Liquidity, Liquidity Risk, and the Cross Section of Mutual Fund Returns

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Abstract

This paper examines the impact of liquidity and liquidity risk on the cross-section of mutual fund returns. We find that funds with the most illiquid equity holdings outperform those with the most liquid holdings by as much as 4.44 percent annually. While funds with high liquidity beta only marginally outperform those with low liquidity beta during the full sample period, this outperformance is significantly stronger after excluding periods of extreme market illiquidity. A one standard deviation increase in liquidity beta is associated with an increase in annualized fund returns by as much as 2.04 percent. Testing the two effects jointly reveals that both independently influence fund returns. Overall, we find that both the liquidity level and liquidity risk of fund holdings are important determinants of mutual fund returns.

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I. Introduction

The liquidity characteristics of assets pervasively affect their returns. Finance theory predicts a positive relation between illiquidity and required rates of return (Amihud and Mendelson (1986)) because illiquid assets must offer a higher expected return than their liquid counterparts in order to attract investors. Moreover, since liquidity systematically varies over time (Chorida, Roll, and Subrahmanyam (2000, 2001)) theory also suggests that liquidity risk, the covariance of asset returns to innovations in market liquidity, should be priced (Acharya and Pedersen (2005)). There is considerable empirical support for a liquidity premium (Brennan and Subrahmanyam (1996), Amihud (2002), and Hasbrouck (2009)) and moderate evidence of a liquidity risk premium (Pastor and Stambaugh (2003), Sadka (2006), Watanabe and Watanabe (2008) and Hasbrouck (2009)) in equity returns.[1]

In this paper we test for the existence of liquidity and liquidity risk premia in equity mutual fund returns. There are at least three reasons why it is important to understand the impact of liquidity and liquidity risk on fund returns. First, with nearly $12 trillion dollars in assets managed at the end of 2010, U.S. mutual funds hold a large percentage of U.S. financial assets and their performance directly impacts 90 million American investors.[2] Second, one of the primary functions of mutual funds is to provide liquidity to investors through daily purchases and redemptions. Evidence suggests that this liquidity provision negatively impacts fund returns (Edelen (1999) and Alexander, Cici and Gibson (2007)). Therefore, it is interesting to see whether mutual funds that hold illiquid assets or funds with high liquidity risk exposure exhibit

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[1] Pastor and Stambaugh (2003), Sadka (2006) and Korajczyk and Sadka (2008) find evidence that liquidity risk is priced in equities. However, several studies find different results. Acharya and Pedersen (2005) find little empirical evidence of a liquidity risk premium and Hasbrouck (2009) finds no evidence. Watanabe and Watanabe (2008) find that only liquidity betas calculated during a high liquidity beta regime (approximately 10 percent of the sample) are priced in the cross section of stock returns.

[2] Investment Company Factbook (2011).

high fund returns. Finally, as managed portfolios, mutual funds provide a natural laboratory as well as an important alternative to artificially constructed portfolios for examining the liquidity and liquidity risk effects in stock returns.

We address the following four research questions. First, do funds with less liquid holdings outperform those with more liquid holdings? Second, does exposure to liquidity risk positively impact mutual fund returns? Third, do liquidity and liquidity risk effects in fund returns vary with the state of market liquidity? Finally, what is the relative importance of the liquidity and liquidity risk effects in fund returns?

We begin by examining the liquidity premium for the sample period of 1984 through 2008. First, we confirm the existence of a liquidity premium in equity returns. Regression results reveal that a one standard deviation increase in a stock's Amihud illiquidity measure is associated with an increase in raw (risk-adjusted) annualized return of 3.96 (4.20) percent during the following year. Turning to mutual funds, we measure a fund's liquidity as the dollar holdings weighted mean of either Amihud's illiquidity ratio or effective spread. An increase in a fund's Amihud measure is associated with an increase in raw (risk-adjusted) annualized net fund return by 0.60 (0.72) percent. The relation is stronger in gross fund returns, predicting a 0.84 (1.08) percent increase in returns. Finding the liquidity effect in fund returns to be smaller than that in equity returns is not surprising. First, diversified and overlapping fund holdings narrow the cross-sectional distribution of both fund liquidity and fund returns compared to equities. Second, the need to provide liquidity to fund investors and the costs of information gathering necessitate funds hold a substantial portion of their portfolios in large, liquid stocks (Daniel et al. (1997), Huang (2010)). This creates an even narrower cross-sectional distribution in fund liquidity than in equity liquidity and, therefore, a smaller dispersion in expected returns across funds sorted by liquidity. In spite of this, we find evidence of a statistically and economically significant liquidity premium in fund returns.

We next test the cross-sectional relation between liquidity risk, i.e., the covariance of asset returns with changes in market liquidity (Pastor and Stambaugh (2003) and Sadka (2010)), and expected returns. To measure liquidity risk, we estimate liquidity betas from rolling regressions of either stock or fund returns on innovations in market liquidity.[3] A fund's liquidity beta is measured either directly from regressions of fund returns ("fund liquidity betas") or as the dollar value weighted mean of fund equity holdings liquidity betas ("holdings liquidity betas"). Holdings liquidity betas are potentially superior measures of liquidity risk than fund liquidity betas for two reasons. Because holdings liquidity betas do not require fund survivorship for any period of time for rolling regressions they preserve young, often illiquid, funds in the sample. Also, stock betas aggregated to the fund portfolio level may be more precise than those estimated directly from mutual fund returns (Jiang, Yao and Yu (2007)).

We confirm the previous evidence of a liquidity risk premium in equities during our sample period. Regressions show that a one standard deviation increase in the Amihud (Sadka) liquidity beta predicts an increase in risk-adjusted annualized return of 1.80 (1.68) percent. Looking at mutual funds we find little evidence of a liquidity risk effect using fund liquidity betas. An increase in Pastor-Stambaugh (Sadka) liquidity beta is associated with a change in annualized expected risk-adjusted returns of -0.24 (0.24) percent. However, using holdings liquidity betas to measure liquidity risk we find a positive relation between liquidity risk and expected returns. For example, the top Sadka liquidity beta decile outperforms the bottom decile by a raw (risk-adjusted) annualized 3.48 (2.64) percent, which is both statistically and

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[3] Market liquidity is defined either as in Acharya and Pedersen (2005), Pastor and Stambaugh (2003) or Sadka (2006).

economically significant. Regressions reveal a uniformly positive relation, though many of the coefficients are not statistically significant. Overall, holdings liquidity betas show a generally positive, albeit weak, relation between fund liquidity risk and returns.

The previously mentioned analyses are all unconditional. However, there are strong reasons to believe that the liquidity and liquidity risk effects are time varying and dependent on market liquidity. Liquid stocks generally outperform illiquid stocks during negative market liquidity shocks (Goyenko and Sarkissian (2008), Acharya and Pedersen (2005), Jensen and Moorman (2011)). Therefore, the normally positive liquidity premium is expected to reverse during periods of high market illiquidity (Brunnermeier and Petersen (2009)). Similarly, for the liquidity risk premium, stocks with high positive liquidity betas will see large contemporaneous negative returns during liquidity crises while stocks with small or negative betas will see zero or positive abnormal returns (Vayanos (2004)).[4] Therefore, negative liquidity shocks can weaken or even invert the normally positive liquidity risk premium for short periods of time (Acharya, Amihud and Bharath (2010)). It is possible both premia exist in fund returns after excluding periods of large negative aggregate liquidity shocks, but are weakened or obscured in unconditional analysis.[5]

[4] This effect is partially mechanical, as equities with negative liquidity betas, by construction, have expected returns higher than equities with positive liquidity betas during periods of sharp declines in market liquidity. Also, demand for stocks with counter-cyclical liquidity characteristics increases during liquidity crises (flight-to-liquidity) exacerbating the mechanical weakening of the liquidity risk premium (Vayano (2004)).

[5] An illiquid asset requires a return premium, on average, to entice investor to hold the asset (Amihud and Mendelson (1986)). If illiquid assets earn abnormally negative returns during liquidity crises, then, in order to generate a liquidity premium on average, those same illiquid assets must earn a large premium during periods not in liquidity crises. A similar argument applies to a liquidity risk premium. Therefore, the fact that illiquid or high liquidity beta stocks outperform their liquid or lower beta counterparts in non-liquidity crisis periods is evidence which supports the existence of liquidity and liquidity risk premia.

We therefore introduce an indicator variable to control for periods of high unexpected aggregate illiquidity in both liquidity and liquidity risk analyses.[6] The interaction of this indicator with fund liquidity reveals a larger cross-sectional liquidity premium during non-liquidity crisis periods. Excluding months of high aggregate illiquidity, a one standard deviation increase in a fund's Amihud measure predicts an increase in annualized raw (risk-adjusted) net fund returns of 1.20 (0.48) percent. During the high illiquidity state, the liquidity effect is either non-existent or negative. Turning to liquidity risk, an increase in either Amihud or Pastor and Stambaugh holdings liquidity beta is associated with an increase in annualized risk-adjusted net and gross fund returns of at least 0.84 percent after excluding the high illiquidity state. During periods of high market illiquidity the liquidity risk effect becomes a discount of as much as -3.36 (-1.44) percent considering raw (risk-adjusted) fund returns. Overall, we find evidence that both the liquidity and liquidity risk premia are time varying, and failing to condition on this time variation can obscure their existence in fund returns.

Liquidity and liquidity risk are closely related. Illiquid assets tend to be more sensitive to changes in market liquidity (Acharya and Pedersen (2005), Watanabe and Watanabe (2008)), implying the high expected returns of illiquid assets may be due, in part or in total, to liquidity risk. It is therefore important to test the two effects jointly in order to correctly measure the individual impact of each effect on fund returns. Our final test considers both the liquidity and liquidity risk effects simultaneously in the presence of controls for negative market liquidity shocks. We find that liquidity and liquidity risk retain their previously identified statistical and economic effects on fund returns. An increase in a fund's Amihud illiquidity measure predicts and increase in raw (risk-adjusted) fund returns of 1.32 (0.36) percent. A similar increase in

[6] The top 20 percent most illiquid months of my sample are assigned to the illiquid regime. We define market illiquidity as innovations in aggregate normalized Amihud (Watanabe and Watanabe (2008)).

Pastor and Stambaugh holdings liquidity beta results in an increase in raw annualized fund return of 1.56 (0.84) percent. This evidence suggests liquidity and liquidity risk are separate effects which independently impact fund returns.

This paper makes several contributions to the mutual fund and asset pricing literatures. First, we find both the liquidity level and liquidity risk of fund holdings impact fund returns in an economically meaningful way, providing support for theories that both are priced. Second, both premia vary significantly with market liquidity. This time variation is large for liquidity and critically important for liquidity risk. Finally, we present empirical evidence suggesting it is more appropriate to measure fund liquidity risk from holdings than from fund returns.

This paper is similar to, yet distinct from, a recent paper Sadka (2010) and a concurrent paper Dong, Feng and Sadka (2011), which investigate the impact of liquidity risk on hedge fund and mutual fund returns respectively. Sadka (2010) focuses on hedge funds, which have different trading strategies and risk characteristics than mutual funds. The use of equity mutual funds in our paper allows analysis of both liquidity and liquidity risk using fund holdings, something that cannot be done in hedge funds. The primary distinction between our paper and Dong, Feng and Sadka (2011) is our use of holdings to measure liquidity and liquidity betas. As previously discussed, we find holdings liquidity betas to be superior proxies of liquidity risk to fund return based betas. Also, multivariate regressions allow for me to test the effects of liquidity and liquidity risk jointly, condition analysis on aggregate liquidity, as well as control for numerous fund characteristics which are known to impact fund returns such as fund and fund family assets, expense ratios, age and asset flows (see e.g. Chen, Hong, Huang and Kubik (2004)).[7]

[7] we find that many of these fund characteristics are also correlated with fund liquidity and liquidity beta, emphasizing the importance of controlling for them in tests.

The remainder of this paper is organized as follows. We outline data and methods in Section II. Section III analyzes the liquidity premium, Section IV analyzes the liquidity risk premium, Section V conducts conditional analysis on both and Section VI looks at them both concurrently. We conclude in Section VII.

II. Data and Methods

To construct our sample we begin with all equity mutual funds listed in the CRSP Survivorship-Bias Free Mutual Fund Database between 1984 and 2008.[8] Fund share classes are aggregated to form fund portfolios and then matched to the Thomson CDA/Spectrum holdings database using the MFLINKs file provided by the Wharton Research Database Service.[9] The holdings database imposes no minimum size or age requirements on funds or equities for inclusion, and is therefore free of survivorship bias.[10] To avoid incubation bias we include funds only after their total net assets exceed 15 million dollars (Evans (2010)).[11] we match equity holdings to the CRSP monthly stock file for price, return and volume characteristics. Finally, effective spreads are calculated from the Trade and Quote (TAQ) database for all equities reported in CRSP and matched to fund holdings. Fund returns are measured either net of expenses, as reported by CRSP, or gross, defined as net returns plus estimated monthly transaction costs (Wermers (2000), Kacperczyk, Sialm and Zheng (2008)) and one twelfth the annual expense ratio. For a more thorough discussion of our sample construction, please see Appendix A.

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[8] See Elton, Gruber and Blake (2001) and Fama and French (2010) for a discussion of the biases inherent in CRSP mutual fund returns prior to 1984.

[9] Aggregate portfolio characteristics such as return, expense ratio, load and turnover are measured as the net asset value weighted mean of fund share class values. Portfolio total net assets are the sum of share class total net assets. Portfolio age is the age of the oldest fund share class, measured from the date it first appears in CRSP.

[10] See Wermers (2000) for a thorough discussion of the CDA holdings database.

[11] Analyses have been conducted using alternative cutoffs of 5 and 10 million dollars, and similar results are found.

As shown in Panel A of Table 1, our final mutual fund sample consists of 2,480 funds with 210,110 fund month observations. Panel B reports the summary statistics of fund characteristics used in our analyses as controls.[12] Total Net Assets is as reported by CRSP. Total Family Assets is the sum of total net assets of all funds managed by the same management company. Age is measured as years since the oldest fund share class was reported in CRSP. Flow is net asset flow, and is the percent change in total net assets not explained by fund returns (implied cash flows). Max load is the larger of the front or rear end load. Cash is percent of total net assets held in cash. Expense ratio is measured as the annual charge levied against the smallest allowed investment in the fund. Turnover is annual assets traded divided by total net assets, as reported by CRSP.

Fund and portfolio returns are risk adjusted using three models. All of our analyses present results using raw returns, single factor alphas (CAPM), three factor alphas (Fama and French (1996)) and four factor alphas (Carhart (1997)). For portfolio sorting analyses, alphas are generated as the intercept from time series regressions. For regression analyses, alphas used as dependent variables are generated through the rolling regression method outlined in Carhart (1997). Every month we use the previous 60 months of returns to generate factor betas (a minimum 48 months of non-missing returns is required). Alphas are defined as the difference between realized returns and expected returns based on the estimated factor loadings.[13]

A. Liquidity Level

We employ two measures of liquidity; the Amihud measure proposed by Amihud (2002) and effective spread. Amihud is calculated from 1984 through 2008 as the monthly equal weighted mean value of daily dollar volume price impact:

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[12] Reported summary statistics are the time series means of cross-sectional summary statistics.
[13] we have also run these analyses using alphas from 36 month (Carhart (1997)) and 48 month rolling regressions and find qualitatively similar results.

$$Amihud_{i,t} = \frac{1}{n}\sum_{d=1}^{n}\frac{|ret_{i,d,t}|}{dvol_{i,d,t}} \tag{1}$$

where $ret_{i,d,t}$ is the return on day *d* in month *t* for stock *i*, $dvol_{i,d,t}$ is the daily dollar volume of stock we (in millions) and *n* is the number of days in month *t* the stock trades. As this measure is a ratio with no upper bound, we minimize extreme values by discarding monthly *Amihud* values for stocks with less than 15 trading days (Watanabe and Watanabe (2008)).[14] As a price impact measure, *Amihud* gauges how sensitive a stock's return is to trading and is, therefore, is decreasing in liquidity.

While Amihud's measure is a good low frequency proxy for liquidity (Hasbrouck (2010)), we also employ the high frequency measure of effective spread (Chordia, Roll and Subrahmanyam (2000), Goyenko, Holden and Trizcinka (2009)). Effective spread is calculated for 1993 through 2008 as the monthly dollar volume mean of transaction log effective spreads:

$$ESpread_{i,t} = \frac{1}{\sum_{\tau=1}^{n} dvol_{i,\tau,t}}\sum_{\tau=1}^{n}\left(dvol_{i,\tau,t} * 2 * \left|ln\left(P_{i,\tau,t}\right) - ln\left(M_{i,\tau,t}\right)\right|\right) \tag{2}$$

where $dvol_{i,\tau.t}$ is the dollar volume, $P_{i,\tau,t}$ is the price and $M_{i,\tau,t}$ is the quoted spread midpoint for transaction τ of stock *i*, and *n* is the number of transactions in month *t*.[15] As with Amihud's measure, higher values of effective spread (higher transaction costs) signal less liquidity.

We measure fund liquidity as the dollar holdings value weighted mean of fund equity holdings liquidity measures.[16] Yan (2008) measures fund liquidity as either dollar value weighted spreads of holdings or a proxy designed to measure the relative size of holdings to daily volume, thereby capturing both spread and price impact liquidity proxies. As the *Amihud*

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[14] As stocks with fewer than 15 trading days also have small market capitalizations, they make up a very small percentage of mutual fund assets (Daniel et al. (1997)). Therefore, this 15 day cutoff has a small impact on my results. Alternate cutoffs of 5 and 10 days produce qualitatively similar results for mutual fund analyses.

[15] Following Chorida, Roll and Subrahmanyam (2002) we remove transactions with the following attributes: quotes with negative spreads or depth, quotes with spread greater than 4 dollars or 20 percent the midpoint, trades with negative prices, trades out of sequence and trades occurring outside times the market is open.

[16] Massa and Phalippou (2005) measure fund liquidity in a similar manner, though they use a normalized *Amihud* measure (Acharya and Pedersen (2005)).

measure captures price impact and has been used in the literature to test cross-sectional pricing of liquidity, we believe using both *Amihud* and effective spread is sufficient to capture the two aspects of liquidity. Huang (2010) measures fund liquidity as percent of holdings in the bottom 1, 2 or 5 percent *Amihud* percentile. While this proxy is informative, a weighted average of holdings *Amihud* is a better proxy of liquidity for asset pricing tests. While there are a host of liquidity proxies we could use, we believe these two measures are adequate for a thorough test of liquidity's effect on asset returns.[17]

B. Aggregate Liquidity

We utilize three generally accepted proxies of aggregate liquidity. First, we measure aggregate liquidity from the equal weighted mean of normalized Amihud's measure across all common stocks (Acharya and Pedersen (2005)). Normalized Amihud's measure is defined as:

$$AmihudN_{i,t} = min\left(0.25 + 0.30Amihud_{i,t}P_{M,t-1}, 30.00\right) \tag{3}$$

where $Amihud_{i,t}$ is stock *i*'s *Amihud* measure as defined in equation (1) and $P_{M,t-1}$ is an adjustment factor, defined as the ratio of total market capitalization in month *t-1* to total market capitalization in July 1962.[18] Monthly market liquidity is then calculated as the equal weighted mean of all common equity liquidity with at least 15 trading days per month and prices between 5 and 1000 dollars at the end of the previous year (Watanabe and Watanabe (2008)). Innovations in market *AmihudN* are defined as the negative residuals from an AR(2) process.[19]

[17] Results are qualitatively similar using other high frequency measures, such as quoted spread or a measure based on Kyle's lambda (Hasbrouck (2010)), or other low frequency measures, such as Roll's measure (Roll (1984)), the Pasture and Stambaugh measure (Pastor and Stambaugh (2003)) or Gibbs measure (Hasbrouck (2010)).
[18] For a discussion of how this function normalizes the distribution of the *Amihud* measure, see Acharya and Pedersen (2005).
[19] Multiplying the AR(2) residuals by negative one is done to convert *AmihudN* from a measure of illiquidity into a measure of liquidity. Also, an AR(2) process is sufficient to make *AmihudN* stationary.

Second, we measure aggregate liquidity as the equal weighted mean of all NYSE and AMEX common equity γ values (Pastor and Stambaugh (2003)), calculated from the following stock level regression conducted monthly using daily data:

$$ExcessRet_{i,d+1,t} = \theta_{i,t} + \phi_{i,t}Ret_{i,d,t} + \gamma_{i,t}sign\left(ExcessRet_{i,d,t}\right) * v_{i,d,t} + \varepsilon_{i,d+1,t} \quad (4)$$

where $ExcessRet_{i,d+1,t}$ is stock i's return in excess of that day's CRSP value weighted market return index and $v_{i,d,t}$ is stock i's dollar volume. We then calculate monthly market liquidity as the equal value mean of all common equity γ with at least 15 trading days per month and prices between 5 and 1000 dollars at the end of the previous year (Pastor and Stambaugh (2003)). A two stage process is used to calculate innovations in aggregate liquidity. First, $\Delta\hat{\gamma}_t$ is defined as the first difference of fitted $\gamma_{i,t}$ from equation (4) scaled by the ratio of total market capitalization at time t to total market capitalization in August 1962. Second, $\Delta\hat{\gamma}_t$is regressed on $\Delta\hat{\gamma}_{t-1}$ and scaled $\hat{\gamma}_{t-1}$. Innovations in aggregate Pastor-Stambaugh ("*PS*") liquidity are defined as the residual from the regression in the second step. For a more detailed discussion of the process, see Pastor and Stambaugh (2003).[20]

Third, we measure market liquidity as the equal weighted mean of the stock level Sadka permanent variable component measure (Sadka (2006)). Constructed from transaction level data from 1983 through 2008, using ISSM and TAQ, four price impact components are generated (permanent fixed, transitory fixed, permanent variable and transitory variable). As Sadka (2006) finds only the permanent variable component is priced in equities, the Sadka market liquidity measure is calculated as the equal weighted mean of the permanent variable component. As in

[20] we use the Pastor-Stambaugh market liquidity measure provided by the Wharton Research Database Service.

Sadka (2010), innovations in market liquidity are defined as the negative residuals from an AR(3) process.[21]

C. Liquidity Risk

We estimate equity liquidity betas from rolling regressions as in Sadka (2010). Time-varying betas are measured as the β_L regression coefficient from the following model:

$$RETRF_{i,t} = \alpha_{i,k} + \beta_{i,k,L} LiqInnov_t + \beta_{i,k,M} MKTRF_t + \beta_{i,k,S} SMB_t$$
$$+\beta_{i,k,H} HML_t + \beta_{i,k,U} UMD_t + \varepsilon_{i.k} \qquad (5)$$

where $RETRF_{i,t}$ is a stocks return in excess of the risk free rate, $LiqInnov_t$ is the innovation in market liquidity (measured by either *AmihudN*, *PS* or *Sadka*), and $MKRTF_t$, SMB_t, HML_t, UMD_t are the traditional measures from the four factor model (Fama and French (1996), Carhart (1997)).[22] The liquidity beta in month k, $\beta_{i,k,L}$, is calculated using the prior 60 months (minimum 48 months)[23] of returns.[24]

Liquidity betas for funds are generated in two ways. Initially we use equation (5), regressing fund excess net returns on innovations in market liquidity. We refer to these as fund liquidity betas. We also measure fund liquidity risk as the dollar value weighted mean of equity holdings liquidity betas. We refer to these as holdings liquidity betas. While we use both betas in our initial liquidity risk tests, there are several reasons to expect holdings liquidity betas to be superior proxies of liquidity risk in asset pricing tests to fund liquidity betas. The requirement of

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[21] See Sadka (2006) for a thorough discussion of the construction of the Sadka market liquidity measure. We use the permanent variable component provided by Ronnie Sadka through the Wharton Research Database Service.

[22] MKTRF, SMB, HML and UMD factors are provided by the Wharton Research Database Service. MKTF, SMB and HML can be directed downloaded from Kenneth French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_bench_factor.html

[23] we require a minimum 48 months of non-missing return observations during that 60 month window. Since the Sadka market liquidity measure is only available starting in 1983, and we require a minimum 48 months of returns to generate betas, the sample of Sadka betas spans 1987 through 2008 unlike the AmihudN and PS betas which span 1984 through 2008.

[24] These analyses have been replicated using liquidity betas generated from a model including only the market risk premium (as in Watanabe and Watanabe (2008) and Sadka (2010)) and produce qualitatively similar results.

at least 48 months of returns to generate fund liquidity betas removes funds from our analysis during their formation years, when they have smaller total net assets and are more likely to hold riskier stocks. This narrows the cross-sectional dispersion in liquidity risk across funds and weakens the magnitude of the relation between liquidity risk and expected returns. Holdings liquidity betas do not suffer from this problem, as we am able to assign betas to funds the first month they enter the sample.[25] Second, stock betas aggregated to the fund portfolio level may be more precise than those generated directly from mutual fund returns (Jiang, Yao and Yu (2007)).

III. Liquidity Premium

While there is considerable research suggesting liquidity is priced in equities, current evidence is mixed concerning the relation between liquidity and fund returns. Massa and Phalippou (2005) and Yan (2008) find evidence of a liquidity premium conditioned on high market liquidity and small fund size, respectively, while Khandani and Lo (2009) finds no evidence for the premium utilizing a return auto-correlation proxy of fund liquidity. We first confirm the liquidity premium in equities during our sample period, then examine whether a cross-sectional dispersion in fund holdings liquidity results in a fund level liquidity premium.

Table 2 reports analysis based on all common stocks in CRSP with monthly share prices in excess of 1 dollar. In Panel A we sort equities at the end of every December into decile portfolios by their mean illiquidity during that year and hold those portfolios for the following year. The table reports the equal weighted mean monthly liquidity measures and realized returns for these portfolios. We find a very large dispersion in liquidity across stocks. The highest illiquidity portfolio has an *Amihud* measure over four thousand times larger than the bottom

[25] we am able to assign holdings liquidity betas to each of the 210,110 fund observations in my sample, but only 142,721 observations using fund liquidity betas.

portfolio. Turning to effective spreads we find a 4.10 percent difference in spread between the top and bottom portfolios. This reinforces the notion that trading the most illiquid assets requires either extensive private information or long holding periods to be profitable (Amihud and Mendelsen (1986)).

Looking at portfolio returns in Panel A reveals two important results. First, the cross-sectional liquidity premium is economically substantial and not driven merely by the extreme portfolios. The four factor alpha of the difference in returns between the ninth and second decile portfolios is 37 basis points per month. The second interesting finding is the non-monotonicity of the effect. For instance, looking again at *Amihud* portfolio four factor alphas, the difference between any portfolio and the bottom liquidity portfolio doesn't become positive until the seventh decile or significant until the ninth. The important implication of this finding, applied to portfolios, is that the cross-sectional dispersion in liquidity required to measure a statistically and economically significant liquidity premium is substantial.

Panel B of Table 2 tests liquidity and equity returns with regressions using the same sample as Panel A. Excess and risk-adjusted stock returns are regressed on lagged annual mean illiquidity standardized with a mean of zero and a unit standard deviation, utilizing both Fama-MacBeth regressions and pooled OLS.[26] The results align with the portfolio sorting analysis, showing liquidity has a large effect on expected returns. A one standard deviation increase in *Amihud* (effective spread) is associated with an increase in expected returns of as much as 37 (38) basis points per month. The economic magnitude of these results is large and in line with

[26] Standard errors for panel regressions are clustered by time (monthly) and firm (Pedersen (2009)).

similar studies (Brennan, Chordia and Subrahmanyam (1998), Amihud (2002), Goyenko, Holden and Trzcinka (2009)). [27]

We next analyze the effect of liquidity on mutual fund returns. Given strong evidence of a liquidity premium in equity returns, the expectation is that illiquid funds will outperform liquid funds. However, the substantial transaction costs associated with trading illiquid equities may depress the returns of illiquid funds, weakening or eliminating the liquidity premium in net fund returns. Panel A of Table 3 reports fund characteristics sorted by fund *Amihud* measure. As expected, we find strong correlation between liquidity and several fund attributes. Funds with less liquid holdings (higher mean *Amihud* illiquidity ratio) hold more cash, have smaller total assets, have larger cash inflows, are younger and charge higher expenses but lower loads.[28] An intriguing finding is the lack of positive correlation between holdings illiquidity and turnover ratio. Theory suggests investors with longer expected holding periods will hold more illiquid assets (Amihud and Mendelson (1986)). However, it is difficult to draw inferences from this result, as we do not know the composition of the assets turned over.[29] What is important to learn from Panel A is that, as many of these characteristics are known to impact fund returns (Chen, Hong, Huang and Kubik (2004)), it will be important to control for these fund characteristics with a multivariate analysis to accurately test the liquidity premium.

Panels B and C of Table 3 report the liquidity values and returns (both net and gross) of decile fund illiquidity portfolios. We find the cross-sectional dispersion in liquidity across funds is much smaller than that across equities. While in equities there is a difference of 8.636 between

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[27] When, as in other studies, traditional asset pricing control variables are included (i.e. logged market capitalization, book-to-market ratio, return standard deviation and lagged returns) the magnitude of the liquidity premium we find is very similar to those studies. As my primary concern here is with fund illiquidity, and the implications of including different control variables for equity regressions than fund regressions uncertainly alters comparative interpretations, we choose to report only univariate results.

[28] All differences between top and bottom portfolios are statistically significant at the 1 percent level.

[29] It is possible funds with more illiquidity turnover the liquid assets in their portfolio frequently, resulting in similar aggregate turnover to funds with more liquid assets.

the top and bottom *Amihud* portfolios, the difference between top and bottom fund *Amihud* portfolios is only 0.262 . This is not surprising. We find, as in prior literature, average fund holdings consist of stocks in the fourth size quintile (Daniel et al. (1997)). Since liquidity is highly positively correlated with market capitalization the expectation is that funds hold mostly liquid stocks.[30] The span of fund illiquidity (0.001 to 0.263) is roughly equivalent to the span between the bottom and fifth equity illiquidity decile (0.002 to 0.264). Notice in equities the cross-sectional liquidity premium between the first and fifth deciles is small (negative) looking at raw (risk-adjusted) returns.

Given the narrow distribution in fund liquidity, it is somewhat surprising to find a significant positive difference in returns between the top and bottom fund illiquidity deciles. The difference in net returns is not statistically different for either *Amihud* or effective spread portfolios. However, there is a strong economic and statistical difference of 29 (15) basis points in raw (risk-adjusted) gross returns between top and bottom *Amihud* portfolios. While the difference in returns for effective spreads is not statistically significant they are still positive and economically large (37 (10) basis points). These portfolio sorting results suggest funds earn a liquidity premium, though statistically little of that premium is passed on to fund investors after trading costs and expenses.

We next employ multivariate regressions to control for important fund characteristics. Panel D reports Fama-MacBeth and pooled OLS regressions (with standard errors clustered by time and fund) of excess and risk adjusted fund returns on lagged standardized annual mean liquidity, total net assets, family total net assets, asset flow, age, expense ratio, turnover and

[30] Huang (2010) finds, on average, funds have 18.44 percent of their holdings in the lowest *Amihud* 1st percentile.

maximum load (though only the liquidity coefficients are reported).[31] Fama-MacBeth regressions reveal a strong positive relation between Amihud illiquidity and risk adjusted returns. A one standard deviation increase in *Amihud* predicts a mean net (gross) increase in four factor alphas of 6 (9) basis points per month over the following year. However, when considering effective spread the relation is only statistically significant for gross returns. Pooled OLS produces slightly different results, suggesting that only raw and CAPM adjusted returns are related to either fund Amihud measures or effective spreads.

Overall, we take the evidence presented in Tables 2 and 3 to suggest the liquidity of holdings impacts fund returns. However, on average, little of this liquidity premium is passed on to investors. The discrepancy between gross and net returns reveals that trading costs have a substantial negative impact on returns to holding illiquid equities, and much of the remaining premium is captured by managers through expenses. The remaining liquidity premium in net returns, while positive, is statistically weak.

IV. Liquidity Risk Premium

We start our analysis of the liquidity risk premium in Table 4 by measuring the effect of common stock liquidity betas on the expected returns. In Panel A we sort equities monthly into decile portfolios by liquidity betas calculated using rolling regressions as outlined in Equation 5 and hold those portfolios for the following month (Sadka (2010)). The difference between the top liquidity beta decile and bottom decile, while strong for *AmihudN* betas, is statistically weak for *Pastor-Stambaugh* and *Sadka* betas. However, the differences are all positive and in many

[31] For a discussion of why inclusion of these fund characteristics is important in fund performance studies, see Chen, Hong, Huang and Kubik (2004)).

cases economically strong. The top *AmihudN* (*Sadka*) beta decile outperforms the bottom decile by 43 (39) basis points monthly on a risk adjusted basis.

Regressions of excess and risk-adjusted equity returns on cross-sectionally standardized liquidity betas, reported in Panel B, reveal a statistically and economically strong relation. Looking at four factor alphas, an increase in any of the three liquidity betas predicts an increase in the following month's risk-adjusted return of at least 14 basis points (using either Fama-MacBeth or pooled OLS). We draw two conclusions from Table 4. First, liquidity betas generated from 60 month rolling regressions appear to capture equity's exposure to liquidity risk. Second, liquidity risk appears to be priced in equity returns during our sample period of 1984 through 2008.

As discussed in Section II.C., we calculate liquidity betas for funds with two methods. The first is rolling regressions of fund excess returns on innovations in market liquidity and the four Carhart (1997) risk factors (Equation 5). We refer to this as the fund liquidity beta. The second method is a two-step procedure. We calculate rolling betas for all equities using Equation 5 and then measure the liquidity beta of a fund as the dollar holdings weighted mean of fund holdings equity liquidity betas. We refer to this as the holdings liquidity beta. Before assessing how these proxies related to fund returns, we first test the realized differences between the two.

Table 5 reports the time series means of cross-sectional summary statistics of holdings liquidity betas (HBeta), fund liquidity betas (FBeta) and the pairwise absolute difference between the two (|H-F|), for betas generated from innovations in *AmihudN*, *Pastor-Stambaugh* and *Sadka* market liquidity. Before addressing the difference in the two liquidity risk methods, we point out the near symmetry of liquidity betas around zero. While equity liquidity betas are positive on average, the 20 to 30 percent most liquid equities have negative liquidity betas

(Watanabe and Watanabe (2008)).[32] Since funds invest in mostly large, highly liquid stocks it is not surprising to find slightly over half of equity funds have negative liquidity betas.

Comparing holdings liquidity betas to fund liquidity betas, there are two relevant differences. The first is that holdings betas have a larger cross-sectional dispersion than fund betas. As holdings betas can be calculated for funds the first month they enter the sample, a portion of this increased dispersion may be explained by being able to assign a HBeta to young, small funds that are most likely more concerned with liquidity risk for which an FBeta cannot be calculated.[33] The second difference is that the two methods calculate different betas for many of the same fund observations. The variable |H-F| is measured as the pairwise absolute difference between HBeta and FBeta. This variable demonstrates that while some funds are assigned economically similar betas (the 10th percentile *AmihudN* absolute difference is only 0.002) the difference for some funds is very large. For instance, considering *AmihudN* betas, the 99th percentile value of |H-F| is 0.072. The increase in FBeta from the 1st percentile to the 99th percentile is 0.093. Choosing HBeta over FBeta (or visa-versa) effectively moves some funds from the bottom liquidity risk decile to the top. This large magnitude absolute difference exists for *PS* and *Sadka* betas as well. While these results do not necessarily provide insight into which measure of fund liquidity risk is more accurate, they do show there are substantial differences in the two measures both for the entire sample and on a fund level basis.

Table 6 applies the same analysis as Table 4 to fund liquidity risk, though in this case we conduct portfolio sorting and regressions using both fund liquidity betas (Panels A and B) and holdings liquidity betas (Panels C and D). While fund betas and holdings betas are different,

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[32] In untabulated results we find results similar to Watanabe and Watanabe (2008) using equities during my sample period; that only the most liquid stocks have negative liquidity betas.

[33] However, this difference between fund and holdings liquidity betas remains after lowering the rolling window from 60 months to 12 (Sadka (2010)). At 12 months most fund observations can be assigned fund betas. The difference in betas is, therefore, not due solely to differing samples.

analyzing the relation between both betas and expected returns provides insight into which more accurately proxies for fund liquidity risk.[34] Starting with fund liquidity betas, portfolio sorting in Panel A reveals a mixed relation between betas and expected returns. In 6 out of 12 return series the top beta decile underperforms the bottom decile. The only statistically significant difference, three factor adjusted returns to *Pastor-Stambaugh* beta sorted portfolios, is a negative 16 basis points per month. Regression results reported in Panel B are no more coherent. While many of the coefficients show a positive relation between betas and expected returns, there are still several which are negative. Pooled OLS finds an increase in Sadka beta predicts a 4 basis point increase in four factor alphas. However, Fama-MacBeth regressions find a prediction of -3 basis points for an increase in *Pastor-Stambaugh* beta. As theory suggests a positive relation between liquidity risk and returns, fund liquidity beta does not appear to be an accurate proxy of fund liquidity risk.

We next look at holdings liquidity betas. While the relation between holdings liquidity beta and returns is not as strong as that found between equity liquidity betas and returns, these results are much more in line with the expected positive impact of liquidity risk on expected returns. Portfolio sorting, reported in Panel C, shows 11 out of 12 top minus bottom beta portfolio return differences are positive, 5 statistically so. Top decile *Sadka* beta funds outperform the bottom decile funds by a raw (risk-adjusted) 29 (22) basis points per month. The regression results in Panel D are not as strong, but are uniformly positive. A one standard

[34] Admittedly, this analysis suffers from a joint hypothesis problem. If a liquidity beta measure is not related to asset returns, that does not inherently mean it does not proxy for liquidity risk. It is possible liquidity risk is not priced, hence no relation between beta and returns. However, the alternate situation is not inherently true. Current asset pricing theory does not provide for explanations of how a liquidity beta measure could be related to expected returns without being a proxy for liquidity risk. We therefore posit that if one type of liquidity beta is positively related to returns while the other is not, then the beta related to returns is the better proxy for liquidity risk.

deviation increase in *Sadka* beta predicts a raw (single factor adjusted) return increase of 6 (7) basis points.

This evidence is indicative of a liquidity risk premium in mutual fund returns, though it is not overwhelming. These results do reveal, however, that holdings liquidity betas show a relation to expected returns that is much more in line with asset pricing theory than fund liquidity betas. We conclude holdings liquidity betas are a better proxy of fund liquidity risk, and therefore use them to proxy for fund exposure to liquidity risk for the remainder of the paper.

V. Conditional Analysis

All the analyses up to this point have been unconditional. However, there are strong reasons to believe the liquidity and liquidity risk premia are time varying and dependent on market liquidity. The contemporaneous response of equity prices to changes in aggregate liquidity (Amihud (2002)) is dependent on a stock's liquidity. Liquid stocks tend to perform well during negative market liquidity shocks (Goyenko and Sarkissian (2008)) compared to their illiquid counterparts (Acharya and Pedersen (2005), Jensen and Moorman (2011)). Therefore, the expected liquidity premium can weaken or even reverse(liquidity discount) during periods of high market liquidity (Brunnermeier and Pedersen (2009)). Similarly, for the liquidity risk premium, stocks with high positive liquidity betas will see large contemporaneous negative returns during liquidity crises while stocks with low or negative betas will see zero or positive abnormal returns (Vayanos (2004)). The expectation is that, during such liquidity crises, the liquidity risk premium will invert (Acharya, Amihud and Bharath (2010)).

The effect of negative aggregate liquidity shocks on the liquidity and liquidity risk premia is especially severe for mutual funds, as their holding period is exogenously determined.

Forced asset sales due to cash outflows correlated with liquidity crises (Acharya and Pedersen (2005)) will exacerbate negative returns for funds with illiquid holdings (Alexander, Cici and Gibson (2007)). For both premia, it is possible they conditionally exist in fund returns during periods which do not have high market illiquidity, but are obscured or weakened unconditionally due to liquidity crises.

We therefore create a high illiquidity regime indicator variable equal to one for all months with aggregate *AmihudN* innovations in the highest quintile[35] of our sample period.[36] Figure 1 shows a line graph of the innovations in aggregate *AmihudN* with a horizontal line at 0.142, representing the 80th percentile of innovations. The dark gray shaded regions represent months traditionally considered by the literature as liquidity crises (i.e. October 1987) and light gray shaded regions represent months which have been classified by the NBER as in recession. While the generated regime variable does not perfectly align with these exogenously determined poor liquidity periods, we believe it is sufficiently accurate to serve as a conditioning variable (Watanabe and Watanabe (2008)).

A. Conditional Liquidity Premium

We find that once we control for the effects of high illiquidity periods, fund liquidity has a more substantial impact on fund returns. Excluding high aggregate illiquidity months, a one standard deviation increase in *Amihud* (effective spread) predicts an increase in raw net returns of 10 (24) basis points. Considering risk-adjusted returns, an increase in Amihud results in a statistically significant increase in expected net and gross returns of 4 basis points. Another important result of this analysis is that the difference in coefficient magnitude between net and

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[35] we have also conducted these analyses with the high liquidity regime defined as the top decile of aggregate AmihudN innovations, and have found similar results.
[36] This is not to be confused with the high liquidity beta state used by Watanabe and Watanabe (2008). While there may be some correlation between negative aggregate liquidity shocks and high liquidity betas, we am concerned with these shocks immediate impact on returns, not on betas.

gross returns becomes small, implying managers pass on to investors almost the entire conditional liquidity premium they earn (even when accounting for trading costs).

Interestingly, we also find evidence for a flight-to-liquidity effect in fund returns. Looking at the interaction between the regime indicator variable and fund liquidity, there exists a liquidity discount in the presence of negative aggregate illiquidity shocks. Combining the liquidity effect with the marginal effect measured during the high illiquidity regime, a one standard deviation increase in *Amihud* predicts a decrease of 1 (4) basis points in raw (risk-adjusted) net returns during highly illiquid periods.[37] While this effect may be attributable to many phenomena, it supports a theory where investors transfer assets from illiquid to liquid stocks during liquidity crises putting upward pressure on liquid stock prices and downward pressure on illiquid stock prices. During high illiquid regimes the cross-sectional liquidity premium not only weakens but marginally inverts.

B. Conditional Liquidity Risk Premium

Conditional on excluding the high market illiquidity regime, we find evidence of a significant liquidity risk premium in mutual fund returns. Similar to Table 7, Table 8 reports the coefficients from regressions of excess and abnormal fund returns on cross-sectionally standardized liquidity betas, a regime indicator variable, and their interaction (control variables are included but coefficients are not reported). We find *AmihudN* and *Pastor-Stambaugh* liquidity betas have a significant positive relation with future net and gross fund returns.[38] A one standard deviation increase in *Pastor-Stambaugh* liquidity beta predicts an increase in raw (risk-

[37] The joint test of the liquidity effect with the interaction produces a statistically significant risk-adjusted -4 basis points with a p-value of 0.03.
[38] we have run this analysis using fund liquidity betas instead of holdings liquidity betas and find results consistent with those of Table 6. Fund liquidity betas during non-liquidity crisis periods show mixed results; sometimes positive and sometimes negative.

adjusted) monthly returns of 13 (7) basis points while an increase in *AmihudN* betas results in an increase in expected net (gross) risk-adjusted monthly returns of 7 (8) basis points.

We also find the expected inversion in the liquidity risk premium during the high illiquidity regime. The negative risk and return relation during negative liquidity shocks is several times larger in absolute value than the positive relation during non-liquidity crisis periods. A one standard deviation increase in *AmihudN* beta decreases expected risk-adjusted net return by 21 basis points during the illiquid regime, three times the 7 basis point increase predicted outside the regime (a net decrease in expected returns of 14 basis points, statistically significant with a p-value of 0.04). These results not only explain the weakly positive unconditional liquidity risk relation to expected returns shown in Table 6, but also provide additional evidence of the flight-to-liquidity effect and how it impacts portfolio returns.

It is also worth noting the similarity in the magnitudes of the liquidity risk effect for both net and gross returns. It is interesting that managers appear to generate a conditional liquidity risk premium for their funds and yet capture little to none of it through expenses. The most likely explanation is that since the abnormal returns to holdings liquidity risk is small on average and expenses are sticky, equilibrium cash flow adjustment (Berk and Green (2004)) dictates managers pass on positive returns to liquidity risk to investors during non-liquidity crisis periods (and, conversely, pass on negative returns to liquidity risk during high illiquidity periods).

VI. Joint Analysis of Liquidity and Liquidity Risk Premia

Current research suggests that the liquidity and liquidity risk premia are related. It is possible that the liquidity effect is subsumed by the liquidity risk effect (Watanabe and Watanabe (2008)), the liquidity effect dominates the liquidity risk effect (Acharya and Pedersen (2005)), or both independently impact returns (Korajczyk and Sadka (2008)). While the results in the previous sections suggest liquidity and liquidity risk impact fund returns, the close relation between the two require both be tested jointly. Illiquid assets are inherently sensitive to changes in market liquidity (Acharya and Pedersen (2005), Watanabe and Watanabe (2008)), implying the high expected returns generated by illiquid assets may be due, in part or in total, to liquidity risk. It is therefore prudent to test the two effects jointly in order to correctly attribute their impacts on fund returns. We therefore combine the models from Tables 7 and 8 and run pooled OLS regressions of excess and risk-adjusted returns on cross-sectionally standardized holdings liquidity beta, holdings *Amihud* liquidity level, high illiquidity regime indicator, the interaction between the indicator and liquidity beta, the interaction between the indicator and liquidity, and previously discussed fund characteristic controls. The coefficients from these regressions are found in Table 9.[39]

Overall, the impact of both liquidity and liquidity risk on fund returns remains. Interestingly, while the impact of liquidity on fund returns remains strong for raw and single factor alphas, it is weaker for three and four factor alphas. Table 7 reported an increase in *Amihud* predicts an increase in gross four factor alpha of 4 basis points (t-statistic of 1.98). In Table 9, that relation is an economically similar 3 basis points, but with a weaker t-statistic of 1.47. Liquidity results are similar across all three liquidity betas. Jointly tested, liquidity strongly impacts raw returns and single factor alphas, but has a much smaller impact on three- and four-factor alphas.

The liquidity risk premium in fund returns is still evident in the presence of fund liquidity. A one standard deviation increase in *Pastor-Stambaugh* beta predicts an increase in

[39] As liquidity and liquidity risk are correlated, there is some concern of multicolinearity in this multivariate setting. Variance inflation factors for all coefficients in these regressions are all below 1.6, suggesting they are unbiased.

raw (risk-adjusted) net returns of 13 (7) basis points monthly during non-liquidity crisis months. An increase in *AmihudN* beta predicts an increase of 7 (4) basis points. The *Sadka* liquidity beta demonstrates the weakest relation to returns. While unconditional analysis in Table 7 reveals a significant relation between fund holdings *Sadka* beta and raw and single factor risk-adjusted returns, conditional analysis reveals a statistically insignificant relation of only 2 (1) basis points.

Our conclusion from the evidence presented in Table 9 is that, jointly tested, both liquidity and liquidity risk impact fund returns. As the two measures are related, we see an expected weakening of both effects when included in the same regressions. However, *Pastor-Stambaugh* and *AmihudN* betas reveal a significant liquidity risk premium while mean holdings Amihud reveals a jointly significant liquidity premium. The two effects, while related, independently impact fund returns.

VII. Conclusion

In this paper, we examine the impact of liquidity and liquidity risk on mutual fund returns. This analysis is important both for understanding the determinants of mutual fund performance and gaining additional insight into the liquidity and liquidity risk premia. Overall, we find that liquidity and liquidity risk impact both equity and equity mutual fund returns during our sample period of 1984 through 2008. A one standard deviation increase in fund illiquidity is associated with an increase in annualized return of as much as 1.08 percent while an increase in holdings liquidity beta results in an increase in annualized expected returns of 0.96 percent.

As theory suggests both the liquidity and liquidity risk premia are time-varying in relation to market liquidity, we introduce an indicator variable for high market illiquidity periods to both liquidity and liquidity risk analyses. We find that both effects invert during periods of high market illiquidity. Conditioning on months not in a high aggregate illiquidity state reveals a stronger liquidity premium and, in contrast to unconditional results, a statistically and economically significant liquidity risk premium in fund returns.

Finally, we test both liquidity and liquidity risk simultaneously and find evidence that both impact fund returns. Excluding periods of high aggregate illiquidity, a one standard deviation in *Pastor-Stambaugh* liquidity beta predicts an increase of 1.56 percent annualized return while an increase in *Amihud* liquidity increases expected returns by 1.32 percent. Overall, we conclude the liquidity characteristics of fund holdings have a substantial impact on returns. The effects are time varying; strong outside of liquidity crises and inverted during. And, most importantly, liquidity and liquidity risk both independently impact mutual fund returns.

Appendix A: Mutual Fund Sample Construction

We begin with all fund share classes in the CRSP Mutual Fund Database with Lipper objective codes which suggest an investment focus of growth (ELCC, G, LCCE, LCGE, LCVE, MLCE, MLGE, MLVE, SESE), growth and income (EI, EIEI, GI, I), small capitalization (MC, MCCE, MCGE, MCVE, SCCE, SCGE, SCVE, SG) and aggressive growth (CA, MR). This removes all funds with bond, mixed, derivatives, leverage, emerging markets or international investment objectives.

Fund share classes are aggregated into fund level portfolios by matching their holdings portfolios with MFLINKs. This portfolio matching strategy does not work for funds without reported holdings, but as we require fund holdings to calculate fund liquidity and liquidity betas this problem has no impact on our study. Aggregate fund characteristics are measured as either the total net asset value weighted means of share class characteristics (net return, expense ratio, turnover, loads, asset flow), the sum of share class characteristics (total net assets) or, in the case of age, the oldest share class in the fund. As new funds are often subsidized by their fund families (incubation bias, Evans (2010)) we include funds only once their total aggregate portfolio total net assets exceed 15 million dollars. Also, as a significant portion of funds report only annual earnings prior to 1984 (Elton, Gruber and Blake (2001)) we exclude fund observations prior to 1984.

Funds are then matched to their equity holdings in the Thomson CDA/Spectrum database using MFLINKs. In order for a fund observation to be included in our final sample it must have a return and total net assets reported in CRSP and have holdings reported in the Thomson CDA/Spectrum database. Our final sample consists of 2,480 funds and 210,100 fund month observations.

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Figure 1: Innovations in Market Amihud

The line graph represents the innovations in equal weighted market normalized Amihud measure, assuming an AR(2) process, between January 1984 and December 2008. The light gray shaded areas represent months classified as in recession by the National Bureau of Economic Research. The dark gray shaded areas represent months traditionally identified as market liquidity crises (October and November 1987, October and November 1989, October and November 1997, August and September 1998, July and August 2007 and June through December 2008). The horizontal line across the y-axis is the value of the 80th percentile of normalized Amihud innovations, and all months with values above are classified as high liquidity periods.

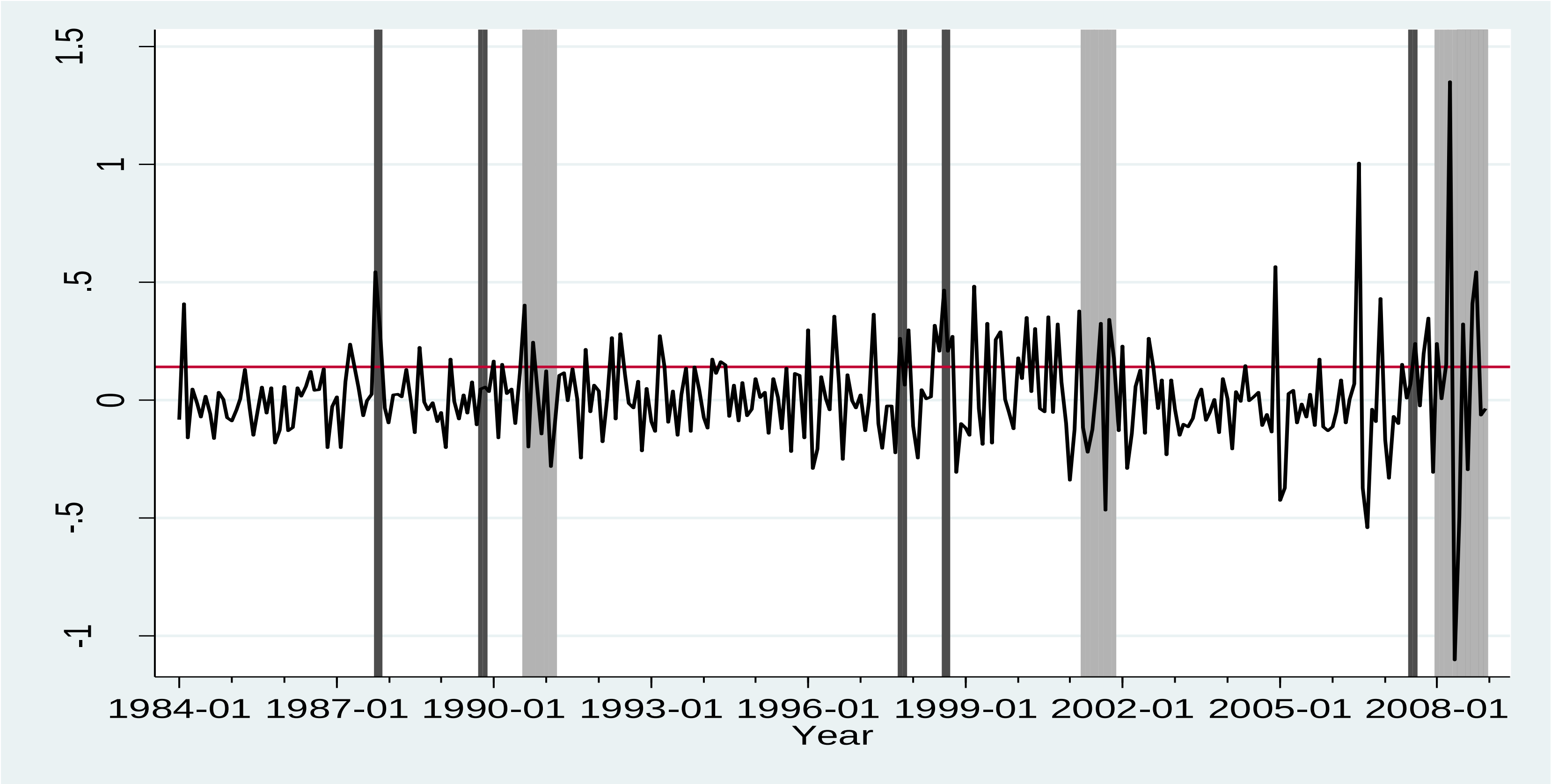

Table 1: Summary Statistics

The sample is generated from all mutual funds in the CRSP Survivor-bias-free Mutual Fund Database, retaining only funds which are actively managed and have Lipper Objective codes showing they invest only in domestic equities between January 1984 and December 2008. Individual fund share classes are aggregated to form a single observation per fund per month. Equity funds are matched to their holdings in the Thomson CDA/Spectrum database through MFLINKs. Funds are only included in the sample once they have exceeded 15 million dollars in assets. Panel A reports the size of the sample. Panel B reports the times series means of monthly cross sectional means, medians and standard deviations of fund characteristics. Total Net Assets is the aggregate market value (in millions) of all assets held by all share classes of a fund. Total Family Assets is the aggregate market value (in millions) of all assets held by each fund management company. Age is the number of years since the fund's oldest share class was first issued. Return Gap is the different between a fund's gross (before fee return) and holdings returns (Kacpercyzk, Sialm and Zheng (2008)). Trading Costs is the estimated cost to quarterly transactions divided by 3 (Wermers (2000)). Net Asset Flow is the percentage change in Total Net Assets not attributable to fund returns over the previous month, and is Winsorized at the 1^{st} and 99^{th} percentiles. Max Load is the maximum of the fund's front and rear load. Cash is the percent of fund TNA held in cash. Expense Ratio is the annual percentage charged on assets under management and Turnover Ratio is annual asset purchases divided by assets under management. Size, Book/Market and Momentum are the mean quintile rankings of fund equity holdings as defined by Daniel, Grinblatt, Titman and Wermers (1997).

Panel A: Sample Size

Number of Funds	2,480
Number of Observations	210,110

Panel B: Fund Characteristics

	Mean	Median	Standard Deviation
Total Net Assets (mil)	$1,018	$234	$3,140
Total Family Assets (mil)	$13,663	$3,042	$29,900
Age	14	12	10
Flow (Monthly)	1.06%	0.03%	5.89%
Max Load	6.68%	7.26%	2.48%
Cash (Percent of Assets)	7.14%	4.91%	8.41%
Expense Ratio	1.18%	1.12%	0.55%
Turnover	83.03%	61.33%	89.95%

Table 2: Liquidity and Equity Returns

Common stocks are sorted into portfolios every December by their mean monthly liquidity value over the previous 12 months and portfolios are held for the following year. Amihud is defined as the equal-weighted monthly mean of daily dollar volume price impact, in millions (Amihud (2002)), generated from daily CRSP file for 1984 through 2008. ESpread is defined as the monthly dollar-volume weighted mean of transaction log effective spread (Goyenko, Trzcinki and Holden (2010)), generated from TAQ for 1993 through 2008. Panel A reports the equal weighted mean liquidity measure and raw and risk adjusted portfolio returns for funds sorted by the previous year's mean liquidity. Row 10-1 (9-2) is the time series mean of the difference in returns between the 10 (9) and 1 (2) deciles. Panel B reports the coefficients of both cross sectional and panel regressions of equity raw and risk adjusted returns on the prior year's cross-sectionally standardized (~N(0,1)) mean liquidity. Regressions are univariate. Risk adjusted returns for portfolios are generated using single factor (CAPM), three factor (Fama French) and four factor (Carhart) time series models. Risk adjusted returns used as dependent variables for regressions are generated from a rolling 60 (minimum 48) month regressions of equity excess returns on either the single, three or four factor models. t-statistics for panel regressions are generated from standard errors clustered by time and stock.

Panel A: Portfolio Sorting

Liquidity Portfolios	Amihud (1984-2008) Amihud	Ret	α_1	α_3	α_4	Effective Spread (1993-2008) ESpread	Ret	α_1	α_3	α_4
1	0.002	0.94%	0.10%	0.08%	0.11%	0.29%	0.73%	0.09%	0.06%	0.15%
2	0.014	0.87%	-0.02%	-0.04%	-0.03%	0.45%	0.70%	0.01%	-0.07%	-0.01%
3	0.046	0.90%	0.00%	-0.02%	-0.01%	0.62%	0.74%	0.04%	-0.04%	0.00%
4	0.118	0.89%	-0.01%	-0.03%	0.00%	0.81%	0.80%	0.10%	0.01%	-0.01%
5	0.264	0.97%	0.09%	0.07%	0.02%	1.01%	0.85%	0.16%	0.04%	0.05%
6	0.499	1.07%	0.17%	0.14%	0.08%	1.28%	0.77%	0.05%	-0.03%	-0.08%
7	0.925	1.19%	0.31%	0.28%	0.22%	1.64%	0.96%	0.23%	0.15%	0.08%
8	1.634	1.25%	0.42%	0.31%	0.24%	2.08%	1.25%	0.51%	0.43%	0.33%
9	3.049	1.39%	0.56%	0.45%	0.34%	2.79%	1.30%	0.57%	0.49%	0.37%
10	8.638	2.18%	1.28%	1.20%	1.05%	4.39%	2.14%	1.36%	1.31%	1.10%
10-1	8.636	1.24%	1.18%	1.12%	0.94%	4.10%	1.41%	1.27%	1.25%	0.95%
		(4.69)	(4.46)	(4.92)	(4.05)		(3.76)	(3.55)	(3.91)	(2.99)
9-2	3.035	0.52%	0.58%	0.49%	0.37%	2.34%	0.60%	0.56%	0.56%	0.38%
		(5.39)	(5.31)	(5.39)	(4.57)		(4.14)	(3.95)	(4.27)	(3.41)

Panel B: Regressions

	Amihud (1984 - 2008) Ret	α_1	α_3	α_4	Effective Spread (1993-2008) Ret	α_1	α_3	α_4
Fama-MacBeth	0.33	0.34	0.34	0.35	0.36	0.30	0.34	0.36
	(6.11)	(5.74)	(6.30)	(6.49)	(3.34)	(2.55)	(3.60)	(3.65)
Pooled	0.35	0.36	0.35	0.37	0.38	0.31	0.35	0.37
	(6.35)	(6.70)	(7.08)	(7.15)	(3.56)	(2.94)	(3.84)	(3.93)

Table 3: Liquidity and Fund Returns

All funds are assigned an liquidity measure defined as the value-weighted mean of the liquidity of their equity holdings. Equity Amihud and effective spread measures are calculated as described in Table 2. Panel A reports the equal weighted mean fund characteristics of portfolios sorted by prior year's Amihud measure. TNA and FTNA are fund and family total net assets, in millions. Asset flow is the monthly change in net total assets unexplained by fund returns. Cash is the percent of total net assets held in cash. Age is the number of years since the fund's oldest share class was issued. Expense ratio is 1/12 the annual reported expense ratio. Turnover ratio is the annual turnover ratio as reported by CRSP. Max load is the maximum of the highest front and rear end loads. Panel B reports the equal weighted raw and risk adjusted net and gross returns for each Amihud liquidity decile portfolio. Panel C reports the equal weighted raw and risk adjusted net and gross returns for each Effective Spread liquidity decile portfolio. Panel D reports coefficients from cross sectional and pooled OLS regressions of raw and risk adjusted returns on the prior year's cross-sectionally normalized mean liquidity (~N(0,1)) and normalized fund characteristics. Lagged fund TNA, family TNA, Expense Ratio, Turnover, Max Load, Asset Flow and Returns are used as in Chen et al. (2004), though only the coefficients on lagged liquidity are reported. Risk adjusted returns for portfolios are generated using single factor (CAPM), three factor (Fama French) and four factor (Carhart) time series models. Risk adjusted returns used as dependent variables for regressions are generated from a rolling 60 (minimum 48) month regressions of fund excess returns on either the single, three or four factor models. Gross returns are net returns plus estimated monthly transaction costs (Wermers (2000)) plus 1/12 the fund's annual expense ratio. t-statistics for pooled OLS regressions are generated from standard errors clustered by time and fund, and are reported in parentheses below.

Panel A: Fund Characteristics (Amihud: 1984-2008)

Liquidity Portfolios	Cash	TNA	Asset Flow	Age	Expense Ratio	Turnover Ratio	Max Load
1	5.81%	$2,304	0.46%	19	1.09%	65.57%	5.63%
2	6.31%	$1,230	0.21%	18	1.08%	70.46%	5.69%
3	6.75%	$1,466	0.31%	19	1.09%	86.57%	5.71%
4	7.21%	$1,387	0.23%	19	1.12%	84.26%	5.37%
5	7.11%	$1,387	0.30%	18	1.13%	82.30%	5.37%
6	7.71%	$1,087	0.18%	17	1.15%	87.96%	5.27%
7	7.60%	$1,004	0.43%	17	1.22%	75.66%	5.10%
8	8.27%	$728	0.57%	15	1.22%	84.71%	5.08%
9	8.64%	$781	0.44%	14	1.25%	75.65%	5.03%
10	8.02%	$681	0.92%	13	1.34%	59.14%	4.72%

Panel B: Portfolio Sorting (Amihud: 1984-2008)

Liquidity Portfolios	Amihud	Net Ret	Net α_1	Net α_3	Net α_4	Gross Ret	Gross α_1	Gross α_3	Gross α_4
1	0.001	0.90%	-0.12%	-0.09%	-0.06%	1.02%	0.01%	0.04%	0.06%
2	0.002	0.93%	-0.08%	-0.10%	-0.06%	1.07%	0.06%	0.04%	0.08%
3	0.004	0.95%	-0.07%	-0.07%	-0.11%	1.11%	0.09%	0.09%	0.05%
4	0.005	0.99%	-0.05%	-0.06%	-0.08%	1.15%	0.10%	0.09%	0.08%
5	0.008	1.01%	-0.03%	-0.06%	-0.06%	1.19%	0.15%	0.12%	0.13%
6	0.012	1.03%	-0.01%	-0.04%	-0.02%	1.22%	0.18%	0.15%	0.16%
7	0.022	0.99%	-0.09%	-0.08%	-0.07%	1.17%	0.09%	0.10%	0.11%
8	0.039	1.11%	0.02%	0.02%	0.02%	1.30%	0.22%	0.22%	0.21%
9	0.068	1.11%	0.00%	0.00%	-0.04%	1.31%	0.21%	0.20%	0.16%
10	0.263	1.10%	0.05%	-0.03%	0.00%	1.31%	0.26%	0.18%	0.21%
10-1	0.262	0.20%	0.17%	0.06%	0.06%	0.29%	0.25%	0.14%	0.15%
		(1.35)	(1.11)	(0.86)	(0.97)	(1.96)	(1.70)	(2.21)	(2.23)

Panel C: Portfolio Sorting (Effective Spread: 1993-2008)

Liquidity		Net				Gross			
Portfolios	ESpread	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4
1	0.21%	0.74%	-0.17%	-0.11%	-0.09%	0.86%	-0.06%	0.00%	0.03%
2	0.23%	0.69%	-0.21%	-0.20%	-0.15%	0.81%	-0.09%	-0.09%	-0.03%
3	0.25%	0.73%	-0.14%	-0.20%	-0.16%	0.85%	-0.02%	-0.08%	-0.04%
4	0.27%	0.78%	-0.07%	-0.17%	-0.09%	0.93%	0.07%	-0.03%	0.06%
5	0.30%	0.90%	0.00%	-0.04%	-0.09%	1.05%	0.14%	0.10%	0.05%
6	0.33%	0.89%	-0.03%	-0.09%	-0.14%	1.06%	0.13%	0.08%	0.03%
7	0.39%	0.88%	-0.03%	-0.13%	-0.12%	1.04%	0.13%	0.03%	0.04%
8	0.49%	0.84%	-0.14%	-0.26%	-0.23%	1.02%	0.04%	-0.08%	-0.06%
9	0.61%	0.92%	-0.04%	-0.13%	-0.21%	1.10%	0.14%	0.06%	-0.02%
10	0.83%	1.03%	0.09%	-0.07%	-0.07%	1.23%	0.29%	0.13%	0.13%
10-1	0.62%	0.29%	0.26%	0.04%	0.02%	0.37%	0.35%	0.13%	0.10%
		(1.29)	(1.17)	(0.44)	(0.17)	(1.70)	(1.57)	(1.33)	(1.00)

Panel D: Regressions

	Net				Gross			
	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4
Amihud (1984-2008)								
Fama-MacBeth	0.05	0.03	0.05	0.06	0.07	0.07	0.07	0.09
	(1.42)	(0.92)	(1.99)	(2.76)	(1.60)	(1.71)	(2.70)	(3.25)
Pooled	0.07	0.06	0.00	0.02	0.09	0.07	0.01	0.02
	(2.64)	(2.28)	(0.24)	(1.20)	(3.00)	(2.69)	(0.74)	(1.61)
ESpread (1993-2008)								
Fama-MacBeth	0.09	0.08	0.02	0.02	0.11	0.13	0.05	0.06
	(1.33)	(1.28)	(0.56)	(0.91)	(1.57)	(1.98)	(1.74)	(2.33)
Pooled	0.12	0.10	-0.01	0.00	0.16	0.12	0.02	0.03
	(2.14)	(1.77)	(-0.34)	(0.05)	(2.61)	(2.17)	(0.83)	(1.27)

Table 4: Liquidity Risk and Equity Returns

Liquidity betas are formed using 60 month (minimum 48 months) rolling regressions of excess returns on market liquidity innovations and the four Carhart factors. All common equity (share codes 10 and 11) with a share price in excess of 1 dollar are included in the sample. Market liquidity innovations are defined as the residuals from an AR(2) process of the equal-weighted normalized Amihud measure (Acharya and Pedersen (2005) or PS measure (Pastor and Stambaugh (2003), or as the permanent variable component Sadka measure (Sadka (2006)). Panel A reports the raw and risk adjusted returns of equal-weighted portfolios sorted monthly by lagged liquidity betas. Panel B reports the coefficients of both cross sectional and panel regressions of equity raw and risk adjusted returns on lagged cross-sectionally normalized (~N(0,1)) liquidity betas. Regressions are univariate. Risk adjusted returns for portfolios are generated using single factor (CAPM), three factor (Fama French) and four factor (Carhart) time series models. Risk adjusted returns used as dependent variables for regressions are generated from a rolling 60 (minimum 48) month regressions of fund excess returns on either the single, three or four factor models. t-statistics for panel regressions are generated from standard errors clustered by time and stock.

Liquidity Beta Portfolios	AmihudN Ret	AmihudN α_1	AmihudN α_3	AmihudN α_4	Pastor-Stambaugh Ret	Pastor-Stambaugh α_1	Pastor-Stambaugh α_3	Pastor-Stambaugh α_4	Sadka Ret	Sadka α_1	Sadka α_3	Sadka α_4
1	0.86%	-0.05%	-0.13%	0.12%	1.00%	0.09%	-0.02%	0.27%	1.05%	0.19%	0.08%	0.33%
2	1.02%	0.16%	0.01%	0.22%	1.01%	0.18%	-0.01%	0.19%	0.95%	0.19%	-0.04%	0.19%
3	1.00%	0.20%	0.01%	0.14%	1.04%	0.24%	0.06%	0.19%	0.96%	0.25%	0.05%	0.21%
4	0.99%	0.22%	0.02%	0.12%	0.96%	0.19%	-0.01%	0.11%	0.94%	0.26%	0.07%	0.20%
5	0.97%	0.22%	0.04%	0.14%	1.03%	0.28%	0.10%	0.20%	0.90%	0.23%	0.02%	0.14%
6	1.07%	0.32%	0.15%	0.26%	0.93%	0.18%	0.00%	0.08%	1.03%	0.34%	0.14%	0.30%
7	1.03%	0.26%	0.08%	0.18%	1.06%	0.28%	0.11%	0.25%	0.99%	0.28%	0.08%	0.24%
8	1.14%	0.33%	0.15%	0.33%	1.10%	0.28%	0.12%	0.28%	1.13%	0.40%	0.19%	0.40%
9	1.15%	0.31%	0.14%	0.35%	1.12%	0.25%	0.13%	0.36%	1.22%	0.45%	0.26%	0.53%
10	1.15%	0.23%	0.19%	0.55%	1.14%	0.21%	0.18%	0.48%	1.29%	0.46%	0.31%	0.72%
10-1	0.29%	0.28%	0.32%	0.43%	0.14%	0.12%	0.20%	0.21%	0.24%	0.27%	0.23%	0.39%
	(1.76)	(1.74)	(1.97)	(2.57)	(0.85)	(0.78)	(1.29)	(1.36)	(1.24)	(1.40)	(1.14)	(1.96)

Panel B: Regressions

	AmihudN Ret	AmihudN α_1	AmihudN α_3	AmihudN α_4	Pastor-Stambaugh Ret	Pastor-Stambaugh α_1	Pastor-Stambaugh α_3	Pastor-Stambaugh α_4	Sadka Ret	Sadka α_1	Sadka α_3	Sadka α_4
Fama-MacBeth	0.09	0.11	0.10	0.15	0.06	0.11	0.11	0.14	0.07	0.09	0.10	0.14
	(2.08)	(2.63)	(2.14)	(2.77)	(1.12)	(2.22)	(2.10)	(2.44)	(1.19)	(1.58)	(1.38)	(1.78)
Pooled	0.09	0.11	0.10	0.15	0.05	0.10	0.11	0.14	0.08	0.10	0.10	0.14
	(1.98)	(2.47)	(2.03)	(2.78)	(1.22)	(2.31)	(2.26)	(2.93)	(1.41)	(1.70)	(1.58)	(2.15)

Table 5: Liquidity Beta Summary Statistics

Equity liquidity betas (EBeta) are formed using 60 month (minimum 48 months) rolling regressions of excess returns on market liquidity innovations and the four Carhart factors. All common equity (share codes 10 and 11) with share price in excess of 1 dollar are included in the sample. Fund liquidity betas are measured as either the value-weighted mean of holdings equity liquidity betas (HBeta) or from rolling regressions of fund returns on market liquidity innovations (FBeta), in a procedure identical to equity betas. Market liquidity innovations are defined as the residuals from an AR(2) process of the equal-weighted normalized Amihud measure (Acharya and Pedersen (2005) or PS measure (Pastor and Stambaugh (2003), or as the permanent variable component Sadka measure (Sadka (2006)). Reported are the time series means of cross sectional summary statistics holdings-based betas (HBeta), fund-return based betas (FBeta) and pairwise difference between the two (|H-F|). Means are computed as the time series means of cross sectional means.

	AmihudN			PS			Sadka		
	HBeta	FBeta	|H-F|	HBeta	FBeta	|H-F|	HBeta	FBeta	|H-F|
Mean	-0.007	-0.003	0.015	-0.016	-0.006	0.047	-0.250	-0.025	0.542
P1	-0.069	-0.054	0.000	-0.173	-0.162	0.001	-2.055	-1.485	0.008
P5	-0.043	-0.035	0.001	-0.112	-0.094	0.003	-1.318	-0.904	0.037
P10	-0.032	-0.025	0.002	-0.087	-0.071	0.006	-1.017	-0.673	0.073
P25	-0.018	-0.013	0.005	-0.050	-0.038	0.016	-0.601	-0.339	0.187
P50	-0.005	-0.002	0.011	-0.015	-0.004	0.035	-0.232	-0.022	0.403
P75	0.005	0.008	0.020	0.018	0.027	0.064	0.101	0.292	0.738
P90	0.016	0.016	0.033	0.053	0.058	0.101	0.476	0.628	1.173
P95	0.025	0.023	0.043	0.078	0.080	0.131	0.773	0.847	1.505
P99	0.046	0.039	0.072	0.145	0.122	0.211	1.585	1.386	2.398

Table 6: Liquidity Risk and Fund Returns

Fund and holdings liquidity betas are calculated as described in Table 4. Panel A reports the equal weighted raw and risk adjusted fund returns for portfolios sorted monthly by lagged AmihudN, PS and Sadka fund liquidity betas. . Panel B reports the coefficients of both cross sectional and panel regressions of fund raw and risk adjusted net returns on lagged cross-sectionally normalized (~N(0,1)) fund liquidity betas and fund characteristics. Panel C reports the equal weighted raw and risk adjusted fund returns for portfolios sorted monthly by lagged AmihudN, PS and Sadka holdings liquidity betas. Panel D reports the coefficients of both cross sectional and panel regressions of fund raw and risk adjusted net returns on lagged cross-sectionally normalized (~N(0,1)) holdings liquidity betas and fund characteristics. Lagged fund TNA, family TNA, Expense Ratio, Turnover, Max Load, Asset Flow and Returns are used as in Chen et al. (2004), though only the coefficients on lagged liquidity are reported. Risk adjusted returns for portfolios are generated using single factor (CAPM), three factor (Fama French) and four factor (Carhart) time series models. Risk adjusted returns used as dependent variables for regressions are generated from a rolling 60 (minimum 48) month regressions of fund excess returns on either the single, three or four factor models. t-statistics for panel regressions are generated from standard errors clustered by time and stock.

Panel A: Portfolio Sorting (Fund Liquidity Betas)

Liquidity Beta Portfolios	AmihudN Ret	AmihudN α_1	AmihudN α_3	AmihudN α_4	Pastor-Stambaugh Ret	Pastor-Stambaugh α_1	Pastor-Stambaugh α_3	Pastor-Stambaugh α_4	Sadka Ret	Sadka α_1	Sadka α_3	Sadka α_4
1	0.88%	-0.07%	0.04%	-0.01%	0.88%	-0.03%	0.08%	0.04%	0.76%	-0.06%	-0.08%	-0.11%
2	0.82%	-0.09%	-0.04%	-0.08%	0.76%	-0.12%	-0.07%	-0.09%	0.75%	-0.04%	-0.08%	-0.10%
3	0.86%	-0.01%	0.00%	-0.02%	0.77%	-0.10%	-0.07%	-0.09%	0.75%	-0.03%	-0.07%	-0.07%
4	0.78%	-0.08%	-0.10%	-0.11%	0.76%	-0.11%	-0.10%	-0.11%	0.73%	-0.04%	-0.09%	-0.09%
5	0.79%	-0.06%	-0.09%	-0.09%	0.80%	-0.05%	-0.08%	-0.07%	0.73%	-0.05%	-0.09%	-0.10%
6	0.80%	-0.05%	-0.07%	-0.07%	0.79%	-0.06%	-0.09%	-0.10%	0.76%	-0.01%	-0.06%	-0.06%
7	0.78%	-0.06%	-0.10%	-0.09%	0.81%	-0.03%	-0.08%	-0.06%	0.78%	-0.01%	-0.05%	-0.05%
8	0.79%	-0.05%	-0.10%	-0.09%	0.88%	0.04%	-0.04%	-0.04%	0.73%	-0.06%	-0.09%	-0.08%
9	0.84%	0.01%	-0.04%	-0.03%	0.89%	0.04%	-0.04%	-0.03%	0.82%	0.02%	-0.01%	-0.03%
10	0.84%	0.02%	-0.05%	-0.03%	0.85%	-0.02%	-0.08%	-0.06%	0.82%	0.01%	-0.03%	-0.03%
10-1	-0.04%	0.09%	-0.09%	-0.02%	-0.03%	0.01%	-0.16%	-0.10%	0.06%	0.07%	0.05%	0.08%
	(-0.30)	(0.84)	(-1.13)	(-0.23)	(-0.32)	(0.09)	(-1.71)	(-1.06)	(0.69)	(0.73)	(0.55)	(0.81)

Panel B: Regressions (Fund Liquidity Betas)

	AmihudN Ret	AmihudN α_1	AmihudN α_3	AmihudN α_4	Pastor-Stambaugh Ret	Pastor-Stambaugh α_1	Pastor-Stambaugh α_3	Pastor-Stambaugh α_4	Sadka Ret	Sadka α_1	Sadka α_3	Sadka α_4
Fama-	-0.00	0.03	0.01	0.01	0.01	0.00	-0.03	-0.02	0.03	0.03	0.01	0.02
MacBeth	(-0.13)	(1.57)	(0.38)	(0.39)	(0.30)	(0.02)	(-1.69)	(-1.34)	(1.23)	(1.07)	(0.86)	(1.01)
Pooled	0.01	0.04	0.01	0.02	0.01	0.06	-0.01	-0.00	0.01	0.04	0.04	0.04
	(0.26)	(1.25)	(0.71)	(0.78)	(0.25)	(1.56)	(-0.49)	(-0.00)	(0.27)	(1.48)	(2.01)	(2.19)

Panel C: Portfolio Sorting (Holdings Liquidity Betas)

Liquidity Beta	AmihudN				Pastor-Stambaugh				Sadka			
Portfolios	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4
1	0.81%	-0.15%	0.02%	-0.06%	0.82%	-0.09%	0.01%	-0.01%	0.69%	-0.16%	-0.11%	-0.16%
2	0.84%	-0.06%	0.02%	-0.04%	0.80%	-0.08%	-0.04%	-0.03%	0.72%	-0.09%	-0.09%	-0.10%
3	0.86%	-0.01%	0.03%	-0.01%	0.80%	-0.08%	-0.04%	-0.05%	0.79%	0.00%	-0.04%	-0.03%
4	0.83%	-0.03%	-0.04%	-0.08%	0.78%	-0.07%	-0.07%	-0.07%	0.77%	-0.01%	-0.05%	-0.04%
5	0.87%	0.02%	-0.01%	-0.01%	0.81%	-0.04%	-0.06%	-0.07%	0.78%	0.00%	-0.05%	-0.05%
6	0.83%	-0.01%	-0.05%	-0.05%	0.86%	0.00%	-0.03%	-0.03%	0.76%	-0.01%	-0.07%	-0.05%
7	0.81%	-0.03%	-0.08%	-0.05%	0.83%	-0.02%	-0.07%	-0.07%	0.79%	0.02%	-0.02%	-0.03%
8	0.84%	0.00%	-0.06%	-0.03%	0.89%	0.05%	-0.02%	-0.02%	0.83%	0.04%	0.00%	-0.01%
9	0.87%	0.04%	-0.03%	0.00%	0.91%	0.06%	-0.01%	-0.03%	0.84%	0.05%	0.01%	-0.04%
10	0.89%	0.06%	-0.02%	-0.01%	0.96%	0.09%	0.10%	0.04%	0.98%	0.16%	0.12%	0.06%
10-1	0.08%	0.21%	-0.04%	0.05%	0.14%	0.18%	0.09%	0.05%	0.29%	0.32%	0.23%	0.22%
	(0.56)	(1.67)	(-0.40)	(0.49)	(1.17)	(1.48)	(0.80)	(0.47)	(2.29)	(2.61)	(1.89)	(1.74)

Panel D: Regressions (Holdings Liquidity Betas)

	AmihudN				Pastor-Stambaugh				Sadka			
	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4
Fama-	0.04	0.02	0.00	0.02	0.01	0.03	0.01	0.01	0.03	0.03	0.01	0.01
MacBeth	(0.17)	(0.92)	(0.06)	(0.76)	(0.52)	(0.87)	(0.44)	(0.29)	(1.01)	(1.02)	(0.56)	(0.57)
Pooled	0.05	0.05	0.00	0.02	0.03	0.08	0.03	0.03	0.06	0.07	0.03	0.02
	(0.97)	(1.18)	(0.00)	(0.66)	(0.53)	(1.75)	(0.97)	(0.95)	(1.91)	(2.01)	(0.84)	(0.76)

Table 7: Conditional Liquidity and Fund Returns

All funds are assigned an liquidity measure defined as the value-weighted mean of the liquidity of their equity holdings. Equity Amihud and effective spread measures are calculated as described in Table 2. Regime is an indicator variable with a value of 1 for the top quintile illiquid months as measured by the innovations in equal-weighted market normalized Amihud liquidity (Acharya and Pedersen (2005)) and 0 otherwise. Coefficients reported are from panel regressions of raw and risk adjusted returns on the prior year's cross sectionally normalized mean liquidity (~N(0,1)), liquidity regime indicator, regime and normalized liquidity indicator interaction, and normalized fund characteristics. Lagged fund TNA, family TNA, Expense Ratio, Turnover, Max Load, Asset Flow and Returns are used as in Chen et al. (2004), though only the coefficients on lagged liquidity, regime and regime and liquidity interaction are reported. Net returns are as reported by CRSP. Gross returns are net returns plus estimated monthly transaction costs (Wermers (2000)) plus 1/12 the fund's annual expense ratio. Risk adjusted returns used as dependent variables for regressions are generated from a rolling 60 (minimum 48) month regressions of fund excess returns on either the single (CAPM), three (Fama-French) or four factor (Carhart) models. t-statistics for panel regressions are generated from standard errors clustered by time and fund, and are reported in italics below.

	Net				Gross			
	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4
Amihud	0.10	0.12	0.02	0.04	0.11	0.11	0.02	0.04
	(2.93)	(3.91)	(1.20)	(2.23)	(3.04)	(3.85)	(1.08)	(1.98)
Reg*Amihud	-0.11	-0.24	-0.07	-0.08	-0.10	-0.20	-0.04	-0.05
	(-1.33)	(-3.45)	(-2.75)	(-2.97)	(-1.28)	(-3.09)	(-1.37)	(-1.68)
Regime	-2.53	-0.21	0.13	0.16	-2.05	-0.22	0.11	0.15
	(-2.46)	(-1.76)	(1.23)	(1.46)	(-2.35)	(-1.73)	(0.96)	(1.31)
ESpread	0.24	0.22	0.02	0.02	0.25	0.22	0.04	0.04
	(3.40)	(3.31)	(0.57)	(0.93)	(3.40)	(3.32)	(1.24)	(1.65)
Reg *ESpread	-0.46	-0.46	-0.09	-0.09	-0.39	-0.41	-0.06	-0.06
	(-3.18)	(-3.58)	(-1.74)	(-1.60)	(-2.80)	(-3.10)	(-1.10)	(-1.01)
Regime	-2.37	-0.23	0.14	0.16	-1.83	-0.23	0.13	0.15
	(-2.17)	(-1.79)	(1.23)	(1.38)	(-1.96)	(-1.74)	(1.00)	(1.27)

Table 8: Conditional Liquidity Risk and Fund Returns

Fund and holdings liquidity betas are calculated as described in Table 4. Amihud regime is an indicator variable with a value of 1 for the top quintile illiquid months as measured by the innovations in equal-weighted market normalized Amihud liquidity (Acharya and Pedersen (2005)) and 0 otherwise. Coefficients reported are from regressions of raw and risk adjusted fund excess net and gross returns on cross-sectionally normalized liquidity betas (~N(0,1)), liquidity regime indicator variable, the interaction of liquidity beta and regime indicator, and fund controls (Chen et al. (2004)) which include fund holdings Amihud liquidity. For brevity, only the coefficients for liquidity betas, regime and interactions with liquidity regime and beta are reported. Net returns are as reported by CRSP. Gross returns are net returns plus estimated monthly transaction costs (Wermers (2000)) plus 1/12 the fund's annual expense ratio. Risk adjusted returns used as dependent variables for regressions are generated from a rolling 60 (minimum 48) month regressions of fund excess returns on either the single (CAPM), three (Fama-French) or four factor (Carhart) models. t-statistics, based on standard errors clustered by fund and time are reported below.

	Net				Gross			
	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4
AmihudN								
Beta	0.07	0.09	0.05	0.07	0.08	0.09	0.06	0.08
	(1.29)	(1.91)	(1.22)	(2.19)	(1.36)	(1.80)	(1.46)	(2.20)
Regime*Beta	-0.07	-0.14	-0.19	-0.21	-0.07	-0.13	-0.21	-0.22
	(-0.51)	(-1.24)	(-2.32)	(-2.71)	(-0.49)	(-1.02)	(-2.23)	(-2.44)
Regime	-2.47	-0.22	0.15	0.19	-2.01	-0.19	0.15	0.19
	(-2.46)	(-1.73)	(1.35)	(1.74)	(-2.33)	(-1.47)	(1.26)	(1.64)
Pastor-Stambaugh								
Beta	0.13	0.16	0.08	0.07	0.14	0.17	0.07	0.07
	(2.95)	(3.20)	(2.17)	(2.40)	(3.07)	(3.36)	(2.01)	(2.07)
Regime *Beta	-0.41	-0.33	-0.19	-0.19	-0.39	-0.33	-0.18	-0.18
	(-2.89)	(-3.21)	(-2.47)	(-2.49)	(-2.76)	(-3.08)	(-2.06)	(-2.18)
Regime	-2.47	-0.22	0.15	0.19	-2.01	-0.19	0.15	0.19
	(-2.47)	(-1.74)	(1.35)	(1.74)	(-2.33)	(-1.48)	(1.25)	(1.64)
Sadka								
Beta	0.06	0.05	0.02	0.02	0.08	0.07	0.04	0.04
	(1.42)	(1.39)	(0.53)	(0.73)	(1.77)	(1.60)	(1.08)	(1.18)
Regime *Beta	0.05	0.06	0.03	-0.00	0.06	0.06	0.01	-0.03
	(0.51)	(0.83)	(0.40)	(-0.04)	(0.69)	(0.65)	(0.08)	(-0.36)
Regime	-2.36	-0.23	0.15	0.19	-1.86	-0.20	0.16	0.19
	(-2.32)	(-1.78)	(1.37)	(1.73)	(-2.13)	(-1.52)	(1.29)	(1.64)

Table 9: Liquidity, Liquidity Risk and Fund Returns

Fund and holdings liquidity betas are calculated as described in Table 4. Amihud is defined in described in Table 2. Amihud regime is an indicator variable with a value of 1 for the top quintile illiquid months as measured by the innovations in equal-weighted market normalized Amihud liquidity (Acharya and Pedersen (2005)) and 0 otherwise. Coefficients reported are from regressions of raw and risk adjusted fund excess net and gross returns on cross-sectionally normalized liquidity betas (~N(0,1)), liquidity regime indicator variable, the interaction of liquidity beta and regime indicator, and fund controls (Chen et al. (2004)) which include fund holdings Amihud liquidity. For brevity, only the coefficients for liquidity betas, regime, interactions with liquidity regime and beta, liquidity and interactions with liquidity are reported. Net returns are as reported by CRSP. Gross returns are net returns plus estimated monthly transaction costs (Wermers (2000)) plus 1/12 the fund's annual expense ratio. Risk adjusted returns used as dependent variables for regressions are generated from a rolling 60 (minimum 48) month regressions of fund excess returns on either the single (CAPM), three (Fama-French) or four factor (Carhart) models. t-statistics, based on standard errors clustered by fund and time are reported below.

	Net				Gross			
	Ret	α_1	α_3	α_4	Ret	α_1	α_3	α_4
AmihudN								
Beta	0.07	0.08	0.02	0.04	0.08	0.08	0.03	0.04
	(1.22)	(1.74)	(0.69)	(1.47)	(1.28)	(1.62)	(0.81)	(1.46)
Regime*Beta	-0.06	-0.09	-0.13	-0.14	-0.06	-0.06	-0.39	-0.15
	(-0.41)	(-0.77)	(-1.73)	(-1.93)	(-0.42)	(-0.48)	(-1.65)	(-1.83)
Amihud	0.11	0.12	0.01	0.03	0.12	0.11	0.01	0.03
	(3.02)	(3.72)	(0.70)	(1.62)	(3.12)	(3.51)	(0.61)	(1.41)
Regime*Amihud	-0.14	-0.27	-0.06	-0.07	-0.11	-0.23	-0.03	-0.04
	(-1.49)	(-3.51)	(-1.82)	(-2.04)	(-1.26)	(-2.87)	(-0.81)	(-1.02)
Regime	-2.53	-0.22	0.13	0.15	-2.05	-0.22	0.12	0.15
	(-2.46)	(-1.78)	(1.23)	(1.45)	(-2.35)	(-1.74)	(0.97)	(1.32)
Pastor-Stambaugh								
Beta	0.13	0.14	0.07	0.07	0.13	0.16	0.07	0.08
	(2.88)	(2.97)	(2.02)	(2.80)	(2.90)	(3.12)	(2.11)	(2.95)
Regime *Beta	-0.43	-0.32	-0.16	-0.15	-0.38	-0.31	-0.16	-0.15
	(-2.86)	(-3.04)	(-1.92)	(-1.90)	(-2.63)	(-2.83)	(-1.75)	(-1.84)
Amihud	0.11	0.12	0.01	0.03	0.12	0.11	0.01	0.03
	(2.97)	(3.75)	(0.67)	(1.69)	(3.08)	(3.51)	(0.61)	(1.47)
Regime*Amihud	-0.14	-0.27	-0.07	-0.09	-0.11	-0.23	-0.04	-0.05
	(-1.59)	(-3.69)	(-2.18)	(-2.43)	(-1.26)	(-2.92)	(-1.05)	(-1.31)
Regime	-2.53	-0.22	0.13	0.15	-2.05	-0.22	0.11	0.15
	(-2.47)	(-1.79)	(1.22)	(1.44)	(-2.35)	(-1.75)	(0.96)	(1.31)
Sadka								
Beta	0.02	0.03	0.01	0.01	0.03	0.04	0.01	0.01
	(0.59)	(0.87)	(0.17)	(0.54)	(0.81)	(0.91)	(0.29)	(0.63)
Regime *Beta	0.08	0.14	0.07	0.03	0.09	0.15	0.08	0.04
	(0.79)	(2.12)	(0.96)	(0.60)	(0.96)	(2.07)	(1.09)	(0.77)
Amihud	0.12	0.13	0.02	0.03	0.13	0.12	0.02	0.03
	(3.14)	(3.77)	(0.80)	(1.77)	(3.28)	(3.60)	(0.71)	(1.56)
Regime*Amihud	-0.17	-0.29	-0.08	-0.09	-0.15	-0.25	-0.06	-0.06
	(-1.82)	(-3.93)	(-2.49)	(-2.64)	(-1.76)	(-3.28)	(-1.35)	(-1.50)
Regime	-2.41	-0.23	0.14	0.15	-1.90	-0.23	0.12	0.15
	(-2.32)	(-1.83)	(1.23)	(1.42)	(-2.15)	(-1.78)	(0.98)	(1.30)