grown to 638 stocks in 2008. The market capitalization in 2008 is about three times greater than that in 1996. The trading value varies from one thousand to four billion. Most stocks are priced less than a US 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.

Year	Panel A: China				Panel B: Taiwan			
	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

Year	Panel A: China				Panel B: Taiwan			
	N	Market Capitalization	Trading Value	Average Price	N	Market Capitalization	Trading Value	Average Price
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

Daily closing price and trading data of stocks as well as risk-free rate from January 1, 1993 to December 31, 2008 are collected from Thomson DataStream. Stock return and Amihud's illiquidity ratio are calculated on daily basis before being average within the month. Daily stock return is calculated as a log value of current closing price over past closing price, $\log\left(\frac{P_t}{P_{t-1}}\right)$, and daily Amihud's illiquidity ratio is the ratio of absolute daily return to daily trading value expressed in million of local currency to each market. Monthly market return and liquidity are calculated each month as an average value of all stocks in the market.

Because liquidity, of both a market and stock, is persistent, the unconditional LCAPM of Acharya and Pederson (2005) focus 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 is estimated.

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

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 is recommended in Acharya and Pederson (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 ($P_{M,t-1}$) is required to ensure that the innovation is measured only a change in liquidity, not a change in the index. The residual, u_t of the regression is interpreted as the illiquidity innovation. The same specification is also used to predict the market return, as well as the residual. 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*[Ill*q*]) 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
$\sigma^2(R)$	0.2407	0.2242	0.2243	0.2173	0.2085	0.3340	0.2921	0.2824	0.2878	0.2541
E[Ill*q*]	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 show contradict to the expected pattern that higher return should relate to higher level of illiquidity and risk factors. The table shows however that stocks in the largest quintile yield 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) are lower.

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
$\sigma^2(R)$	0.2063	0.1955	0.3183	0.2832
E[Ill*q*]	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

Table 3 presents the properties of stocks classified by sub-periods. 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 varies across periods. The average return in both countries is lower in the first sub-period than in the second sub-period, but volatility of return is higher in the first sub-period than in the second sub-period. Higher average illiquidity level and its volatility in the second sub-period indicate that price impact is greater and more volatile in the second period. Market risk (β^1) is higher during the first sub-period, while commonality in liquidity (β^2) is higher during the second period for both countries. The absolute value of return sensitivity to market illiquidity (β^3) and illiquidity sensitivity to market return (β^4) indicates that the effect of these risks is greater during the first sub-period in China, but it is greater during the second sub-period in Taiwan. Overall, systematic risk, as indicated by net liquidity beta (β^5), and net beta (β^6), is slightly greater in the second sub-period in Taiwan, but is slightly greater in the first sub-period in China.

5. Methodology and Empirical Results

To test whether liquidity risk is priced, as well as its relative importance as pricing factor to market risk, in China and Taiwan, the regression model similar to the unconditional LCAPM as given in equation (2) is cross-sectional estimated each month. In the model, stock expected risk premium is regressed against expected liquidity, and market and liquidity betas as followed.

$$[E(R]_{i,t} - R_t^f) = \alpha_t + \theta_t E(C_{i,t}) + \gamma_t^1 \beta_{i,t}^1 + \gamma_t^2 \beta_{i,t}^2 - \gamma_t^3 \beta_{i,t}^3 - \gamma_t^4 \beta_{i,t}^4 \quad (10)$$

Risk premium is the difference between stock monthly return and monthly risk-free rate. Monthly return is calculated as daily average of return within a month. A 6-month money market rate and a 6-month time deposit rate are proxy for risk-free rate in Taiwan and in China, respectively. Expected liquidity cost, $E(C_{i,t})$ is 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), is obtained by 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) is calculated as $\beta_{i,t}^2 - \beta_{i,t}^3 - \beta_{i,t}^4$ and net beta (β^6) is calculated as $\beta_{i,t}^1 + \beta_{i,t}^2 - \beta_{i,t}^3 - \beta_{i,t}^4$. The model controls for stock size that might affect the risk premium. 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 are averaged over the sub-periods. The first period is from 1996 to 2002 and the second is from 2003 to 2008. The second column presents the results estimated by running the risk premium against expected illiquidity and market beta. The third to sixth column present the results estimated by adding one at a time the liquidity betas: liquidity commonality, return sensitivity to market illiquidity, illiquidity sensitivity to market return, and net liquidity beta. The last column of each panel shows the estimated results of risk premium against expected illiquidity and net beta.

The Table 4 clearly shows variations in pricing effects across periods. For China, shown in Panel A of the Table, the coefficients estimated on market beta (β^1) are negatively and statistically insignificant in the first sub-period, while they are positive and statistically insignificant in the second-sub-period. Therefore, there is no strong evidence that market risk is priced in China. The expected illiquidity may be more important as a pricing factor than market risk as its coefficients estimated show consistent sign as expected and are statistically significant particularly in the second sub-period. The liquidity risk however is not such an important pricing factor for Chinese stocks as expected illiquidity. The estimated coefficient on net liquidity beta has a negative sign and statistically significant in the second sub-period indicating the liquidity risk is not priced in China. Each type of liquidity risks leads 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) is inconsistent with the expected. Moreover, they are statistically significant in the second sub-period. For Taiwan, shown in Panel B of the Table, the estimated coefficients on market beta (β^1) lead to the similar conclusion to that of China that no strong evidence supporting that market risk is priced. The coefficients estimated on market beta (β^1) are insignificantly positive in the first sub-period, and are insignificantly with inconclusive sign in the second sub-period. In contrast to China, evidence support that both expected liquidity and liquidity risk are priced in Taiwan. Evidence strongly supports that expected illiquidity (E[Illq]) is priced during the second sub-period. The coefficients estimated on expected illiquidity (*E*[Ill*q*]) are insignificant with inconclusive sign among specifications in the first sub-period, but they are significantly positive in the second period. Both commonality in liquidity (β^2) and stock illiquidity sensitivity to market return (β^4) are priced. The estimated coefficients on commonality in liquidity (β^2) are significantly positive, while the estimated coefficients on stock illiquidity sensitivity to market return (β^4) are significantly negative in both sub-periods, especially in the model that adding either one in addition to expected illiquidity and market beta. For stock return sensitivity to market illiquidity (β^3), there is no strong supporting evidence that it is priced in Taiwan. The estimated coefficients are insignificantly positive during the first sub-period, and are insignificantly negative during the second sub-period. The estimated coefficient on net liquidity beta (β^5) confirms 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

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

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[Ill*q*]	-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)	-15.0897	-15.2060	-8.8518
E[Ill*q*]	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

6. Conclusion

Liquidity level is well accepted as one of pricing factors. Should liquidity risk is 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. indicate that liquidity risk is partly systematic risk.

This study, following the framework of Acharya and Pederson (2005), investigates 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 are gathered from 1996 to 2008, and Amihud's illiquidity ratio is 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 find that the results vary accordingly to country, and time period. Evidence indicates market risk is less important, as pricing factor, than expected liquidity and liquidity risk. Chinese and Taiwanese investors generally demand positive premium for expected illiquidity. In addition, systematic liquidity risk is more notable in Taiwan, especially after the year 2003.

Bibliography

1. ACHARYA, V. V. & PEDERSON, L. H. (2005) Asset Pricing with Liquidity Risk. *Journal of Financial Economics,* 77**,** 375–410.
2. AMIHUD, Y. (2002) Illiquidity and Stock Returns: Cross-Section and Time-Series Effects. *Journal of Financial Markets,* 5**,** 31–56.
3. AMIHUD, Y. & MENDELSON, H. (1986) Asset Pricing and Bid-Ask Spread. *Journal of Financial Economics* 17**,** 223–249.
4. BRENNAN, M. J. & SUBRAHMANYAM, A. (1996) Market Microstructure and Asset Pricing: On the Compensation for Illiquidity in Stock Returns. *Journal of Financial Economics,* 41**,** 441–464.
5. BROCKMAN, P. & CHUNG, D. Y. (2002) Commonality in Liquidity: Evidence from an Order-Driven Market Structure. *Journal of Financial Research* 25 521–539.
6. BROCKMAN, P. & CHUNG, D. Y. (2006) Index Inclusion and Commonality in Liquidity: Evidence from Stock Exchange of Hong Kong. *International Review of Financial Analysis,* 15**,** 291–305.

7. BROCKMAN, P., CHUNG, D. Y. & PÉRIGNON, C. (2009) Commonality in Liquidity: a Global Perspective. *Journal of Financial and Quantitative Analysis,* 44 851–882.

8. CHORDIA, T., ROLL, R. & SUBRAHMANYAM, A. (2000) Commonality in Liquidity. *Journal of Financial Economics,* 56**,** 3–28.

9. COOPER, M. (2007) Capital markets and regime type in East Asia. *American Political Science Association.* Chicago.

10. COUGHENOUR, J. F. & SAAD, M. M. (2004) Common Market Makers and Commonality in Liquidity. *Journal of Financial Economics,* 73**,** 37–69.

11. DATAR, V. T., NAIK, N. Y. & RADCLIFFE, R. (1998) Liquidity and Stock Returns: An Alternative Test. *Journal of Financial Markets,* 1**,** 203–219.

12. DAVIVONGS, K. (2010) Commonality in Liquidity within Emerging Markets. *Finance.* Bangkok, Thailand, Thammasat University. *Doctoral Thesis.*

13. EUN, C. S. & HUANG, W. (2007) Asset Pricing in China's Domestic Stock Markets: Is There a Logic? *Pacific-Basin Finance journal,* 15**,** 452–480.

14. FABRE, J. & FRINO, A. (2004) Commonality in Liquidity: Evidence from the Australian Stock Exchange. *Accounting and Finance* 44**,** 357–368.

15. FAMA, E. F. & MACBETH, J. D. (1973) Risk, Return and Equilibrium: Empirical Tests. *Journal of Political Economy,* 81**,** 607–636.

16. FUJIMOTO, A. (2004) Macroeconomic Sources of Systematic Liquidity. *Working Paper*.

17. GALARIOTIS, E. & GIOUVRIS, E. (2007) Liquidity Commonality in the London Stock Exchange. *Journal of Business Finance & Accounting* 34 374–388.

18. GIOUVRIS, E. & GALARIOTIS, E. (2008) Sytematic Liquidity and Excess Returns: Evidence from the Athens Stock Exchange. *Journal of Money, Investment and Banking,* 2**,** 81–96.

19. HASBROUCK, J. & SEPPI, D. (2001) Common Factors in Prices, Order Flows, and Liquidity. *Journal of Financial Economics* 59**,** 383–411.

20. HUBERMAN, G. & HALKA, D. (2001) Systematic Liquidity. *Journal of Financial Research,* 24**,** 161–178.

21. LEE, K. H. (2011) The world price of liquidity risk. *Journal of Financial Economics,* 99**,** 136–161.

22. LESMOND, D. A. (2005) Liquidity of Emerging Markets. *Journal of Financial Economics,* 77**,** 411–452.

23. MARTÍNEZ, M. A., NIETO, B., RUBIO, G. & TAPIA, M. (2005) Asset Pricing and Systematic Liquidity Risk: An empirical Investigation of the Spanish Stock Market. *International Review of Economics and Finance,* 14**,** 81–103.

24. PÁSTOR, L. & STAMBAUGH, R. F. (2003) Liquidity Risk and Expected Stock Returns. *Journal of Political Economy* 111**,** 642–685.

25. PAVABUTR, P., SIRODOM, K. & TIAN, G. (2009) Liquidity provision in Asian equity markets. POSCO Foundation, Korea.

26. QIN, Y. (2008) Liquidity and Commonality in Emerging Markets. *Working paper*.

27. SADD, M. M. (2006) Floor Information and Common Variations in Liquidity. *Applied Financial Economics Letters,* 2**,** 275–278.