The Diminishing Liquidity Premium

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Abstract

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Abstract

Previous evidence suggests that less liquid stocks yield higher average returns. Using NYSE data, we present evidence that both the sensitivity of returns to liquidity and liquidity premia have significantly declined over the past four decades to levels that we cannot statistically distinguish from zero. Furthermore, the profitability of trading strategies based on buying illiquid stocks and selling liquid stocks has significantly declined over the past four decades. Our results are robust to several conventional liquidity measures related to volume. When using a liquidity measure that is not related to volume, we find just weak evidence of a liquidity premium even in the early periods of our sample. We offer possible explanations for these results related to the proliferation of hedge funds, index funds, and exchange-traded funds.

1 Introduction

Starting from the seminal work of Amihud and Mendelson (1986), it has been argued that transaction costs and liquidity have an important effect on the prices of financial assets. Amihud and Mendelson assume exogenous trading frequencies and conclude that less liquid securities yield higher expected returns, which in turn benefit investors with long trading horizons. Furthermore, the price effects of illiquidity may be first order, since the price reflects the present value of all future transaction costs.[1]

The empirical presence of liquidity premia has been investigated extensively for various asset classes and by using several different methodologies.[2] Amihud and Mendelson (1986, 1989), Amihud (2002), Brennan and Subrahmanyam (1996), Brennan, Chordia and Subrahmanyam (1998), and Eleswarapu (1997), among many others, find that different measures of illiquidity are associated with higher future stock returns.[3] Amihud and Mendelson (1991) find similar results in bond markets. Recent studies (e.g., Pastor and Stambaugh (2003), Acharya and Pedersen (2005), Sadka (2006), Korajczyk and Sadka (2008)), and Charoenrook and Conrad (2008) have taken liquidity premia one step further and argued that liquidity is a priced risk factor.[4]

In this paper we argue that the sensitivity of expected returns to conventional

[1] This idea has been subject to some theoretical debate, as models that endogenize the trading frequency suggest that the price effect of transaction costs is second order. See Constantinides (1986) and Vayanos (1998), as opposed to Jang, Koo, Liu, and Loewenstein (2007).
[2] For a comprehensive survey of this literature see Amihud, Mendelson, and Pedersen (2006).
[3] Some exceptions should be noted. Hasbrouck (2006) finds only weak pricing effects of illiquidity. Spiegel and Wang (2005) find that much of the pricing effect of illiquidity is subsumed by the effect of idiosyncratic risk. Barclay, Kandel, and Marx (1998) do not find a significant price effect following a change in liquidity resulting from stocks moving between NASDAQ, NYSE, and AMEX.
[4] Kamara, Lou, and Sadka (2007) show divergence over time between the systematic liquidity components of small-cap and large-cap firms. They attribute their findings to patterns of institutional ownership over their sample period.

measures of liquidity has significantly declined over the past 40 years. Obviously, liquidity itself has improved over the years following numerous regulatory reforms (such as decimalization) and technological improvements. Our key insight, however, is distinct from this point. Our main claim is not regarding liquidity itself; rather, we argue that the effect of each unit of liquidity on returns has declined over the years. In a practical sense, we hypothesize that if we put returns on the left-hand side of a regression and a conventional measure of liquidity on the right-hand side, then the coefficient of liquidity declines over time (in absolute value), and the total effect (liquidity times the coefficient) declines over time. We further argue that the profitability of liquidity-based long-short trading strategies has decreased over the years.

We test these hypotheses using NYSE common stocks between 1964 and 2005. Our main tests employ three popular volume-related measures of liquidity. The first measure is an inflation-adjusted version of Amihud's illiquidity measure (Amihud, 2002), defined as the absolute return per unit of 1 million dollar volume. This measure is easy to calculate from daily CRSP data, and it has gained popularity in recent years as a useful measure of illiquidity (see, e.g., Acharya and Pedersen (2005), Korajczyk and Sadka (2008), and Kamara, Lou and Sadka (2007)). Adjusting for inflation is needed to facilitate comparisons over time, since the real value of dollar volume is changing.

The two other volume-related liquidity measures are the annual dollar volume, and annual turnover. These measures have frequently been used as liquidity proxies (e.g., Brennan, Chordia, and Subrahmanyam (1998), Chordia, Subrahmanyam, and Anshuman (2001), Korajczyk and Sadka (2008), and Datar, Naik, and Radcliffe (1998)).

We also use one liquidity measure that is not related to volume. This is Roll's

(1984) measure of the effective bid-ask spread obtained using a Gibbs estimator as in Hasbrouck (2006).

In our first set of tests we use a Fama-MacBeth approach to estimate the effect of liquidity on returns and the liquidity premium during different sub-periods of our sample period (1964–2005). We use a sequence of parametric and non-parametric tests to show that over this time period both the sensitivity of returns to liquidity and liquidity premia have declined. For example, we find that the sensitivity of monthly returns to Amihud's measure of illiquidity has dropped from being positive and large, both statistically and economically, between 1964 and 1973 to an amount that is not statistically different from zero starting from the mid 1970s. Furthermore, the average annual liquidity premium has declined from about 1.8% in the 1960s and early 1970s to an amount that is not significantly different from zero starting in the mid 1970s. Qualitatively similar results are obtained using the other two volume-related measures of liquidity, the only difference being that the decline becomes significant in the mid 1980s.

We further show that popular trading strategies based on buying illiquid stocks and selling liquid stocks have lost much of their profitability over the years. For example, applying Amihud's measure and using an out-of-sample analysis, we show that a trading strategy that buys the top decile of illiquid stocks and sells the bottom decile yielded an average annual Fama-French four-factor alpha of 9.4% between 1964 and 1973. Starting from the mid 1970s, the average alpha of such strategies is not significantly different from zero. Again, qualitatively similar results are obtained when using dollar volume and turnover as measures of liquidity, the only difference being that the trading strategies cease to be profitable in the mid 1980s.

Naturally, firm size and liquidity are highly correlated. Importantly, our results regarding the decline in the effect of liquidity on returns are distinct from well-documented trends in the small-firm anomaly (e.g., Fama and French (1992), Dichev (1998), and Schwert (2003). We verify this in three ways. First, in our regression analysis we control for size effects. Second, in our analysis of liquidity-based trading strategies we control for the sensitivity of the liquidity-based portfolios to common variations in small vs. large firms (the SMB factor). Finally, we present an analysis in which we pre-sort the data by size. The decline in profitability of liquidity-based strategies applies to all size cohorts.

When using Hasbrouck's version of Roll's measure of liquidity (which proxies for half of the effective bid-ask spread and is not directly related to volume) we find different results from those obtained using the volume-related liquidity measures. First, we cannot identify a significant sensitivity of returns to liquidity or a liquidity premium even in the early periods of our analysis. Second, we do not find any decline in the liquidity premium, since we start and end the time series with amounts that are not statistically different from zero. Thus, like Hasbrouck (2006), we find that stock liquidity has different facets. The facets related to volume seem to have been priced in the early periods of our analysis, while others were not. The consistent result across all measures is that in the later periods none of them seems to be priced in our sample.

Overall, the results show a strong decline in the effect of volume-related liquidity on expected returns in NYSE stocks. Depending on the liquidity measure used, starting from the mid 1970s or 1980s we cannot distinguish the liquidity premium from zero, and liquidity-based trading strategies appear to be unprofitable.

These results are important for both valuation and asset management applications. The existence of liquidity premia plays a central role in the valuation of financial assets. A 1% decrease in the discount rate may translate into a 10%–20% increase in valuation. Furthermore, liquidity-based long-short trading strategies have become very common, especially for hedge funds. Our findings cast doubt on the profitability of such strategies in recent years for stocks listed on NYSE.

We present two possible explanations for these results. The first is based on hedge fund proliferation in the past few decades. It is possible that hedge-funds, being long-horizon traders who incur relatively small transaction costs, "arbitrage away" the liquidity premium by buying illiquid stocks and short-selling liquid stocks. The second explanation is related to financial innovation. We conjecture that the presence of financial instruments that allow investors to buy and sell illiquid assets indirectly (such as index funds and ETFs) works to lower the sensitivity of returns to liquidity. These instruments enable investors to hold illiquid stocks indirectly for very low transaction costs, prolonging the investment horizon of the marginal investor in illiquid stocks, and thereby reducing the sensitivity of returns to liquidity.

The rest of the paper is organized as follows. Section 2 describes the data and the main variables of interest. Section 3 presents the empirical results regarding the decline in liquidity coefficients and liquidity premia. Section 4 presents the results regarding the decline in profitability of liquidity-based trading strategies. Section 5 discusses possible explanations for the results. We conclude in Section 6.

2 Data and Main Variables

Following Chordia, Subrahmanyam, and Anshuman (2001), Pastor and Stambaugh (2003), Acharya and Pedersen (2005) and Hasbrouck (2006) among others, we restrict attention to common stocks only. Our sample consists of all NYSE common stocks drawn from CRSP between January 1964 and December 2005 with share codes 10 or 11 (common shares), which excludes ETFs, REITs, closed end funds, primes, and scores.

We do not consider NASDAQ stocks for two reasons. First, CRSP data on NASDAQ until 1983 is very scarce, precluding a valid longitudinal analysis of NASDAQ illiquidity using *any* liquidity measure. Second, our main liquidity measures are a function of volume. It is well known that volume in NASDAQ is inflated (see Atkins and Dyl (1997)). Furthermore, the amount of inflation in volume numbers has varied over the years because of the introduction of electronic communications networks (ECNs) and other mechanisms that enable traders to bypass the dealer system. This prevents the use of volume-related measures in a time-series analysis of NASDAQ liquidity.

The results reported in the paper also exclude AMEX stocks. Our concern here is that the reduction in the number of common stocks traded on AMEX over our sample period could generate trends in the data that might contaminate the findings. For example, starting from the year 2000, the number of stocks available for our analysis on AMEX is only about 200.

We use four measures of liquidity. The first three are related to trading volume, and the fourth is a measure of transaction cost. Our first liquidity measure is a modified version of the measure presented in Amihud (2002). This is an annual measure of illiquidity in the spirit of Kyle's (1985) lambda, calculated based on the annual averages of daily absolute price changes adjusted for dollar volume and for inflation. Formally, Amihud's measure for firm *i* in year *t* is denoted by $Amihud_{i,t}$ and is given by

$$Amihud_{i,t} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{|R_{idt}|}{VOLD_{idt} \cdot \inf_{dt}},$$

where R_{idt} is the return of stock *i* in day *d* of year *t*, $VOLD_{idt}$ is the dollar volume (in millions) of stock *i* on day *d* of year *t*, D_{it} is the number of available trading days for stock *i* in year *t*, and inf_{dt} is an adjustment factor for inflation, which allows us to present Amihud's measure using end-of-2005 prices. Such an adjustment is necessary since the real economic meaning of dollar volume has changed significantly over the years. For robustness we have also used a version of Amihud's measure scaled by total stock-market capitalization. The results (not reported here) are similar.

The two additional volume-related liquidity measures are dollar volume, defined as the logarithm of the annual dollar volume (in millions), and turnover, defined as annual share volume divided by the average number of outstanding shares throughout the year.

Our fourth measure is related to transaction costs and not directly to trade volume. This is the annual average of Roll's estimate of effective half bid-ask spread (Roll, 1984). The idea behind this measure is that in the absence of new information, daily price changes should exhibit negative autocorrelation. Moreover, the bid-ask spread is proportional to the square root of negative the covariance of daily price changes. In practice, this covariance is often positive, making the estimation of the spread problematic. Hasbrouck (2006) solved this problem by using a Bayesian Gibbs estimator that imposes a negative prior on the covariance to estimate the spread. Hereafter we denote this measure by Roll-Hasbrouck (RH). Our estimates of the RH measure were obtained from Joel Hasbrouck's webpage. As discussed in Hasbrouck (2006), the correlation between the Gibbs estimator and TAQ data bid-ask spreads for 1993–2005 is 0.965.

Similar to Amihud (2002), to ensure the reliability of the data in the annual calculations, we calculate the liquidity measures only for stocks that satisfy the following two requirements: (i) the stock must have return data for at least 150 trading days during the year; and (ii) the stock must be listed at the end of the year and have a year-end price higher than $5. We also censored the upper and lower 1% of the distribution of Amihud's illiquidity measures to avoid outliers.[5] After we account for these restrictions, the number of stocks in our sample ranges from 1,053 in 1964 to 1,338 in 2005.[6]

Table 1 presents summary statistics for the four liquidity measures. The median of Amihud's measure is 2.8%, suggesting that the median absolute price change associated with $1 million of volume (in 2005 prices) is 2.8%. The median of the annual turnover is 41%. The median of the log of dollar volume is 5.02, suggesting that median dollar volume in our sample is about $150 million. Finally, the median of Roll's measure in our period is 0.37%, suggesting that the median estimated bid-ask spread in the sample is 0.74%.

Figure 1 plots the evolvement over time of the four liquidity measures. For each year we plot the equal-weighted average of the liquidity measures across the firms available for analysis during that year. The picture in all four measures seems similar: while liquidity seemed to fluctuate during the 1970s and 1980s, it appears to be

[5] Censoring the data based on the other liquidity measures yielded similar results.
[6] These are average numbers. Our analysis is done on a monthly basis and the actual number changes somewhat from month to month.

improving since the early 1990s. This is consistent with the several market reforms (such as decimalization) and technological changes that took effect during these years. Chordia, Roll, and Subrahmanyam (2008) study the determinants of this trend. They find that the increased turnover is associated with more frequent smaller orders and with higher level of institutional holdings. It is important to distinguish between this gradual improvement in liquidity and the effect of liquidity on returns, which is the focus of this paper. The fact that liquidity has improved does not by itself mean that the sensitivity of returns to illiquidity has changed or that liquidity premia have gone down.

Table 1 also reports summary statistics for additional variables used in the analysis. The main dependent variable is the stock return. We use monthly returns from CRSP and adjust the returns to account for delisting bias.[7]

Following Amihud (2002), we calculate beta using a methodology in the spirit of Fama and French (1992) as follows. At the end of each year t, we rank stocks by their market capitalization and divide them into ten equal portfolios. We then estimate ten market models for year t in which the dependent variable is the daily excess return of one of the above ten portfolios, and the explanatory variable is the daily market excess return using the Scholes and Williams (1977) method. The beta assigned to each individual stock i in year t is the estimated beta of the size portfolio containing this stock. The resulting average beta in the sample is 1.03, and the median is 1.04.

Other variables of interest whose summary statistics are reported in Table 1 are market capitalization, book-to-market ratio, daily standard deviation of returns (sdret),

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[7] Our approach here follows Shumway (1997) and is similar to Amihud (2002). The last return used is either the last return available on CRSP, or the delisting return, if available. Shumway finds an average delisting return of –30% using OTC returns of delisted stocks. We thus assign a return of –30% if a delisting is coded as 500 (reason unavailable), 520 (went to OTC), 551–573 and 580 (various reasons), 574 (bankruptcy) and 584 (does not meet exchange financial guidelines).

dividend yield (divyld), and two variables that account for past returns in an attempt to capture short-term momentum effects (R100 and R100yr).

Table 2 reports averages of the monthly cross-sectional correlations between the main variables of interest from January 1964 to December 2005. It is important to keep in mind that Amihud's and Roll-Hasbrouck's measures are negative measures of liquidity (they measure illiquidity), whereas dollar volume and turnover are positive measures of liquidity. Given this, the four liquidity measures are correlated as expected. However, the correlations are not extremely high. The highest correlation among the four is between the log of dollar volume and Amihud's illiquidity measure (–0.65). Apparently, the four measures reflect somewhat different aspects of liquidity.

Importantly, the correlation between the log of firm size (Lnsize) and the log of dollar volume (Lndvol) is very high at 0.87. This makes it virtually impossible to draw statistical inferences when using these two variables in one regression. For this reason, we do not present some of our regression analysis with the volume measure. We discuss this further below.

3 Analysis of Time Trends

Our main hypotheses are that (i) the sensitivity of returns to liquidity has declined over the period 1964–2005; and (ii) liquidity premia have declined over this time period. To start, we test these hypotheses by employing the Fama-MacBeth (1973) methodology to estimate the sensitivity of returns to illiquidity from monthly cross-sections of stocks. We use a series of parametric and non-parametric tests to check for trends in the liquidity coefficients and liquidity premia.

To minimize the error-in-variables problem we carry out the analysis on liquidity-based portfolios. For each month *m* in year *t* between January 1964 and December 2005 (504 months) we sort the stocks in our sample into 100 portfolios based on their previous year level of liquidity. We do this for each liquidity measure. Then, for each month we estimate a cross-sectional regression of the form:

$$R_{imt} = \alpha_{mt} + \sum_{j=1}^{J} \beta_{jmt} X_{ij,t-1} + \varepsilon_{imt} . \qquad (1)$$

That is, we regress the returns of portfolio i=1,…,100 in month m of year t on a set of J explanatory variables calculated using data from year t–1. This ensures that the explanatory variables are known to investors at the time that monthly returns are realized. The explanatory variables used in the regression are the equal-weighted variables of each portfolio's constituents.

The main explanatory variables are the four liquidity measures. We include additional explanatory variables that have been shown (or are suspected) to be determinants of returns. These are beta (*beta*), size (*market capitalization*), momentum, book-to-market, standard deviation of returns, and dividend yield.

For the purpose of our analysis, the main output from the above regressions is twofold. First, for each liquidity measure we obtain 504 monthly estimates of the sensitivity of returns to liquidity - one for each month in the sample period. Second, multiplying these monthly coefficients by the average liquidity measure of the relevant month, we obtain an estimate of the monthly liquidity premium.[8] We then use these coefficient estimates and the estimates of the illiquidity premia to test for trends.

To begin, Table 3 presents a standard Fama-MacBeth analysis of the entire sample period. For each explanatory variable the table reports the average of the coefficient based on all of the monthly observations, as well as a t-statistic testing against the null hypothesis that this average is zero. The results are quite typical of this kind of test. First, as noted by Fama and French (1992), *beta* is not priced. Second, book-to-market and momentum are priced in the familiar way: "value" (high book-to-market) stocks entail higher returns, and winners stay winners in the short run.

The relevant part for our purposes is the coefficient of the four liquidity measures. It is significant for Amihud's measure and turnover, and insignificant for volume and Roll-Hasbrouck's measure. To see the economic magnitude of the coefficients, consider for example specification (1), which is related to Amihud's measure. A coefficient of 0.44 implies that an increase of one standard deviation in Amihud's measure (0.185; see Table 1) would increase monthly returns by 0.44%*0.185=0.0814%. On a yearly basis this amounts to approximately 1%. The average monthly liquidity premium estimated using this specification (bottom of the table) is 0.024%, which translates into an annual premium of approximately 0.3%. Note that these numbers are economically quite large. A 1% increase in discount rates would typically translate in standard valuation models into a discount of about 10%–20% in value (depending on the discount rate and the assumptions about expected growth).

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[8] The premium has an intuitive economic meaning only for Amihud's and Roll's measures, as for these the case of a measure equal to zero corresponds to perfect liquidity. Hence, we report the premium only for these two measures.

It seems, then, that over the entire sample period, liquidity is priced in an economically and statistically significant way for some measures but not for others. We argue that this inconclusive result reflects a mix of highly significant liquidity coefficients in the beginning of our sample period, and low and insignificant liquidity coefficients more recently.

To get a first impression of the plausibility of this assertion, in Figure 2A we plot the liquidity regression coefficients obtained from Eq. (1) using Amihud's measure over time. For each year the figure depicts the average monthly estimates of the liquidity coefficient for that year. While these coefficient estimates are noisy and seem to fluctuate quite a bit, there appears to be a clear downward trend. Similarly, Figure 2B plots the average liquidity premium, which again appears to be quite noisy but clearly downward trending. The analysis below formally tests for the existence of these trends.

In our first attempt to identify trends in the liquidity coefficients we divide the 42 years in our sample period into four sub-periods of 10 or 11 years. The idea behind slicing the entire sample period into sub-periods is to neutralize some of the noise in the monthly coefficients by averaging them over several years of data. For example, in examining Figure 2A one might wonder whether the trend is an artifact of the very high coefficient in 1969 or the very low coefficient in 1999. By using 10–11 years of data in each sub-period we have 120–132 monthly observations per sub-period, which is likely to alleviate some of the inevitable noise. Another approach would be to use non-parametric tests for trend (see below).

The sub-periods we consider are: Period 1 is 1964–1973, Period 2 is 1974–1984, Period 3 is 1985–1995, and Period 4 is 1996–2005. We then apply the Fama-MacBeth analysis (as above) separately to each of the sub-periods and compare the resulting coefficients.

The results are presented in Table 4. As before, the coefficients reported in the table are the averages of the coefficients of the monthly cross-sectional Fama-MacBeth regressions over the relevant time periods.

Consider first the results for Amihud's measure. The average liquidity coefficient in Period 1 is 2.54 with a t-stat of 3.01. By contrast, the coefficients in Periods 2, 3, and 4 are not significantly different from zero. The average monthly liquidity premium in Period 1 is 0.15%, or approximately 1.8% in annual terms. In Periods 2, 3, and 4 the monthly liquidity premium is not significantly different from zero.

When we use turnover as a measure of liquidity we find that returns are sensitive to liquidity in the first two sub-periods. The coefficients on turnover become insignificant starting from the third period. As mentioned above, because of the high correlation between the log of dollar volume and size we cannot use these regressions to assess the effect of volume on returns while controlling for size. In non-tabulated results we estimated the liquidity coefficients using volume without controlling for size. These show significant effects in Periods 1 and 2 and insignificant effect in Periods 3 and 4, similar to the results with turnover.

The results using Roll-Hasbrouck's measure are completely different. In all four time periods the coefficient of liquidity is not significant and neither is the liquidity premium.

Given these results, and to further increase the power of our tests by decreasing noise, we group Periods 1 and 2 into one early sub-period extending from 1964 to 1984, and Periods 3 and 4 into one later sub-period extending from 1985 to 2005. We then repeat the analysis for each of the two half-sample periods. The results are reported in Table 5.

Consider the results for Amihud's measure. Between 1964 and 1984 the coefficient estimate is 1.1 and the monthly liquidity premium is 0.055%. Both are statistically significant. By contrast, between 1985 and 2005 both the liquidity coefficient and the premium are not statistically different from zero. A comparison of the liquidity coefficient and the liquidity premium across the two periods (bottom of table) shows a statistically significant decline in both specifications. For robustness and to reduce possible effects of outliers we also use the Wilcoxon non-parametric test. The results again show a significant decline in both coefficient and premium.

A qualitatively similar but statistically even stronger result is obtained using the turnover measure. By contrast, when using Roll-Hasbrouck's measure we cannot identify any liquidity premium in either sub-period, and the difference between the periods is insignificant using both parametric and non-parametric tests.

We next turn to a set of non-parametric tests of trend. The main concern from the above analysis is that the averaging of monthly coefficients across sub-periods does not do a good enough job in cancelling out noisy observations, and that the results are driven by just a few outliers. The advantage of non-parametric tests of trend is that they consider only the order of the magnitudes of the coefficients, and do not account for the magnitude itself. Thus, extremely high or low coefficient estimates do not have an unusual effect on the test results, unlike with parametric methods.

We apply two standard non-parametric tests of trend: the Spearman test and the Kendall test. Like the standard Pearson's correlation, these non-parametric tests produce a number between –1 and 1, and allow for rejecting the null hypothesis of no trend. We apply these tests to the time series of 504 liquidity coefficients obtained by each measure and similarly to the time series of estimated monthly liquidity premia. The non-parametric tests as well as standard Pearson's correlations between the variables and time are reported in Table 6. The results show a significant negative time trend in the coefficients using both Amihud's measure and Turnover. No trend is identified with the coefficients related to Roll-Hasbrouck's measure.

Overall, the parametric and non-parametric analyses reinforce one another. They both support the claim that liquidity coefficients and liquidity premia have been trending down for volume-related measures. No liquidity premium (and thus, no trend) is identified for Roll-Hasbrouck's measure.

4 Profitability of Liquidity-Based Trading Strategies

The higher expected returns of illiquid stocks have long attracted long-term investors, who tried to reap the higher gains, not having to liquidate early. Anecdotal evidence suggests that many hedge funds use long-short strategies, buying illiquid stocks and short-selling liquid stocks of the same class. Are such strategies still profitable given our results on the decline in liquidity premia?

To answer this question, for each year between 1964 and 2005 we sort the stocks into deciles based on their annual liquidity level. We do this sort for each of the four liquidity measures. The most illiquid stocks in each year are placed in Decile 1 (the top decile), whereas the most liquid stocks are in Decile 10 (the bottom decile). We then construct three rolling portfolios. The first is a portfolio of the most illiquid stocks based on illiquidity estimations in the previous year. Thus, this portfolio assigns equal weights to all stocks in the top liquidity decile for a given year, and it rebalances the holdings once a year on January 1. The second portfolio is composed of the most liquid stocks, and thus assigns equal weights to all the stocks in the bottom decile, again rebalanced annually. A third portfolio is a long-short portfolio that is long in the illiquid portfolio and short in the liquid one.

Panel A of Table 7 reports the average monthly excess returns for these three portfolios over the four sub-periods described above for each of the four liquidity measures. The most striking results in this panel are for the excess returns on the long-short portfolio (top minus bottom). Consider first the results for Amihud's measure. The average monthly excess return on the "top-minus-bottom" portfolio between 1964 and 1973 is 0.81%, which amounts to approximately 9.7% annually. Surprisingly, the average excess return of this long-short portfolio is even higher (1.46%) in the second sub-period. However, in the two sub-periods starting from 1985, the average excess return of the long-short portfolio is not statistically different from zero. To test for trend, in Panel B we compare the sub-periods 1964–1984 and 1985–2005. The difference in excess returns of the long-short strategy between the two sub-periods is highly significant (t-stat of 3.34, Wilcoxon test of 3.15). Similar results are obtained when using volume as a liquidity measure. By contrast, Roll-Hasbrouck's measure shows only weak evidence of decline in excess returns, and turnover does not show any evidence of excess returns in any sub-period.

To further evaluate the profitability of liquidity-based strategies we estimate out-of-sample alphas of the three portfolios relative to the Fama-French four factors (excess market return, HML, SMB, and UMD) for each liquidity measure. Our approach here is similar to Brennan, Chordia, and Subrahmanyam (1998) and Chordia, Subrahmanyam, and Anshuman (2001). For each month *m* between 1964 and 2005 we regress the monthly excess returns of the three liquidity portfolios on the returns of the Fama-French four factors during the preceding 60 months: *m*–60 to *m*–1. Thus, for each month *m* in our sample period we obtain an estimate of the four-factor loadings as of that month. Denote these factor loadings by $\beta_{MKT,p,m}$, $\beta_{HML,p,m}$, $\beta_{SMB,p,m}$, and $\beta_{UMD,p,m}$, where, for example, $\beta_{MKT,p,m}$ stands for the loading on the market factor related to month *m* and portfolio *p* (one of the three liquidity portfolios). Now, for each month *m* we calculate the out-of-sample four-factor alpha of portfolio *p* (denote $Alpha_{m,p}$) as the realized excess return of the portfolio less the expected excess return calculated from the realized returns on the factors and the estimated factor loadings:

$$\begin{aligned} Alpha_{m,p} = & \left(RET_{p,m} - Rf_m\right) - \beta_{MKT,p,m}\left(RET_{MKT,m} - Rf_m\right) - \beta_{SMB,p,m}SMB_m \\ & - \beta_{HML,p,m}HML_m - \beta_{UMD,p,m}UMD_m, \end{aligned} \quad (2)$$

where $RET_{p,m}$, $RET_{MKT,m}$, and Rf_m are the realized returns on portfolio *p*, the CRSP value-weighted index, and the risk-free rate, respectively, during month *m*; and SMB_m, HML_m, *and* UMD_m are the appropriate realized returns on the factor portfolios in month *m*.

For each of the three portfolios we thus obtain a time series of between 120 and 132 out-of-sample alpha estimates for each of the sub-periods defined above. Panel A of Table 8 reports the averages of these alpha estimates for each liquidity measure.

Consider first Amihud's illiquidity measure. In the first two sub-periods, a long investment in this portfolio yielded average out-of-sample monthly four-factor alphas of 0.50% and 0.27%, respectively. Both are statistically significant. In contrast, the average alpha of this portfolio is not significantly different from zero in the two later sub-periods. As for the bottom decile (the most liquid stocks), a short position in these stocks yielded an average positive monthly alpha of 0.27% in sub-period 1. However, starting from Period 2 and on, the average alpha of this portfolio is not significantly different from zero. Finally, the long-short portfolio tells a similar story. A strategy that is long in the most illiquid stocks and short in the most liquid stocks yielded an average monthly alpha of 0.78% in Period 1. However, in the later periods, the average alphas are not significantly different from zero. Figure 3 depicts the trend of alphas over the sample priod.

A similar down-trend is revealed when we examine the long-short portfolios for the two other volume-related measures. The average alphas are significant in the earlier two periods and become insignificant in later periods. By contrast, Roll-Hasbrouck's measure does not show any liquidity-related alpha in any period, and consequently also no trend.

In Panel B we again divide the sample period into two sub-periods and compare the alpha estimates between them. The results confirm a statistically and economically significant decline in the profitability of the long, short, and long-short strategies for all three volume-related liquidity measures. These strategies appear to be unprofitable starting from the mid 1980s. By contrast, the results show no alpha (and no trend) related to Roll-Hasbrouck's measure.

To check the robustness of the results regarding the trends in alphas of the long-short portfolio we have used the Spearman and Kendall non-parametric tests applied to the time series of all 504 monthly alpha estimates. The Spearman and Kendall coefficients (not tabulated) are negative for all three volume-related measures, with p-values of less than 0.03. Thus, the null hypothesis of no trend in profitability of long-short liquidity-based portfolios is rejected. By contrast, when using Roll-Hasbrouck's measure, we cannot identify any trend using the non-parametric tests.

We next examine more closely the important relation between liquidity and firm size. Prior research has pointed out that the effect of firm size on expected returns has declined since the early 1980s (e.g., Fama and French (1992), Dichev (1998), and Schwert (2003)). Our Fama-MacBeth regressions control for firm size, already taking any trends in this variable into account. In our portfolio analysis we have taken into account the sensitivity of our liquidity-based portfolios to systematic size effects by adjusting for the SMB factor. Still, a concern is that the results obtained so far somehow reflect a size effect in a non-linear fashion.

To check whether this is indeed the case, we repeat the prior analysis by first sorting stocks by firm size. That is, for each month in our sample period we sort the stocks into five size quintiles. We then construct five liquidity-based long-short portfolios as above within each size quintile. The portfolios are rebalanced annually. The idea is that if size effects are driving the decline in the profitability of liquidity-based portfolios, then sorting first by firm size would eliminate the liquidity effect within each size quintile. By contrast, if we do see a decline in the profitability of liquidity-based portfolios within the size quintiles, then this effect is independent of documented trends in the size effect.

Table 9 reports separate four-factor alpha averages for liquidity-based long-short portfolios within each size quintile for each liquidity measure. Sizes 1-5 refer to the smallest to largest quintiles, respectively. The results confirm that the decline in the liquidity effect applies to all firm sizes for the three volume-related liquidity measures.

Consider for example the results for Amihud's measure. In the first period (1964–1973), the average alphas are positive and significant both statistically and economically within all size quintiles. By contrast, the average alphas are not significantly different from zero for all size quintiles in the last period (1996–2005). The size quintiles do differ to some extent in the path of the decline in alphas. Qualitatively, similar results apply to turnover and dollar volume.

Panel B divides the sample period into two sub-periods. Out of the 15 size quintiles related to Amihud's, turnover, and dollar volume measures, 14 show alphas that are positive and significant in the first sub-period. In sharp contrast, in the second sub-period, 10 out of the 15 show alphas that are not significantly different from zero. And in all five cases in which the alphas are still significant in the second period, their magnitude appears smaller compared to the first period.

To perform a formal test regarding the difference between the two periods we constructed a "balanced portfolio" that has equal weights in each of the five long-short portfolios for each measure. In contrast to the portfolios in Table 8, this portfolio is forced to have stocks from all size quintiles. We then estimated the average alphas on the balanced portfolio in both sub-periods. For Amihud's measure, the average monthly alpha in the first sub-period is 0.47% with a t-stat of 4.14, whereas in the second sub-period the average alpha is 0.18% and just marginally insignificant. The difference between the two is significant with a t-stat of 1.96 and Wilcoxon value of 1.76. Qualitatively similar (though statistically a bit weaker) results hold for the two other volume-related measures. By contrast, Roll-Hasbrouck's measure again does not show a significant alpha for any size quintile and any of the periods. Naturally, this measure also does not show a trend.

Overall, these results confirm that the decline in the profitability of liquidity-based portfolios is intact even accounting for time trends in the size effect, and it applies to all size levels. Volume-related measures of liquidity yield statistically and economically significant alphas in the first half of our sample period. These alphas have significantly declined in the second sub-period.

5 Possible Explanations and Discussion

The empirical results presented so far call for an explanation. Why would the sensitivity of returns to liquidity and liquidity premia decline over the years? We suggest two *possible* explanations related to changes and innovations in financial markets in recent decades.

5.1 Hedge Funds

Hedge funds are often organized as partnerships in which investments are often locked for long periods. Some hedge funds require an advance notice of several months before investors can withdraw their investments. This allows hedge funds to maintain relatively long investment horizons. In the presence of liquidity premia, a natural strategy for hedge funds is to short liquid stocks and long illiquid stocks, holding this position for an extended period of time.[9] The long trading horizon enables the hedge-fund to benefit from the liquidity premium without having to liquidate the short position early.

Long-short equity-neutral trading strategies associated with liquidity hedges have become very popular in hedge-funds. Hedge funds provide liquidity to markets. They buy illiquid stocks and sell liquid stocks, and the liquidity premium shows up in the return they provide to their investors. Of course, the proliferation of hedge funds and the high arbitrage activity of this kind are expected to diminish the liquidity premium. Put differently, higher competition in the hedge fund industry reduces profit margins in the "business" of providing liquidity to markets. We thus conjecture that the proliferation of hedge funds in the past few decades has contributed to the decline in liquidity premia as documented in this paper.

5.2 Index Funds and Exchange-Traded Funds

Index funds and exchange-traded funds (ETFs) allow investors to buy and sell illiquid assets indirectly for low transaction costs (see a similar argument in Cherkes, Sagi, and Stanton (2008) in the context of closed-end funds). For example, direct investment in Russell 2000 stocks is quite expensive in terms of transaction costs. However, Russell 2000 ETFs (e.g., IWM) are highly liquid, presumably because (as in

[9] This strategy is also consistent with arbitraging mis-pricing as in Baker and Stein (2004). In their model, liquidity is related to overpricing of stocks driven by investors' sentiment.

Subrahmanyam, 1991) there is almost no information trading in ETFs.[10] The ETFs and index funds themselves are long-term holders of the illiquid stocks, and thus incur only low transaction costs over the long run. They employ a passive trading strategy, and trade only following index changes or as a result of significant mismatches between inflows and outflows. While these instruments charge management fees that can be avoided by direct investment in the underlying stocks, these management fees are typically very low.[11]

Index funds and ETFs enable short-term investors to invest indirectly in illiquid tocks at low cost. As a result, in the presence of index funds and ETFs, direct investors in illiquid stocks are more likely to be long-term investors. In other words, it is possible that with the proliferation of these instruments, the holding horizon of direct investors in illiquid stocks has increased. Therefore, we expect that investors' compensation for investing in illiquid stocks has declined over the years as index funds and ETFs have become more popular. Importantly, none of the existing theoretical papers suggesting the existence of illiquidity premia considers investors that are allowed to invest in illiquid stocks indirectly through liquid funds that specialize in such stocks.

The past four decades have seen the introduction and proliferation of many such investment tools. Mutual funds grew dramatically in the late 1960s, index funds were introduced in the mid 1970s, and ETFs were introduced in the 1990s. The coverage and popularity of these instruments has constantly increased over the years. Thus, we hypothesize that these tools have contributed to a decline in the sensitivity of returns to

[10] For example, during April 2006 the average relative bid-ask spread of IWM was 31 times smaller than the average relative bid-ask spread of the shares composing the index: 0.018% vs. 0.558%.
[11] For example, in 2006, the annual expense ratio of the Russell 2000 index fund of E*TRADE was 0.22%, and the expense ratio of IWM was 0.2%.

the illiquidity of individual stocks, and to a decline in the liquidity premium.

5.3 Discussion

The past 40 years have seen many technological and regulatory changes that may have contributed to improving liquidity by lowering trading costs in financial markets. Our focus in this paper, however, is on the effect of liquidity on returns, and hence on the liquidity premium. We believe that changes in the liquidity premium are associated with another trend of the past 40 years: the introduction and proliferation of new financial tools such as hedge funds, index funds, and ETFs among others.

It appears to us that the arbitrage activity of hedge funds and the presence of low cost diversification tools such as index funds and ETFs lower the compensation investors receive for holding illiquid assets. Importantly, these arguments do not suggest that liquidity premia should completely vanish. Rather, they offer a plausible explanation for their decline.

Furthermore, while the decline in liquidity premia (those associated with volume-related measures) appears to be an empirical regularity, the validity of our suggested explanations cannot be easily tested. Insofar as hedge funds, index funds and ETFs were introduced and gained popularity slowly over the years, it is not possible to identify a single abrupt structural change that induced a decline in liquidity premia, which rules out an event study approach. Still, we view these explanations as economically plausible scenarios that are consistent with the empirical results.

6 Conclusion

Using NYSE common-stock data between 1964 and 2005 and volume-related liquidity measures, we find that both the sensitivity of returns to liquidity and liquidity premia have significantly declined over the past four decades. In fact, starting from the mid 1980s we cannot identify a significant liquidity premium. As profitability of liquidity-based trading strategies has declined significantly for all firm sizes, the results are orthogonal to trends in the size effect.

A caveat is nevertheless in order. For the technical reasons explained above, our sample excludes NASDAQ stocks and stocks with less than 150 trading days in a given year and does not therefore include the most illiquid stocks. Hence, despite our inability to identify a liquidity premium in the more recent periods, a fair interpretation of our results should not be that the liquidity premium has vanished. Our results do suggest, however, that the liquidity premium has significantly declined over the years.

We suggest two possible explanations for these results. It is possible that hedge-funds being long-term investors have been arbitraging the liquidity premium. It is also possible that many investors have moved to investing in illiquid stocks indirectly through index funds and ETFs, bypassing the high transaction costs, and prolonging the investment horizon of the marginal investor in these stocks.

The results have important implications for valuation and asset management. A reduction of the average annual liquidity premium from 1.8% to 0% implies a very large price effect (depending on the discount rate and the expected dividend growth).[12] Thus, our results seem to be related to the conclusion of Dimson, Marsh, and Staunton (2003) that a part of the realized equity returns in the second half of the 20th century is due to a

[12] The estimated average monthly Amihud liquidity premium during 1964-1973 was 0.15% (1,8% annually). See Table 4.

reduction in the equity discount rates. Our findings suggest that a portion of this reduction may have been due to the decline of the liquidity components in expected returns. On the asset management side the results raise a question regarding the profitability of liquidity-based strategies (at least for NYSE stocks), which have become very popular in the years since Amihud and Mendelson's (1986) seminal paper.

Finally, it has been argued that other attributes of firms such as disclosure policy may affect their cost of capital (and value) through its effect on liquidity. These claims should be evaluated in light of our findings.

References

Acharya, V. V. and L. H. Pedersen, 2005, Asset pricing with liquidity risk, *Journal of Financial Economics* 77, 375–410.

Amihud, Y., 2002, Illiquidity and stock returns: Cross-section and time series effects, *Journal of Financial Markets* 5, 31–56.

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

Amihud, Y. and H. Mendelson, 1989, The effects of beta, bid-ask spread, residual risk and size on stock returns, *Journal of Finance* 44, 479-486.

Amihud, Y. and H. Mendelson, 1991, Liquidity, maturity and the yields on U.S. government securities, *Journal of Finance* 46, 1411–1426.

Amihud Y., H. Mendelson, and L. H. Pedersen, 2006, Liquidity and asset prices, *Foundations and Trends in Finance* 1, 269–364.

Atkins, A. and E. Dyl, 1997, Market structure and reported trading volume: Nasdaq versus the NYSE, *Journal of Financial Research* 20, 291–304.

Baker M., and J. C. Stein, 2004, Market Liquidity as a Sentiment Indicator, Journal of Financial Markets 7, 271-299.

Barclay, M. J., E. Kandel, and L. M. Marx, 1998, The effects of transaction costs on stock prices and trading volume, *Journal of Financial Intermediation* 7, 130–150.

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

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

Charoenrook, A., and J. Conrad, 2008, Identifying Risk-Based Factors, working paper, UNC and Washington University.

Cherkes, M., J. Sagi, and R. Stanton, 2008, A liquidity-based theory of closed-end funds, *Review of Financial Studies*, forthcoming.

Chordia, T., A. Subrahmanyam, and R. V. Anshuman, 2001, Trading activity and expected stock returns, Journal of Financial Economics 59, 3–32.

Chordia, T., R. Roll, and A. Subrahmanyam, 2007, Why has trading volume increased?, Working Paper, Anderson School, UCLA.

Constantinides, G. M., 1986, Capital market equilibrium with transaction costs, *Journal of Political Economy* 94, 842–862.

Datar, V. T., N. Y. Naik, and R. Radcliffe, 1998, Liquidity and stock returns: An alternative test, *Journal of Financial Markets* 1, 205–219.

Dichev, I. D., 1998, Is the risk of bankruptcy a systematic risk? *Journal of Finance* 53, 1131–1147.

Dimson, E., P. Marsh, and M. Staunton, 2003, Global evidence on the equity risk premium, *Journal of Applied Corporate Finance* 15, 8–19.

Eleswarapu, V. R., 1997, Cost of transacting and expected returns in the Nasdaq market, *Journal of Finance* 52, 2113–2127.

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

Fama, E. F. and K. R. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 47, 427–465.

Hasbrouck, J., 2006, Trading costs and returns for US equities: Estimating effective costs from daily data, Working Paper, New York University.

Jang, B., H. K. Koo, H. Liu, and M. Loewenstein, 2007, Liquidity premia and transaction costs, *Journal of Finance* 62, 2329–2366.

Kamara, A., X. Lou, and R. Sadka, 2007, The divergence of systematic liquidity and the cross-section of stock returns, Working Paper, University of Washington.

Korajczyk, R. A. and R. Sadka, 2008, Pricing the commonality across alternative measures of liquidity, *Journal of Financial Economics* 87, 45–72.

Kyle, Albert S, 1985, Continuous Auctions and Insider Trading, *Econometrica*, 53(6), 1315-35.

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

Roll, R., 1984, A simple implicit measure of the effective bid-ask spread in an efficient market, *Journal of Finance* 39, 1127–1139.

Sadka, R., 2006, Momentum and post-earnings-announcement drift anomalies: The role of liquidity risk, *Journal of Financial Economics* 80, 309–349.

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

Schwert, G. W., 2003, Anomalies and market efficiency, in *Handbook of the Economics of Finance*, edited by G. M. Constantinides, M. Harris, and R. Stulz, Elsevier Science B.V.

Shumway, T., 1997, The delisting bias in CRSP data, *Journal of Finance* 52, 327–340.

Spiegel, M. and X. Wang, 2005, Cross-sectional variation in stock returns: Liquidity and idiosyncratic risk, Yale ICF Working Paper No. 05-13, , SSRN #709781.

Subrahmanyam, A., 1991, A theory of trading in stock index futures, *Review of Financial Studies* 4, 17–51.

Vayanos, D., 1998, Transaction costs and asset prices: A dynamic equilibrium model, *Review of Financial Studies* 11, 1–58.

Table 1: Summary Statistics

The table reports the average of the monthly cross-sectional sample statistics for all the stocks in our sample. For each month in the sample we calculate the mean, median, min, max, and standard deviation. The table reports the time averages of these statistics. The sample period for the returns is 1964–2005. The sample period for the rest of the variables (explanatory variables) is 1963–2004. Ret is the CRSP monthly return adjusted for stock delisting. Amihud is Amihud's (2002) illiquidity measure adjusted for inflation presented in December 2005 prices. Turnover is the sum of monthly stock volume values divided by the average number of outstanding shares throughout the year. Lndvol is the logarithm of the annual dollar volume (in millions of dollars). Roll-Hasbrouck is the Gibbs estimator illiquidity measure as in Hasbrouck (2006). Beta is the size-sorted portfolio beta calculated each year based on daily observations using the Scholes-Williams (1977) method. Sdret is the standard deviation of the daily returns. Divyld is the dividend yield. R100 is the accumulated return over the last 100 days of the year. R100yr is the accumulated return from the beginning of the year until the last 100 days. BM is the book-to-market ratio. Size is the end-of-year market capitalization.

Variables	Mean	Median	Min	Max	Std
Ret (%)	1.20	0.73	-41.70	69.87	9.38
Amihud	0.095	0.028	0.001	1.555	0.185
Turnover	0.52	0.41	0.02	5.09	0.42
Lndvol	5.00	5.02	0.82	8.91	1.58
Roll-Hasbrouck (%)	0.46	0.37	0.07	2.37	0.31
Beta	1.03	1.04	0.87	1.18	0.10
Sdret (%)	2.17	2.02	0.67	7.02	0.82
Divyld (%)	3.95	3.40	0.10	90.72	4.97
R100 (%)	4.73	3.16	-57.13	159.56	19.90
R100yr (%)	10.58	7.27	-65.23	248.93	27.88
BM	0.81	0.72	-3.71	8.75	0.64
Size ($ million)	1,761	504	12	42,934	3,858
Obs	1,255	1,267	1,043	1,598	130

Table 2: Cross-Sectional Correlations

The table presents the average of the monthly cross-sectional Pearson's correlations from January 1964 to December 2005. Ret is the CRSP monthly return adjusted for stock delisting. Amihud is Amihud's (2002) illiquidity measure adjusted for inflation presented in December 2005 prices. Turnover is the sum of monthly stock volume values divided by the average number of outstanding shares throughout the year. Lndvol is the logarithm of the annual dollar volume (in millions of dollars). Roll-Hasbrouck is the Gibbs estimator illiquidity measure as in Hasbrouck (2006). Beta is the size-sorted portfolio beta calculated each year based on daily observations using the Scholes-Williams (1977) method. Sdret is the standard deviation of returns calculated each year based on daily observations. Divyld is the dividend yield. R100 is the accumulated return over the last 100 days of the year. R100yr is the accumulated return from the beginning of the year until the last 100 days. Lnsize is the logarithm of the end-of-year market capitalization (in millions of dollars). LnBM is the logarithm of book-to-market ratio.

Variables	Amihud	Turnover	Lndvol	Roll Hasbrouck	Beta	Sdret	Divyld	R100	R100yr	Lnsize	LnBM
Ret	0.016	-0.018	-0.021	0.008	0.011	-0.013	0.003	0.021	0.009	-0.012	0.018
Amihud		-0.18	-0.65	0.45	0.18	0.24	0.05	-0.03	-0.01	-0.59	0.23
Turnover			0.37	0.07	0.09	0.51	-0.17	0.00	0.13	-0.03	-0.06
Lndvol				-0.40	-0.37	-0.11	-0.13	0.04	0.04	0.87	-0.31
Roll-Hasbouck					0.22	0.56	0.04	-0.03	-0.02	-0.49	0.17
Beta						0.23	0.03	-0.04	0.01	-0.46	0.11
Sdret							-0.26	-0.04	0.06	-0.42	0.04
Divyld								-0.14	-0.13	-0.08	0.28
R100									0.05	0.13	-0.14
R100yr										0.04	-0.14
Lnsize											-0.33

Table 3: Fama-MacBeth Regressions over the Entire Sample Period

Each month we sort the stocks into 100 portfolios based on their previous-year Amihud, Turnover, Lndvol, and Roll liquidity measures. In each portfolio the variable values are the equally weighted average of the constituents.The table presents the mean of the coefficients from monthly cross-sectional regressions of portfolio returns on the portfolio explanatory variables (Eq. (1)). The sample period is 1964–2005, resulting in 504 monthly regressions. Amihud is Amihud's (2002) illiquidity measure adjusted for inflation presented in December 2005 prices. Turnover is the sum of monthly stock volume values divided by the average number of outstanding shares throughout the year. Lndvol is the logarithm of the annual dollar volume (in millions of dollars). Roll-Hasbrouck is the Gibbs estimator illiquidity measure as in Hasbrouck (2006). Lnsize is the logarithm of the end-of-year market capitalization (in millions of dollars). Beta is the size-sorted portfolio beta calculated each year based on daily observations using the Scholes-Williams (1977) method. Sdret is the standard deviation of daily returns. Divyld is the dividend yield. R100 is the accumulated return over the last 100 days of the year. R100yr is the accumulated return from the beginning of the year until the last 100 days. LnBM is the logarithm of book-to-market ratio. RSQ is the average of the R-squared of all the monthly regressions. The monthly liquidity premium is the product of the monthly liquidity coefficient and the monthly average liquidity measure calculated for Amihud's and Roll's measures. T-stats are reported in parentheses below the coefficient estimates.

Variables	**(1)**	**(2)**	**(3)**	**(4)**
Intercept	2.11	1.98	0.71	1.83
	(2.28)	(1.73)	(0.76)	(1.63)
Amihud	0.44			
	(1.65)			
Turnover		-0.58		
		(4.66)		
Lndvol			-0.10	
			(1.27)	
Roll-Hasbrouck				0.08
				(0.51)
Lnsize	-0.05	-0.08	0.06	-0.05
	(0.98)	(1.16)	(0.53)	(0.79)
Beta	-0.45	-0.50	0.60	-0.25
	(0.66)	(0.57)	(0.84)	(0.30)
Sdret	-0.18	0.00	-0.10	-0.13
	(1.69)	(0.00)	(0.90)	(1.21)
Divyld	-0.01	0.01	0.00	-0.02
	(0.69)	(0.35)	(0.25)	(0.87)
R100	0.01	0.01	0.01	0.01
	(3.34)	(1.86)	(3.31)	(3.51)
R100yr	0.00	0.00	0.00	0.00
	(0.03)	(1.97)	(0.87)	(1.86)
LnBM	0.30	0.12	0.25	0.30
	(3.70)	(1.42)	(2.86)	(3.44)
RSQ	0.239	0.267	0.230	0.220
Liquidity Premium (%)	0.024			0.030
t-stat	(1.30)			(0.44)

Table 4: Fama-MacBeth Regressions — Four Sub-Periods

Each month we sort the stocks into 100 portfolios based on their previous-year Amihud, Turnover, and Roll liquidity measures. In each portfolio the variable values are the equally weighted average of the portfolio constituents. The table presents the mean of the coefficients from monthly cross-sectional regressions of portfolio returns on the portfolio explanatory variables (Eq. (1)). The sub-periods are 1964–1973, 1974–1984, 1985–1995, and 1996–2005. Amihud is Amihud's (2002) illiquidity measure adjusted for inflation presented in December 2005 prices. Turnover is the sum of monthly stock volume values divided by the average number of outstanding shares throughout the year. Roll-Hasbrouck is the Gibbs estimator illiquidity measure as in Hasbrouck (2006). Lnsize is the logarithm of the end-of-year market capitalization (in millions of dollars).Beta is the size-sorted portfolio beta calculated every year based on daily observations using the Scholes-Williams (1977) method. Sdret is the standard deviation of the returns calculated every year based on daily observations. Divyld is the dividend yield. R100 is the accumulated return over the last 100 days of the year. R100yr is the accumulated return from the beginning of the year till the last 100 days. LnBM is the logarithm of book-to-market ratio. RSQ is the average of the R-squared of all the monthly regressions in a period. The monthly liquidity premium is the product of the monthly liquidity coefficient and the monthly average liquidity measure calculated for Amihud's and Roll's measures. T-stats are reported in parentheses below the coefficient estimates.

Variables	(1)				(2)				(3)			
	64-73	74-84	85-95	96-05	64-73	74-84	85-95	96-05	64-73	74-84	85-95	96-05
Intercept	2.01	2.26	0.65	3.66	3.02	2.08	0.57	2.38	3.41	-0.34	2.70	1.68
	(0.93)	(1.08)	(0.37)	(2.88)	(1.29)	(0.79)	(0.25)	(1.38)	(1.52)	(0.13)	(1.13)	(0.99)
Amihud	2.54	-0.21	0.04	-0.50								
	(3.01)	(0.67)	(0.12)	(0.90)								
Turnover					-0.89	-1.26	-0.11	-0.03				
					(3.67)	(3.70)	(0.62)	(0.16)				
Roll-Hasbrouck									0.17	-0.04	0.16	0.03
									(0.49)	(0.17)	(0.61)	(0.08)
Lnsize	-0.10	-0.21	0.16	-0.06	-0.24	-0.25	0.18	0.01	-0.18	-0.13	0.08	0.02
	(0.75)	(1.89)	(1.96)	(0.71)	(1.53)	(1.79)	(1.71)	(0.09)	(1.20)	(0.87)	(0.90)	(0.14)
Beta	-0.70	0.47	0.33	-2.07	-1.31	-0.26	0.23	-0.76	-1.80	2.61	-0.97	-1.05
	(0.44)	(0.33)	(0.28)	(1.61)	(0.80)	(0.14)	(0.13)	(0.43)	(1.11)	(1.54)	(0.54)	(0.68)
Sdret	-0.25	-0.02	-0.21	-0.24	0.04	0.45	-0.37	-0.13	-0.18	-0.08	-0.24	-0.03
	(1.06)	(0.08)	(1.10)	(1.14)	(0.14)	(1.81)	(1.85)	(0.51)	(0.71)	(0.37)	(1.30)	(0.11)
Divyld	-0.01	-0.02	-0.05	0.02	0.02	0.05	0.00	-0.04	-0.04	-0.01	-0.04	0.02
	(0.27)	(0.49)	(1.48)	(0.34)	(0.48)	(1.56)	(0.12)	(0.80)	(0.92)	(0.33)	(1.14)	(0.30)
R100	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01
	(1.06)	(0.83)	(3.12)	(1.38)	(0.57)	(1.08)	(1.14)	(0.87)	(1.32)	(1.46)	(2.83)	(1.25)
R100yr	0.01	0.00	0.00	-0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
	(1.55)	(0.02)	(0.64)	(2.33)	(2.38)	(0.99)	(0.34)	(0.01)	(1.79_	(1.24)	(0.42)	(0.11)
LnBM	0.13	0.48	0.46	0.08	0.13	0.29	0.02	0.05	0.19	0.56	0.48	-0.07
	(1.38)	(2.54)	(2.89)	(0.46)	(1.36)	(1.37)	(0.12)	(0.26)	(1.90)	(2.60)	(2.83)	(0.41)
RSQ	0.23	0.26	0.22	0.25	0.35	0.27	0.20	0.25	0.23	0.25	0.19	0.21
Liquidity Premium (%)	0.15	-0.04	0.01	-0.02					0.06	-0.03	0.07	0.02
t-stat	(2.87)	(0.95)	(0.60)	(0.97)					(0.43)	(0.24)	(0.58)	(0.13)

Table 5: Fama-MacBeth Regressions — Two Sub-Periods

Each month we sort the stocks into 100 portfolios based on their previous-year Amihud, Turnover, and Roll liquidity measures. In each portfolio the variable values are the equally weighted average of the portfolio constituents. The table presents the mean of the coefficients from monthly cross-sectional regressions of portfolio returns on the portfolio explanatory variables (Eq. (1)). The sub-periods are 1964–1984 and 1985–2005. Amihud is Amihud's (2002) illiquidity measure adjusted for inflation presented in December 2005 prices. Turnover is the sum of monthly stock volume values divided by the average number of outstanding shares throughout the year. Roll-Hasbrouck is the Gibbs estimator illiquidity measure as in Hasbrouck (2006). Lnsize is the logarithm of the end-of-year market capitalization (in millions of dollars).Beta is the size-sorted portfolio beta calculated every year based on daily observations using the Scholes-Williams (1977) method. Sdret is the standard deviation of the returns calculated every year based on daily observations. Divyld is the dividend yield. R100 is the accumulated return over the last 100 days of the year. R100yr is the accumulated return from the beginning of the year till the last 100 days. LnBM is the logarithm of book-to-market ratio. RSQ is the average of the R-squared of all the monthly regressions in a period. The monthly liquidity premium is the product of the monthly liquidity coefficient and the monthly average liquidity measure calculated for Amihud's and Roll's measures. T-stats are reported in parentheses below the coefficient estimates.

Variables	(1)		(2)		(3)	
	64-84	85-05	64-84	85-05	64-84	85-05
Intercept	2.14	2.08	2.53	1.43	1.45	2.21
	(1.43)	(1.89)	(1.43)	(0.98)	(0.85)	(1.49)
Amihud	1.10	-0.22				
	(2.51)	(0.71)				
Turnover			-1.08	-0.07		
			(5.11)	(0.58)		
Roll-Hasbrouck					0.06	0.10
					(0.29)	(0.43)
Lnsize	-0.16	0.05	-0.25	0.10	-0.15	0.05
	(1.84)	(0.91)	(2.36)	(1.27)	(1.46)	(0.68)
Beta	-0.09	-0.82	-0.76	-0.24	0.51	-1.01
	(0.09)	(0.94)	(0.61)	(0.19)	(0.43)	(0.84)
Sdret	-0.13	-0.23	0.25	-0.25	-0.13	-0.14
	(0.82)	(1.59)	(1.39)	(1.62)	(0.77)	(0.96)
Divyld	-0.01	-0.01	0.04	-0.02	-0.03	-0.01
	(0.53)	(0.46)	(1.25)	(0.74)	(0.91)	(0.37)
R100	0.01	0.02	0.01	0.01	0.01	0.01
	(1.32)	(3.30)	(1.19)	(1.44)	(1.97)	(2.95)
R100yr	0.00	0.00	0.01	0.00	0.01	0.00
	(1.09)	(1.10)	(2.39)	(0.24)	(2.15)	(0.40)
LnBM	0.31	0.28	0.22	0.03	0.38	0.22
	(2.88)	(2.37)	(1.78)	(0.26)	(3.14)	(1.74)
RSQ	0.25	0.23	0.31	0.23	0.24	0.20
Liquidity Premium (%)	0.055	-0.008			0.013	0.046
t-stat	(1.71)	(0.48)			(0.14)	(0.47)
t-stats of:						
Liquidity coefficient differences		2.47		4.16		0.14
Liquidity premium differences		1.74				0.24
Wilcoxon test of:						
Liquidity coefficient differences		2.31		4.28		0.12
Liquidity premium differences		2.02				0.14

Table 6: Non-Parametric Tests for Trend

The table presents the Spearman and Kendall non-parametric tests for trends applied to the 504 monthly estimates obtained from model (3). We apply the non-parametric tests to the coefficient estimates of Amihud, Turnover, and Roll-Hasbrouck liquidity measures. The test of the liquidity premium is only to the Amihud measure. Parametric Pearson's correlations are reported for completeness. P-values, reported in parentheses below the coefficient estimates, test against the null hypothesis of no trend.

	Coefficients			Liquidity Premium
	Amihud	Turnover	Roll-Hasbrouck	Amihud
Spearman	-0.16	0.18	0.00	-0.15
p-value	(0.00)	<.0001	(0.92)	(0.00)
Kendall	-0.11	0.11	0.00	-0.10
p-value	(0.00)	(0.00)	(0.96)	(0.00)
Pearson	-0.15	0.16	0.00	-0.13
p-value	(0.00)	(0.00)	(0.93)	(0.00)

Table 7: Monthly Excess Return Averages of Liquidity-Based Portfolios
In each year between 1964 and 2005 we sort the stocks into ten deciles based on their previous-year Amihud, Turnover, Lndvol, and Roll-Hasbrouck liquidity measures. The top decile consists of the most illiquid stocks and the bottom decile consists of the most liquid stocks. We construct three portfolios: The top decile portfolio assigns equal weights to the most illiquid stocks; the bottom decile portfolio assigns equal weights to the most liquid stocks; and the top-minus-bottom portfolio is long in the top decile and short in the bottom decile portfolios. The portfolios are rebalanced annually. Panel A reports the average monthly excess returns (returns less risk-free rate) for each of the three portfolios during the four sub-periods 1964–1973, 1974–1984, 1985–1995, and 1996–2005. Panel B reports the average monthly excess returns over the periods 1964–1984 and 1985–2005.

Panel A – Four sub-periods

Amihud

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-73	0.87%	1.64	0.06%	0.13	0.81%	2.67
74-84	1.63%	2.76	0.18%	0.40	1.46%	3.56
85-95	0.75%	1.70	0.99%	2.67	-0.24%	-0.80
96-05	0.89%	2.09	0.67%	1.57	0.23%	0.60

Turnover

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-73	0.24%	0.76	-0.22%	-0.30	0.46%	0.85
74-84	1.07%	2.67	0.71%	1.08	0.36%	0.98
85-95	0.72%	2.20	0.50%	0.93	0.23%	0.78
96-05	1.01%	3.07	0.64%	0.97	0.36%	0.80

Lndvol

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-73	0.76%	1.70	-0.04%	-0.07	0.79%	2.74
74-84	1.62%	3.12	0.22%	0.46	1.40%	3.81
85-95	0.78%	1.93	0.91%	2.33	-0.13%	-0.52
96-05	0.93%	2.44	0.71%	1.48	0.22%	0.56

Roll-Hasbrouck

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-73	0.53%	0.84	0.37%	0.90	0.17%	0.51
74-84	1.54%	2.21	0.63%	1.37	0.91%	2.17
85-95	0.69%	1.40	0.92%	2.62	-0.23%	-0.79
96-05	1.02%	1.86	0.75%	2.25	0.27%	0.74

Panel B – Two sub-periods

Amihud

Years	Top Decile		Bottom Decile		Top minus Bottom	
	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-84	1.27%	3.19	0.12%	0.39	1.15%	4.45
85-05	0.82%	2.66	0.84%	2.99	-0.02%	-0.07
t-stat	0.90		1.72		3.34	
Wilcoxon	0.46		2.25		3.15	

Turnover

Years	Top Decile		Bottom Decile		Top minus Bottom	
	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-84	0.67%	2.61	0.26%	0.54	0.41%	1.27
85-05	0.86%	3.71	0.57%	1.35	0.29%	1.11
t-stat	0.53		0.47		0.29	
Wilcoxon	1.41		0.70		0.33	

Lndvol

Years	Top Decile		Bottom Decile		Top minus Bottom	
	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-84	1.21%	3.51	0.10%	0.29	1.11%	4.70
85-05	0.85%	3.06	0.82%	2.66	0.03%	0.15
t-stat	0.81		1.54		3.29	
Wilcoxon	0.41		1.95		2.96	

Roll-Hasbrouck

Years	Top Decile		Bottom Decile		Top minus Bottom	
	Excess Return	t-stat	Excess Return	t-stat	Excess Return	t-stat
64-84	1.06%	2.24	0.51%	1.63	0.56%	2.07
85-05	0.85%	2.32	0.84%	3.47	0.01%	0.03
t-stat	0.36		0.85		1.59	
Wilcoxon	0.27		1.37		1.27	

Table 8: Averages of Out-of-Sample Four-Factor Alphas of Liquidity-Based Portfolios

In each year between 1964 and 2005 we sort the stocks into ten deciles based on their previous-year Amihud, Turnover, Lndvol, and Roll-Hasbrouck liquidity measures. The top decile consists of the most illiquid stocks and the bottom decile consists of the most liquid stocks. We construct three portfolios: The top decile portfolio assigns equal weights to the most illiquid stocks; the bottom decile portfolio assigns equal weights to the most liquid stocks; and the top-minus-bottom portfolio is long in the top decile and short in the bottom decile portfolios. The portfolios are rebalanced annually. Panel A reports the average monthly out-of-sample four-factor alphas calculated using Eq. (2) for each of the four sub-periods: 1964–1973, 1974–1984, 1985–1995, and 1996–2005. Panel B repeats the analysis for two sub-periods: 1964–1984 and 1985–2005.

Panel A – Four sub-periods

Amihud

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Alphas	t-stat	Alphas	t-stat	Alphas	t-stat
64-73	0.50%	3.87	-0.27%	-2.47	0.78%	3.97
74-84	0.27%	2.02	0.06%	0.75	0.21%	1.37
85-95	0.13%	0.83	0.10%	1.63	0.03%	0.17
96-05	-0.02%	-0.08	0.11%	0.92	-0.13%	-0.54

Turnover

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Alphas	t-stat	Alphas	t-stat	Alphas	t-stat
64-73	0.25%	2.21	-0.85%	-4.18	1.10%	4.09
74-84	0.36%	3.63	-0.33%	-1.79	0.69%	3.05
85-95	0.14%	1.24	-0.32%	-2.06	0.46%	2.17
96-05	0.14%	0.98	-0.13%	-0.54	0.27%	0.97

Lndvol

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Alphas	t-stat	Alphas	t-stat	Alphas	t-stat
64-73	0.53%	4.33	-0.50%	-3.09	1.03%	4.19
74-84	0.46%	3.45	0.03%	0.27	0.43%	2.54
85-95	0.21%	1.47	0.01%	0.18	0.20%	1.27
96-05	0.08%	0.42	0.19%	1.33	-0.11%	-0.46

Roll-Hasbrouck

	Top Decile		Bottom Decile		Top minus Bottom	
Years	Alphas	t-stat	Alphas	t-stat	Alphas	t-stat
64-73	0.18%	1.36	0.17%	2.06	0.01%	0.03
74-84	0.12%	0.71	0.23%	2.10	-0.11%	-0.54
85-95	-0.02%	-0.11	0.15%	1.66	-0.17%	-0.89
96-05	0.06%	0.29	-0.09%	-0.60	0.15%	0.67

Panel B – Two sub-periods

Amihud

Years	Top Decile Alphas	Top Decile t-stat	Bottom Decile Alphas	Bottom Decile t-stat	Top minus Bottom Alphas	Top minus Bottom t-stat
64-84	0.38%	4.07	-0.10%	-1.42	0.48%	3.87
85-05	0.06%	-0.34	0.11%	1.60	-0.05%	-0.34
t-stat	2.16		2.22		2.90	
Wilcoxon	1.69		1.56		2.33	

Turnover

Years	Top Decile Alphas	Top Decile t-stat	Bottom Decile Alphas	Bottom Decile t-stat	Top minus Bottom Alphas	Top minus Bottom t-stat
64-84	0.31%	4.12	-0.58%	-4.21	0.88%	5.08
85-05	0.14%	2.14	-0.23%	-1.63	0.37%	2.14
t-stat	1.47		1.75		2.10	
Wilcoxon	0.84		1.43		2.12	

Lndvol

Years	Top Decile Alphas	Top Decile t-stat	Bottom Decile Alphas	Bottom Decile t-stat	Top minus Bottom Alphas	Top minus Bottom t-stat
64-84	0.49%	5.44	-0.22%	-2.37	0.72%	4.85
85-05	0.15%	0.37	0.10%	1.26	0.05%	0.37
t-stat	2.37		2.64		3.28	
Wilcoxon	1.98		2.12		2.88	

Roll-Hasbrouck

Years	Top Decile Alphas	Top Decile t-stat	Bottom Decile Alphas	Bottom Decile t-stat	Top minus Bottom Alphas	Top minus Bottom t-stat
64-84	0.15%	1.38	0.20%	2.92	-0.06%	-0.42
85-05	0.02%	-0.13	0.04%	0.47	-0.02%	-0.13
t-stat	0.77		1.51		0.19	
Wilcoxon	0.27		0.86		0.36	

Table 9: Averages of Out-of-Sample Four-Factor Alphas — Portfolios Pre-Sorted by Size

In each month between 1964 and 2005 we sort the stocks in our sample to five size quintiles based on the previous end-of-year size. Sizes 1 to 5 refer to the smallest to largest size quintiles. Within each size quintile we sort the stocks into five illiquidity quintiles based on the previous year's Amihud, Turnover, Lndvol, and Roll-Hasbrouck liquidity measures. We then form five long-short liquidity-based trading portfolios, one for each size quintile. The portfolios are long in the most illiquid stocks and short in the most liquid stocks within each size quintile. The portfolios are rebalanced annually. Panel A reports the average monthly out-of-sample four-factor alphas calculated using Eq. (2) for each of the four sub-periods: 1964–1973, 1974–1984, 1985–1995, and 1996–2005. In Panel B the sample period is split into two sub-periods. The panel reports the alphas for these two sub-periods and the T-statistics of the differences between period alphas.

Panel A – Four sub-periods

Amihud

	Size 1		Size 2		Size 3		Size 4		Size 5		Balanced	
Years	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat
64-73	1.11%	4.30	0.84%	3.34	0.74%	2.93	0.46%	2.00	0.48%	2.29	0.73%	4.02
74-84	0.30%	1.20	0.46%	1.84	0.41%	1.87	-0.06%	-0.30	0.13%	0.79	0.25%	1.72
85-95	0.71%	2.90	0.60%	2.56	0.28%	1.33	0.36%	2.08	0.13%	0.93	0.41%	3.74
96-05	0.38%	1.12	-0.02%	-0.07	-0.15%	-0.57	-0.48%	-1.56	-0.14%	-0.70	-0.08%	-0.49

Turnover

	Size 1		Size 2		Size 3		Size 4		Size 5		Balanced	
Years	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat
64-73	0.94%	3.69	0.92%	3.15	0.60%	2.10	0.62%	2.13	0.70%	2.58	0.76%	3.27
74-84	0.65%	2.36	0.60%	2.61	0.48%	1.99	0.43%	1.76	0.36%	1.58	0.51%	2.95
85-95	0.90%	3.33	0.54%	2.22	0.34%	1.34	0.19%	0.93	0.15%	0.74	0.42%	2.80
96-05	0.64%	1.84	0.50%	1.50	0.16%	0.55	-0.09%	-0.28	-0.20%	-0.65	0.20%	0.95

Lndvol

	Size 1		Size 2		Size 3		Size 4		Size 5		Balanced	
Years	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat
64-73	1.22%	4.24	0.96%	3.36	0.66%	2.34	0.65%	2.44	0.56%	2.30	0.81%	3.60
74-84	0.55%	2.01	0.59%	2.39	0.59%	2.41	0.27%	1.18	0.36%	1.79	0.47%	2.84
85-95	1.11%	4.29	0.70%	3.13	0.34%	1.35	0.22%	1.08	0.10%	0.67	0.49%	3.69
96-05	0.49%	1.49	0.39%	1.24	0.08%	0.27	-0.33%	-1.12	-0.06%	-0.27	0.11%	0.57

Roll-Hasbrouck

	Size 1		Size 2		Size 3		Size 4		Size 5		Balanced	
Years	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat	Average Alpha	t-stat
64-73	0.21%	0.88	0.19%	0.87	-0.19%	-0.98	-0.09%	-0.57	-0.28%	-1.95	-0.03%	-0.28
74-84	-0.28%	-1.00	0.16%	0.75	0.04%	0.23	-0.18%	-0.97	-0.10%	-0.49	-0.07%	-0.58
85-95	0.02%	0.06	-0.24%	-1.15	0.12%	0.63	-0.07%	-0.39	-0.18%	-1.30	-0.07%	-0.61
96-05	0.20%	0.67	-0.23%	-0.91	0.10%	0.51	0.05%	0.22	0.28%	1.04	0.08%	0.52

Panel B – Two sub-periods

Amihud

Years	Size 1 Average Alpha	t-stat	Size 2 Average Alpha	t-stat	Size 3 Average Alpha	t-stat	Size 4 Average Alpha	t-stat	Size 5 Average Alpha	t-stat	Balanced Average Alpha	t-stat
64-84	0.68%	3.78	0.64%	3.62	0.57%	3.42	0.19%	1.19	0.30%	2.24	0.47%	4.14
85-05	0.55%	2.69	0.30%	1.63	0.07%	0.44	-0.04%	-0.25	0.00%	0.00	0.18%	1.75
t-stat	0.49		1.33		2.09		0.98		1.66		1.96	
Wilcoxon	0.65		1.29		2.08		0.82		1.71		1.64	

Turnover

Years	Size 1 Average Alpha	t-stat	Size 2 Average Alpha	t-stat	Size 3 Average Alpha	t-stat	Size 4 Average Alpha	t-stat	Size 5 Average Alpha	t-stat	Balanced Average Alpha	t-stat
64-84	0.79%	4.19	0.75%	4.10	0.54%	2.90	0.52%	2.77	0.52%	2.97	0.62%	4.41
85-05	0.77%	3.58	0.52%	2.57	0.25%	1.33	0.06%	0.33	-0.02%	-0.10	0.32%	2.49
t-stat	0.05		0.84		1.09		1.77		2.14		1.62	
Wilcoxon	0.18		1.05		1.15		1.39		1.88		1.50	

Lndvol

Years	Size 1 Average Alpha	t-stat	Size 2 Average Alpha	t-stat	Size 3 Average Alpha	t-stat	Size 4 Average Alpha	t-stat	Size 5 Average Alpha	t-stat	Balanced Average Alpha	t-stat
64-84	0.87%	4.37	0.76%	4.09	0.62%	3.37	0.45%	2.59	0.45%	2.91	0.63%	4.58
85-05	0.82%	3.93	0.55%	2.90	0.21%	1.13	-0.04%	-0.25	0.02%	0.17	0.31%	2.67
t-stat	0.19		0.79		1.55		2.01		2.09		1.78	
Wilcoxon	0.03		0.96		1.50		1.59		2.14		1.70	

Roll-Hasbrouck

Years	Size 1 Average Alpha	t-stat	Size 2 Average Alpha	t-stat	Size 3 Average Alpha	t-stat	Size 4 Average Alpha	t-stat	Size 5 Average Alpha	t-stat	Balanced Average Alpha	t-stat
64-84	-0.04%	-0.23	0.17%	1.14	-0.07%	-0.56	-0.14%	-1.12	-0.19%	-1.45	-0.05%	-0.63
85-05	0.10%	0.55	-0.24%	-1.45	0.11%	0.81	-0.01%	-0.06	0.04%	0.28	0.00%	0.02
t-stat	0.55		1.84		0.97		0.67		1.18		0.43	
Wilcoxon	0.40		1.66		0.75		0.72		1.15		0.55	

Figure 1: Liquidity Measures Averages over Time

Figure 1-A — Amihud Measure

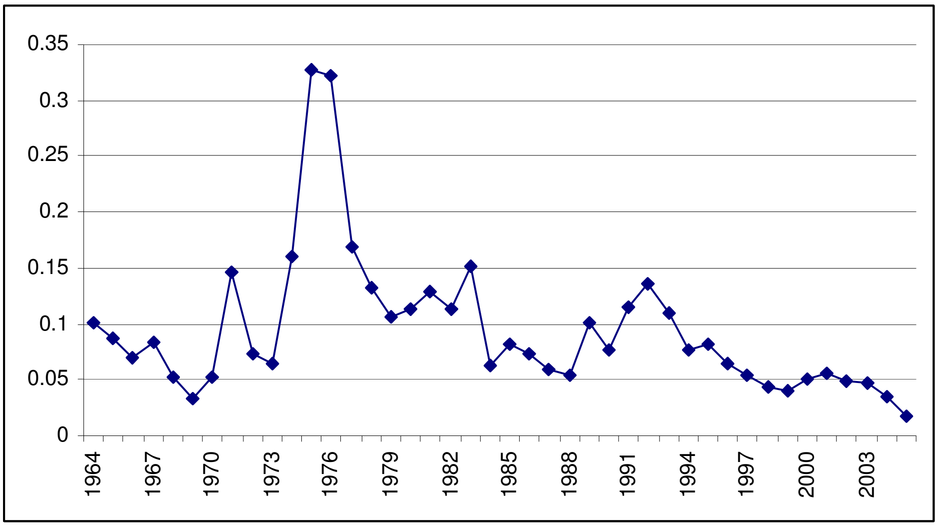

Figure 1-A presents the yearly averages of the monthly cross-sectional Amihud's illiquidity measures (Amihud) scaled for inflation in December 2005 prices.

Figure 1-B —Turnover Measure

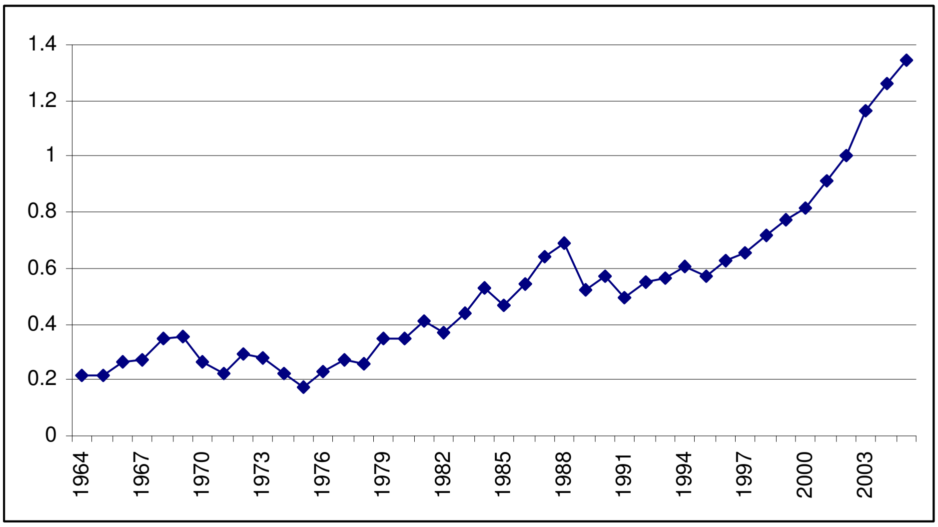

Figure 1-B presents the yearly averages of the monthly cross-sectional Turnover measure.

Figure 1-C — Lndvol Measure

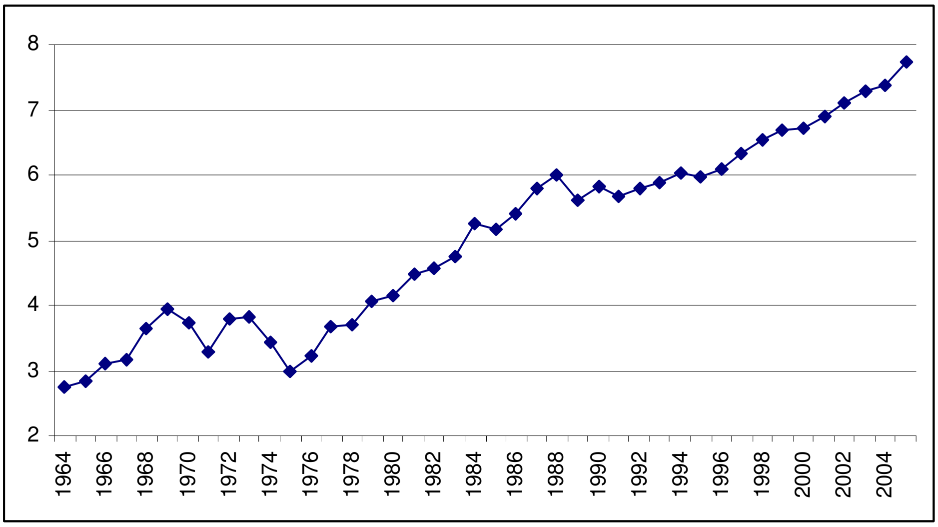

Figure 1-C depicts the yearly averages of the monthly cross-sectional Lndvol measure.

Figure 1-D — Roll-Hasbrouck Measure

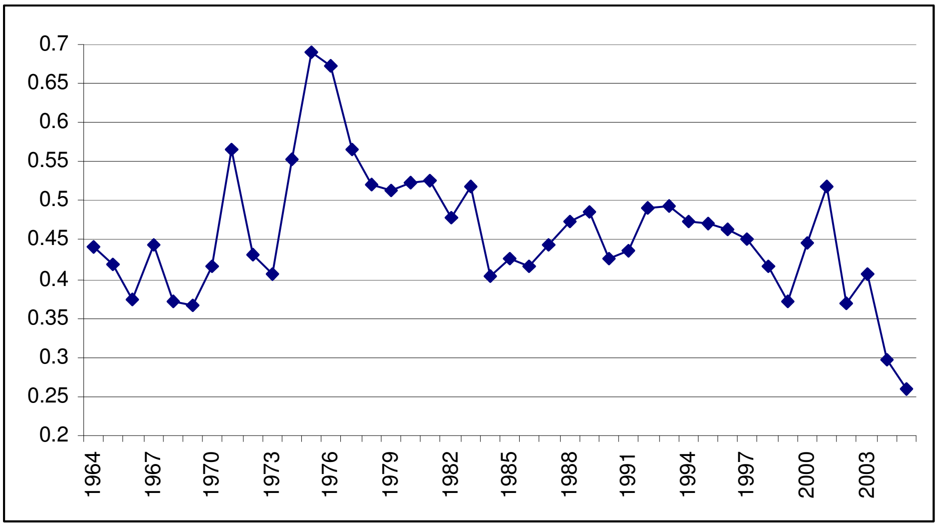

Figure 1-D depicts the yearly averages of the monthly cross-sectional Roll-Hasbrouck measure.

Figure 2: Average Illiquidity Cross-Sectional Regression Coefficients and Amihud Liquidity Premiums

Figure 2-A — Liquidity Coefficient

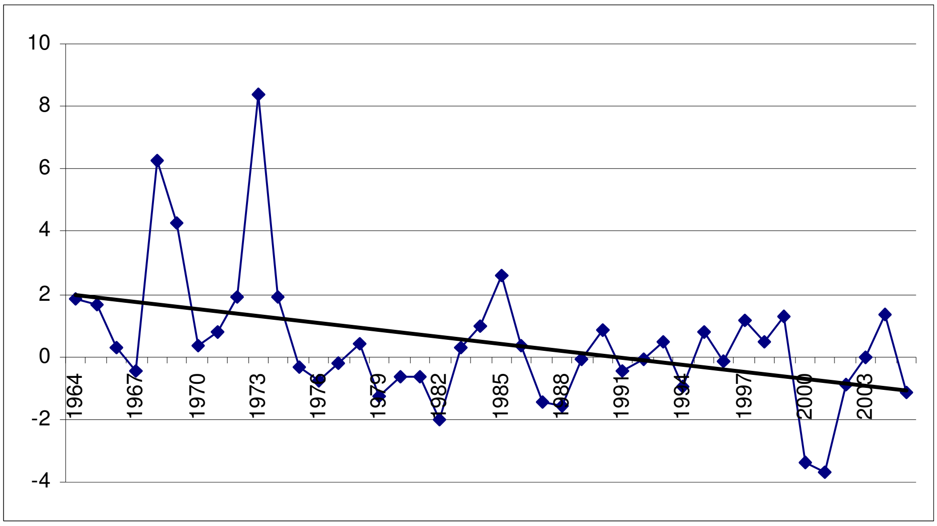

Figure 2-A depicts the yearly coefficient averages of Amihud's illiquidity from January 1964 to December 2005 based on specification (1) of Table 3.

Figure 2-B — Liquidity Premium

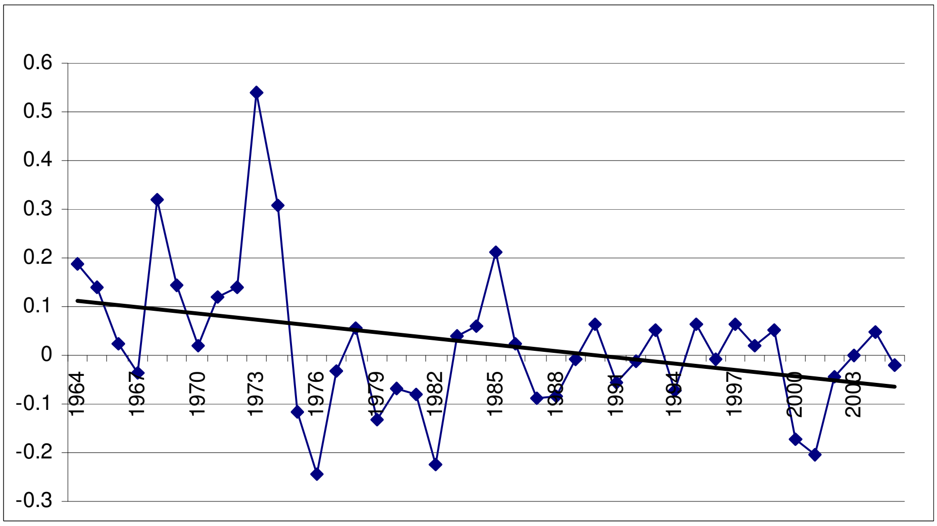

Figure 2-B depicts the 12-month average for each year of the liquidity premium measure from January 1964 to December 2005 based on specification (1) of Table 3.

Figure 3: Alphas of Long-Short Liquidity Portfolios Based on Amihud Measure

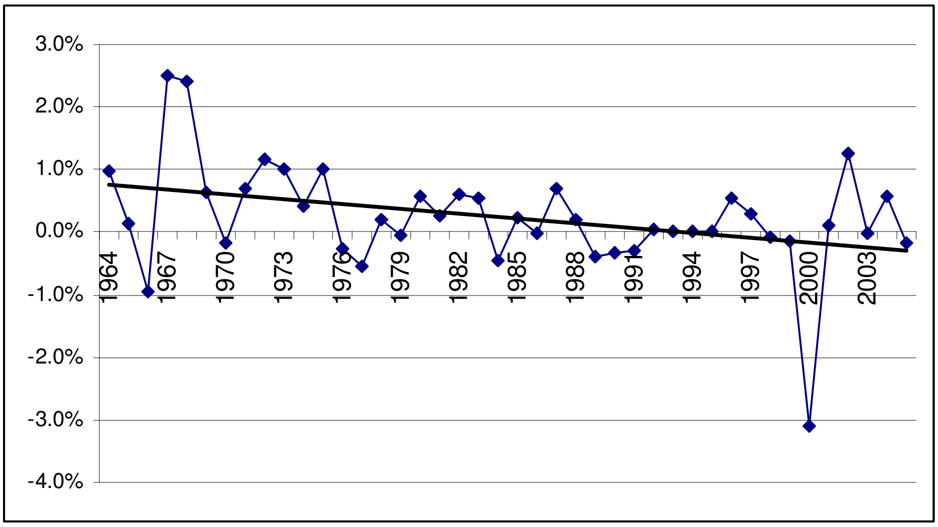

Figure 3 presents the 12-month average for each year of the four-factor alphas of a portfolio that is long in the most illiquid stocks and short in the most liquid stocks based on the Amihud measure.