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Liquidity Risk and Asset Returns : The Case of the Korean Stock Market*

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〈abstract〉

This paper investigates various channels through which liquidity can affect stock returns and examines whether behavioral explanation for liquidity risk is reasonable. First, we examine whether liquidity level (average liquidity) plays a significant role in determining asset returns. The result is consistent with the hypothesis that a stock with higher average illiquidity will have a higher expected return. Second, we focus on the argument that liquidity has a non-diversifiable systematic component. If systemic liquidity has a different impact across individual securities, a stock that is more sensitive to systematic liquidity will have a higher expected return. The results of various tests are inconsistent with each other, not completely supporting the argument. Finally, the intra-market tests in Korea support the behavioral explanation for the liquidity premium, and the effect is stronger in the liquidity level than in the liquidity beta related to systematic liquidity.

Keywords : Liquidity Level, Systematic Liquidity, Sensitivity, Asset Returns, Investor Behavior

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Ⅰ. Introduction

This paper investigates why asset pricing models such as Sharpe (1964), Lintner (1965), and Mossin (1966)'s Capital Asset Pricing Model(CAPM) fail to explain the cross-section of stock returns in the Korean stock market. We study among the three possible reasons (transaction costs, investors' irrationality, and missing risk factors), which holds responsible for the model's failure. Since the CAPM was developed in 1960's, it has been one of the major paradigms in modern finance. This parsimonious model has been applied in various areas of finance such as calculation of cost of equity and explanation of cross-section of stock returns. The CAPM has been applauded when a study supports it such as Fergusonand Shockley (2003), Cohen, Polk, and Vuolteenaho (2005), and etc. However, this noticeable model has also come under criticism as in Fama and French (1992, 1993, 1996b, 2006), and others. With increasing criticism, numerous studies have followed to find a better model than the CAPM, such as the Arbitrage Pricing Theory (APT), Fama-French three factor model, and Carhart's four factor model. However, none of these models resolve at least one anomaly in stock returns. For example, Fama and French (1996a) admit that their three factor model cannot explain the intermediate horizon momentum profit, which is shown in Jegadeesh and Titman (1993). Also, many studies criticize this empirically outstanding model for its ad hoc feature of the theoretical foundation (see, e.g., Lakonishok, Shleifer and Vishny, 1994 MacKinlay, 1995; Daniel and Titman, 1997 Frankel and Lee, 1998; Dechow, Hutton and Sloan, 1999; Piotroski, 2000; Daniel, Titman, and Wei, 2001). Other asset pricing models are also believed to have their own weakness and unavoidable limitation to explain the cross-section of stockreturns. Therefore, the main objective of our study is to find why asset pricing models fail to explain the cross-section of stock returns and which reason is most accountable for this failure.

Since the CAPM is created under assumptions of no transaction costs and short-sale constraints, it is not surprising that these transaction restrictions impede performance of the CAPM. For example, short-sale constraint can cause overvaluation since pessimistic investors cannot effectively implement their trading strategy as shown in Miller (1977) or Duffie, Galeanu, and Pedersen (2002). Diamond and Verrecchia (1987), and Hong and Stein (2003) also argue that short-sale constraints dampen the informational efficiency of prices because these constraints hold back negative information when determining prices. Tax is another important factor that has been closely scrutinized. Brennan (1973) and Litzenberger and Ramaswamy (1979) proposed the after-tax version of the CAPM that accounted for the taxation of dividends. After all, many agree that the original form of the CAPM would have worked well had there been no transaction costs. In this paper, by regressing the pricing error on transaction costs, we investigate whether transaction costs are negatively related to the performance of asset pricing models.

In explaining the reasons for the CAPM's failure, Fama and French (2004) argue that investors'irrationality and unrealistic assumptions such as single risk factor or no transaction costs are most responsible. Indeed, investors'irrationality has been regarded as a main cause for failure of many asset pricing models. Investors' overreaction or underreaction has been shown as the main driving force of the momentum profit, one of the strongest evidence against the CAPM and other asset pricing models. Daniel et al. (2001) offers a model in which asset prices reflect both covariance risk and investor misperception. This study suggests that the investor biases can weaken the relation between the expected return and the beta of the CAPM. Lakonishok et al. (1994) also argue that the incorrect extrapolation of investors is the main source of the return premium associated with high book-to-market (B/M) stocks. They show that the return premium is too large and its covariance with macro factors is too low to be considered compensation for systemic risk. Investors'bias is believed to affect the asset prices as in Daniel et al. (2001) and Gervais and Odean (2001). Investors' biases such as disposition effect, overreaction, and mental accounting etc. are most frequently observed among individual investors (see Odean, 1998; Goetzmann and Kumar, 2005; Locke and Mann, 2005). Therefore, if investors' irrationality deteriorates the performance of an asset pricing model, we hypothesize that more individual transaction generates poorer performance of an asset pricing model.

Fama and French (2004) also argue that unrealistic assumptions such as existence of a 'single' risk factor can cause the failure of the CAPM. Actually, many studies try to add additional risk factors to improve the CAPM as in Merton (1973), Ross (1976), Fama and French (1993), Carhart (1997), and Lettau and Ludvigson (2001). Even though the above models surpass the performance of the CAPM, each model also has its own drawbacks. In this paper, we show whether an asset pricing model performs better if more factors are taken into account. Especially, we are interested to see if there are any changes in the relation between the pricing error and explanatory variables for the pricing error when we add more factors. We find that this relation does not change and argue that just adding more factors to an asset pricing model will not correct the pricing error from transaction costs and investor's irrationality.

The Korean studies about asset pricing models follow on the heels of the U.S studies. In Koreaearlier studies support the CAPM. Cho (1980) tests the CAPM and finds the linear relation between the return and the systematic risk. Jee (1982) also finds the positive linear relation, but the relation is weaker than that of the U.S. and Japan. Since then, the unrealistic assumption of the CAPM has been also investigated in Korea. Nam and Lee (1995) test the time-varying property of expected return, conditional covariance, and market variance. They conclude that these have the time-varying property, but fail to explain the conditional CAPM.

On other hand, the anomalies against the CAPM are investigated in Korea in line with the U.S. Jee (1987) finds that size effect also exists in Korea as in the U.S., and this effect is mainly derived from the negative excess return of large firms rather than the positive excess return of small firms. Meanwhile, Song (1999) finds that the book-to-market ratio is significant in explaining the cross sectional returns, but the firm size appears to be insignificant in the Korean market. Kwon and Park (1997) argue that the liquidity premium exists in the Korean market as supported by the U.S. study of Amihud and Mendelson (1986). Kimand Kim (2000) investigate whether the firm size and book-to-market ratio are valid in the Korean market and find that Fama and French (1993)'s three factor model can be applicable in Korea. They conclude that size and book-to-market ratio are significant, but beta has an insignificant and negative relation with stock return in the cross-sectional analysis. They argue that Fama and French(1993)'s three factor model is also useful in the Korean market.

Some studies are performed to defend the CAPM. Cho (1996) tests the CAPM under conditional heteroscadasticity and finds that stock return can be explained by the

ARCH(1) and Harvey(1989)'s method. Ahn(1999) divides the overall sample into two sub-samples of negative and positive market excess returns and test the CAPM. He shows beta-return relation of the CAPM can be valid in the sub-samples, even if this is invalid in the full sample. Kook and Han(1999) test the explanatory power of the conditional CAPM for the cross-sectional difference of asset return using the Jagannathan and Wang (1996)model. They conclude that the conditional CAPM has statistical significance in the Korean market. Kim (2004) re-examine the relation between betas and average stock returns in the cross-section after considering the structural shift points of systematic risk. He finds that betas have a statistical significance in explaining average stock return. He also concludes that the two-factor model containing the market factor and size factor (SMB) accurately explain the intertemporal variation of Korean stock returns.

Studies against the CAPM also continue. Kim and Kim (2001) investigate determinants of expected stock returns in the Korean stock market by using the cross-sectional regressions, time-series regressions, and non-parametric tests. Theyfind that the firm size and the ratio of book to market equity are statistically significant in determining stock returns, but they deny the validity of the beta coefficient as a systematic risk. Chang and Kim (2003) argue that value stocks (especially high B/M ratio stocks) outperform the marketand that value premiums do not stem from risk factors, but from the firms' financial soundness. Kim and Lee (2006) also find that the value premium existsamong the non-financial listed companies, but they argue that the Fama and French's three factors are the systematic risk factors that determine the value premium in Korea.

As such, the validity of asset pricing models is a controversial issue in Korea as it is in the U.S. To investigate the odels in Korea, we examine the relation between the pricing error by the CAPM and proxies of investors' irrationality and transaction costs. This analysis is to clarify which reason is most accountable for poor performance of the CAPM. We use three variables as proxies for transaction costs; the proportional spread, the Roll's spread, and the Lesmond, Ogden, and Trzcinka (1999) measure. The individual composition of trading volume for a stock is used as a proxy for the degree of investors' irrationality for the stock (Odean, 1998, 1999; Barber and Odean, 2000; Goetzmann and Kumar, 2005). The Fama-MacBeth type regression shows that both transaction costs and investors'irrationality are statistically significantly related to the error from the CAPM.

However, this test does not provide an answer for the question whether a missing factor other than the market beta is the real reason for the failure of the CAPM due to transaction costs and investors' irrationality. To answer this question, we investigate the pricing error from other asset pricing models with additional factors like Fama-French's three factor model or Carhart's four factor model. If, for example, the Fama-French model can explain cross section of stock returns that the CAPM cannot explain due to transaction costs and investors'irrationality, we should observe different patterns of coefficients in the regressions with error terms and proxies of transaction costs and investors' irrationality. The result of the Fama-MacBeth regression shows both transaction costs and investors' irrationality have statistically significant relation with the pricing error from the Fama-French three factor model. Then, we compare the regression coefficients from the CAPM with those from the three factor model by using the Wald test. If the added risk factors explain pricing errors of the CAPM due to transaction costs or investors' irrationality, we should be able to observe a different pattern of coefficients. However, all Wald statistics cannot reject the null hypothesis that the coefficients of the CAPM and Fama-French's three factor model are the same. We also implement this procedure using the Carhart's four factor model, but the result does not change. Therefore, based upon this evidence, we argue that the poor performance of any asset pricing models can result from both transaction costs and investors' irrationality. Also, this specific pricing error from transaction costs and investors' irrationality cannot be improved by including more factors in asset pricing models even though adding factors can partly explain the other pricing error.

Our study contributes by showing why any existing asset pricing model fails to work in financial markets. Mainly, transaction costs and investor's irrationality are responsible for the failure of any asset pricing model. Even though any new asset pricing model with additional factors increases explanatory power of old model, the unexplained part of the return due to transaction costs and investors' irrationality remains unresolved. One may regard our study as criticism to an effort to improve an asset pricing model by adding more factors. Rather, the cross-sectional relation between pricing error and idiosyncraticfactors (transactions costs and investors' irrationality) deserves more attention. In previous literature, it is not certain whether an asset pricing model just fails or performs worse when the assumptions of no transaction costs or rational investors break. This paper answers that question by showing that an asset pricing model does not fail totally but performs worse as more transaction costs or investors' irrationality involves.

This article is organized as follow: In section Ⅱ, we develop research questions and hypotheses. Data descriptions are in section Ⅲ, and empirical methodologies and variables are introduced in section Ⅳ. Main test results are found in section Ⅴ. Finally, section Ⅵ will conclude.

Ⅱ. Literature Review and Hypotheses

1. Risk of Liquidity Level (First Moment)

Average liquidity (level of liquidity) has an important role in determining asset returns. This argument was first raised by Amihud and Mendelson (1986) and Eleswarapu (1997) who found a positive and significant effect of quoted bid-ask spreads on stock returns (risk-adjusted). Datar et al. (1998) implement the same test as Amihud and Mendelson (1986) by using turnover as an alternative measure of liquidity and find similar results. Rowenhorst (1999) also find that turnover has a significant effect on the cross section of asset returns in 20 emerging countries.

Brennan and Subrahmanyam (1996) find positive and significant relations between stock returns and stock illiquidity measured by the price impact, which is the price response to signed order flow (order size) and is estimated from intra-day data on transactions and quotes. Chalmers and Kadlec (1998) use the amortized effective spread obtained from quotes and subsequent transactions as a liquidity measure, and find that it positively affects stock returns. Brennan et al. (1998) demonstrate a negative relation between average returns and dollar trading volume, with the latter being used as a proxy for liquidity.

Amihud (2002) shows that over time, the expected market illiquidity positively affects ex ante stock excess returns, suggesting that expected stock excess return partly represents an illiquidity premium. Recently, Liu (2006) demonstrates that liquidity is an important priced risk, using a new measure of liquidity which emphasizes the trading speed. He also shows that various anomalies can be explained by his two-factor model: market and liquidity factors. According to the above statements, we design the following hypothesis:

HYPOTHESIS 1 : *The liquidity level will affect asset returns significantly. Therefore, a stock with higher average illiquidity will have a higher return than a stock with lower average illiquidity.*

This view is plausible because investors should consider how much they pay on average for trading securities. The real wealth of investors is the amount remaining after transaction costs are deducted from their revenue. Moreover, an institutional investor should consider liquidity when they decide their portfolios because they need to buy and sell securities immediately to meet the needs of their customers. Therefore, liquidity or the trading cost will severely affect the performance of investors. Investors will require a premium for holding illiquid stocks in the market.

2. Asset's Covariance Risk with Market Liquidity (Second Moment)

Researchers became interested in the second moment of liquidity along with the first moment. Chordia, Subrahmanyam, and Anshuman (2001) document a negative and surprisingly strong relation between average returns and the variability of liquidity as well as the level of liquidity, after controlling the well-known size, book-to-market ratio, momentum effects, price level, and dividend yield. At first they expected that the variability of liquidity (measured by volume and turnover) was positively correlated with stock returns because it is plausible that volatility in liquidity could be a source of stock risks, and thereby investors also require a higher return for the stock with more volatile liquidity; nevertheless, the results have been just the opposite. To answer this puzzle, researchers began to apply the logic of the CAPM to liquidity : the logic that the covariance risk between an individual stock return and market portfolio plays a major role in pricing the asset, rather than merely the volatility of an individual asset.

If we can apply the CAPM's logic to liquidity, liquidity will have a non-diversifiable component and stock's sensitivity to this component is more important than volatility of liquidity in determining returns.

Chordia et al. (2000), Huberman and Halka (2001), and Coughenour and Saad (2004) find that liquidity of an individual stock comoves with market-wide liquidity in the U.S. and list inventory risks, information asymmetry, and specialist's behavior as possible causes. Brockman and Chung (2002) report similar results with Chordia et al. (2000) on a limit order market, such as the Hong Kong Exchange. Seon et al. (2005) and Nam et al. (2005) show that liquidity commonality also exists in the Korean stock market.

Afterward, studies on the relation between liquidity commonality (market liquidity or systematic liquidity)[1] and individual asset prices have been investigated. Acharya and Pedersen (2005) examine the possible ways commonality in liquidity can affect asset prices. They show that the covariance between stock returns and unexpected innovation in market liquidity has an effect on expected return by estimating their liquidity-adjusted capital asset pricing model. Pastor and Stambaugh (2003) find that stocks with a higher sensitivity of return to unexpected innovation in market liquidity have higher returns than stocks with lower sensitivities by 7.5% annually. Sadka (2006) shows that liquidity risk is important to understand asset-pricing anomalies, such as momentum and post-earnings-announcement drift (PEAD). Liu (2006) also shows the same results with Pastor and Stambaugh (2003), using a new measure of liquidity which emphasizes the trading speed. Based on the above argument, we form the following hypothesis:

HYPOTHESIS 2 : *Liquidity commonality will have a significant effect on the stock return through the channel of the asset return's comovement with the unexpected innovation in market liquidity. Therefore, stocks with a higher sensitivity of return to the innovation in market liquidity will have higher returns than stocks with lower return sensitivity.*

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1) Liquidity commonality points out that there are common sources that affect individual securities simultaneously. Market liquidity (Market-wide liquidity) and systematic liquidity point out the non-diversifiable component of liquidity originated from the commonality in liquidity. In this paper, we use these terms to mean the same thing.

3. Behavioral Explanations for Liquidity

The liquidity asset pricing test in Korea has meaning in that behavioral explanations for liquidity risk can be tested. The traditional explanation for why liquidity might affect expected returns is based on the rational foundations: inventory cost or information asymmetry.[2] However, Baker and Stein (2004) develop an alternative theory of investor behavior to explain the connection between liquidity and expected return. Their model includes a class of irrationally overconfident investors. Investors' overconfidence to private signals can cause the sentiment shock, or overconfident investors underreact to the information contained in the order flow of other investors. This underreaction lowers the price impact of trades, thus boosting liquidity. Baker and Stein (2004) argue that in the presence of short-sales constraints, high liquidity is a symptom that the market is dominated by these irrational investors, and hence overall stocks are overvalued. The subsequent falling of stock returns follows. Odean (1998a) and Kyle and Wang (1997) employ a similar model to connect overconfidence to liquidity as well.

However, their theory is mainly used to explain the time-variation in liquidity premium. To apply their logic to the cross-sectional analysis of stock returns, we will explain what kind of investor irrationality can cause the cross-sectional differences in the liquidity premium. Investor's irrationality can be generated by the heuristic bias such as overconfidence and representativeness. Overconfidence means the investor's tendency to overvalue their own private information and undervalue others' information. Representativeness refers to judgments based on stereotypes. To illustrate, an investor can trade securities based on the situation of the whole market rather than the precise information on the securities.

When investors behave irrationally, their behavior can affect the liquidity in two ways as follows. First, irrationality can induce the increasing expected illiquidity. An overconfident investor overweighs their private signals. Generally, investors who think they have valuable information have a tendency to use the market order rather that limit

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2) For example, investors who plan to sell their shares in the future will face transaction costs. These costs can arise either from the inventory costs of a market maker (Grossman and Miller, 1988) or from adverse selection costs (Glosten and Milgrom, 1985; Kyle, 1985). When the transaction costs are greater, the investor rationally requires a higher discount rate to the asset.

order. They prefer submitting the market order to use their information quickly (Angel, 1994; Harris, 1998; Bloomfield, O'Hara and Saar, 2005). Meanwhile, in the order-driven market like Korea, whether liquidity increases or not is determined by the type of order (market order vs. limit order). When the market order is submitted, liquidity decreases (Domowitz, Hansch and Wang, 2005). Therefore, the more the irrationally overconfident investors trade, the more the market orders are submitted, thereby resulting in decrease of the expected liquidity.

Second, we can consider the aspect of covariance risk, i.e., liquidity risk. Irrational investors have the tendency to trade securities based on the situation of the whole market or their sentiment, not based on the precise information on the securities. Meanwhile, one of the best proxies for investors' sentiment in market is the market liquidity (Baker and Stein, 2004; Baker and Wurgler, 2006). Higher market liquidity means that investors' desire to trade is greater and that their trading is more aggressive. Therefore, as more irrational investors are intervened, the security's liquidity will more closely comove with market-wide liquidity. The greater comovement of liquidity induces larger non-diversifiable component, and thereby its liquidity risk becomes higher.

Korea provides good conditions to test these behavioral explanations for liquidity. First, the Korean stock market is an electronic order-driven market. A quote-driven market, such as the NYSE, has a market maker who observes the order flow and maintains market liquidity. An order-driven market, like the Korean stock market, has no designated market maker and thereby has more possibility for market liquidity to be influenced by irrational investors rather than controlled by the central market maker. Second, the Korean stock market is one of the most liquid markets in the world. For example, the turnover of the Korean Exchange, 171.4%, is higher than that of the NYSE group, 134.3% (Annual report 2006, World Federation of Exchange). Third, individual investors are major players in the Korean stock market. Individual investors' composition of trading volume is about 87% when 700 firms are investigated for the period 1998～2004 (Chae and Yang, 2008). The fact that there is high liquidity in a market dominated by individual investors gives a clue that high liquidity is related to the investors' irrationality.

A special feature of trading data in the Korean stock market also makes the intra-market test for the behavioral explanations possible. The Korean Stock Exchange has recorded investors' type for each trade since 1995. Using this categorized data, a variable to measure investors' irrationality can be created for each stock. Meanwhile, a stock which is more exposed to investors' irrationality should be more influenced by liquidity risk according to Baker and Stein (2004). If we assume that an irrational investor is an individual investor, a stock which is more frequently traded by individual investors will contain a stronger effect of liquidity. We can test this by forming the quintiles by the individual composition of trading volume, which is a proxy for investors' irrationality, and then comparing the effects of liquidity risk within quintiles.

HYPOTHESIS 3 : *Investors' irrationality (sentiment) is a cause of liquidity. Therefore, a stock which is more exposed to investors' irrationality will be more influenced by liquidity risk. If we assume that an irrational investor is an individual investor, a stock which is more frequently traded by individual investors will contain a stronger effect of liquidity.*

Ⅲ. Data and Research Design

1. Liquidity Measure

In this paper, Amihud (2002) illiquidity measure is used as a liquidity measure based on the previous study (Acharya and Pedersen, 2005). The Amihud (2002) illiquidity measure is defined as

$$Amihud_t^i = \frac{1}{Days_t^i} \sum_{d=1}^{Days_t^i} \frac{|R_{td}^i|}{V_{td}^i} \quad (1)$$

where R_{td^i} and V_{td}^i are, respectively, the return and won volume (in 10 million won) on day d in month t, and $Days_t^i$ is the number of valid observation days in month t for stock i. The Amihud (2002) measure represents the *illiquidity* of individual stock.

Hereafter, we express the Amihud (2002) measure as *AMIHUDx,* which is calculated by averaging monthly Amihud (2002) measure over the prior x months (x = 1, 6, 12). This expression will make it easy to present the liquidity effect of various periods. Furthermore, other liquidity measures will be used to check the robustness.

2. Data

Sample includes all non-financial firms listed in the Korean Stock Exchange for the period 1993~2004.[3] TAQ (Trade and Quote) database provided by Institute of Finance and Banking of Seoul National University (IFB/KSE database), Korea Capital Market Institute (KCMI) and KIS-VALUE (Korea Investors Service Inc.) database are used to obtain liquidity measures.

Bid-ask quotes are obtained from the best bid/offer (BBO) quotations of the IFB/KSE database. The IFB/KSE database is composed of three parts : order data, trade data, and BBO data. The BBO data include quotation time, best bid price with depth, and best offer price with depth. Daily volume, daily trading amount, and number of shares outstanding are obtained from the KIS-VALUE database for the period 1993~2004. Daily stock return data is derived from the KCMI database.

For each firm, liquidity measures are calculated as follows. Turnover is the number of shares traded for one month scaled by the number of shares outstanding. Proportional spread is defined as $\sum_{t=1}^{T} \frac{AsK_t - Bid_t}{(Ask_t + Bid_t)/2}$, where Ask_t denotes a ask price at time t, and Bid_t denotes a bid price at time t. For each stock we calculate daily proportional spread by averaging all BBO quotes at the transaction during the continuous auction period. Then we obtain the monthly averages of daily proportional spreads. Zero is the proportion of zero daily return, which is calculated as the number of days with zero returns divided by the number of total trading days in that month.

Panel A of <Table 1> represents cross-sectional distributions of time-series means of firm characteristics and liquidity measures for the period 1994~2004. The medians of size, B/M, and volume are 43,458 million won, 1.723, and 117,535 shares, respectively.

3) The numbers of sample firms are 459, 472, 491, 562, 619, 569, 530, 525, 533, 617, and 616 from 1994 to 2004.

<Table 1> Summary Statistics of Sample Firms

This table reports the cross-sectional distributions and correlations of time-series means of firm characteristics and liquidity measures. Size is the market capitalization at the end of previous year in million won. B/M is the book value divided by market capitalization at the end of the previous year. Volume is time-series mean of monthly trading volume measured by shares traded. TURNOVER is the number of shares traded for one month scaled by the number of stock outstanding. Amihud measure (AMIHUD) is $\frac{1}{Days_t^i}\sum_{d=1}^{Days_t^i}\frac{|R_{td}^i|}{V_{td}^i}$,where R_{td}^i and V_{td}^i are, respectively, the return and won volume (in 10 million won) on day d in month t, and $Days_t^i$ is the number of valid observation days in month t for stock i. Proportional spread (SPREAD) is defined as $\sum_{t=1}^{T}\frac{Ask_t - Bid_t}{(Ask_t + Bid_t)/2}$, where Ask_t denotes a ask price at time t, Bid_t denotes a bid price at time t. ZERO is the number of days with zero return divided by total number of trading days. Liquidity measures are calculated for every month during 1994-2004. *AMIHUDx* is calculated by averaging the Amihud (2002) illiquidity measure over the prior x months (x = 1, 6, 12). TURNOVER6, SPREAD6, and ZERO6 are also calculated by the same way with AMIHUD6. Panel A contains the cross-sectional distributions of time-series means of liquidity measures such as TURNOVER6, AMIHUD6, SPREAD6, and ZERO6. Panel B reports correlations of firm characteristic variables and liquidity measures. The left-low triangle of table represents the Pearson correlation and the right-high triangle represents the Spearman correlation. Total samples are 722 stocks.

Panel A: Distribution of variables

	Mean	Std	Min	Q1	Median	Q3	Max
Size	280,979	1,541,938	2,569	21,947	43,458	109,803	24,185,659
B/M	1.578	3.004	-38.778	1.020	1.723	2.562	9.916
Volume	443,494	3,169,725	392	48,079	117,535	335,000	83,692,687
TURNOVER6	0.428	0.629	0.011	0.169	0.276	0.477	11.037
AMIHUD6	5.490	10.451	0.004	0.805	2.345	5.960	171.316
SPREAD6	0.013	0.007	0.002	0.009	0.012	0.016	0.066
ZERO6	0.091	0.031	0.027	0.073	0.086	0.104	0.327

Panel B. Correlations

	Size	B/M	Volume	Turnover 6	Amihud6	Prop. spread6	Zero6
Size		-0.144	0.384	-0.455	-0.700	-0.688	-0.046
B/M	-0.083		-0.301	-0.198	0.271	0.244	0.096
Volume	0.383	-0.208		0.399	-0.662	-0.674	-0.262
TURNOVER6	-0.234	-0.063	0.311		-0.050	-0.068	-0.351
AMIHUD6	-0.357	0.075	-0.465	-0.088		0.936	0.251
SPREAD6	-0.524	0.101	-0.680	-0.064	0.739		0.343
ZERO6	-0.109	0.069	-0.352	-0.136	0.231	0.498	

AMIHUD6 is calculated by averaging the monthly Amihud (2002) measure over the prior 6 months. TURNOVER6, SPREAD6, and ZERO6 are also calculated by the same way with *AMIHUD6*. The means of TURNOVER6, AMIHUD6, SPREAD6, and ZERO6 are 0.428, 5.49, 1.3%, and 9.1% and their standard deviations are 0.629, 10.45, 0.7%, and 3.1%, respectively. Their medians are 0.276, 2.345, 1.2%, and 8.6%, which are all are smaller than their means. It shows that the distributions of liquidity measures are skewed to the right.

In Panel B, correlations among liquidity measures are reported. The most noticeable point in correlation is that the Amihud (2002) measure is highly correlated with the proportional spread, which is known to be the most precise measure extracted from the intra-day trading data (Pearson correlation : 0.739, Spearman correlation: 0.936). This fact verifies the reliability of the Amihud (2002) measure introduced in this paper.

For the asset pricing test, monthly returns are needed. Monthly returns of individual stocks and KOSPI return are extracted from the KCMI database. Size and book-to-market ratio (B/M) are calculated from the KIS-VALUE database. The 365-day monetary stabilization bond (MSB) rate for month *t* is used as risk-free rate.

3. Research Design

As a basic research design, a portfolio-based approach is employed to investigate the effect of various liquidity risks. Stocks are sorted into portfolios S through B based on a variable of interest. Portfolio B can be interpreted as a buy-side portfolio and portfolio S can be regarded as a short-side portfolio.

The first test is implemented by sorting stocks into 10 portfolios based on variables of interest: the average liquidity, the sensitivity of stock's return to the innovation in market liquidity. At the beginning of each month, 10 portfolios are reconstructed and held for n ($n = 1, 6, 12$) months. The portfolios are rebalanced every month. Portfolio S represents the lowest-value (liquid) portfolios, and Portfolio B represents the highest-value (illiquid) portfolios. B-S denotes the difference between portfolio B and S. We investigate whether the B-S portfolio has a significant performance by using the t-test.

The second test is to examine performances of double-sort portfolios. That is, we first form the portfolios by the firm characteristics we want to control, and within each portfolio we sort stocks by a variable of interest: the average liquidity, the sensitivity of stock's return to the innovation in market liquidity. This paper employs various firm characteristics such as firm size and book-to-market ratio (B/M).

The final test is to investigate the Jensen's alpha of B-S portfolios when the portfolios' returns are risk-adjusted by various asset pricing modes such as the CAPM and the Fama-French three-factor model. The Gibbons, Ross, and Shanken (1989) F-test for the Jensen's alphas of portfolios are performed additionally.

Ⅳ. Empirical Results

1. Premium of Liquidity Level (First Moment)

<Table 2> reports the returns of 10 portfolios sorted by the liquidity level for all sample firms over the period 1994~2004. At the beginning of each month, eligible stocks are sorted into 10 portfolios by their liquidity measures, *AMIHUDx* (x = 1, 6, 12). In each decile, stocks are equally weighted and held for n months (n = 1, 6, 12).

Panel A of <Table 2> represents the result from decile portfolios sorted by *AMIHUD1*. Holding-period returns generally increase from the lowest-illiquidity decile (S) to the highest-illiquidity decile (B). The B-S portfolios also have positive and significant returns over the 1, 6 and 12 month holding periods at 3.1% (t = 3.29), 12.9% (t = 4.62), and 21.4% (t = 4.49), respectively. In Panel B and Panel C, the results from 10 portfolios sorted on *AMIHUD6* and *AMIHUD12* show that the B-S portfolios also have positive and significant returns.

<Table 3> reports the returns of double-sort portfolios for all sample firms over the period 1994~2004. We first form quintiles by sorting stocks on the basis of the size (or book-to-market ratio), and then within each quintile we sort stocks into quintiles by the average liquidity, *AMIHUD6*. Size is the market capitalization at the end of previous year in million won and B/M is the book value divided by market capitalization

at the end of the previous year. Quintiles of size and B/M are rebalanced every year, whereas those of Amihud measure are changed every month. Finally 25 portfolios are constructed every month. Within each subsample, the equally weighted portfolios are formed and held for 6 months. Panel A of <Table 4> shows the result when portfolios are sorted by firm size and *AMIHUD6*. Four portfolios among five B-S portfolios have positive and significant returns over the 6 month holding periods. The largest portfolio

<Table 2> Returns of Portfolios Sorted by Liquidity Level

This table reports the returns of portfolios sorted by liquidity level for all sample firms over the period 1994~2004. At the beginning of each month, eligible stocks are sorted into deciles by their average liquidity, *AMIHUDx*. *AMIHUDx* is calculated by averaging the Amihud (2002) illiquidity measure over the prior x months (x = 1, 6, 12). In each decile, stocks are equally weighted and held for n months (n = 1, 6, 12). The portfolios are rebalanced every month. S denotes the lowest-*AMIHUDx* decile portfolio (the most liquid decile), B denotes the highest-*AMIHUDx* decile portfolio (the least liquid decile), and B-S denotes the difference between B and S. HP12m means the holding period return of a portfolio over the 12-month, and similarly for HP1m and HP6m. The t-statistics are in parentheses.

	S	D2	D3	D4	D5	D6	D7	D8	D9	B	B-S
Panel A : Return of portfolios sorted by *AMIHUD1*											
HP1m	0.000	-0.007	-0.001	0.004	0.011	0.012	0.012	0.019	0.027	0.030	0.031
	(-0.035)	(-0.642)	(-0.047)	(0.349)	(1.059)	(1.216)	(1.146)	(1.819)	(2.484)	(2.944)	(3.288)
HP6m	0.015	-0.010	0.003	0.031	0.054	0.065	0.083	0.099	0.132	0.144	0.129
	(0.538)	(-0.414)	(0.118)	(0.986)	(1.749)	(2.064)	(2.563)	(2.794)	(3.546)	(3.620)	(4.621)
HP12m	0.034	0.000	0.018	0.056	0.065	0.100	0.128	0.150	0.226	0.249	0.214
	(0.873)	(-0.006)	(0.471)	(1.212)	(1.522)	(2.119)	(2.778)	(3.017)	(3.423)	(3.714)	(4.486)
Panel B : Return of portfolios sorted by *AMIHUD6*											
HP1m	0.003	-0.001	0.001	0.007	0.007	0.016	0.015	0.016	0.026	0.024	0.021
	(0.283)	(-0.115)	(0.140)	(0.637)	(0.672)	(1.537)	(1.355)	(1.494)	(2.227)	(2.326)	(2.429)
HP6m	0.022	-0.007	0.031	0.014	0.055	0.063	0.072	0.094	0.144	0.134	0.112
	(0.807)	(-0.263)	(1.058)	(0.506)	(1.654)	(2.035)	(2.253)	(2.590)	(3.579)	(3.469)	(4.328)
HP12m	0.042	0.007	0.076	0.042	0.093	0.097	0.121	0.155	0.249	0.230	0.188
	(1.074)	(0.162)	(1.587)	(0.957)	(1.678)	(2.065)	(2.530)	(2.907)	(3.517)	(3.663)	(4.486)
Panel C : Return of portfolios sorted by *AMIHUD12*											
HP1m	0.004	0.002	0.008	0.005	0.010	0.012	0.012	0.014	0.024	0.026	0.022
	(0.385)	(0.172)	(0.710)	(0.491)	(0.977)	(1.118)	(1.122)	(1.368)	(2.088)	(2.684)	(2.900)
HP6m	0.026	-0.001	0.048	0.047	0.053	0.063	0.065	0.079	0.143	0.137	0.112
	(0.941)	(-0.028)	(1.491)	(1.404)	(1.612)	(1.997)	(2.078)	(2.309)	(3.686)	(3.570)	(4.403)
HP12m	0.070	0.026	0.096	0.128	0.089	0.110	0.115	0.134	0.229	0.236	0.166
	(1.550)	(0.580)	(1.646)	(1.866)	(1.896)	(2.525)	(2.336)	(2.664)	(3.590)	(3.763)	(4.302)

does not have positive liquidity premium with -1.4% (t = -0.91). The liquidity premium decreases from the smallest to the largest quintile. It is because the largest firms are generally liquid even in the time of illiquid market. This phenomenon is called 'flight to liquidity'. This result is also consistent with findings of the U.S. market (Liu, 2006). Panel B shows the result when portfolios are sorted by B/M and *AMIHUD6*. All B-S portfolios has positive and significant returns over the 6 month holding periods from the lowest to the highest-B/M quintile.

<Table 3> Returns of Portfolios Double-sorted by Firm Characteristic and Liquidity Level

This table reports the returns of double-sort portfolios for all sample firms over the period 1994-2004. We first form quintiles by sorting stocks on the basis of the size (or book-to-market ratio), and then within each quintile we sort stocks into quintiles by the average liquidity, *AMIHUD6*. Size is the market capitalization at the end of previous year in million won. B/M is the book value divided by market capitalization at the end of the previous year. *AMIHUDx* is calculated by averaging the Amihud (2002) illiquidity measure over the prior x months (x = 1, 6, 12). Finally 25 portfolios are constructed. At the beginning of each month, the equally weighted portfolios are formed and are held for 6 months. The portfolios are rebalanced every month. The lowest-*AMIHUD6* quintile is the most liquid portfolio (S), and the highest-*AMIHUD6* quintile is the least liquid portfolio (B). B-S denotes the difference between B and S. The t-statistics are in parentheses.

Panel A : Return of portfolios sorted by size and liquidity level

		S	Q2	Q3	Q4	B	B-S
	Small	0.053	0.104	0.153	0.184	0.187	0.133
		(1.342)	(3.094)	(3.762)	(3.668)	(4.061)	(4.395)
	Q2	-0.021	0.028	0.073	0.112	0.128	0.149
		(-0.800)	(0.967)	(1.999)	(2.672)	(3.224)	(7.272)
SIZE	Q3	-0.017	0.027	0.073	0.053	0.063	0.080
		(-0.634)	(0.927)	(2.052)	(1.577)	(1.677)	(3.270)
	Q4	-0.032	0.039	0.046	0.060	0.040	0.072
		(-1.222)	(1.128)	(1.448)	(1.956)	(1.610)	(5.409)
	Large	0.028	0.041	0.044	0.067	0.014	-0.014
		(1.079)	(1.271)	(1.485)	(2.000)	(0.663)	(-0.911)

Panel B : Return of portfolios sorted by B/M and liquidity level

		S	Q2	Q3	Q4	B	B-S
	Low	-0.030	-0.032	0.017	-0.027	0.029	0.059
		(-1.208)	(-1.189)	(0.607)	(-0.912)	(0.954)	(2.344)
	Q2	0.022	0.018	0.008	0.088	0.078	0.055
		(0.893)	(0.663)	(0.284)	(2.400)	(2.657)	(2.614)
B/M	Q3	0.003	0.014	0.052	0.062	0.099	0.096
		(0.119)	(0.507)	(1.941)	(1.967)	(2.781)	(4.016)
	Q4	0.057	0.042	0.076	0.097	0.154	0.097
		(1.787)	(1.336)	(2.393)	(2.776)	(3.788)	(3.741)
	High	0.134	0.103	0.115	0.175	0.192	0.058
		(2.966)	(2.251)	(2.781)	(3.602)	(3.641)	(2.353)

<Table 4> Risk-adjusted Returns of Portfolios Sorted by Liquidity Level

This table reports the risk-adjusted returns of portfolios sorted by liquidity measure for all sample firms over the period 1994-2004. At the beginning of each month, eligible stocks are sorted into deciles by their average liquidity, *AMIHUD6*. *AMIHUDx* is calculated by averaging the Amihud (2002) illiquidity measure over the prior x months (x = 1, 6, 12). In each decile, stocks are equally weighted and held for 6 months. The portfolios are rebalanced every month. S denotes the lowest-*AMIHUDx* decile portfolio (the most liquid decile), B denotes the highest-*AMIHUDx* decile portfolio (the least liquid decile), and B-S denotes the difference between B and S. Panel A reports parameter estimates of the capital asset pricing model (CAPM)

$$r_{it} - r_{ft} = \alpha_i + \beta_i MKT + \varepsilon_{it} ,$$

and Panel B reports parameter estimates of the Fama–French three-factor model

$$r_{it} - r_{ft} = a_i + b_i MKT + s_i SMB_t + h_i HML_t + \varepsilon_{it} ,$$

where r_{it} is the return of portfolio i in month t, r_{ft} is the 365-day monetary stabilization bond (MSB) rate for month t. The t-statistics are in parentheses. Gibbons, Ross and Shanken (1989) F-value tests the null hypothesis that the intercepts jointly equal zero and their p-values are reported in parentheses.

	S	D2	D3	D4	D5	D6	D7	D8	D9	B	B-S
Panel A : CAPM-adjusted returns											
α	0.024	-0.005	0.034	0.017	0.057	0.065	0.074	0.097	0.146	0.136	0.112
	(0.985)	(-0.194)	(1.214)	(0.629)	(1.820)	(2.225)	(2.461)	(2.744)	(3.813)	(3.670)	(4.310)
β	1.216	1.077	1.161	1.144	1.190	1.123	1.173	1.089	1.341	1.207	-0.009
	(5.184)	(4.444)	(4.358)	(4.462)	(3.938)	(3.978)	(4.050)	(3.218)	(3.631)	(3.374)	(-0.036)
R^2	0.165	0.125	0.121	0.126	0.100	0.102	0.105	0.067	0.085	0.073	-0.008
F-value for the Gibbons-Ross-Shanken test : 10.467 (p-value : 0.000)											
Panel B : Fama-French three-factor-adjusted returns											
a	0.001	-0.034	0.000	-0.019	0.009	0.021	0.026	0.043	0.079	0.072	0.071
	(0.030)	(-1.360)	(0.008)	(-0.740)	(0.296)	(0.780)	(0.924)	(1.300)	(2.306)	(2.147)	(2.945)
b	1.339	1.230	1.337	1.334	1.447	1.354	1.430	1.374	1.698	1.551	0.212
	(5.849)	(5.296)	(5.290)	(5.560)	(5.313)	(5.256)	(5.513)	(4.465)	(5.270)	(4.962)	(0.941)
s	1.086	1.368	1.565	1.700	2.280	2.076	2.310	2.579	3.248	3.105	2.019
	(3.238)	(4.018)	(4.224)	(4.837)	(5.711)	(5.498)	(6.079)	(5.718)	(6.878)	(6.779)	(6.108)
h	1.351	1.510	1.886	1.790	2.696	2.241	2.371	2.480	2.788	2.996	1.645
	(2.972)	(3.275)	(3.757)	(3.758)	(4.986)	(4.380)	(4.605)	(4.059)	(4.358)	(4.827)	(3.674)
R^2	0.225	0.217	0.229	0.255	0.288	0.270	0.301	0.248	0.322	0.311	0.208
F-value for the Gibbons-Ross-Shanken test : 8.679 (p-value : 0.000)											

<Table 4> reports the risk-adjusted returns of decile for all sample firms over the period 1994～2004. In Panel A of Table 4, after adjusting for the CAPM, the Jensen's alpha of B-S portfolios is 11.2% (t = 4.31) over the 6-month holding period, revealing the inability of the CAPM to capture the liquidity risk. The GRS F-test for 10 portfolios also supports the existence of liquidity level premium, rejecting the null hypothesis that the Jensen's alphas are jointly zero. The Fama-French three-factor model also has a positive and significant Jensen's alpha of B-S portfolio with 7.1% (t = 2.95). The GRS F-test supports the significance of Jensen's alphas as well. Though not reported in this paper, the results of double-sort portfolios are similar. After adjusting for the CAPM and Fama-French three-factor model, the Jensen's alphas of B-S portfolios remain positive and significant except the largest-size quintile. These results support the hypothesis 1 that the liquidity level affects stock returns significantly.

2. Premium of Covariance Risk (Second Moment)

1) Innovation in Market Liquidity

To investigate the question of whether the commonality in liquidity is priced, we calculate the liquidity commonality, namely, market-wide liquidity (hereafter called 'market liquidity'). We construct the market liquidity by averaging the liquidity measures of individual stocks. The aggregate liquidity ($ALIQ$) at the end of month t is

$$ALIQ_t = \frac{1}{N_t}\sum_{i=1}^{N_t} LIQ_{i,t} = \frac{1}{N_t}\sum_{i=1}^{N_t} -AMIHUD1_{i,t} \tag{2}$$

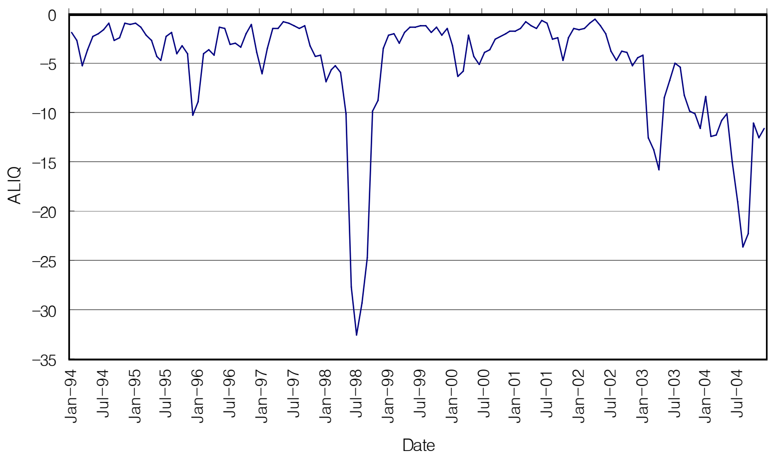
where $LIQ_{i,t}$ is the liquidity measure, $AMIHUD1_{i,t}$ is the Amihud (2002) measure over the prior month for stock i at month t, and N_t is the number of eligible stocks at the end of month t. Because the Amihud (2002) measure represents illiquidity instead of liquidity, a minus sign is added so that positive shock to-$AMIHUD1_{i,t}$ can be interpreted as increasing liquidity. Pastor and Stambaugh (2003) argue that even if individual liquidity measure is an imprecise estimate of a stock, the market-wide liquidity can be estimated more precisely by averaging individual measures. Amihud (2002), Chordia, Roll, and Subrahmanyam (2001), Acharya and Pedersen (2005), and Liu (2006) also use the cross-sectional average of individual liquidity as a measure of market-wide liquidity.

[Figure 1(a)] represents the time-series of aggregate liquidity, $ALIQ_t$. There are four large declines in market liquidity. First, the series identify the largest decline in market liquidity during 1997～1998. It coincides with the period of severe market illiquidity

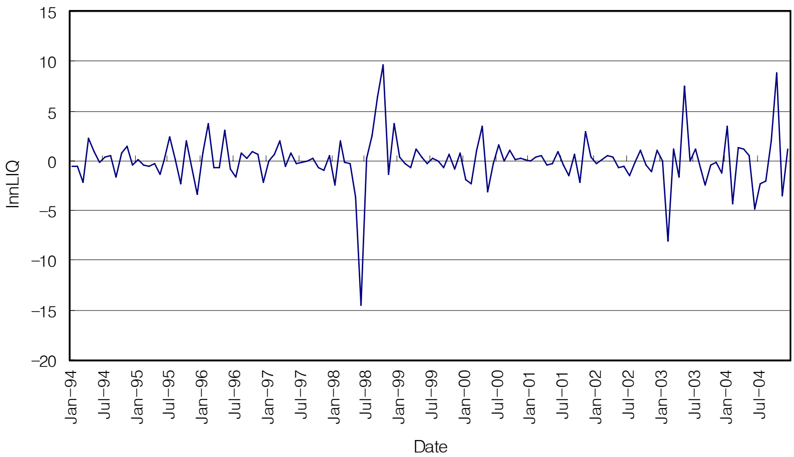
[Figure 1] Aggregate Liquidity and Innovation in Market Liquidity of the Amihud Measure

These figures show the fluctuation of aggregate liquidity (*ALIQ*) and innovation in market liquidity (*InnLIQ*). [Figure 1(a)] shows the aggregate liquidity. [Figure 1(b)] shows the innovation in market liquidity.

(a) Aggregate liquidity



(b) Innovation in market liquidity



in the Asian financial crisis. Second, following the withdrawal of the North Korea from the NPT at January 10, 2003, the Moody's perspective on the Korean economy changed from the positive to the negative at February 11, 2003. In March 2003, the fraudulent accounts of the SK corporation were revealed and the Iraq war followed (March 20, 2003). In this perod, the market suffered a large and continuing decline in liquidity. Third, there was a 'China shock' caused by the announcement of a retrenchment policy by the Chinese Prime Minister on April 28, 2004. Fourth, the Korean stock market experienced a long slowdown during the period 1995-1996, after the KOSPI index broke through 1000 point in September, 1994. The Korean government announced a pump-priming policy three times during the period 1995-1996: April 10, 1995, April 26, 1995, and March 19, 1996. The fluctuation in aggregate liquidity is consistent with the Korean economic conditions. This fact carry conviction that the Amihud (2002) measure and its aggregate liquidity, $ALIQ_t$ captures the state of market liquidity adequately.

Pastor and Stambaugh (2003) consider unexpected innovation in market liquidity as an important source of liquidity risk, rather than market liquidity itself. This usage is based on the argument that shocks, not predictable change, to macroeconomic variables could be priced (Chen, Roll, and Ross, 1986). According to Pastor and Stambaugh (2003), we estimate the innovation in market liquidity using *AMIHUD1* as follows: the aggregate change in market liquidity at month t is calculated as

$$\Delta ALIQ_t = \frac{1}{N_t}\sum_{i=1}^{N_t}(LIQ_{i,t} - LIQ_{i,t-1}) = \frac{1}{N_t}\sum_{i=1}^{N_t}((-AMIHUD1_{i,t}) - (-AMIHUD1_{i,t-1})) \qquad (3)$$

where $LIQ_{i,t}$ is the liquidity measure, $AMIHUD1_{i,t}$ is the Amihud (2002) measure over the prior month for stock i at month t, and N_t is the number of eligible non-financial common stocks at the end of month t. The $\Delta ALIQ$ series are serially correlated over the sample period with a first-order autocorrelation of 0.281 (t-value = 3.34).

Then, the innovation in market liquidity can be estimated as the residuals from the regression

$$\Delta ALIQ_t = a + b\Delta ALIQ_{t-1} + u_t \qquad (4)$$

The residuals of regression are correlated with a first-order autocorrelation of 0.029 (t-value = 0.33). We define the residual of regression as the innovation in market liquidity, $InnLIQ_t$

$$InnLIQ_t = \hat{u}_t \tag{5}$$

Pastor and Stambaugh (2003), Acharya and Pedersen (2005), and Liu (2006) use the fitted residual divided by arbitrary scaling factor (e.g. 1/100 or 1/30) to produce more convenient magnitudes of the sensitivity of stock. However, we do not adjust the residual term in this paper.

<Table 5> reports the summary statistic of innovation in market liquidity. Panel A of <Table 5> shows the time-series of innovation in market liquidity, $InnLIQ_t$. Its

<Table 5> Summary Statistics of the Innovation in Market Liquidity

This table reports the summary statistics of the innovation in market liquidity. The innovation in market liquidity ($InnLIQ$) is estimated as follows: The aggregate change in market liquidity at the end of month t is calculated as

$$\Delta ALIQ_t = \frac{1}{N_t}\sum_{i=1}^{N_t}(LIQ_{i,t} - LIQ_{i,t-1}) = \frac{1}{N_t}\sum_{i=1}^{N_t}((-AMIHUD1_{i,t}) - (-AMIHUD1_{i,t-1}))$$

where $LIQ_{i,t}$ is the liquidity measure, $AMIHUD1_{i,t}$ is the Amihud (2002) measure over the prior month for stock i at month t, and N_t is the number of eligible non-financial common stocks at the end of month t. Then the innovation in market liquidity can be estimated as the residuals from the regression

$$\Delta ALIQ_t = a + b\Delta ALIQ_{t-1} + u_t$$

The residual of regression is defined as the innovation in market liquidity, $InnLIQ_t$, i.e.,$InnLIQ_t = \hat{u}_t$. Panel A reports the distribution of the innovation in market liquidity for the period 1994~2004. Panel B represents the Spearman correlation between the innovation in market liquidity and other factors: MKT, SMB, and HML. MKT, SMB, and HML are market, size, and book-to-market factors of Fama and French (1993).

Panel A : Summary statistics

	Mean	Std	Min	Q1	Median	Q3	Max
InnLIQ	0.000	2.533	-14.568	-0.704	-0.018	0.790	9.603

Panel B : Spearman correlation with other factor

	MKT	SMB	HML
InnLIQ(1994-2004)	0.009	0.088	0.215
InnLIQ(1994-1998)	0.178	0.130	0.270
InnLIQ(1999-2004)	-0.112	0.032	0.162

median is -0.018 and standard deviation is 2.533. [Figure 1(b)] plots the monthly values of the $InnLIQ_t$ and indicates that large low liquidity shock happens around 1998 and 2003 consistent with the Korean economic conditions. Panel B represents the Spearman correlation between innovation in market liquidity and other factors : MKT, SMB, and HML. *InnLIQ* is positively correlated with MKT, SMB, and HML in the whole sample period (1994~2004). The positive correlation with HML indicates that large innovations (low liquidity shocks) coincide with a high distress premium. The positive correlation with MKT is not consistent with our expectation because low liquidity shocks are usually related with decline in the market. Thus, we divide sample period into two periods of the similar term. In the post period (1999~2004), the correlation between *InnLIQ* and MKT is converted into negative indicating relationship between low liquidity shocks and decline in the market becomes apparent recently.

2) Covariance between Stock Return and Innovation in Market Liquidity

Do stocks with higher sensitivity of return to the innovation in market liquidity outperform stocks with lower sensitivity? The return sensitivity of stock i at each month is the coefficient on the innovations in market liquidity, *InnLIQ,* in the following time-series regression

$$r_{it} - r_{ft} = \alpha_i + \beta_i InnLIQ_t + \gamma_i MKT_t + \delta_i SMB_t + \varphi_i HML_t + u_t \tag{6}$$

where r_{it} is the return of stock i in month t, r_{ft} is the 365-day monetary stabilization bond (MSB) rate in month t, *InnLIQ* is the innovation in market liquidity, and *MKT*, *SMB*, and *HML* are the Fama-French three factors. Each month the regression is estimated to obtain the return sensitivity, β_i ,using prior 5-year (at least 30 months) monthly data. The sensitivity (beta) of return to the innovation in market liquidity is estimated for all non-financial common stocks over the period 1997~2004. Test period starts from 1997 because we need at least 30 months to estimate the return sensitivity (beta) to the innovation in market liquidity.

<Table 6> represents the results from decile portfolios sorted on the sensitivity of return to the innovation in market liquidity. Panel A reports the means of return

<Table 6> Returns of Portfolios Sorted by Return Sensitivity to the Innovation in Market Liquidity

This table reports the returns of portfolios sorted by return sensitivity to the innovation in market liquidity for all non-financial common stocks over the period 1997∼2004. To obtain stock's return sensitivity to the innovation in market liquidity, prior 5-year estimation period is needed. In the estimation, firms whose observations are less than 30 months are excluded. Each month the return sensitivities to the innovation in market liquidity are estimated from the following model with liquidity factor, *InnLIQ*:

$$r_{it} - r_{ft} = \alpha_i + \beta_{m,i} InnLIQ_t + \gamma_{m,i} MKT_t + \delta_{m,i} SMB_t + \varphi_{m,i} HML_t + u_t$$

where $InnLIQ_t$ is the month-t innovation in market liquidity, and MKT, SMB, and HML are market, size, and book-to-market factors of Fama and French (1993). Test period starts from 1997 because at least 30 months are needed to estimate the return sensitivity (beta) to the innovation in market liquidity. At the beginning of each month, stocks are sorted into deciles by return sensitivities to the innovation in market liquidity. The portfolios are rebalanced every month. Panel A reports the means of return sensitivities to the innovation in market liquidity for each portfolio. Panel B represents the returns of portfolios equally weighted and held for 1, 6, and 12 months. S denotes the lowest-sensitivity decile and B denotes the highest-sensitivity decile. HP6m shows the holding period returns over the 6-month, and similarly for HP1m and HP12m. Panel C reports the intercepts of the capital asset pricing model (CAPM)

$$r_{it} - r_{ft} = \alpha_i + \beta_i MKT_t + \varepsilon_{it},$$

and Panel D reports the intercepts of the Fama - French three-factor model

$$r_{it} - r_{ft} = a_i + b_i MKT_t + s_i SMB_t + h_i HML_t + \varepsilon_{it},$$

where r_{it} is the return of portfolio i in month t, r_{ft} is the 365-day monetary stabilization bond (MSB) rate for month t. The t-statistics are in parentheses. Gibbons, Ross and Shanken (1989) F-value tests the null hypothesis that the intercepts jointly equal zero and their p-values are reported in parentheses.

	S	D2	D3	D4	D5	D6	D7	D8	D9	B	B-S
Panel A : Return sensitivities to the innovation in market liquidity											
	-0.023	-0.012	-0.009	-0.006	-0.003	-0.001	0.001	0.004	0.007	0.018	0.041
	(-52.20)	(-55.55)	(-51.44)	(-46.43)	(-33.92)	(-10.87)	(9.54)	(24.47)	(32.53)	(37.73)	(48.52)
Panel B : Return of portfolios sorted by return sensitivity to the innovation in market liquidity											
HP1m	0.005	0.006	0.012	0.013	0.017	0.009	0.013	0.017	0.016	0.018	0.013
	(0.389)	(0.445)	(0.909)	(1.034)	(1.295)	(0.660)	(0.991)	(1.299)	(1.257)	(1.244)	(1.845)
HP6m	0.008	0.027	0.057	0.070	0.068	0.077	0.080	0.088	0.105	0.085	0.077
	(0.232)	(0.694)	(1.485)	(1.761)	(1.759)	(1.842)	(1.689)	(2.000)	(2.183)	(1.708)	(3.811)
HP12m	0.051	0.070	0.119	0.110	0.131	0.159	0.151	0.168	0.161	0.184	0.133
	(0.963)	(1.238)	(2.116)	(1.991)	(2.245)	(2.476)	(2.055)	(2.524)	(2.306)	(2.069)	(2.957)
Panel C : CAPM-adjusted returns											
α	0.002	0.003	0.009	0.010	0.014	0.005	0.010	0.014	0.013	0.015	0.013
	(0.252)	(0.341)	(1.150)	(1.323)	(1.768)	(0.734)	(1.323)	(1.822)	(1.634)	(1.570)	(1.811)
β	0.860	0.840	0.882	0.818	0.872	0.904	0.933	0.906	0.855	0.943	0.083
	(11.775)	(11.876)	(13.705)	(12.925)	(13.089)	(14.125)	(14.287)	(13.715)	(12.118)	(11.486)	(1.362)
R^2	0.592	0.596	0.663	0.636	0.642	0.676	0.681	0.663	0.606	0.580	0.009

F-value for the Gibbons-Ross-Shanken test : 1.466 (p-value : 0.167)

	S	D2	D3	D4	D5	D6	D7	D8	D9	B	B-S
Panel D : Fama-French three-factor-adjusted returns											
a	-0.010	-0.010	-0.003	-0.002	-0.001	-0.006	-0.002	0.001	0.002	0.003	0.013
	(-1.279)	(-1.364)	(-0.440)	(-0.286)	(-0.200)	(-0.808)	(-0.373)	(0.106)	(0.210)	(0.319)	(1.745)
b	0.913	0.896	0.932	0.869	0.938	0.952	0.987	0.964	0.907	0.995	0.082
	(14.177)	(14.623)	(16.556)	(16.202)	(18.167)	(16.764)	(17.767)	(17.600)	(14.764)	(13.076)	(1.346)
s	0.523	0.544	0.482	0.502	0.632	0.463	0.525	0.561	0.518	0.500	-0.023
	(5.494)	(6.010)	(5.791)	(6.332)	(8.275)	(5.506)	(6.391)	(6.929)	(5.698)	(4.442)	(-0.257)
h	0.294	0.405	0.425	0.288	0.483	0.367	0.437	0.437	0.268	0.460	0.166
	(2.353)	(3.406)	(3.890)	(2.762)	(4.824)	(3.325)	(4.054)	(4.109)	(2.246)	(3.114)	(1.398)
R^2	0.690	0.704	0.748	0.745	0.790	0.751	0.775	0.774	0.708	0.647	0.029

F-value for the Gibbons-Ross-Shanken test : 0.947 (p-value : 0.495)

<Table 7> Returns of Portfolios Double-sorted by Firm Characteristic and Return Sensitivity to the Innovation in Market Liquidity

This table reports the returns of double-sort portfolios for all non-financial common stocks over the period 1997~2004. We first form quintiles by sorting stocks on the basis of the firm characteristic (size and book-to-market ratio), and then within each quintile we sort stocks into quintiles by the return sensitivity to the innovation in market liquidity (*InnLIQ*). Size is the market capitalization at the end of previous year in million won. B/M is the book value divided by market capitalization at the end of the previous year. To obtain stock's return sensitivity to the innovation in market liquidity, prior 5-year estimation period is needed. In the estimation, firms whose observations are less than 30 months are excluded. Each month the return sensitivities to the innovation in market liquidity are estimated from the following model with liquidity factor, *InnLIQ* :

$$r_{it} - r_{ft} = \alpha_i + \beta_{m,i} InnLIQ_t + \gamma_{m,i} MKT_t + \delta_{m,i} SMB_t + \varphi_{m,i} HML_t + u_t$$

where $InnLIQ_t$ is the month-t innovation in market liquidity, and MKT, SMB, and HML are market, size, and book-to-market factors of Fama and French (1993). Finally 25 portfolios are constructed and rebalanced every month. At the beginning of each month, the equally weighted quintile portfolios are formed and held for 6 months. S denotes the lowest-sensitivity quintile, B denotes the highest-sensitivity quintile. B-S denotes the difference between B and S. Panel A reports the returns of double-sort portfolios sorted by firm size and return sensitivity. Panel B reports the returns of double-sort portfolios sorted by B/M and return sensitivity. The t-statistics are in parentheses.

Panel A : Returns of portfolios sorted by firm size and return sensitivity

		S	Q2	Q3	Q4	B	B-S
SIZE	Small	0.048	0.163	0.145	0.133	0.144	0.096
		(1.039)	(2.741)	(2.849)	(2.505)	(2.418)	(3.089)
	Q2	-0.043	0.030	0.061	0.076	0.154	0.198
		(-1.363)	(0.799)	(1.368)	(1.500)	(2.393)	(5.033)
	Q3	0.032	0.019	0.036	0.059	0.067	0.035
		(0.886)	(0.516)	(0.782)	(1.191)	(1.388)	(1.403)
	Q4	-0.010	0.039	0.039	0.063	0.078	0.088
		(-0.263)	(1.037)	(1.053)	(1.574)	(1.657)	(4.057)
	Large	0.053	0.058	0.098	0.099	0.064	0.011
		(1.442)	(1.745)	(2.166)	(2.384)	(1.701)	(0.983)

Panel B : Returns of portfolios sorted by B/M and return sensitivity

		S	Q2	Q3	Q4	B	B-S
	Low	-0.110	-0.055	-0.012	-0.031	0.022	0.132
		(-4.165)	(-1.843)	(-0.321)	(-0.935)	(0.488)	(4.683)
	Q2	-0.010	0.069	0.067	0.051	0.060	0.070
		(-0.261)	(1.863)	(1.661)	(1.412)	(1.537)	(3.520)
B/M	Q3	-0.029	0.082	0.043	0.062	0.124	0.152
		(-0.877)	(2.192)	(1.136)	(1.486)	(2.555)	(7.339)
	Q4	0.087	0.083	0.098	0.124	0.094	0.007
		(2.044)	(1.954)	(2.209)	(2.543)	(1.874)	(0.405)
	High	0.185	0.131	0.137	0.197	0.237	0.052
		(3.012)	(2.595)	(2.356)	(3.118)	(2.923)	(1.525)

sensitivities to the innovation in market liquidity for each decile portfolio. Panel B represents the returns of portfolios equally weighted and held for 1, 6, and 12 months. Holding-period returns show increasing pattern from the lowest decile (S) to the highest decile (B). The return difference between B and S is positive and significant over the 1, 6 and 12 holding periods at 1.3% (t = 1.85), 7.7% (t = 3.81), and 13.3% (t = 2.96). Panel C represents the Jensen's alphas of the CAPM for the portfolios with one-month holding period. The Jensen's alpha of B-S portfolios are positive at 1.3% (t = 1.81) over the one-month holding period. In Panel D, the Jensen's alphas of the Fama-French three-factor model for the portfolios with one-month holding period is 1.3% (t = 1.75). This result does not strongly support the hypothesis 2 because the Jensen's alpha is significant at 10% level. Therefore, we perform the GRS F-test additionally. The p-value of GRS F-test is 16.7% and 49.5% respectively, not rejecting the null hypothesis that the Jensen's alphas are jointly zero. These GRS F-test results do not support the hypothesis 2 of covariance risk.

To investigate the effect of market liquidity further, we examine the double-sort portfolios. We first form quintiles by sorting stocks on the basis of the firm characteristic such as firm size and B/M, and then within each quintile we sort stocks into quintiles by the return sensitivity to the innovation in market liquidity. Finally 25 portfolios are constructed. Within each subsample, the equally weighted portfolios are formed at the beginning of each month and are held for 6 months. <Table 7> reports the results of these double-sorted portfolios. The return differences between B and S are all positive from the smallest (lowest) to the largest (highest) quintile. Though not reported in this paper, the results of the Jensen's alphas of the CAPM and the Fama-French three-factor model do not strongly support the hypothesis. In short, these results are inconsistent with each other and do not completely support the hypothesis 2 that the covariance risk between the individual stock return and the innovation in market liquidity affects stock returns significantly.

3. Tests for the Bebavoral Explanations for Liquidity Risk

The liquidity asset pricing test in Korea has meaning in that the behavioral explanation for liquidity, such as Baker and Stein (2004), can be tested. At first, we need to remember the magnitude of liquidity premium in Korea. Panel A of <Table 2> shows the liquidity premium from the liquidity level is about 3.1～21.4%. Panel B of <Table 6> shows the liquidity premium from the return sensitivity to the innovation in market liquidity is about 1.3～13.3%. The magnitude of this premium is substantial. In the U.S., Amihud and Mendelson (1986) report the premium from the liquidity level is 0.7% per month using the bid-ask spread. Brennan and Subrahmanyam (1996) report it ranges from 0.6 to 1.4% per month using Kyle's lambda (λ). Liu (2006) reports the premium from the liquidity level is about 0.8% and the premium from the liquidity risk ranges from 0.19 to 0.69%.

We try to examine whether the liquidity premium in Korea has a distinct pattern when portfolios are formed by proxy for investors' irrationality. If Hypothesis 3 is correct, a stock which is more exposed to investors' irrationality should be more influenced by liquidity risk. Under the assumption that an irrational investor is an individual investor[4], we test if a stock that is more frequently traded by individual investors shows a stronger effect on liquidity.[5] We can test this by forming quintiles by the irrationality measure, and then comparing the effects of liquidity risk within each quintile.

4) The literature in behavioral finance argues that individual investors are more irrational than others because individual investors are more influenced by sentiment. The literature provides plenty of evidence that many behavioral biases in trading by individual investors have been observed (Odean, 1998b, 1999; Barber and Odean, 2000; Goetzmann and Kumar, 2005).

5) The large individual composition of trading volume does not necessarily mean the liquidity provision of individual investors is high. Due to this reason, Barber, Odean, and Zhu (2009) argue that measures that can distinguish the market order are better proxies for investor sentiment. As a robustness check, we calculate the individual composition among price-setting volume initiated by market order (or marketable limit order). Though not reported in this paper, the results are similar.

<Table 8> Returns of Portfolios Sorted by Individual Investors' Composition of Trading Volume

These tables report the returns of double-sort and triple-sort portfolios for all non-financial common stocks over the period 1997-2004. In case of double-sort portfolios, we first form quintiles by sorting stocks on the basis of the individual composition of trading volume of firm, and then within each quintile we sort stocks into quintiles by the variables of interest, such as liquidity level and return sensitivity. Finally 25 portfolios are constructed and rebalanced every year. At the beginning of each month, the equally weighted portfolios are formed and held for 6 months. In case of triple-sort portfolios, we first form 3 portfolios by sorting stocks on the basis of the firm size, and then within 3 portfolios we form the double-sort (3×3) portfolios by individual composition of trading volume and the variables of interest, such as liquidity level and return sensitivity. Panel A reports the returns of double-sort and triple-sort portfolios over the period 1994-2004 when portfolios are formed by (firm size,) individual's trading volume, and *AMHUD6*. *AMIHUDx* is the average of the Amihud (2002) illiquidity measure over the prior x months (x = 1, 6, 12). Panel B reports the returns of portfolios sorted by (the firm size,) individual's trading volume, and return sensitivity to the innovation in market liquidity over the period 1997-2004. To obtain stock's return sensitivity to the innovation in market liquidity, prior 5-year estimation period is needed. In the estimation, firms whose observations are less than 30 months are excluded. Each month the return sensitivities to the innovation in market liquidity are estimated from the following model with liquidity factor, *InnLIQ*:

$$r_{it} - r_{ft} = \alpha_i + \beta_{m,i} InnLIQ_t + \gamma_{m,i} MKT_t + \delta_{m,i} SMB_t + \varphi_{m,i} HML_t + u_t$$

where $InnLIQ_t$ is the month-t innovation in market liquidity, and MKT, SMB, and HML are market, size, and book-to-market factors of Fama and French (1993). At the beginning of each month, the equally weighted portfolios are formed and held for 6 months. The t-statistics are in parentheses.

Panel A : Effect of liquidity level

A.1 Double-sort portfolio

		S	Q2	Q3	Q4	B	B-S
	Low	0.107	0.091	0.099	0.048	0.023	-0.084
		(2.742)	(2.701)	(2.749)	(1.452)	(0.769)	(-2.710)
	Q2	0.057	0.046	0.083	0.081	0.112	0.055
		(1.474)	(1.097)	(1.772)	(1.894)	(2.247)	(1.884)
Individual	Q3	-0.011	0.043	0.050	0.102	0.144	0.155
composition		(-0.284)	(1.026)	(1.140)	(1.929)	(2.360)	(3.677)
	Q4	-0.069	-0.020	0.091	0.100	0.225	0.294
		(-1.719)	(-0.498)	(1.749)	(1.983)	(2.896)	(5.870)
	High	-0.049	0.070	0.054	0.136	0.186	0.235
		(-1.167)	(1.255)	(1.119)	(2.478)	(3.102)	

A.2 Triple-sort portfolio

		Small				Medium				Large			
		S	Q2	B	B-S	S	Q2	B	B-S	S	Q2	B	B-S
	Low	0.001	0.095	0.178	0.176	0.021	0.052	0.084	0.063	0.099	0.080	0.031	-0.068
		(0.034)	(2.030)	(2.650)	(4.404)	(0.563)	(1.315)	(1.823)	(2.107)	(2.823)	(2.606)	(1.092)	(-2.723)
Ind.	Q2	0.067	0.088	0.232	0.165	0.021	0.054	0.116	0.095	0.088	0.093	0.092	0.004
Comp.		(1.330)	(1.811)	(3.244)	(2.943)	(0.585)	(1.126)	(1.836)	(2.193)	(2.167)	(2.159)	(2.375)	(0.219)
	High	0.016	0.098	0.189	0.173	-0.032	0.019	0.070	0.102	-0.034	0.055	0.065	0.099
		(0.302)	(1.851)	(3.284)	(7.374)	(-0.811)	(0.383)	(1.321)	(3.379)	(-0.858)	(1.033)	(1.343)	(4.510)

Panel B : Effect of return sensitivity to the innovation in market liquidity

B.1 Double-sort portfolio

		S	Q2	Q3	Q4	B	B-S
	Low	0.065	0.063	0.094	0.107	0.078	0.012
		(1.893)	(1.982)	(2.690)	(2.836)	(2.482)	(0.948)
	Q2	0.068	0.070	0.071	0.117	0.088	0.019
		(1.668)	(1.676)	(1.460)	(2.413)	(1.806)	(1.010)
Individual	Q3	0.018	0.040	0.042	0.065	0.127	0.109
composition		(0.514)	(1.054)	(0.942)	(1.367)	(1.877)	(2.291)
	Q4	-0.066	0.063	0.078	0.095	0.142	0.208
		(-1.973)	(1.338)	(1.586)	(1.659)	(2.170)	(4.775)
	High	0.033	0.084	0.082	0.075	0.112	0.079
		(0.684)	(1.683)	(1.683)	(1.411)	(2.106)	(3.664)

B.2 Triple-sort portfolio

		Small				Medium				Large			
		S	Q2	B	B-S	S	Q2	B	B-S	S	Q2	B	B-S
	Low	0.044	0.062	0.161	0.117	0.038	0.066	0.083	0.045	0.057	0.094	0.081	0.024
		(1.187)	(1.428)	(2.398)	(2.955)	(1.051)	(1.464)	(1.879)	(1.974)	(2.106)	(2.869)	(2.485)	(1.665)
Ind.	Q2	0.007	0.151	0.194	0.187	0.011	0.063	0.122	0.111	0.087	0.104	0.092	0.005
Comp.		(0.162)	(2.974)	(3.178)	(5.850)	(0.297)	(1.210)	(2.019)	(2.835)	(2.028)	(2.436)	(2.294)	(0.483)
	High	0.103	0.099	0.113	0.010	-0.025	0.047	0.033	0.058	-0.012	0.050	0.032	0.044
		(1.865)	(1.959)	(1.925)	(0.459)	(-0.649)	(0.941)	(0.631)	(2.144)	(-0.313)	(0.965)	(0.627)	(2.194)

<Table 8> reports the result of intra-market test for the behavioral explanation. The double-sort portfolios in Panel A.1 show that the liquidity level premium, i.e., the return difference between B and S portfolio is larger in the quintile with higher individual investors' composition of trading volume. However, in general, the individual investors' trading volume used as a proxy for investors' irrationality highly correlates with firm size. Its result can be contaminated by the size effect. To control the size effect, we perform the triple-sort analysis. The results of the triple-sort portfolios in Panel A.2 also show that the liquidity level premium is larger in the quintile with a higher individual investors' trading. The liquidity level has strong monotone pattern in the liquidity premium.

When we observe the results of Panel B, we can find some different patterns between liquidity level and liquidity beta portfolios. The result in Panel B shows the increasing liquidity premium from lower to higher individual composition portfolios except the highest portfolio. However, in the triple-sort result of Panel B.2, all portfolios do not show a monotonic increasing pattern in the liquidity premium.

While the results for the portfolios sorted on the liquidity level may be broadly consistent with behavioral argument, the results for the portfolios sorted on liquidity beta do not quite display the largely monotone pattern. Namely, the liquidity level premium is more evident when portfolios are sorted by investor irrationality measure. These results are in line with Daniel and Titman (1997)'s argument that behavior explanation is more suited for return differences across firm characteristics such book-to-market rather than return covariance.

In brief, the results imply that a substantial portion of the liquidity premium, especially in the liquidity level, is attributable to investor sentiment and irrational behavior, which supports the behavioral explanations for the liquidity premium. A caveat here is that our behavioral argument is not incompatible with the rational explanation. We only argue that behavioral factor can play a role as one of the various determinants of the liquidity premium. Our results do not suggest the invalidity of rational factors, nor are they inconsistent with the traditional finance view that the securities' expected returns are the compensation for the systematic risk.

4. Robustness Check

As a robustness check, the cross-sectional regression is used to investigate the relationship between stock returns and variables of liquidity. Each month Fama and MacBeth (1973) regression are implemented using the cross section of individual securities. The dependent variable is the return adjusted by the Fama and French (1993) three factor model. Explanatory variables are liquidity measures : *adjAMx(mean-adjusted Amihud measure)* and return sensitivity to the innovation in market liquidity. When calculating the *AMIHUDx*, we winsorize the Amihud (2002) measure at 1% to remove the effect of extreme value. Since liquidity measure varies considerably over the times, *AMIHUDx* is replaced in the estimation of the cross-section model by its mean-adjusted value, following the suggestion of Amihud (2002) :

$$AdjAMx_{it} = AMIHUDx_{it} / ALIQ_t \quad (7)$$

where *AMIHUDx* is the average of the Amihud (2002) illiquidity measure over the prior x months (x = 1, 6, 12), and $ALIQ_t$ is the aggregate liquidity at the end of month t.

Return sensitivities to the innovation in market liquidity are estimated each month over the period 1997~2004 using equation (6). The log market capitalization, SIZE; the book-to-market ratio, B/M; the lagged return for the stock over the second and third prior month, RET23; the return over lagged months four through six, RET46; and the return over lagged months seven through twelve, RET712 are included in the regression as control variables.

<Table 9> reports the time-series averages of coefficients obtained from monthly cross-sectional regressions and theirs t-statistics. In the univariate regression, the *AdjAM1,* the *AdjAM6,* the *AdjAM12,* and the return sensitivity have significant effects on the adjusted returns. These results confirm the argument that the liquidity level is important in the asset pricing and the covariance risk between asset's return and systematic component has an effect on asset returns in Korea.

Other robustness checks such as alternative liquidity measure,[6] mimicking liquidity factor,[7] observation filtering,[8] and aggregate liquidity scaled by total market size[9] are performed. However, their results do not change from the previous.

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6) We use the proportional bid-ask spread which is known to be the most precise liquidity measure and perform the same procedure as the Amihud (2002) measure's. The results from alternative liquidity measures are not reported in this paper. However, its result is similar to the Amihud (2002) measure's.

7) The mimicking liquidity factor (*LIQF*) is constructed as follows. At the beginning of each month, all non-financial sample firms are sorted in ascending order based on their Amihud (2002) measure, *AMIHUD6*. Then two portfolios, the lowest-*AMIHUD6* portfolio and highest-*AMIHUD6* portfolio, are formed based on the 30% breakpoint. *LIQF* is constructed as the monthly profits from buying one won of equally-weighted highest-*AMIHUD6* portfolio and short-selling one won of equally-weighted lowest-*AMIHUD6* portfolio. At the beginning of each monthfrom 1997 to 2004, stocks are sorted into deciles by return sensitivities to the liquidity factor. Though not reported in this paper, the results of decile and double-sort portfolios show that the sensitivity of return to the mimicking liquidity factor affects stock returns and support the hypothesis 2.

8) We winsorize the Amihud measure at 1% level. Another cutoff point of 5% is used. I also delete the extreme 1% upper and lower tails of distribution.

9) The Amihud (2002) measure can be interpreted as percentage price change per 10 million won. However, 10 million won in 1990s does not have the same value with that in 2000s considering the expansion of the whole market size. Therefore, we construct the scaled series $(m_t/m_1)AMIHUD1_t$, where m_t is the total won value at the end of month $t-1$of the stocks included in the month t, and m_1 corresponds to the total won value in January 1994.

<Table 9> Cross-sectional Regression Results on Liquidity Measures

Each month Fama and MacBeth (1973) regression are implemented using the cross section of individual securities. The dependent variable is the risk-adjusted return adjusted by the Fama and French (1993) three factor model. Explanatory variables are various liquidity measures. Amihud (2002) measure is defined as $\frac{1}{Days_t^i}\sum_{d=1}^{Days_t} i \frac{|R_{td}^i|}{V_{td}^i}$,where R_{td}^i and V_{td}^i are, respectively, the return and won volume (in 10 million won) on day d in month t, $Days_{at}^i$ is the number of valid observation days in month t for stock *i*. *adjAMx* (mean-adjusted Amihud measure) is caculated as $AdjAMx_{it} = AMIHUDx_{it}/ALIQ_t$, where *AMIHUDx* is the average of the Amihud (2002) illiquidity measure over the prior *x* months (x = 1, 6, 12), and $ALIQ_t$ is the aggregate liquidity at the end of month *t*. Return sensitivities to the innovation in market liquidity are estimated each month over the period 1997~2004 using prior 5-year (at least 30 months) estimation period from the following model with liquidity factor, *InnLIQ*:

$$r_{it} - r_{ft} = \alpha_i + \beta_{m,i} InnLIQ_t + \gamma_{m,i} MKT_t + \delta_{m,i} SMB_t + \varphi_{m,i} HML_t + u_t$$

where $InnLIQ_t$ is the month-t innovation in market liquidity, and MKT, SMB, and HML are market, size, and book-to-market factors of Fama and French (1993). The log of market capitalization, SIZE; the book-to-market ratio, B/M; the lagged return for the stock over the second and third prior month, RET23; the return over lagged months four through six, RET46; and the return over lagged months seven through twelve, RET712 are included in the regression as control variables. This table contains the time-series averages of coefficients obtained from monthly cross-sectional regressions and t-statistics are in parentheses.

Intercept	*AdjAM1*	*AdjAM6*	*AdjAM12*	Return Sens.	Size	B/M	RET23	RET46	RET712	Adj R^2
-0.013	0.002	.	.	.	.	.	.	.	.	0.004
(-2.205)	(3.762)	.	.	.	.	.	.	.	.	
-0.013	.	0.002	.	.	.	.	.	.	.	0.004
(-2.163)	.	(3.037)	.	.	.	.	.	.	.	
-0.013	.	.	0.002	.	.	.	.	.	.	0.004
(-2.150)	.	.	(2.939)	.	.	.	.	.	.	
-0.011	.	.	.	0.746	.	.	.	.	.	0.004
(-1.520)	.	.	.	(2.558)	.	.	.	.	.	
-0.072	0.002	.	.	.	0.005	0.003	-0.036	-0.013	-0.007	0.049
(-2.002)	(3.113)	.	.	.	(1.767)	(1.985)	(-3.316)	(-1.732)	(-1.455)	
-0.074	.	0.003	.	.	0.005	0.003	-0.037	-0.013	-0.006	0.050
(-1.986)	.	(2.835)	.	.	(1.753)	(2.000)	(-3.416)	(-1.798)	(-1.416)	
-0.076	.	.	0.003	.	0.005	0.003	-0.037	-0.014	-0.007	0.050
(-1.993)	.	.	(2.795)	.	(1.766)	(2.006)	(-3.460)	(-1.906)	(-1.535)	
-0.063	.	.	.	0.715	0.004	0.003	-0.038	-0.019	-0.007	0.044
(-1.493)	.	.	.	(2.901)	(1.287)	(2.270)	(-2.869)	(-2.424)	(-1.403)	

Ⅴ. Conclusion

Liquidity is an important dimension investors should consider in selecting their portfolios. Can liquidity affect asset prices? This issue has been studied for a long time by many researchers. This paper investigates various channels through which liquidity can affect stock returns in the Korean stock market.

First, we investigate whether the liquidity level (average liquidity) has a great role in determining asset returns. Major researches are implemented by sorting stocks into 10 portfolios based on average liquidity. The result supports the hypothesis that the liquidity level affects stock returns significantly. The risk premium of the liquidity level decreases from the smallest to the largest quintile. Second, we focus on the argument that liquidity is time-varying and has a non-diversifiable systematic component. If liquidity commonality has different impacts across individual securities, a stock that is more sensitive to systematic liquidity will have a higher expected return. The result of the Jensen's alpha supports the argument marginally, but the GRS F-test does not. Due to these controversial results we cannot completely assure the existence of covariance risk related to liquidity in Korea.

The Korean study also sheds some light on the behavioral explanations for liquidity. The intra-market test for the behavioral explanations shows that a substantial portion of the liquidity premium, especially in the liquidity level, is attributable to investor sentiment and irrational behavior. The evidence in this paper supports the behavioral explanations for the liquidity premium.

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