Illiquidity and Stock Returns: Evidence from Japan

By

Jing Fang
Department of Financial Engineering
Haitong Securities Co., Ltd.
Shanghai, 200021, China
Email: fangjing@htsec.com

Qian Sun*
Department of Finance
Fudan University
Shanghai, 200021, China
Email: sunqian@fudan.edu.cn

Changyun Wang
School of Finance
Renmin University of China
Beijing 100872
Email: wangcy@sfruc.edu.cn

August 2010

Keywords: Illiquidity; Amihud Ratio; Liquidity-adjusted CAPM; Japan

JEL classification: G12

* Corresponding author: Institute for Finance & Accounting Studies, Xiamen University, Xiamen, 361005, China; Tel: (86-592) 2185995, Fax: (86-592) 2181787; Email: qsun@xmu.edu.cn

Illiquidity and Stock Returns: Evidence from Japan

Abstract

This paper extends the illiquidity and stock return studies conducted by Amihud (2002) to the Japanese stock market. The study of the Japanese stock market alongside that of the U.S. is of importance to the evaluation and comparison of empirical models of the cross-sectional stock returns (Chan, Hamao and Lakonishok, 1991). The confirmation of the same determinants in these two countries would strengthen confidence in the evidence found in the U.S. market, while the distinctiveness of the determinants would induce further exploration of asset pricing theories. Our comprehensive study across firms and over time indicates that illiquidity, as measured by the Amihud ratio, has a positive impact on stock returns in Japan in general but not in the second sub-sample period of 1990-1999. While unexpected illiquidity has a hypothesized negative impact on contemporaneous stock returns, the expected illiquidity does not have any impact on expected stock returns. Our results are robust after taking into consideration of some unique Japanese characteristics and across different market states.

Keywords: Illiquidity; Amihud Ratio; Stock Return; Japan

JEL classification: G12

Illiquidity and Stock Returns: Evidence from Japan

I. Introduction

Liquidity or illiquidity is of concern because it has important practical as well as academic implications. Using the illiquidity measure proposed by Amihud (2002), we examine the relationship between illiquidity and stock returns in the Japanese market.

According to Amihud and Mendelson (1980) and Amihud (2002), illiquidity reflects the impact of order flow on price. Since illiquidity is not observed directly but rather has a number of aspects that cannot be captured in a single measure, various proxies for illiquidity have been used in previous studies. Some easily obtained proxies are turnover, trading volume or value, firm size, etc; however, as pointed out by Lesmond (2002), these proxies may capture the effect of variables not related to liquidity. On the other hand, some finer and more accurate measures based on market microstructure data, such as bid-ask spread, amortized effective bid-ask spread, price response to signed order flow and probability of information-based trading (PIN), are not generally available, especially over a long period of time.

Although there is no perfect measure of liquidity, a simple and intuitive measure aiming to balance the limits of data availability and accuracy has been developed in the work of Amihud (2002). This measure only requires the input of daily data to construct and is applicable to all securities and time periods.[1]

The measure proposed by Amihud (2002) is the daily ratio of absolute stock return to its dollar trading volume averaged over a given period (Amihud ratio hereafter). Intuitively, this can be interpreted as the daily stock price response associated with one dollar of trading volume. This is consistent with Kyle's (1985) concept of illiquidity, i.e. the response of price to order flow, and Silber's (1975) thinness measure, i.e. the ratio of absolute price change to absolute excess demand for trading. After comparing a few alternative liquidity measures, Hasbrouck (2005) concludes that the Gibbs estimate of effective cost and Amihud ratio appears better than others.

With his new measure, Amihud (2002) examines the relationship between illiquidity and stock returns and finds that illiquidity not only affects stock returns cross-sectionally but also

[1] Pastor and Stambaugh (2003) use daily data to construct a liquidity measure based on signed order flow. Lesmond (2002) developed a liquidity estimate based on the percentage of zero return trading days over a certain period, such as a year.

over time. Many studies have documented that illiquidity can explain differences in the expected returns across stocks，for example, Amihud and Mendelson (1986), Hasbrouck (1991), Brennan and Subrahmanyam (1996), Chalmers and Kadlec (1998), Easley et al. (2002), Pastor and Stambaugh (2003), among others. Using mainly market microstructure data from the US and various estimation techniques, these authors report a positive relationship between illiquidity and stock returns across companies.

Few studies, however, have examined the illiquidity and stock return relationship over time.[2] As pointed out by Amihud (2002), this is probably due to the fact that illiquidity measures based on microstructure data for long time periods are not available in most markets around the world. In contrast, the Amihud ratio only uses daily data, which is available for most markets over long time periods. With this measure, Amihud (2002) postulates and tests the hypothesis that over time, the ex ante stock excess return increases in expected illiquidity while unexpected illiquidity lowers the contemporary stock return. His empirical results are consistent with this hypotheses.

However, the Amihud ratio has not been employed to test the relationship between illiquidity and stock returns outside the U.S. Yet, if the Amihud ratio is an effective measure of illiquidity, if illiquidity does have a general impact on stock returns across firms and over time, then the results obtained in Amihud (2002) should be replicable using data outside the U.S.

We extend the study of illiquidity and stock returns using the Amihud ratio to the Japanese market, the second largest stock market in the world and next only to the U.S. market in terms of both capitalization and number of securities. As pointed out in Chan, Hamao and Lakonishok (1991), the study of the Japanese stock market alongside that of the U.S. is of importance to the evaluation and comparison of empirical models of the cross-sectional stock returns. The confirmation of the same determinants in these two countries would strengthen confidence in the evidence found in the U.S. market, while the distinctiveness of the determinants would induce further exploration of asset pricing theories. In addition, evidence from the Japanese market may shed further light on the subsumption of explanatory variables and robustness with regard to time period and sample selection.

[2] Using Lesmond measure of liquidity (another daily data based measure) and a pooled data set, Bekaert, Harvey, and Lundblad (2003) study the relationship between liquidity and expected returns across over time across 19 emerging markets.

Chan, Hamao and Lakonishok (1991) relate cross-sectional differences in returns on Japanese stocks to the underlying behavior of earnings yield, size, book-to-market ratio, and cash flow yield. They uncover a significant relationship between these variables and expected returns in the Japanese market, which is largely consistent with findings in the U.S. Using market microstructure data from Japan, Lehmann and Modest (1994) offer a bird's eye view into trading and liquidity on the Tokyo Stock Exchange (TSE) and compared it with that on the NYSE. Hu (1997) finds a negative relationship between turnover and expected returns of the TSE stocks. Bremer and Hiraki (1999) find evidence linking short-term returns of individual TSE stocks and lagged trading volume, which is consistent with the results found in the U.S. stock market. Hodoshima et al. (2000) examine cross-sectional return and beta in Japan. Hamori (2001) studies seasonality and stock returns in Japan.

We examine (1) if the Amihud ratio is correlated with other readily available, traditional liquidity or illiquidity proxies in Japan; (2) if the Amihud ratio is positively related to stock returns across companies listed on the TSE; and (3) if expected (or unexpected) illiquidity is positively (or negatively) related to expected (contemporaneous) stock returns over time in Japan.

Our study takes into consideration factors unique to the Japanese market in constructing our test design and examining alternative model specifications. In addition, we examine if the return-illiquidity relationship is sensitive to market states or the "up" and "down" markets.

Our major findings are: first, while the cross-sectional relationship between illiquidity and stock returns in the Japanese stock market is consistent in general with that found by Amihud in the U.S., it is not consistent in the second sub-sample period between 1990 and 1999; second, while that unexpected illiquidity does have a negative impact on contemporaneous stock returns, expected illiquidity does not have a positive impact of on expected stock returns.

The next section constructs the Amihud ratio and relates it to some other traditional ones. Section III examines the cross-sectional relationship between the Amihud ratio and stock returns. Section IV looks at the time series effect of illiquidity on stock returns. Section V concludes.

II. Amihud Ratio

All data used in this study has been obtained or computed from the PACAP Japan Database. The daily stock illiquidity ILL_d^i (the Amihud ratio based on Amihud (2002)) is computed as the ratio of absolute daily return to daily trading value.

$$ILL_d^i = | R_d^i | / VAL_d^i, \quad (1)$$

where R_d^i is the return for stock i on day d. VAL_d^i is the trading value for stock i on day d in millions of yen, and ILL_d^i represents the absolute percentage price change per million yen of trading value.

Our sample period extends from 1975 to 2000. Following Lehmann and Modest (1994) and Bremer and Hiraki (1999), only the first section stocks in the TSE are included in our study because the stocks in different sections satisfy different listing criteria and are likely to have very different trading and liquidity characteristics. For example, the first section stocks are much larger and much more actively traded than those in the second section. Since most Japanese firms use March as their fiscal year-end and financial reports may not be available until June, we use daily stock returns and trading values from July 1st in the current year till June 30th in the following year to compute the annual illiquidity. For example, the annual stock illiquidity in 1975 is averaged from July 1st, 1975 to June 30th, 1976, so on and so forth. The annual illiquidity is

$$ILL_y^i = 1 / D_{iy} \sum_{d=1}^{D_{iy}} | R_{yd}^i | / VAL_{yd}^i, \quad (2)$$

where D_{iy} is the number of trading days in year y. Similarly, the monthly illiquidity is

$$ILL_m^i = 1 / D_{im} \sum_{d=1}^{D_{im}} | R_{md}^i | / VAL_{md}^i. \quad (3)$$

Following Amihud, a stock admitted to our sample must meet the following criteria: 1) it must have valid observations of daily return and trading value for more than 200 days in year *y* so that the illiquidity estimate is more reliable;[3] 2) the year-end stock price must be greater than ¥100 so that stock returns are not affected too much by the minimum tick size of ¥1[4]. Amihud (2002) confines his sample to stocks with a year-end price greater than $5 to reduce the possible estimation noise caused by minimum tick size. Further eliminating outliers with annual illiquidity at the highest and lowest 1 percent of the distribution results in our final sample,

[3] We have tried to include all firms with valid observations for more than 150 days in year *y*, the results are qualitatively the same.

[4] In addition to tick size, the TSE also has price limit rules. There are both the limit for maximum daily price change and the limit for maximum price change between trades. However, the limit between trades is not relevant because our illiquidity measure uses daily data. The daily price limit is quite large, ranging from 10% to 30%. They are rarely hit in reality. Therefore, we do not particularly consider them in our sample selection process. The information of tick size schedule and price limit rules for TSE stocks as of 2004 is available from the authors.

ranging from 565 firms in 1975 to 1099 firms in 1999, as presented in Table 1. Since independent variables are lagged one-year behind the dependent variable in our model specification, the sample period employed in our regression analysis is from 1976 to 1999.

[Insert Table 1 here]

We further relate the Amihud ratio to three traditional liquidity proxies via cross-section regressions employed year by year from 1976 to 1999. The three proxies are market capitalization, trading value, and turnover. The results are evident that the annual Amihud ratio is strongly and negatively related to all three traditional liquidity measures[5]. This is consistent with common sense: the larger the firm size, the larger the trading value or the higher the trade turnover, and the less illiquid the stock is.

The annual market illiquidity is the average illiquidity across stocks in market portfolio *M* in year *y*

$$ILL_y^M = \sum_M ILL_y^i \ . \tag{4}$$

[Insert Figure 1 here]

Panel A of Figure 1 presents the annual market illiquidity over the period 1975-1999. It appears that market illiquidity is declining from 1975 to 1990 and inclining after that. Correspondingly, as shown in Panel B of Figure 1, the Nikkei 225 Index has an upward trend from 1975 to 1989, followed by a downward trend from 1990 to 1992 and then oscillates thereafter. According to *Securities Market in Japan (2001)*, a publication of the Japan Securities Research Institute, the development of the Japanese securities market from 1975 to 1999 can be divided into several stages: (1) 1975-1984 is the period of coping with the oil crisis; (2) 1985-1989 is the period of the economic bubble; (3) 1990-1999 is the period of financial reform involving debate on, and enforcement of, the Financial System Reform Law. Roughly, the first two periods coincide with the rapid development of the stock market and a declining trend in illiquidity, while the last one is associated with market slowdown and an increasing trend towards illiquidity. Therefore, when we divide the whole sample period into two subsample periods in the subsequent tests, the first one is from 1976 to 1989 and the second one is from 1990 to 1999.

[5] The results are not reported to save space but are available upon request from the authors.

III. Cross-Sectional Relationship between Illiquidity and Stock Returns

For comparison purposes, we first follow Amihud (2002) to estimate the following Fama-MacBeth type cross-sectional regression model for each month during our sample period, where monthly stock return, R^i_m is a function of illiquidity and a set of control variables, $\sum X^i_{j,y-1}$

$$R^i_m = k_{0y} + k_{1y} ILLM^i_{y-1} + \sum_{j=2}^{n} k_{jy} X^i_{j,y-1} + \varepsilon^i . \quad (5)$$

With one year lag of all the right-hand variables, our monthly return sample runs from July 1976 to June 2000, a total of 288 months, while the yearly independent variables run from 1975 to 1998 (a year begins every July and ends next June). Since the annual stock illiquidity varies dramatically over time, following Amihud (2002), the illiquidity variable is further scaled by market illiquidity for stock *i* in year *y* to obtain the mean-adjusted illiquidity[6]

$$ILLM^i_y = ILL^i_y / ILL^M_y . \quad (6)$$

Other stock characteristics or control variables included in the regression are: (1) firm size, $\mathrm{Ln}\, CAP^i_{y-1}$, which is the logarithm market capitalization for stock *i* at the end of year *y-1*; (2) beta, β^{1i}_{y-1}, which is the beta estimated in year y-1; (3) total risk, STD^i_{y-1}, which is the standard deviation of the daily return on stock *i* in year y-1 (multiplied by 10^2); (4) dividend yield, DP^i_{y-1}, which is the sum of the dividends during year y-1 divided by the end of y-1 price; (5) past stock returns, which include PR^{1i}_{y-1}, the return on stock *i* during the last 100 days before the year end of y-1 (June 30 every year) and PR^{2i}_{y-1}, which is the return on stock *i* over the rest of the period, between the beginning of the year y-1 (July 1) and 100 days before its end.

$\mathrm{Ln}\, CAP^i_{y-1}$ is used as a control for the well-known size effect. However, as mentioned earlier, size may also be a proxy for liquidity. In Amihud (2002), this correlation is -0.614. In our case, it is -0.581, as shown in Table 2. STD^i_{y-1} is included since investors' portfolios may not be well diversified. DP^i_{y-1} has been documented as an important determinant of stock returns in the U.S. Previous stock returns are included to control for possible momentum effects (see Brennan et al., 1998) and β^{1i}_{y-1} is used as a control for the market or systematic risk.

---

[6] We have tried illiquidity measures without such adjustment, the results are largely the same. For the sake of consistency with Amihud (2002), we report the results with the adjustment.

The beta is estimated using the Fama-French (1992) methodology. In June of each year, stocks are ranked by their market capitalization and sorted into 25 portfolios. The market model is estimated using daily data for the year of each portfolio with the Scholes and Williams (1977) adjustment used to obtain the portfolio beta. This portfolio beta is then assigned to each individual stock in the portfolio as its beta risk for that year.

We further put forward two additional control variables: cash flow yield (CP^{i}_{y-1}), which is the ratio of earnings plus depreciation per share in year *y-1* versus the year end share price for stock *i*, and book-to-market ratio (BM^{i}_{y-1}), which is the ratio of the book value to market value of equity for stock *i* at the end of year *y-1*. Amihud (2002) does not include BM^{i}_{y-1} in his study because Easley et al. (2002) and Loughran (1997) find it has no effect on NYSE stocks. However, Chan et al. (1991) report that cash flow yield and book to market ratio are the two variables with most significant (positive) impact on expected returns in Japan. Also, the cash flow yield may be a better alternative than dividend yields in Japan because the latter are minuscule for Japanese firms.[7]

[Insert Table 2 here]

Table 2 presents the summary statistics for all the variables put forward above and the correlation matrix between these variables. In each year, the annual mean, standard deviation across stocks, skewness, median, minimum and maximum are calculated for sample stocks and then these annual statistics are averaged over 24 years. Similarly, the correlations between the variables are calculated each year across stocks and then the yearly correlation coefficients are averaged over the years. Notice that the correlations are generally low except for the one between illiquidity and size, which is -0.581.

To facilitate the comparison, cross-sectional regression results presented in Table 3 are formulated after Table 2 in Amihud (2002). The first four columns in the table report the results for the four-variable model:

$$R^{i}_{m} = k_{0y} + k_{1y} ILLM^{i}_{y-1} + k_{2y} \beta^{1i}_{y-1} + k_{3y} PR^{1i}_{y-1} + k_{4y} PR^{2i}_{y-1} \qquad (7)$$

while the last four columns report for the seven-variable model:

[7] Earnings yield may be distorted because only accelerated depreciation are allowed in financial reporting for tax purposes. The cash flow yield can avoid the earnings distortion from firms with large capital investments. Correspondingly, Chan et al. (1991) find that the earnings yield is not a significant determinant of stock returns in Japan.

$$R_m^i = k_{0y} + k_{1y} ILLM_{y-1}^i + k_{2y}\beta_{y-1}^{1i} + k_{3y} PR_{y-1}^{1i} + k_{4y} PR_{y-1}^{2i} + k_{5y} \ln CAP_{y-1}^i + k_{6y} STD_{y-1}^i + k_{7y} DP_{y-1}^i \qquad (8)$$

The mean of the 288 estimated coefficients is calculated for each independent variable, followed by a t-test conducted on the hypothesis that states that the mean should be equal to zero (columns 1 and 5). To control for the famous January effect[8] and to verify whether the cross-sectional relationship is stable over time, tests are also performed for the sample, excluding January (264 months; columns 2 and 6), and for the sub-samples 1976-1989 (168 months, columns 3 and 7) and 1990-1999 (120 months, columns 4 and 8).

[Insert Table 3 here]

For equation (7) regressions, the mean estimated coefficient of illiquidity for all months is 0.0014 and significant at the 5 percent level. When January is excluded, the coefficient is 0.0016 and significant at the 1 percent level. These are consistent with Amihud's results and suggest the existence of a positive cross-sectional relationship between illiquidity and stock returns in general. However, the relationship appears unstable over the two sub-periods. The mean illiquidity coefficient in the first sub-sample period is 0.0024, much larger compared to the all-month sample and highly significant at the 1 percent level, while it is only 0.0003 for the second sub-period and not significant at all. In contrast, the results reported in Amihud (2002) show that the illiquidity is significant in both sub-sample periods.[9] Our estimated mean beta coefficient is negative, though not statistically significant, in all the four-variable regressions. In contrast, Amihud shows that the similar beta estimates for NYSE stocks are all positive and significant. However, the insignificant beta estimates are consistent with previous studies for the Japanese market. Hodoshima, Garza–Gomez and Kunimura (2000) find that a regression of return on beta without differentiating positive and negative market excess returns produces a flat relationship between return and beta in Japan for the period of 1956-1995. While the mean estimated coefficients for past returns, PR_{y-1}^{1i} and PR_{y-1}^{2i}, are all positive and mostly significant for NYSE stocks, as reported in Amihud (2002), our estimates for PR_{y-1}^{1i} are all negative but only marginally significant for the first sub-sample period and the sample period excluding January. Our estimates for PR_{y-1}^{2i} are all insignificant.

---

[8] Hamori (2001) documents the January effect in Japan for the entire period between 1971 and 1997 although it tends to disappear in the later part of the sample period.

[9] We have also tried sub-sample periods 1976-1990 vs. 1991-1999 and 1976-1988 vs. 1989-1999. The results are similar.

For equation (8) regressions, the results are consistent with equation (7) regressions in the sense that illiquidity is positive and significantly priced in all but the second sub-sample period. However, for all equation (8) regressions, the mean coefficient estimates for various control variables are insignificant except for STD^{i}_{y-1} with the sample excluding January, which is negative and significant at the 5 percent level. This is a bit surprising given the findings of Amihud (2002) that all estimates but beta are significant in his seven-variable regressions. This suggests that the determinants of stock returns in the U.S. may not be the same as those in Japan.

It is conceivable that PR^{1i}_{y-1} and PR^{2i}_{y-1} may have prediction power for stock returns in the U.S. but not necessarily in Japan. On the other hand, Bremer and Hiraki (1999) document that TSE stocks with short-term price reversals (stocks with losses in week t-1 experience price reversals in week t). As mentioned earlier, DP^{i}_{y} may not be a good cross-sectional determinant for stock returns because many Japanese firms simply do not pay or pay very little dividends. In addition, CP^{i}_{y} and BM^{i}_{y} are documented by Chan et al. (1991) as major determinants for Japanese stock returns. Therefore, we replace PR^{1i}_{y-1} and PR^{2i}_{y-1} with PR^{i}_{m-1}, the one-month lagged return for stock *i*, DP^{i}_{y-1} with CP^{i}_{y-1} and further add in BM^{i}_{y-1} in our regressions. Moreover, since we have monthly data for illiquidity ILL^{i}_{m-1}, we use it to replace the annual illiquidity so that the right-hand side variables are not just annual variables.

[Insert Table 4 here]

Table 4 presents the regression results for the following specifications:

$$R^{i}_{m} = k_{0y} + k_{1y} ILLM^{i}_{m-1} + k_{2y}\beta^{1i}_{y-1} + k_{3y} PR^{i}_{m-1} \tag{9}$$

and

$$R^{i}_{m} = k_{0y} + k_{1y} ILLM^{i}_{m-1} + k_{2y}\beta^{1i}_{y-1} + k_{3y} R^{i}_{m-1} + k_{4y} BM^{i}_{y-1} + k_{5y} \ln CAP^{i}_{y-1} + k_{6y} STD^{i}_{y-1} + k_{7y} CP^{i}_{y-1} \tag{10}$$

For equation (9) regressions, the results are similar to the equation (7) regression results reported in Table 3. $ILLM^{i}_{m-1}$ shows a positive and significant impact on expected stock returns for the all-month sample, the sample excluding January, and the first sub-sample period, but nothing significant for the second sub-sample period. While β^{1i}_{y-1}, is still not significant, PR^{i}_{m-1} is negative and highly significant in all four samples, suggesting monthly price reversals for Japanese stocks.

For equation (10) regressions, we find that BM^{i}_{y-1} is indeed positive and significant in all but the second sub-sample period regressions. This seems consistent with Chan et al. (1991). However, CP^{i}_{y-1} is only significant in the second sub-sample period. $ILLM^{i}_{m-1}$ is still positive but its significance level is reduced. For the all-month sample, the t-value becomes marginally insignificant. For the sample excluding January, the t-values are only significant at the 10 percent level. For the first sub-sample, it is significant at the 5 percent level, while the illiquidity coefficient is mostly significant at the 1 percent level for those samples in equation (7), (8) and (9) regressions (as shown in Tables 3 and 4). For the second sub-sample period, $ILLM^{i}_{m-1}$ is still insignificant but β^{1i}_{y-1} and $\mathrm{Ln}\,CAP^{i}_{y-1}$ become significant.

On the whole, our results suggest that illiquidity is priced in the Japanese market but not so in the second sub-sample period. This pattern is robust across different specifications. From Figure 1, we see that the first sub-sample period corresponds to a booming market trend with declining illiquidity, while the second sub-sample period coincides with a down and oscillating market and a trend of increasing illiquidity. A further examination of the monthly market excess return shows that, for 168 months in the first sub-sample period, 111 months are associated with the positive market excess return and 57 with negative ones. For 120 months in the second sub-sample period, only 54 months are associated with the positive market excess return and 66 with negative ones. Therefore, the ratio of negative excess market return months over positive ones is much higher in the second sub-sample period (66/54) than in the first (57/111).

Using stock return data in Japan from 1956 to 1995, Hodoshima, et al. (2000) find that regression of return on beta without differentiating positive and negative market excess returns produces a flat relationship between beta and return. However, significant conditional positive or negative relationships between beta and return are found once the observations are separated into up and down market groups, where the up (or down) market refers to observations associated with positive (or negative) market premium, $R_m - R_f > 0$ ($R_m - R_f < 0$).[10] They explain that the expected market excess return should never be negative, but actual observations used in the

[10] Chan and Lakonishok (1993), Grundy and Malkiel (1996), and Pettengill et al. (1995) investigate the relationship between return and beta by taking into account whether the market excess return is positive or negative in the US market and find that the beta and stock returns are significantly related.

regression are often negative. Similarly, one may argue that the expected illiquidity premium should never be negative but the realized premium may well be so. If the realized illiquidity premium is positively correlated with excess market return, then the estimated relationship between the Amihud ratio and stock returns may be distorted. Therefore, we further separate our sample into up and down markets and repeat the cross-sectional regressions to see if illiquidity is priced differently in those market states. To save space, we only repeat the regressions for equations (9) and (10) and present the results in Table 5.[11]

[Insert Table 5 here]

Panels A and B of Table 5 present the results for equations (9) and (10) in up and down markets, respectively. Here, the beta is mostly significant. Specifically, the beta is positive for the up market but negative for the down market. This is very much consistent with the findings of Hodoshima et al. (2000). In addition, $ILLM^{i}_{m-1}$ is insignificant for all samples in the down market. This suggests that the Amihud ratio cannot be properly priced in the down market. Moreover, even during the up market, illiquidity is still not priced in the second sub-sample period. Therefore, the insignificant mean estimate for the illiquidity coefficient in the second sub-sample period is not totally or even mainly due to the concentration of more negative excess market returns in the period. The second sub-sample period may be a special period because it coincides with a lot of changes in the Japanese financial system. Hamao, Mei and Xu (2003) document that idiosyncratic volatility in Japanese stocks has fallen, coinciding with a slowdown in the capital allocation process within the Japanese economy. They opined that Japanese corporate managers may have chosen to bail out large companies rather than allocate capital to young companies and that this caused the stock prices of Japanese stocks in the 1990s to be more correlated compared to those of the 1980s. It is possible that corporate behavior as well as investor risk tolerance may have experienced some big changes in the 1990s, rendering illiquidity risk not being captured by the Japanese data during this period. On the other hand, Hasbrouck (2005) also finds that the relations between stock returns and Amihud measure are not robust and he conjuncts that the relations are sensitive to the extreme values, etc.

However, in contrast to equation (9) results, the estimated mean coefficient of $ILLM^{i}_{m-1}$ for equation (10) is mostly insignificant in the up and down market. On the other hand, beta,

[11] The up and down market results for equations (7) and (8) are qualitatively the same.

STD^i_{y-1}, $\mathrm{Ln}\,CAP^i_{y-1}$, CP^i_{y-1} and BM^i_{y-1} are largely significant. Recall that in table 4, we find that once additional variables such as BM^i_{y-1}, $\mathrm{Ln}\,CAP^i_{y-1}$, etc. are controlled, the significance of the illiquidity coefficient is reduced. Now the illiquidity effect is almost all subsumed once the up-market and down-market are further controlled. It is possible that the correlation between the Amihud ratio and other control variables, especially size, may become stronger once the sample is divided into up and down markets.

IV. Time Series Effect of Illiquidity

Amihud (2002) argues that stocks are not only riskier but also less liquid than short-term treasury securities. Hence, stock return in excess of the T-bill rate (risk premium) includes a premium for illiquidity. It follows that if investors anticipate higher market illiquidity, they will expect higher returns. More specifically, expected stock returns should be positively related to expected illiquidity while unexpected illiquidity should be negatively related to contemporaneous unexpected stock return.

Following Amihud (2002), the market illiquidity used in the time-series test is the logarithmic form of the average illiquidity across stocks. Since the yearly time series is short, with only 24 data points from 1976-1999, we focus on the monthly data (288 observations). The expected and unexpected market illiquidity are estimated through the *AR(1)* model

$$\ln ILL^M_m = c_0 + c_1 \ln ILL^M_{m-1} + v_m, \tag{11}$$

where $\ln ILL^M_m$ is the monthly market illiquidity as defined in Section II and v_m is the residual representing the unexpected market illiquidity $\ln ILLU^M_m$. Investors determine the expected illiquidity $\ln ILLE^M_m$ at the beginning of a month based on information from the previous month,

$$\ln ILLE^M_m = c_0 + c_1 \ln ILL^M_{m-1}, \tag{12}$$

The market price is then set at the beginning of the month through the following model to generate the expected return,

$$R^M_m - R^f_m = f_0 + f_1 \ln ILLE^M_m + u_m = g_0 + g_1 \ln ILL^M_{m-1} + u_m. \tag{13}$$

In this equation, $g_0 = f_0 + f_1 c_0$ and $g_1 = f_1 c_1$, R^M_m is the return of market portfolio *M* (all stocks in our sample) in month m and R^f_m is the monthly call money rate or one-month Gensaki rate for month m, as in Chan *et al.* (1991). This is retrieved from the monthly key economic file of the

PACAP Database. u_m can be decomposed into the unexpected illiquidity $\ln ILLU_m^M$ and an error term w_m. After controlling for the January effect, the time-series regression of the excess market return on the market illiquidity is as follows[12]

$$R_m^M - R_m^f = g_0 + g_1 \ln ILL_{m-1}^M + g_2 \ln ILLU_m^M + g_3 JAN_m + w_m . \quad (14)$$

The two testable hypotheses are:

H1: expected market illiquidity is positively related to expected market excess return (g_1>0).

H2: unexpected market illiquidity is negatively related to contemporaneous market excess return (g_2<0).

Amihud (2002) further puts forward and tests the "flight to liquidity" hypothesis. Amihud, Mendelson and Wood (1990)[13] point out that there are two effects on expected stock returns when expected market illiquidity rises. On the one hand, the stock price declines and expected returns rise for all stocks, while on the other, capital flies from less liquid to more liquid stocks. These two effects reinforce each other for illiquid stocks but offset each other for liquid ones. Increasing market illiquidity not only negatively affects prices for illiquid stocks but also induces investors to switch to more liquid stocks, which further depresses the price for illiquid stocks. However, increasing market illiquidity leads to an increase in demand for liquid stocks, which mitigates their price decline. Therefore, the illiquidity effect should be stronger for small stocks and weaker for large stocks because firm size is negatively correlated with illiquidity. Replacing market portfolio return series with size portfolio return series[14], we can rewrite the equation (14) as follows

$$R_m^p - R_m^f = g_0^p + g_1^p \ln ILL_{m-1}^M + g_2^p \ln ILLU_m^M + g_3^p JAN_m + w_m^p , \quad (15)$$

where *p* denotes one of the 25 size-based portfolios (portfolio 25 contains the largest stocks) and R_m^p is the average return across stocks in portfolio *p* for month *m*. The testable hypotheses are:

H3: The expected illiquidity effect $g_1{}^p$ should be positive and decrease as firm size does ($g_1{}^5 > g_1{}^{10} > g_1{}^{15} > g_1{}^{20} > g_1{}^{25} > 0$).

[12] A similar specification has been used by French, Schwert and Stambaugh (1987) in testing the effect of risk on excess stock return.

[13] Amihud *et al.* (1990) study the relationship between market liquidity and market return for the 1987 crash by estimating the effects of changes in the bid-ask spread, the initial spread, and the change in quote size or the change in stock prices for three periods around the crash. They reason that "the price decline reflects, in part, a reassessment of market liquidity," while price recovery results from liquidity improvement to some degree.

[14] 25 size portfolios are the same as those formed in Section III,

H4: The unexpected illiquidity effect $g_2{}^p$ should be negative and increase as firm size does

$$(g_2{}^5 < g_2{}^{10} < g_2{}^{15} < g_2{}^{20} < g_2{}^{25} < 0).$$

Amihud (2002) includes two additional variables, default yield premium and term yield premium, in his time series test. Since we do not have default yield data for Japan, only term yield premium TM_m is used in the expanded specifications

$$R_m^M - R_m^f = g_0 + g_1 \ln ILL_{m-1}^M + g_2 \ln ILLU_m^M + g_3 JAN_m + aTM_{m-1} + u_m \tag{16}$$

and

$$R_m^p - R_m^f = g_0^p + g_1^p \ln ILL_{m-1}^M + g_2^p \ln ILLU_m^M + g_3^p JAN_m + a^p TM_{m-1} + u_m^p . \tag{17}$$

The term yield premium $TM_m = YL_m - R_m^{G3}$ is computed as the difference between the yield to maturity of 10-year government bonds (YL_m) and the three-month Gensaki rate in month m (R_m^{G3}). The additional hypothesis about the premium is that $a > 0$.

Kendall (1954) points out that the estimated coefficient $\hat{c}_1$ from the finite samples is biased downward in *AR(I)* models such as equation (11). He proposes a simple but accurate bias correction approximation procedure: the estimated coefficient $\hat{c}_1$ is augmented by the term $(1+3\hat{c}_1)/T$, where *T* is the sample size.

Our estimation of equation (11) provides the following results for the time-series test with monthly illiquidity, $\ln ILL_m^M = -0.213 + 0.918 \ln ILL_{m-1}^M + v_m$. Applying Kendall's bias correction method, the adjusted slope coefficient is 0.931 (and the intercept is adjusted accordingly)[15]. The monthly unexpected illiquidity is calculated as a residual from the above autoregressive model using the adjusted coefficients.

[Insert Table 6 here]

Table 6 presents the estimation results for the whole sample period from July 1976 to June 2000 (288 months). Several observations are evident. First, including the term yield premium TM_m in the estimation has no impact on the results. The coefficient estimate is not significantly different from zero and the inclusion of TM_m has almost no effect on the estimated coefficients of other variables. Second, expected illiquidity $\ln ILL_{m-1}^p$ has no impact on expected

[15] The corresponding estimate in Amihud (2002) is $\ln ILL_m^M = 0.313 + 0.945 \ln ILL_{m-1}^M + v_m$ and the adjusted slope coefficient is 0.954.

return at all and there is no monotonic pattern for the estimated coefficients across size portfolios either. No matter for the market or individual portfolios, the estimated coefficient is insignificant. This is inconsistent with our H1 that expected illiquidity should be positively and significantly related to the expected stock return and H3 that expected illiquidity effect is decreasing along with firm size. Third, unexpected illiquidity $\ln ILLU_m^p$ is negatively associated with expected stock return premiums and the estimated coefficient is significant and monotonically increasing along with firm size. This finding is consistent with H2 that contemporaneous stock return is negatively associated with unexpected illiquidity and H4 that the unexpected illiquidity effect is negative and increases as firm size does. Finally, we find that the January effect is more significant for smaller stock portfolios but insignificant for the portfolio with the largest firms. While the last two observations are consistent with the findings in Amihud (2002), the first two are not.

We repeat the regressions for equations (16) and (17) over the two sub-sample periods. Since equation (17) results are similar to that of equation (16) and the estimated coefficient for TM_m is never significant, table 7 only presents the regression results for equation (16).

[Insert Table 7 here]

Unlike the cross-sectional regression results presented in tables 3 to 5, our time series regression results are consistent across the two sub-sample periods. They are largely the same as those presented in table 6. We also performed the same tests using portfolios formed on book-to-market value and using yearly data. The results are again very much alike.[16] So the expected illiquidity proxied by the lagged Amihud ratio cannot help to predict future stock returns in Japan but the unexpected illiquidity derived from first order autoregression of the Amihud ratio does have significant impact on contemporaneous returns. This finding is interesting and deserves further studies.

V. Summary and Conclusion

Using the illiquidity measure proposed by Amihud (2002), we conduct a comprehensive study on the relationship between illiquidity and stock returns among stocks listed on the Tokyo Stock Exchange. We first examine the cross-sectional relationship between illiquidity and stock returns and find that illiquidity has a positive impact on stock returns in Japan in general but not

[16] We do not report the results to save space.

in the second sub-sample period of 1990-1999. Even after using controls to account for up and down markets, and other Japan specific factors, we still fail to find a significant relationship between illiquidity and stock returns in the second sub-sample period. This may be due to the dramatic changes occurred in the Japanese financial sector during the 1990s. This also echoes the finding of Hasbrouck (2005) that the relations between Amihud measure and stock returns are not robust.

Next, we look at the time series relationship between illiquidity and stock returns. Again, the results are only partially consistent with those found by Amihud. While unexpected illiquidity does have a negative impact on contemporaneous stock returns, the expected illiquidity does not have any impact on expected stock returns. In addition, evidence for the "fly to liquidity" hypothesis associated with expected illiquidity is not supportive. Separating the whole sample into two sub-periods produces similar results.

Overall, our results indicate that the liquidity-stock return relationship found in the U.S. cannot be totally replicated in Japan. Specifically, the period 1990-1999 in Japan may be a unique period, with a lot of transitions rendering the cross-sectional relationship between illiquidity and stock returns undetectable. Also, the expected illiquidity measured by a lagged Amihud ratio does not have any impact on the expected stock premium.

Our study contributes to the extant literature in two directions. First, we provide a comprehensive study on the relationship between Amihud illiquidity measure and stock returns over a long period of time for the second largest stock market in the world. Second, we show that the Amihud ratio as a measure to capture the illiquidity effect may be sensitive to time periods and the presence of up and down markets, which deserves further explorations.

References

Amihud, Y. (2002). Illiquidity and Stock Returns: Cross-Section and Time-Series Effects. *Journal of Financial Markets 5,* 31-56.

Amihud, Y. & Mendelson, H. (1980). Dealership market: market making with inventory. *Journal of Financial Economics 8*, 311–353.

Amihud, Y. & Mendelson, H. (1986). Asset pricing and the bid–ask spread. *Journal of Financial Economics 17*, 223–249.

Amihud, Y., Mendelson, H. & Wood, R. (1990). Liquidity and the 1987 stock market crash. *Journal of Portfolio Management 16*, 65–69.

Bekaert, G., Harvey, C. & Lundblad, C. (2003). *Liquidity and Expected Returns: Lessons from Emerging Markets*. New York: Columbia University.

Bremer, M. & Hiraki, T. (1999). Volume and individual security returns on the Tokyo Stock Exchange. *Pacific-Basin Finance Journal 7*, 351–370.

Brennan, M., Chordia, T. & Subrahmanyam, A. (1998). Alternative factor specifications, security characteristics, and the cross-section of expected stock returns. *Journal of Financial Economics 49*, 345–373.

Brennan, M. & Subrahmanyam, A. (1996). Market microstructure and asset pricing: on the compensation for illiquidity in stock returns. *Journal of Financial Economics 41*, 441–464.

Chalmers, J. & Kadlec, G. (1998). An empirical examination of the amortized spread. *Journal of Financial Economics 48*, 159–188.

Chan, L., Hamao, Y. & Lakonishok, J. (1991). Fundamental and Stock Returns in Japan. *Journal of Finance 46*, 1739-1764.

Chan, L. & Lakonishok, J. (1993). Are the Reports of Beta's Death Premature*? Journal of Portfolio Management 19(4),* 51-62.

Chordia, T., Roll, R. & Subrahmanyam, A. (2000). Commonality in Liquidity. *Journal of Financial Economics 56,* 3-28.

Easley, D., Hvidkjaer, S. & O'Hara, M. (2002). Is information risk a determinant of asset returns? *Journal of Finance 57*, 2185-2221.

Fama, E. & French, K. (1992). The cross section of expected stock returns. *Journal of Finance 47*, 427–465.

Fama, E. & MacBeth, J. (1973). Risk, return and equilibrium: empirical tests. *Journal of Political Economy 81*, 607–636.

Hamao, Yasushi, Jianping Mei & Yexiao Xu (2003). Idiosyncratic risk and the creative destruction in Japan, NBER working paper.

Hamori, S. (2001). Seasonality and stock returns: some evidence from Japan. *Japan and the World Economy 13*, 463-481.

Hasbrouck, J. (1991). Measuring the information content of stock trades. *Journal of Finance 46*, 179–207.

Hasbrouck, J. (2005). *Inferring Trading Costs from Daily Data: US Equities from 1962 to 2001*. New York City: New York University.

Hodoshima, J., Garza-Gomez, X. & Kunimura, M. (2000). Cross-sectional regression analysis of return and beta in Japan. *Journal of Economics and Business 52*, 515-533.

Hu, S. (1997). Trading turnover and expected stock returns: the trading frequency hypothesis and evidence from the Tokyo Stock Exchange. Working Paper, National Taiwan University.

Japan Securities Research Institute(2001). *Securities Market in Japan 2001*

Kendall, M. (1954). Note on bias in the estimation of autocorrelation. *Biometrica 41*, 403–404.

Kyle, A. (1985). Continuous auctions and insider trading. *Econometrica 53*, 1315–1335.

Lehmann, B. & Modest, D. (1994). Trading and liquidity on the Tokyo Stock Exchange: a bird's eye view. *Journal of Finance 49*, 951-984.

Lesmond, D. (2002). Liquidity of emerging markets. Working paper, A.B. Freeman School of Business. New Orleans: Tulane University.

Pastor, L. & Stambaugh, R. (2003). Liquidity risk and expected stock returns. *Journal of Political Economy 111*, 642-685.

Pettengill, G., Sundaram, S. & Mathur, I. (1995). The conditional relation between beta and returns. *Journal of Financial and Quantitative Analysis 30(1),* 101-116.

Scholes, M. & Williams, J. (1977). Estimating betas from non-synchronous data. *Journal of Financial Economics 5*, 309–327.

Silber, W.L. (1975). Thinness in capital markets: the case of the Tel Aviv Stock Exchange. *Journal of Financial and Quantitative Analysis 10*, 129–142.

Table 1 Sample Selection Process

This table reports the sample selection process. The sample period covers 1975-1999. The stocks included in the sample must have valid observations of return and trading value data for more than 200 days and have year-end prices greater than 100 yen, outliers with annual illiquidity at the highest or lowest 1% tails of the distribution are eliminated.

Year	*Trading days*	*Original stocks*	*Stocks with price>¥100*	*Stocks with trading days>200*	*Final sample*
1975	286	985	915	577	565
1976	286	994	932	656	643
1977	285	1002	939	729	714
1978	286	1011	1009	757	742
1979	285	1022	1021	731	716
1980	285	1030	1027	684	670
1981	285	1041	1037	671	658
1982	286	1058	1047	759	744
1983	287	1077	1074	826	809
1984	285	1086	1084	878	860
1985	279	1109	1109	953	934
1986	274	1129	1129	963	944
1987	273	1152	1152	1027	1006
1988	249	1170	1170	1060	1039
1989	246	1184	1184	1057	1036
1990	246	1192	1192	1020	1000
1991	247	1223	1223	1031	1010
1992	246	1231	1230	1055	1034
1993	247	1236	1236	1115	1093
1994	249	1239	1239	1119	1097
1995	247	1252	1250	1170	1147
1996	245	1296	1293	1135	1112
1997	247	1332	1248	1150	1127
1998	245	1350	1278	1147	1124
1999	245	1350	1278	1122	1099

Table 2 Summary Statistics and Correlation of Stock Characteristics

This table presents the summary statistics and correlation matrix for the stock characteristics used in the cross-sectional regression. $ILLM_y^i$ is the mean-adjusted illiquidity for stock *i* across the days in year *y*. $\ln CAP_y^i$ is the logarithm for the market capitalization of stock *i* at the end of year *y*. β_y^{1i} is the market beta for stock *i* in year *y* as estimated using the Fama-French (1992) method with the Scholes and Williams (1977) adjustment. STD_y^i is the standard deviation of return for stock *i* across days in year *y* and multiplied by 10^2. DP_y^i is the ratio of dividend per share to share price for stock *i* in year *y*. CP_y^i is the ratio of earnings per share plus depreciation to share price for stock *i* in year *y*. BM_y^i is the ratio of book value to market value of equity for stock *i* at the end of year *y*. PR_y^{1i} is the past returns for the last 100 days for stock *i* in year *y* calculated as the log ratio of its daily closing price. PR_y^{2i} is the past returns for the rest of the days for stock *i* in year *y* calculated as the log ratio of its daily closing price. The period covers 1975-1998. The stocks included in the sample must have valid observations of return, trading value data for more than 200 days and have year-end prices greater than 100 yen; outliers with annual illiquidity at the highest or lowest 1% tails of the distribution are eliminated.

Panel A: Summary Statistics

Variable	*Mean of annual means*	*Mean of annual standard deviation*	*Mean of annual skewness*	*Median of annual means*	*Minimum of annual means*	*Maximum of annual means*
$ILLM_y^i$	0.093	0.110	1.853	0.081	0.018	0.195
CAP_y^i	206.947	428.704	5.562	213.487	58.419	417.027
β_y^{1i}	1.042	0.185	-0.008	1.048	0.959	1.143
STD_y^i	2.309	0.641	0.642	2.168	1.871	3.354
DP_y^i (%)	1.189	0.706	0.457	1.108	0.548	2.198
CP_y^i (%)	7.381	11.439	4.979	6.973	3.978	11.474
BM_y^i	0.514	0.254	-0.689	0.506	0.265	1.051
PR_y^{1i} (%)	-1.235	20.664	0.160	1.802	-46.750	36.658
PR_y^{2i} (%)	3.612	17.076	0.639	5.198	-27.634	24.335

Panel B: Correlation

Variable	$\ln CAP_y^i$	β_y^{1i}	STD_y^i	DP_y^i	CP_y^i	BM_y^i	PR_y^{1i}	PR_y^{2i}
$ILLM_y^i$	**-0.581**	0.358	0.217	0.007	-0.006	0.135	-0.093	0.073
$\ln CAP_y^i$		-0.453	-0.258	-0.174	-0.014	-0.226	0.054	-0.067
β_y^{1i}			0.231	-0.008	-0.027	0.058	-0.073	-0.058
STD_y^i				-0.291	-0.154	0.078	-0.127	0.153
DP_y^i					0.269	0.374	-0.063	-0.016
CP_y^i						0.079	0.040	0.001
BM_y^i							-0.330	0.037
PR_y^{1i}								-0.020

Table 3 Cross-Sectional Illiquidity Effects on Stock Return

This table presents the means of the estimated coefficients from the monthly cross-sectional regression of stock return on the respective variables:

$R_m^i = k_{0y} + k_{1y} ILLM_{y-1}^i + k_{2y} \beta_{y-1}^{1i} + k_{3y} PR_{y-1}^{1i} + k_{4y} PR_{y-1}^{2i}$, and

$R_m^i = k_{0y} + k_{1y} ILLM_{y-1}^i + k_{2y} \beta_{y-1}^{1i} + k_{3y} PR_{y-1}^{1i} + k_{4y} PR_{y-1}^{2i} + k_{5y} \ln CAP_{y-1}^i + k_{6y} STD_{y-1}^i + k_{7y} DP_{y-1}^i$.

The coefficients are averaged for the whole sample period, one including and one excluding January, and for the two sub-periods, from 1976 to 1989 and from 1990 to 1999. $ILLM_{y-1}^i$ is the ratio of stock illiquidity of stock *i* to market illiquidity in year *y*-1. β_{y-1}^i is the market beta for stock *i* in year *y*-1 as estimated using the Fama-French (1992) method with the Scholes and Williams (1977) adjustment. PR_{y-1}^{1i} is the past returns for the last 100 days for stock *i* in year *y*-1 calculated as the log ratio of its daily closing price. PR_{y-1}^{2i} is the past return for the rest of the days for stock *i* in year *y*-1 calculated as the log ratio of its daily closing price. $\ln CAP_{y-1}^i$ is the logarithm of the market capitalization for stock *i* at the end of year *y*-1. STD_{y-1}^i is the standard deviation of return for stock *i* across the days in year *y*-1. DP_{y-1}^i is the ratio of dividend per share to share price for stock *i* in year *y*-1. The monthly returns are from 1976 to 1999 and the stock characteristics are from 1975 to 1998. The *t*-statistics are reported in parentheses.

Variable	All months	Excl. Jan	1976-1989	1990-1999	All months	Excl. Jan	1976-1989	1990-1999
Constant	0.0082	0.0105	0.0120	0.0028	0.0060	-0.0017	0.0401	-0.0418
	(1.552)	(1.973)**	(1.902)*	(0.307)	(0.254)	(-0.068)	(1.329)	(-1.133)
$ILLM_{y-1}^i$	0.0014	0.0016	0.0022	0.0003	0.0014	0.0017	0.0019	0.0005
	(2.493)**	(2.758)***	(3.061)***	(0.314)	(2.526)**	(3.118)***	(2.923)***	(0.607)
β_{y-1}^i	-0.0015	-0.0064	0.0029	-0.0077	-0.0003	-0.0019	-0.0028	0.0031
	(-0.311)	(-1.331)	(0.520)	(-0.877)	(-0.110)	(-0.610)	(-0.838)	(0.543)
PR_{y-1}^{1i}	-0.0060	-0.0053	-0.0076	-0.0037	-0.0030	-0.0018	-0.0037	-0.0022
	(-1.676)*	(-1.447)	(-1.858)*	(-0.578)	(-0.937)	(-0.540)	(-0.939)	(-0.388)
PR_{y-1}^{2i}	0.0004	0.0003	0.0074	-0.0094	0.0017	0.0030	0.0073	-0.0060
	(0.085)	(0.060)	(1.251)	(-1.333)	(0.391)	(0.669)	(0.226)	(-0.901)
$\ln CAP_{y-1}^i$					0.0001	0.0005	-0.0008	0.0015
					(0.166)	(0.558)	(-0.701)	(1.089)
STD_{y-1}^i					-0.0014	-0.0029	-0.0011	-0.0017
					(-0.053)	(-2.287)**	(-0.824)	(-0.696)
DP_{y-1}^i					0.0718	0.0940	0.0904	0.0458
					(1.051)	(1.340)	(0.985)	(0.448)

Note: ***, ** and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 4 Cross-Sectional Illiquidity Effects on Stock Return

This table presents the means of the estimated coefficients from the monthly cross-sectional regression of stock return on the respective variables.

$R_m^i = k_{0y} + k_{1y} ILLM_{m-1}^i + k_{2y} \beta_{y-1}^{1i} + k_{3y} PR_{m-1}^i$.

$R_m^i = k_{0y} + k_{1y} ILLM_{m-1}^i + k_{2y} \beta_{y-1}^{1i} + k_{3y} PR_{m-1}^i + k_{4y} BM_{y-1}^i + k_{5y} \ln CAP_{y-1}^i + k_{6y} STD_{y-1}^i + k_{7y} CP_{y-1}^i$.

The coefficients are averaged for the whole sample period, one including and one excluding January, and for the two sub-periods, from 1976 to 1989 and from 1990 to 1999. $ILLM_{m-1}^i$ is the mean adjusted illiquidity for stock i in month m-1. β_{y-1}^i is the market beta for stock i in year y-1estimated using the Fama-French (1992) method with the Scholes and Williams (1977) adjustment. PR_{m-1}^i is the monthly return for stock i in month m-1. BM_{y-1}^i is the book-to-market ratio for stock i at the end of year y-1. $\ln CAP_{y-1}^i$ is the logarithm for the market capitalization of stock i at the end of year y-1. STD_{y-1}^i is the standard deviation of return for stock i across the days in year y-1. CP_{y-1}^i is the ratio of earnings per share plus depreciation to share price for stock i in year y-1. The monthly returns are from 1976 to 1999, and the stock characteristics are from 1975 to 1998. The *t*-statistics are reported in parentheses.

Variable	All months	Excl. Jan	1976-1989	1990-1999	All months	Excl. Jan	1976-1989	1990-1999
Constant	0.0058	0.0067	0.0116	-0.0024	-0.0027	-0.0111	0.0630	-0.0940
	(1.123)	(1.293)	(1.618)	(-0.342)	(-0.111)	(-0.439)	(1.911)*	(-2.839)***
$ILLM_{m-1}^i$	0.0008	0.0008	0.0017	-0.0004	0.0005	0.0006	0.0012	-0.0004
	(2.289)**	(2.278)**	(3.524)***	(-0.911)	(1.594)	(1.730)*	(2.451)**	(-0.840)
β_{y-1}^i	0.0014	-0.0022	0.0045	-0.0029	0.0034	0.0021	-0.0016	0.0102
	(0.273)	(-0.419)	(0.719)	(-0.336)	(0.999)	(0.634)	(-0.388)	(1.772*)
PR_{m-1}^i	-0.0595	-0.0533	-0.0335	-0.0956	-0.0659	-0.0600	-0.0406	-0.1010
	(-6.557)***	(-5.871)***	(-3.056)***	(-6.439)***	(-7.675)***	(-6.989)***	(-3.904)***	(-7.227)***
BM_{y-1}^i					0.0067	0.0069	0.0090	0.0036
					(2.852)***	(2.761)***	(2.558)**	(1.280)
$\ln CAP_{y-1}^i$					0.0002	0.0006	-0.0019	0.0031
					(0.221)	(0.622)	(-1.541)	(2.645)***
STD_{y-1}^i					-0.0004	-0.0017	-0.0003	-0.0006
					(-0.331)	(-1.301)	(-0.251)	(-0.223)
CP_{y-1}^i					0.0041	0.0042	0.0025	0.0065
					(1.210)	(1.133)	(0.497)	(1.474)

Note: ***, ** and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 5 Cross-Sectional Illiquidity Effects on Stock Return in Up/Down Markets

The table presents the means of the estimated coefficients from the monthly cross-sectional regression of stock return on the respective variables.

$R^i_m = k_{0y} + k_{1y} ILLM^i_{m-1} + k_{2y} \beta^{1i}_{y-1} + k_{3y} PR^i_{m-1}$.

$R^i_m = k_{0y} + k_{1y} ILLM^i_{m-1} + k_{2y} \beta^{1i}_{y-1} + k_{3y} PR^i_{m-1} + k_{4y} BM^i_{y-1} + k_{5y} \ln CAP^i_{y-1} + k_{6y} STD^i_{y-1} + k_{7y} CP^i_{y-1}$.

The coefficients are averaged for the whole sample period, one including and one excluding January, and for the two sub-periods, from 1976 to 1989 and from 1990 to 1999, in up and down markets, respectively. $ILLM^i_{m-1}$ is the mean adjusted illiquidity for stock *i* in month *m*-1. β^i_{y-1} is the market beta for stock *i* in year *y*-1 estimated using the Fama-French (1992) method with the Scholes and Williams (1977) adjustment. PR^i_{m-1} is the monthly return for stock *i* in month *m*-1. BM^i_{y-1} is the book-to-market ratio for stock *i* at the end of year *y*-1. $\ln CAP^i_{y-1}$ is the logarithm for the market capitalization of stock *i* at the end of year *y*-1. STD^i_{y-1} is the standard deviation of return for stock *i* across the days in year *y*-1. CP^i_{y-1} is the ratio of earnings per share plus depreciation to share price for stock *i* in year *y*-1. The monthly returns are from 1976 to 199, and the stock characteristics are from 1975 to 1998. The *t*-statistics are reported in parentheses.

Panel A: Up market

Variable	All months	Excl. Jan	1976-1989	1990-1999	All months	Excl. Jan	1976-1989	1990-1999
Constant	0.0174	0.0162	0.0251	0.0018	0.0838	0.0774	0.1157	0.0186
	(2.648)***	(2.445)**	(3.052)***	(0.169)	(2.804)***	(2.429)**	(3.171)***	(0.363)
$ILLM^i_{m-1}$	0.0010	0.0010	0.0022	-0.0012	0.0005	0.0006	0.0012	-0.0009
	(2.315)**	(1.955)*	(3.688)***	(-1.489)	(1.098)	(1.217)	(2.029)*	(-1.115)
β^i_{y-1}	0.0236	0.0224	0.0096	0.0522	0.0117	0.0121	0.0014	0.0327
	(3.693)***	(3.555)***	(1.330)	(4.391)***	(2.687)***	(2.825)***	(0.320)	(3.621)***
PR^i_{m-1}	-0.0791	-0.0712	-0.0489	-0.1406	-0.0858	-0.0788	-0.0550	-0.1484
	(-5.965)***	(-5.323)***	(-3.502)***	(-5.243)***	(-6.803)***	(-6.219)***	(-4.220)***	(-5.768)***
BM^i_{y-1}					0.0050	0.0052	0.0049	0.0050
					(1.580)	(1.550)	(1.184)	(1.144)
$\ln CAP^i_{y-1}$					-0.0028	-0.0025	-0.0035	-0.0015
					(-2.593)**	(-2.117)**	(-2.555)**	(-0.827)
STD^i_{y-1}					0.0068	0.0048	0.0022	0.0162
					(4.026)***	(2.894)***	(1.227)	(4.861)***
CP^i_{y-1}					0.0000	-0.0005	0.0021	-0.0042
					(0.002)	(-0.104)	(0.347)	(-0.640)

Panel B: Down market

Variable	All months	Excl. Jan	1976-1989	1990-1999	All months	Excl. Jan	All months	Excl. Jan
Constant	-0.0098	-0.0053	-0.0144	-0.0059	-0.1179	-0.1216	-0.0388	-0.1862
	(-1.237)	(-0.655)	(-1.085)	(-0.622)	(-3.166)***	(-3.153)***	(-0.602)	(-4.645)***
$ILLM^{i}_{m-1}$	0.0005	0.0006	0.0008	0.0002	0.0005	0.0006	0.0010	0.0000
	(0.960)	(1.190)	(0.939)	(0.354)	(1.037)	(1.272)	(1.368)	(0.017)
β^{i}_{y-1}	-0.0282	-0.0329	-0.0053	-0.0480	-0.0078	-0.0103	-0.0073	-0.0082
	(-3.668)***	(-4.237)***	(-0.441)	(-5.156)***	(-1.520)	(-2.001)**	(-0.917)	(-1.229)
PR^{i}_{m-1}	-0.0333	-0.0310	-0.0039	-0.0587	-0.0393	-0.0365	-0.0129	-0.0622
	(-2.957)***	(-2.699)***	(-0.230)	(-4.081)***	(-3.757)***	(-3.403)***	(-0.767)	(-4.967)***
BM^{i}_{y-1}					0.0091	0.0090	0.0167	0.0025
					(2.535)**	(2.413)**	(2.653)**	(0.673)
$\ln CAP^{i}_{y-1}$					0.0042	0.0044	0.0012	0.0068
					(3.124)***	(3.169)***	(0.494)	(5.027)***
STD^{i}_{y-1}					-0.0101	-0.0098	-0.0052	-0.0143
					(-5.795)***	(-5.393)***	(-2.427)**	(-5.571)***
CP^{i}_{y-1}					0.0097	0.0100	0.0033	0.0152
					(1.841)*	(1.829)*	(0.359)	(2.631)**

Note: ***, ** and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 6 Time-Series Illiquidity Effects on the SZ-Portfolio Return

The excess monthly market return is regressed on monthly market illiquidity

$R_m^M - R_m^f = g_0 + g_1 \ln ILL_{m-1}^M + g_2 \ln ILLU_m^M + g_3 JAN_m + aTM_{m-1} + u_m$,

where R_m^M is the monthly equally-weighted market return, R_m^f is the one-month Gensaki monthly rate, $\ln ILL_m^M$ is the expected monthly market illiquidity, $\ln ILLU_m^M$ is the unexpected monthly market illiquidity, $TM_m = YL_m - R_m^{G3}$ is the term yield premium, and JAN_m is a January dummy that equals 1 in January and zero otherwise. The test on 25 SZ portfolios is:

$R_m^p - R_m^f = g_0^p + g_1^p \ln ILL_{m-1}^M + g_2^p \ln ILLU_m^M + g_3^p JAN_m + a^p TM_{m-1} + u_m^p$,

where R_m^p, *p* = 5, 10, 15, 20, and 25, are the equally weighted monthly returns on the SZ portfolio *p*. The period of estimation is from 1976 to 1999.

Portfolio	*Constant*	$\ln ILL_{m-1}^M$	$\ln ILLU_m^M$	JAN_m	TM_{m-1}	R^2
Market	0.016	0.005	-0.127	0.034		*0.354*
	(1.43)	(1.14)	(-11.81)***	(3.38)***		*(0.347)*
Portfolio 5	0.012	0.003	-0.138	0.045		*0.303*
	(0.82)	(0.61)	(-10.21)***	(3.53)***		*(0.295)*
Portfolio 10	0.021	0.008	-0.127	0.039		*0.280*
	(1.46)	(1.42)	(-9.60)***	(3.11)***		*(0.272)*
Portfolio 15	0.017	0.006	-0.113	0.026		*0.253*
	(1.32)	(1.28)	(-9.18)***	(2.22)**		*(0.245)*
Portfolio 20	0.019	0.007	-0.101	0.019		*0.221*
	(1.50)	(1.41)	(-8.44)***	(1.71)*		*(0.213)*
Portfolio 25	0.025	0.008	-0.080	0.009		*0.140*
	(1.85)*	(1.57)	(-6.36)***	(0.74)		*(0.131)*
Market	0.015	0.005	-0.127	0.034	0.004	*0.354*
	(1.33)	(1.12)	(-11.75)***	(3.38) ***	(0.13)	*(0.345)*
Portfolio 5	0.012	0.003	-0.138	0.045	-0.000	*0.303*
	(0.77)	(0.61)	(-10.13)***	(3.52)***	(-0.01)	*(0.293)*
Portfolio 10	0.022	0.008	-0.127	0.039	-0.010	*0.280*
	(1.46)	(1.44)	(-9.50)***	(3.09)***	(-0.27)	*(0.269)*
Portfolio 15	0.018	0.006	-0.113	0.026	-0.006	*0.253*
	(1.30)	(1.29)	(-9.09)***	(2.21)**	(-0.19)	*(0.242)*
Portfolio 20	0.019	0.007	-0.101	0.019	-0.001	*0.221*
	(1.39)	(1.39)	(-8.38)***	(1.71)*	(-0.04)	*(0.210)*
Portfolio 25	0.027	0.008	-0.079	0.009	-0.014	*0.141*
	*(1.88)**	*(1.61)*	*(-6.27)****	*(0.73)*	*(-0.41)*	*(0.128)*

Note: ***, ** and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 7 Time-Series Illiquidity Effects on the SZ-Portfolio Return in Sub-periods

The excess monthly market return is regressed on monthly market illiquidity

$R_m^M - R_m^f = g_0 + g_1 \ln ILL_{m-1}^M + g_2 \ln ILLU_m^M + g_3 JAN_m + w_m$,

where R_m^M is the monthly equally-weighted market return, R_m^f is the one-month Gensaki monthly rate, $\ln ILL_m^M$ is the expected monthly market illiquidity, $\ln ILLU_m^M$ is the unexpected monthly market illiquidity, and JAN_m is a January dummy that equals 1 in January and zero otherwise.

The test on 25 SZ portfolios is: $R_m^p - R_m^f = g_0^p + g_1^p \ln ILL_{m-1}^M + g_2^p \ln ILLU_m^M + g_3^p JAN_m + w_m^p$,

where R_m^p, p = 5, 10, 15, 20, and 25, are the equally weighted monthly returns on the SZ portfolio p.

Panel A: 1976~1989

Portfolio	*Constant*	$\ln ILL_{m-1}^M$	$\ln ILLU_m^M$	JAN_m	R^2
Market	0.009	-0.000	-0.092	0.032	0.371
	(1.03)	(-0.13)	(-9.84)***	(4.11)***	(0.353)
Portfolio 5	-0.003	-0.005	-0.099	0.040	0.361
	(-0.28)	(-1.20)	(-8.38)***	(3.94)***	(0.349)
Portfolio 10	0.012	0.002	-0.085	0.026	0.271
	(1.09)	(0.39)	(-7.20)***	(2.56)**	(0.257)
Portfolio 15	0.010	0.001	-0.075	0.022	0.209
	(0.83)	(0.26)	(-6.12)***	(2.08)**	(0.195)
Portfolio 20	0.017	0.003	-0.065	0.017	0.153
	(1.35)	(0.75)	(-5.06)***	(1.58)	(0.137)
Portfolio 25	0.021	0.005	-0.050	0.015	0.067
	(1.35)	(0.87)	(-3.11)***	(1.08)	(0.050)

Panel B: 1990~1999

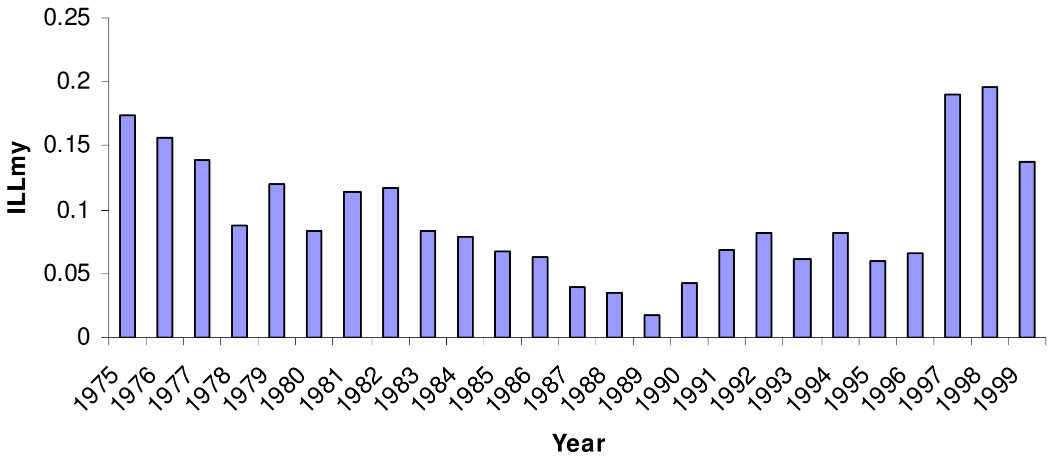
Portfolio	*Constant*	$\ln ILL_{m-1}^M$	$\ln ILLU_m^M$	JAN_m	R^2
Market	0.021	0.010	-0.159	0.042	0.371
	(0.79)	(1.04)	(-7.39)***	(1.85)*	(0.353)
Portfolio 5	0.029	0.014	-0.172	0.057	0.321
	(0.91)	(1.13)	(-6.46)***	(2.04)**	(0.302)
Portfolio 10	0.025	0.013	-0.167	0.064	0.327
	(0.80)	(1.10)	(-6.48)***	(2.37)**	(0.308)
Portfolio 15	0.023	0.012	-0.148	0.037	0.309
	(0.81)	(1.09)	(-6.39)***	(1.50)	(0.289)
Portfolio 20	0.017	0.009	-0.134	0.027	0.290
	(0.66)	(0.94)	(-6.18)***	(1.18)	(0.270)
Portfolio 25	0.027	0.011	-0.107	0.003	0.231
	(1.10)*	(1.14)	(-5.24)***	(0.15)	(0.209)

Note: ***, ** and * denote significance at the 1, 5, and 10 percent levels, respectively.

Figure 1 Time-Series Pattern of Annual Market Illiquidity and the Nikkei 225

This figure shows the time-series pattern of the annual market illiquidity ILL_y^M in Panel A and Nikkei 225 in Panel B during the sample period. ILL_y^M is calculated as the cross-sectional average of annual stock illiquidity for all the sample stocks during 1975~1999. The stocks included in the sample must have valid observations of return and trading value data for more than 200 days in a year and have year-end prices greater than 100 yen; outliers with annual illiquidity at the highest or lowest 1% tails of the distribution are eliminated. Nikkei 225 is the index value at the end of each fiscal year.

Panel A: Annual Market Illiquidity



Panel B: Nikkei 225