Liquidity Level or Liquidity Risk? Evidence from the Financial Crisis*

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Abstract

This paper distinguishes between a stock's liquidity (liquidity level), as measured by the average cost of trading it, and its liquidity beta (liquidity risk), as measured by the covariation of its return with unexpected changes in aggregate liquidity. Although considered safe assets in general, liquid stocks underperformed illiquid stocks during the financial crisis of 2008–2009. The performance of stocks during the crisis can be better explained by their historical liquidity betas. These findings therefore highlight the importance of accounting for both liquidity level and liquidity risk in risk-management applications.

JEL classification: G12; G14; G23

Keywords: Liquidity risk; Liquidity Level; Asset pricing; Risk Management; Financial Crisis

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"What's your liquidity?" This is the question many investment managers, across different markets and asset classes, have been facing in the wake of the recent financial crisis. A typical answer of a savvy manager often includes a statement such as "a significant proportion of our investments are in liquid securities." As important as liquidity may be, does investing in liquid securities offer protection during periods of crisis? Did large-cap, liquid stocks suffer less than small-cap, illiquid stocks during the fall of 2008 through the winter of 2009? Not at all. In fact, this paper shows that stocks that were perceived liquid before the crisis performed worse than illiquid stocks. How then can one anticipate the stock-price behavior of firms during a crisis?

The purpose of this article is to highlight the difference between liquidity level and liquidity risk and show that the latter is a better predictor of performance during a crisis. We refer to the level of a stock's liquidity as the ability to trade large quantities of its shares quickly at low cost, on average. In contrast, the liquidity risk (beta) of a stock is measured by the covariation of its returns with unexpected changes in aggregate liquidity. The two measures capture different attributes of a stock's liquidity profile. For example, liquidity level may be considered a mean effect while liquidity beta may signify a volatility or correlation effect. We find that during the financial crisis of 2008–2009, stocks with high liquidity betas underperformed, irrespective of their historical liquidity levels, while stocks with different historical levels of liquidity did not experience different returns after controlling for liquidity risk. As the correlation between stock liquidity variations has been increasing over the past few decades (see Kamara, Lou, and Sadka (2009)), these results highlight the importance of accounting for liquidity risk in risk-management applications.

Data and Measures

Our sample consists of all NYSE/AMEX-listed common stocks whose price is in the range \$5–\$1,000 at the end of 2007. We use the Amihud (2002) illiquidity measure as a measure of the liquidity level of a given stock. The Amihud measure, $ILLIQ$, is calculated as the daily ratio of the absolute value of the return and dollar volume, averaged over all trading days during a given period. Specifically,

$$ILLIQ_i = \frac{1}{D}\sum_{d=1}^{D}\frac{|R_{i,d}|}{dvol_{i,d}}, \tag{1}$$

where $R_{i,d}$ is the return of stock i during day d, $dvol$ denotes daily dollar volume, and D is the number of trading days during the time period. Note that a higher value of $ILLIQ$ signifies higher

illiquidity, as a particular dollar volume traded is associated with a relatively high price movement.

In contrast, the liquidity risk exposure of a given stock is calculated through a regression of monthly stock returns on the value-weighted return index and an aggregate liquidity risk factor,

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i^{Ret} [R_{m,t} - R_{f,t}] + \beta_i^{Liq} L_{m,t} + \varepsilon_{i,t}, \tag{2}$$

where $R_{i,t}$ is the return of stock i during month t, $R_{f,t}$ is the monthly risk-free rate, $R_{m,t}$ is the value-weighted market average return, $L_{m,t}$ is a (nontraded) liquidity risk factor, and $\varepsilon_{i,t}$ is an error term.[1] The coefficient on the liquidity factor, β_i^{Liq}, measures the return sensitivity of a stock to changes in market-wide liquidity and is referred to as the measure of liquidity risk (beta). To estimate liquidity beta, we consider two liquidity factors, those proposed by Pástor and Stambaugh (2003) and Sadka (2006).[2] The Pástor and Stambaugh measure is based on daily stock-price reversal while the Sadka factor is based on the permanent component of trade-to-trade price impact (see the appendix for more description of these factors).[3] Because price impact measures illiquidity, not liquidity, a negative sign is added to the time series of price impact, so that a positive shock can be interpreted as an improvement to market liquidity. Both measures are estimated monthly at the individual stock level, then averaged to compose a market measure of liquidity each month. Therefore, a higher value of β_i^{Liq} means that a lower stock return is exhibited during a month of a negative liquidity shock (i.e., $L_{m,t}$ is negative). Stocks with higher liquidity betas are more sensitive to market liquidity shocks and are therefore considered to be more risky.[4] Pástor and Stambaugh report that liquidity beta typically increases with average stock illiquidity, average volume, and share price, while it decreases with return volatility and shares outstanding. It has no particular relation with past performance (momentum).

[1] We thank Ken French for providing the risk-free rate and market return on his website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[2] We thank Ľuboš Pástor for providing the aggregate measure of Pástor and Stambaugh (2003) on his website: http://faculty.chicagobooth.edu/lubos.pastor/research/.

[3] Four components of price impact—permanent-fixed, transitory-fixed, permanent-variable, and transitory-variable—are estimated in Sadka (2006). Sadka shows that only the permanent-variable component is priced in the cross-section of stocks. We therefore use this component as a liquidity factor.

[4] The non-diversifibility of market liquidity shocks still remains a subject of research. Recently, Korajczyk and Sadka (2008) report that systematic liquidity variations capture between 20% and 60% of individual firm liquidity variation, depending on the liquidity measure used. Furthermore, shocks to assets' liquidity have a common component across measures which accounts for most of the explained variation in individual liquidity measures.

The Liquidity Level Return Spread

We begin the analysis by forming two portfolios based on stock liquidity level. The portfolios are formed once, at the beginning of 2008, based on liquidity levels measured over 2007. Table 1 and Figure 1 report the monthly portfolio returns and cumulative returns over the period 2008–2009. The spread between the portfolio return of illiquid firms and that of the liquid firms is positive throughout most of the crisis period, peaking at 6.6% at the end of September 2008. These results contrast with the view that the return spread between illiquid and liquid firms represents a premium for liquidity risk because such a view would predict that illiquid firms would have underperformed during the liquidity crisis of 2008. Additionally, the results suggest that investing in liquid securities does not offer a good hedge against liquidity crises.

The Liquidity Risk Return Spread

If one is interested in designing a strategy that offers a good hedge for unanticipated drops in aggregate liquidity, a more appropriate approach would be to form portfolios based on historical exposure to liquidity risk. For Table 2 and Figure 2, we sort firms into two portfolios based on liquidity beta measured over the 60-month period of 2003–2007. We report results for two sets of portfolio sorts, each using a different liquidity factor to measure liquidity risk. For both liquidity factors, we find that the return spread between high liquidity risk and low liquidity risk stocks sharply declines around the crisis period, followed by a rebound after the first quarter of 2009. Note that the liquidity risk measure is based on the historical sensitivity of stock returns to the liquidity factor. These results therefore highlight the out-of-sample predictability of liquidity risk. When a liquidity crisis hits the market, the high liquidity risk stocks drop more than the low liquidity risk stocks. Therefore, hedging against liquidity risk would involve taking the opposite strategy–i.e. long low-liquidity risk and short high-liquidity risk stocks.

Double Sorts

To better understand the relation between liquidity level and liquidity risk during the crisis, we construct a 2-by-2 portfolio sort on liquidity level and liquidity risk (portfolios are independently formed by each variable). Table 3 reports the equally weighted average of liquidity level, liquidity

risk, and market capitalization (in logs) for the stocks in each portfolio. As expected, the liquid portfolios seem to include larger stocks, on average, than the illiquid portfolios. Yet, there is no substantial difference in firm size across portfolios with different liquidity risks. This suggests that some large-cap firms, although liquid, entail significant liquidity risk while some small-cap, illiquid stocks bear a low liquidity-risk exposure.

To demonstrate that not all liquid stocks behaved in the same manner during the crisis, we first investigate the liquidity dynamics of two portfolios, the liquid and high-liquidity risk stocks and the liquid and low-liquidity risk stocks. For each portfolio, we calculate its average monthly liquidity over August 2008 through December 2009. Monthly liquidity per stock is calculated using the Amihud (2002) measure computed over the trading days of each month. The results are plotted in Figure 3. The portfolios are fairly liquid in August 2008, as indicated by values very close to zero. Since September 2008, both portfolios exhibit a drop in liquidity, as shown by the increase in the Amihud illiquidity measure. Yet, their liquidity deteriorates to different extents. Specifically, the liquid stocks with high liquidity risk show a more significant drop in liquidity compared to the liquid stocks with low liquidity risk (one exception is November 2008, using exposures to the Pástor and Stambaugh factor). These results suggest that among the liquid stocks, those with high liquidity risk became less liquid than those with low liquidity risk, during the crisis.

A different and arguably more important question is the performance of the different portfolios during the crisis period. Table 4 and Figure 4 track the performance of the portfolios over September 2008 through December 2009. Table 4 reports the cumulative returns for the four portfolios sorted by liquidity level and liquidity risk estimated using the Pástor and Stambaugh (2003) liquidity factor (Panel A) and the Sadka (2006) liquidity factor (Panel B). The return values are all negative, suggesting that all portfolios experience a price decline over the sample period. Figure 4 provides a visual illustration of the gross cumulative returns of the portfolios over the sample period. The cumulative gross returns are all below one, reflecting the poor performance of the stock market during the crisis. The four portfolios appear to fall into two distinct groups based on their liquidity risks. The two high-liquidity risk portfolios lie well below the two low-liquidity risk portfolios. In each liquidity-risk group, the differences between the two portfolios with different pre-crisis liquidity levels appear to be small. The results indicate that while all four portfolios experience a price decline over the sample period, the high liquidity beta portfolios, both liquid and illiquid, exhibit a more significant drop than the low liquidity risk portfolios. In both liquidity-risk categories,

the differences between liquid and illiquid stocks seem rather insignificant. Some stocks that were considered liquid by historical measures, suffered more than other liquid stocks. In some cases, the price of liquid stocks dropped more than that of illiquid stocks. This suggests that liquidity risk is more appropriate for predicting performance during crisis periods than liquidity level. Similar results are obtained when using market capitalization as of end of 2007 instead of liquidity level to form the portfolios.

Regression Analysis

To gauge the statistical significance of our findings, we report results of cross-sectional regressions in Table 5. We run cross-sectional regressions of the form:

$$R_{i,t\to t+j} = \lambda_{0,j} + \lambda_{1,j}\beta_i^{Ret} + \lambda_{2,j}\beta_i^{Liq} + \lambda_{3,j}ILLIQ_i + \eta_{i,j}, \tag{3}$$

where $R_{i,t\to t+j}$ is the cumulative return of stock i for the period t through $t+j$, β_i^{Ret} and β_i^{Liq} are market return beta and liquidity beta estimated jointly through Equation (2) over the period 2003–2007, $ILLIQ_i$ is the illiquidity measure calculated as in Equation (1) over the year 2007, and $\eta_{i,j}$ is an error term. Month t is September 2008, and j receives values of 0 through 15. In other words, we consider 16 time intervals: all beginning in September 2008 and ending in each of the subsequent months through December 2009. We report the regression coefficients, t-statistics, and R^2. To relate to our earlier discussion of the liquidity level return spread, we also report regression results using $ILLIQ_i$ as a single explanatory variable.

There are several interesting results. First, when considered as a single explanatory variable, the illiquidity of a stock generally assumes a positive (and sometimes significant) coefficient, which is consistent with the results of Table 1 and Figure 1. Second, market return betas have significant coefficients, which is consistent with the market return index capturing some systematic return variation among stocks. Third, liquidity betas are also significant through about mid 2009, suggesting that liquidity risk has incremental risk-relevant information. Fourth, even though the illiquidity of a stock is generally positive when considered as a single variable, it turns out to be insignificant once controlling for market and liquidity beta. Finally, the regression R^2s seem relatively high given that the regressions are performed using individual firms, implying that market beta and liquidity beta seem to explain a significant proportion of the cross-sectional variation in stock returns during the financial crisis. Overall, the results of the regression analysis are consistent with those of the

portfolio analysis and provide further evidence for the predictive power of liquidity risk, and the lack thereof liquidity level, for stock returns in periods of crisis.

Liquidity Level and Risk Over Time

The evidence provided thus far suggests little correlation between the liquidity level return spread and liquidity risk, that is, the performance of illiquid stocks relative to liquid stocks is not highly related to the overall liquidity conditions in the market. The implication is that liquid stocks do not necessarily serve as a valuable hedging tool against liquidity crises.

To study this relation more closely, we track the monthly liquidity level return spread over 1968–2008. This is done by sorting stocks into two portfolios at the beginning of each year based on the Amihud measure calculated over the previous year, and comparing their returns over the following year. We run a time-series regression of the monthly liquidity level return spread on each liquidity factor (the Sadka factor is only available from 1983). To allow for some response time, we also include two monthly lags of each factor in the regressions. The results are reported in Table 6. The regression coefficients are generally positive, and even significant for the Sadka factor. Yet, the regression R^2 are lower than 3.5%, indicating a very low correlation between the liquidity level return spread and market liquidity. Thus, the results outlaid for the recent liquidity crisis seem to extend to a longer sample.

Conclusion

In sum, this paper emphasizes the importance of distinguishing between a stock's liquidity level and its liquidity risk. We show that during the crisis of 2008, liquidity risk rather than liquidity level could explain the cross-section of stock returns. The results show that during the crisis, liquid stocks suffered as bad or, in some cases, even worse than illiquid stocks. With some benefit of hindsight, these results are perhaps not particularly surprising. After all, which stocks are more likely to suffer during a liquidity crisis? We advance that liquid stocks with high liquidity risk are those which a portfolio manager should worry about because their liquidity is likely to dry-up during a crisis; the illiquid stocks will continue to be illiquid. The liquidity beta offers a way of measuring this type of risk. Furthermore, as variances are more persistent than means, liquidity beta, albeit itself an

estimate, could provide more accurate out-of-sample signals for risk management. Finally, relating to concurrent events, the SEC and the CFTC recently published their report on the "flash-crash" of May 6, 2010. Once again, large companies, such as P&G and Accenture, were some of those most affected by this crisis, which lends further supporting evidence for our argument.

Appendix

This appendix summarizes the estimation procedures of the Pástor and Stambaugh and Sadka liquidity factors.

Pástor and Stambaugh (2003)

Using daily data, the following regression is estimated per firm per month

$$r^e_{i,d+1,t} = \theta_{i,t} + \phi_{i,t} r_{i,d,t} + \gamma_{i,t} sign\left(r^e_{i,d,t}\right) v_{i,d,t} + \varepsilon_{i,d+1,t}, \tag{4}$$

where $r_{i,d,t}$ is the return on stock i on day d in month t, $r^e_{i,d,t} = r_{i,d,t} - r_{m,d,t}$ ($r_{m,d,t}$ is the CRSP value-weighted market return on day d in month t), $v_{i,d,t}$ is the dollar volume for stock i on day d in month t, and $\varepsilon_{i,d+1,t}$ is an error term. The measure γ represents the dimension of liquidity that is associated with temporary price changes accompanying order flow. It is typically negative, capturing a price-reversal effect, and the more negative its value, the more illiquid the stock.

After estimating γ per firm per month, it is averaged across firms monthly, thereby creating an aggregate time series. Two final adjustments are implemented to obtain the liquidity risk factor. First, an adjustment is made to capture the significant change in firm market capitalization over time which affects this measure of liquidity. Second, since the time series exhibits significant persistence, liquidity shocks are calculated as the error terms from a model similar to an AR(2).

Sadka (2006)

Using intra-day data, the following regression is estimated per firm per month

$$\Delta p_t = \Psi D_t + \lambda D_t V_t + \overline{\Psi} \Delta D_t + \overline{\lambda} \Delta D_t V_t + y_t, \tag{5}$$

where Δp_t is change in transaction price, V_t is the order flow (trade size), D_t an indicator variable that receives a value of (+1) for a buyer-initiated trade and (-1) for a seller-initiated trade, and y_t is the unobservable pricing error. A trade is classified as buyer- or seller-initiated if the trade price is above or below the midpoint of the quoted bid and ask as of a second before the transaction

had occurred, respectively (trades priced exactly at midpoint are discarded from the estimation). The equation above is further adjusted to account for predictability in order flow and block trades. Specifically, D_tV_t is replaced with unanticipated order flow, calculated as the fitted error term from a five-lag autocorrelation regression of D_tV_t (D_t is also replaced with its unanticipated component), and a dummy variable is included for each of the four terms to separate trades of above 10,000 shares.

The regression thus separates four components of price impact: Fixed effects (unrelated to trade size), Ψ and $\overline{\Psi}$ (permanent and transitory, respectively), and variable costs, λ and $\overline{\lambda}$ (permanent and transitory, respectively). A permanent price effect is one that carries on to the next trade, while a transitory effect is one that affects only the current trade price.

After estimating the four components of price impact per firm per month, each component is averaged across firms monthly, thereby creating four aggregate time series. Two final adjustments are implemented to obtain liquidity risk factors. First, since price impacts measure illiquidity rather than liquidity, a negative sign is added to each time series so that negative values represent a deterioration in market liquidity. Second, since the time series exhibit significant persistence, liquidity shocks are calculated as the error terms from an AR(2) model applied to each time series. Sadka (2006) shows that of the four aggregate price-impact factors, only the variable-permanent liquidity factor, λ, is priced in the cross-section of stocks. We therefore use this factor for our tests throughout this paper.

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Table 1. Returns of Portfolios Sorted by Liquidity Level

	A. Return			*B. Cumulative Return since January, 2008*		
Month	Liquid	Illiquid	Illiquid - Liquid	Liquid	Illiquid	Illiquid - Liquid
Jan-08	-4.1	-4.5	-0.4	-4.1	-4.5	-0.4
Feb-08	-3.0	-1.2	1.8	-7.2	-5.8	1.4
Mar-08	-2.6	0.0	2.6	-9.4	-5.6	3.7
Apr-08	5.3	2.3	-3.0	-4.5	-3.6	0.9
May-08	3.3	3.8	0.5	-1.0	0.0	1.0
Jun-08	-9.9	-8.4	1.6	-9.1	-7.2	1.9
Jul-08	-0.7	2.2	2.9	-11.0	-6.4	4.6
Aug-08	4.7	2.8	-1.9	-8.1	-4.1	4.0
Sep-08	-11.7	-8.7	3.0	-18.7	-12.1	6.6
Oct-08	-22.3	-22.8	-0.5	-35.9	-30.5	5.4
Nov-08	-12.0	-13.9	-2.0	-43.0	-38.5	4.5
Dec-08	5.8	5.6	-0.2	-40.9	-36.0	4.8
Jan-09	-7.2	-9.2	-2.0	-45.0	-42.4	2.7
Feb-09	-12.8	-14.1	-1.3	-51.1	-49.6	1.5
Mar-09	11.7	11.1	-0.6	-46.8	-46.4	0.4
Apr-09	24.4	26.7	2.3	-38.4	-37.4	1.0
May-09	7.4	9.1	1.7	-35.9	-34.7	1.1
Jun-09	-0.7	1.3	2.0	-36.1	-34.0	2.1
Jul-09	11.3	11.5	0.2	-29.9	-28.2	1.7
Aug-09	8.0	7.4	-0.6	-26.5	-25.5	0.9
Sep-09	6.0	8.4	2.3	-22.5	-21.3	1.2
Oct-09	-4.7	-6.0	-1.3	-25.6	-25.7	-0.1
Nov-09	4.7	2.2	-2.5	-22.0	-23.9	-1.9
Dec-09	6.0	7.8	1.8	-17.6	-18.7	-1.1

Notes: This table reports the returns and cumulative returns (in percent) of two portfolios formed based on liquidity level. The cumulative returns are computed over expanding time intervals beginning January 2008 through each of the months until December 2009. Liquidity level is measured by the average daily Amihud (2002) measure over the year of 2007 for firms with at least 100 non-missing daily observations. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

Table 2. Returns of Portfolios Sorted by Liquidity Risk

	A. Return						*B. Cumulative Return*					
	A.1. Pástor and Stambaugh (2003)			*A.2. Sadka (2006)*			*B.1. Pástor and Stambaugh (2003)*			*B.2. Sadka (2006)*		
Month	Low Liquidity Risk	High Liquidity Risk	High Risk-Low Risk	Low Liquidity Risk	High Liquidity Risk	High Risk-Low Risk	Low Liquidity Risk	High Liquidity Risk	High Risk-Low Risk	Low Liquidity Risk	High Liquidity Risk	High Risk-Low Risk
Jan-08	-4.0	-4.2	-0.2	-3.9	-4.3	-0.4	-4.0	-4.2	-0.2	-3.9	-4.3	-0.4
Feb-08	-3.2	-0.9	2.3	-2.0	-2.0	0.0	-7.2	-5.3	1.9	-6.0	-6.5	-0.4
Mar-08	-0.7	-1.5	-0.9	-0.3	-1.9	-1.6	-7.7	-6.6	1.1	-6.2	-8.2	-2.0
Apr-08	3.3	5.0	1.8	4.3	3.9	-0.4	-4.9	-2.1	2.8	-2.3	-4.7	-2.4
May-08	2.1	4.8	2.8	3.2	3.7	0.5	-2.9	2.8	5.7	0.9	-1.0	-1.9
Jun-08	-9.6	-9.3	0.3	-8.3	-10.7	-2.4	-11.0	-5.1	6.0	-6.3	-9.9	-3.6
Jul-08	2.0	-0.1	-2.1	1.0	0.9	0.0	-10.2	-6.6	3.6	-6.5	-10.4	-3.9
Aug-08	3.6	4.7	1.1	3.8	4.5	0.7	-7.3	-3.8	3.6	-4.2	-6.9	-2.7
Sep-08	-7.8	-12.4	-4.6	-9.8	-10.3	-0.5	-14.0	-15.9	-1.9	-13.8	-16.1	-2.3
Oct-08	-19.5	-25.7	-6.2	-20.1	-25.1	-5.0	-29.4	-36.8	-7.4	-30.2	-36.0	-5.7
Nov-08	-11.5	-14.4	-2.9	-11.2	-14.7	-3.4	-36.6	-45.3	-8.7	-37.6	-44.2	-6.6
Dec-08	5.1	6.0	0.9	3.6	7.6	3.9	-34.5	-42.9	-8.4	-35.7	-41.7	-6.0
Jan-09	-8.7	-8.4	0.3	-8.5	-8.5	0.0	-40.0	-48.2	-8.1	-41.0	-47.2	-6.2
Feb-09	-12.6	-14.6	-2.0	-12.6	-14.6	-1.9	-46.8	-54.9	-8.1	-47.5	-54.1	-6.6
Mar-09	11.5	10.8	-0.7	11.5	10.8	-0.6	-42.5	-51.2	-8.7	-43.2	-50.7	-7.5
Apr-09	21.0	30.0	9.0	22.0	29.2	7.2	-35.1	-40.7	-5.6	-35.0	-41.0	-6.0
May-09	5.2	10.0	4.9	5.9	9.4	3.5	-33.7	-37.4	-3.7	-33.1	-38.0	-4.9
Jun-09	0.7	-0.1	-0.8	-0.1	0.8	0.9	-32.9	-37.6	-4.7	-32.7	-37.8	-5.1
Jul-09	9.9	13.3	3.4	10.6	12.5	1.9	-27.3	-30.6	-3.3	-26.7	-31.2	-4.5
Aug-09	7.3	8.2	0.9	6.5	9.0	2.5	-25.0	-26.7	-1.7	-24.2	-27.5	-3.4
Sep-09	5.4	8.1	2.6	6.1	7.4	1.3	-22.2	-21.5	0.8	-20.4	-23.3	-2.9
Oct-09	-5.3	-5.3	0.0	-4.9	-5.7	-0.8	-25.4	-25.3	0.1	-23.5	-27.3	-3.7
Nov-09	3.7	3.6	-0.1	3.6	3.7	0.1	-22.7	-22.4	0.3	-20.7	-24.4	-3.7
Dec-09	5.7	8.0	2.3	6.2	7.6	1.4	-18.7	-17.0	1.7	-16.4	-19.3	-2.9

Notes: This table reports the returns and cumulative returns (in percent) of two portfolios sorted by liquidity beta. The cumulative returns are computed over expanding time intervals beginning January 2008 through each of the months until December 2009. A firm's liquidity beta is estimated using monthly data from January 2003 to December 2007 by regressing the firm's monthly excess returns on the market risk premium and a liquidity factor, either the Pástor and Stambaugh (2003) factor or the Sadka (2006) factor. Only firms with at least 24 monthly return observations to estimate liquidity beta are included in the portfolios. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

Table 3. Characteristics of Portfolios Sorted by Liquidity Level and Liquidity Risk

	A. Pástor and Stambaugh (2003) Liquidity Factor				*B. Sadka (2006) Liquidity Factor*			
	liquid + low risk	liquid + high risk	illiquid + low risk	illiquid + high risk	liquid + low risk	liquid + high risk	illiquid + low risk	illiquid + high risk
Amihud Measure (10^{-3})	0.279	0.365	272.9	106.2	0.313	0.328	205.8	168.1
liquidity Risk	-0.079	0.257	-0.116	0.279	-1.379	2.224	-1.969	2.921
Log(Market Cap in millions)	9.032	8.514	6.110	6.023	8.865	8.698	6.230	5.900

Notes: This table reports the characteristics of four portfolios formed based on liquidity level and liquidity risk. Liquidity level is measured by the average daily Amihud (2002) measure over the year of 2007 for firms with at least 100 non-missing daily observations. Liquidity risk is estimated using monthly data from January 2003 to December 2007 by regressing a firm's monthly excess returns on market excess returns and a liquidity factor, either the Pástor and Stambaugh (2003) factor or the Sadka (2006) factor. A firm needs to have at least 24 monthly return observations to have a beta estimate. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

Table 4. Cumulative Returns of Portfolios Sorted by Liquidity Level and Liquidity Risk

	A. Pástor and Stambaugh (2003) Liquidity Factor				*B. Sadka (2006) Liquidity Factor*			
Month	liquid + low risk	liquid + high risk	illiquid + low risk	illiquid + high risk	liquid + low risk	liquid + high risk	illiquid + low risk	illiquid + high risk
Sep-08	-8.6	-14.6	-5.9	-10.6	-11.3	-11.8	-7.8	-8.8
Oct-08	-25.6	-36.5	-24.0	-33.8	-28.7	-33.2	-26.1	-31.9
Nov-08	-32.1	-45.1	-33.2	-43.3	-35.6	-41.3	-34.2	-42.7
Dec-08	-30.0	-42.4	-30.8	-40.5	-33.4	-38.8	-32.2	-39.4
Jan-09	-34.9	-46.9	-37.7	-46.8	-38.6	-43.0	-38.7	-46.1
Feb-09	-42.2	-53.2	-45.1	-54.6	-45.2	-50.1	-46.1	-53.9
Mar-09	-37.3	-48.7	-40.8	-51.4	-40.0	-46.0	-42.1	-50.4
Apr-09	-30.1	-36.9	-30.9	-40.5	-31.7	-35.3	-32.5	-39.2
May-09	-27.9	-33.2	-30.3	-36.1	-29.4	-31.6	-31.2	-35.3
Jun-09	-27.0	-34.5	-29.3	-34.6	-29.4	-32.0	-30.1	-33.8
Jul-09	-21.1	-26.3	-22.9	-26.8	-23.1	-24.3	-23.6	-26.2
Aug-09	-17.2	-21.4	-21.2	-22.6	-19.0	-19.5	-21.8	-22.0
Sep-09	-14.2	-15.7	-17.6	-17.1	-15.3	-14.6	-17.4	-17.3
Oct-09	-17.4	-20.4	-21.9	-22.5	-18.8	-19.0	-21.1	-23.4
Nov-09	-13.0	-17.1	-20.5	-19.9	-14.6	-15.3	-19.8	-20.6
Dec-09	-9.6	-10.7	-15.0	-13.9	-10.7	-9.6	-14.7	-14.2

Notes: This table reports the cumulative returns (in percent) of four portfolios formed based on liquidity level and liquidity risk. The returns are computed over expanding time intervals beginning September 2008 through each of the months until December 2009. Liquidity level is measured by the average daily Amihud (2002) measure over the year of 2007 for firms with at least 100 non-missing daily observations. Liquidity risk is estimated using monthly data from January 2003 to December 2007 by regressing a firm's monthly excess returns on market excess returns and a liquidity factor, either the Pástor and Stambaugh (2003) factor or the Sadka (2006) factor. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

Table 5. Explaining the Cross-Section of Stock Returns, September 2008 -- December 2009

Month	*A. Illiquidity Only*		*B. Pástor and Stambaugh (2003) Liquidity Factor*				*C. Sadka (2006) Liquidity Factor*			
	Illiquidity	R^2	Market Risk	Liquidity Risk	Illiquidity	R^2	Market Risk	Liquidit Risk	Illiquidity	R^2
Sep-08	0.003	0.000	-0.037	-0.083	-0.024	0.053	-0.043	0.000	-0.024	0.039
	[0.13]		[-6.22]	[-4.99]	[-1.13]		[-7.19]	[-0.22]	[-1.15]	
Oct-09	0.071	0.005	-0.076	-0.169	0.017	0.123	-0.085	-0.006	0.020	0.098
	[2.44]		[-9.69]	[-7.73]	[0.62]		[-10.79]	[-3.24]	[0.71]	
Nov-08	0.046	0.001	-0.097	-0.186	-0.019	0.129	-0.106	-0.010	-0.015	0.114
	[1.32]		[-10.61]	[-7.30]	[-0.57]		[-11.57]	[-4.41]	[-0.46]	
Dec-08	-0.004	0.000	-0.090	-0.175	-0.064	0.098	-0.099	-0.008	-0.062	0.084
	[-0.11]		[-9.05]	[-6.30]	[-1.79]		[-9.97]	[-3.22]	[-1.72]	
Jan-09	0.020	0.000	-0.100	-0.162	-0.046	0.115	-0.108	-0.008	-0.042	0.105
	[0.56]		[-10.39]	[-5.98]	[-1.34]		[-11.30]	[-3.29]	[-1.21]	
Feb-09	0.081	0.004	-0.094	-0.158	0.019	0.113	-0.101	-0.008	0.024	0.104
	[2.32]		[-9.97]	[-5.98]	[0.57]		[-10.81]	[-3.68]	[0.70]	
Mar-09	0.034	0.001	-0.087	-0.197	-0.025	0.098	-0.095	-0.011	-0.019	0.084
	[0.90]		[-8.44]	[-6.83]	[-0.69]		[-9.33]	[-4.29]	[-0.52]	
Apr-09	0.057	0.002	-0.055	-0.156	0.015	0.047	-0.062	-0.008	0.020	0.038
	[1.45]		[-5.07]	[-5.15]	[0.39]		[-5.75]	[-3.28]	[0.53]	
May-09	0.084	0.004	-0.058	-0.093	0.044	0.039	-0.062	-0.004	0.047	0.036
	[2.25]		[-5.51]	[-3.14]	[1.17]		[-5.97]	[-1.71]	[1.24]	
Jun-09	0.088	0.004	-0.066	-0.111	0.042	0.042	-0.071	-0.003	0.045	0.036
	[2.12]		[-5.67]	[-3.40]	[1.02]		[-6.20]	[-1.06]	[1.07]	
Jul-09	0.047	0.001	-0.059	-0.099	0.006	0.026	-0.064	-0.001	0.008	0.021
	[1.02]		[-4.56]	[-2.73]	[0.13]		[-5.01]	[-0.36]	[0.16]	
Aug-09	0.021	0.000	-0.045	-0.072	-0.010	0.014	-0.051	0.005	-0.012	0.014
	[0.45]		[-3.45]	[-1.95]	[-0.22]		[-3.90]	[1.47]	[-0.25]	
Sep-09	0.003	0.000	-0.036	-0.010	-0.020	0.006	-0.039	0.007	-0.024	0.009
	[0.05]		[-2.55]	[-0.26]	[-0.39]		[-2.77]	[2.18]	[-0.46]	
Oct-09	0.004	0.000	-0.060	-0.022	-0.034	0.019	-0.062	0.002	-0.035	0.019
	[0.08]		[-4.67]	[-0.61]	[-0.72]		[-4.87]	[0.77]	[-0.74]	
Nov-09	-0.005	0.000	-0.058	-0.028	-0.042	0.016	-0.060	0.002	-0.042	0.016
	[-0.10]		[-4.18]	[-0.71]	[-0.82]		[-4.40]	[0.66]	[-0.84]	
Dec-09	0.010	0.000	-0.043	-0.006	-0.016	0.007	-0.046	0.006	-0.020	0.009
	[0.18]		[-2.77]	[-0.13]	[-0.29]		[-2.98]	[1.72]	[-0.36]	

Notes: This table reports the results from the cross-sectional regressions of cumulative returns on market beta, liquidity beta, and Amihud (2002) measure of illiquidity: $[\text{Cumulative return}]_{i,t->t+j} = \lambda_{0,j} + \lambda_{1,j} \cdot [\text{Market risk}]_i + \lambda_{2,j} \cdot [\text{Liquidity risk}]_i + \lambda_{3,j} \cdot [\text{Illiquidity}]_i + \eta_{i,j}$. Month t is September 2008, and j is assigned values of zero through 15. The table presents the parameter estimates and the t-statistics (in squared brackets below each estimate), as well as regression R^2s. For each firm, its market risk and liquidity risk are estimated from a time-series regression of firm's monthly excess returns on monthly market excess returns and a liquidity factor, either the Pástor and Stambaugh (2003) factor or the Sadka (2006) factor, from January 2003 through December 2007. Only firms with at least 24 monthly return observations to estimate betas are included. Illiquidity is measured by the average daily Amihud (2002) measure over the year of 2007 for firms with at least 100 non-missing daily observations. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

Table 6. Liquidity Return Spread and Liquidity Risk Over Long Time Horizon

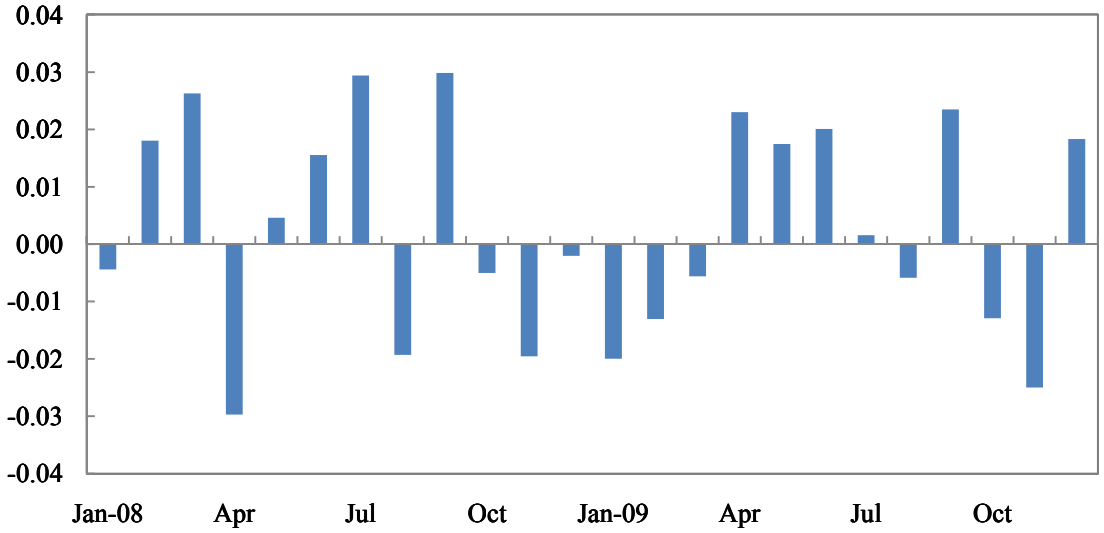
Liquidity Return Spread(t) = a + b·Liq(t) + b $_1$·Liq(t-1) + b $_2$· Liq(t-2) + e(t)

Pástor and Stambaugh (2003) factor					*Sadka (2006) Factor*				
Intercept	Market Liquidity shock	First Lag	Second Lag	R2	Intercept	Market Liquidity shock	First Lag	Second Lag	R2
		1968-2008					*1983-2008*		
0.005	0.029			0.002	0.001	0.727			0.017
[2.51]	[0.94]				[0.28]	[2.28]			
0.005	0.028	0.056		0.009	0.001	0.725	0.056		0.017
[2.54]	[0.92]	[1.82]			[0.29]	[2.27]	[0.18]		
0.005	0.028	0.057	-0.003	0.009	0.001	0.715	0.048	0.293	0.020
[2.53]	[0.92]	[1.82]	[-0.11]		[0.32]	[2.23]	[0.15]	[0.92]	
		1968-2007					*1983-2007*		
0.005	0.038			0.003	0.000	1.097			0.030
[2.50]	[1.16]				[0.14]	[3.00]			
0.005	0.035	0.062		0.011	0.000	1.099	0.246		0.031
[2.51]	[1.09]	[1.92]			[0.15]	[3.00]	[0.68]		
0.005	0.035	0.062	-0.017	0.011	0.000	1.100	0.253	0.263	0.033
[2.51]	[1.10]	[1.94]	[-0.51]		[0.15]	[3.00]	[0.69]	[0.73]	

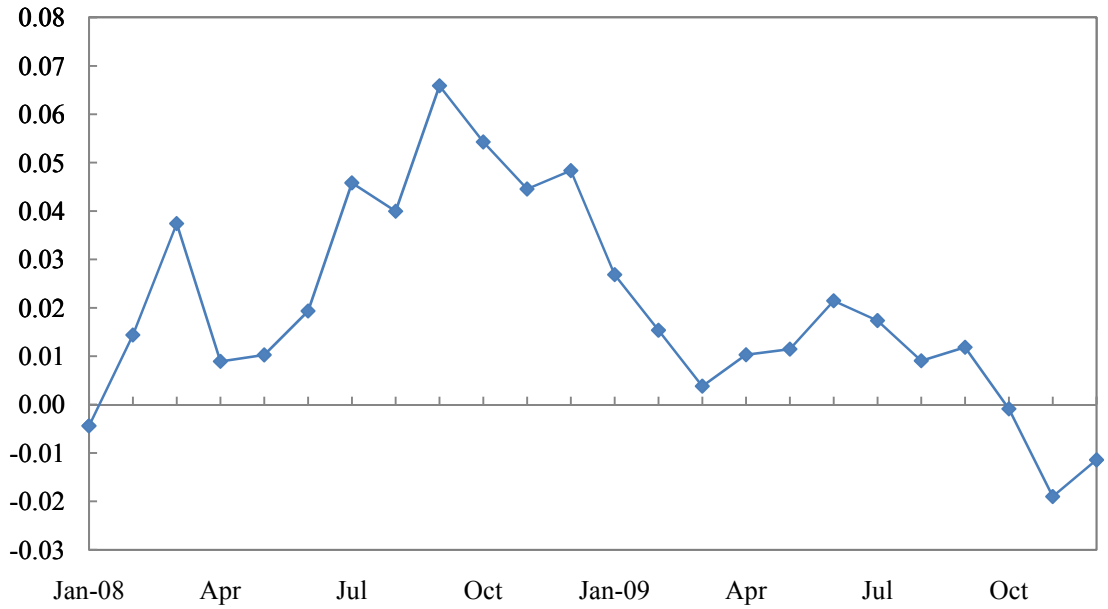
Notes: This table presents the estimation results of regressing monthly illiquidity return spread on monthly aggregate liquidity shock over the time period from 1968 to 2008 for the Pástor and Stambaugh (2003) liquidity factor, and from 1983 to 2008 for the Sadka (2006) factor. At the beginning of each year, 10 portfolios are formed based on the illiquidity level in the prior year, measured by the average daily Amihud (2002) measure over the year for firms with at least 100 non-missing daily observations. The most illiquid portfolio contains stocks that have the highest Amihud (2002) measure in the prior year, and the most liquid portfolio are those stocks with the lowest Amihud (2002) measure. The monthly illiquid return spread is defined as the return difference between the most illiquid portfolio and the most liquid portfolio in the 12 months of the year. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars in the time period from 1968 through 2008.

Figure 1. Return Difference Between Illiquid and Liquid Portfolios, January 2008 -- December 2009

A. Return Spread



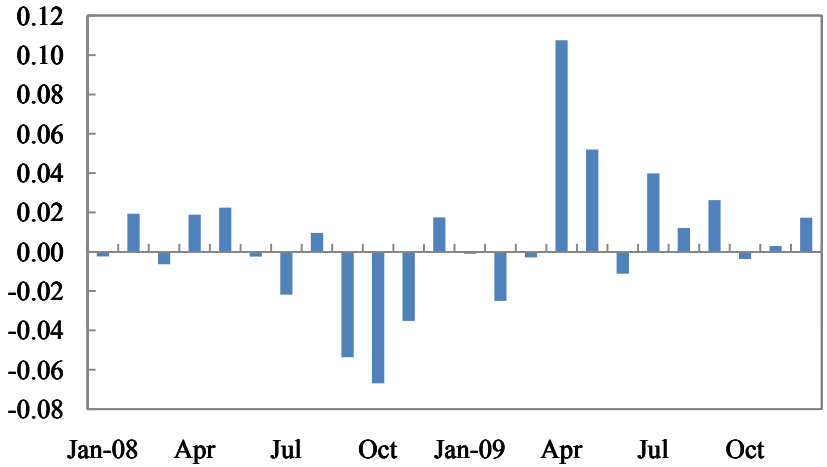
B. Cumulative Return Spread

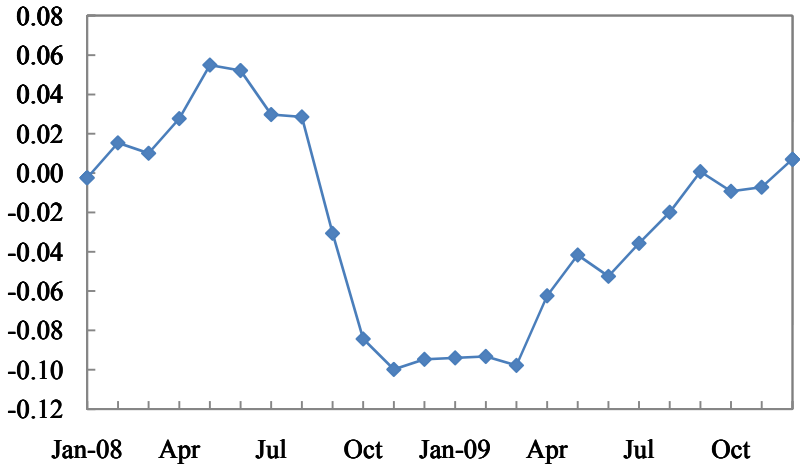


Notes: This figure plots the difference in monthly returns between the illiquidity portfolio and the liquid portfolio. At the beginning of 2008, two portfolios are formed based on the liquidity level in 2007, measured by the average daily Amihud (2002) measure over the year of 2007 for firms with at least 100 non-missing daily observations. The illiquid portfolio contains stocks that have the highest Amihud (2002) measure in 2007, and the liquid portfolio are those stocks with the lowest Amihud (2002) measure. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

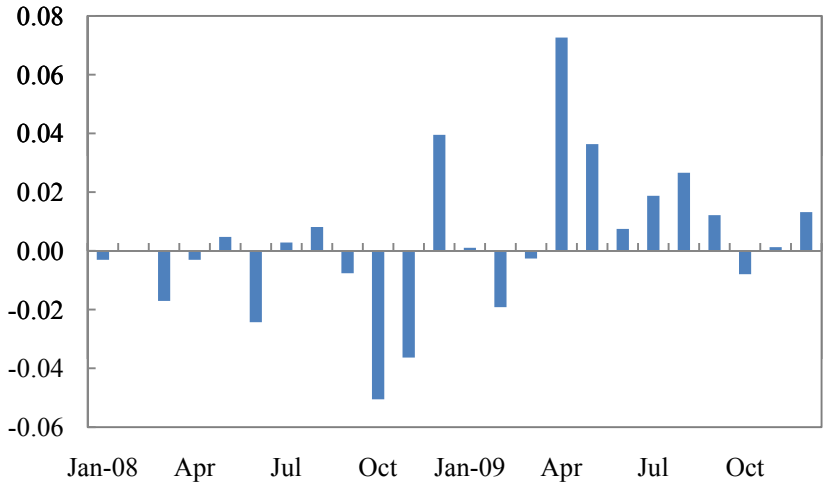
Figure 2. Return Difference and Cumulative Return Difference Between High Liquidity Risk and Low Liquid Risk Portfolios, January 2008 -- December 2009

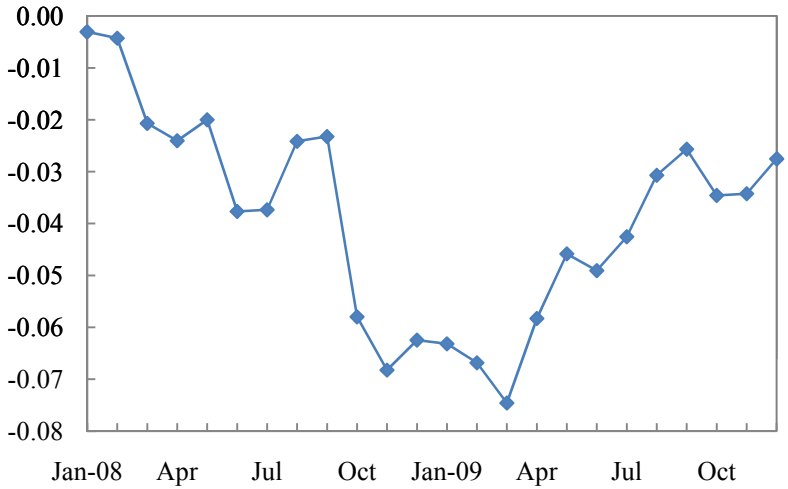
A. Pástor and Stambaugh (2003) Liquidity Factor





B. Sadka (2006) Liquidity Factor

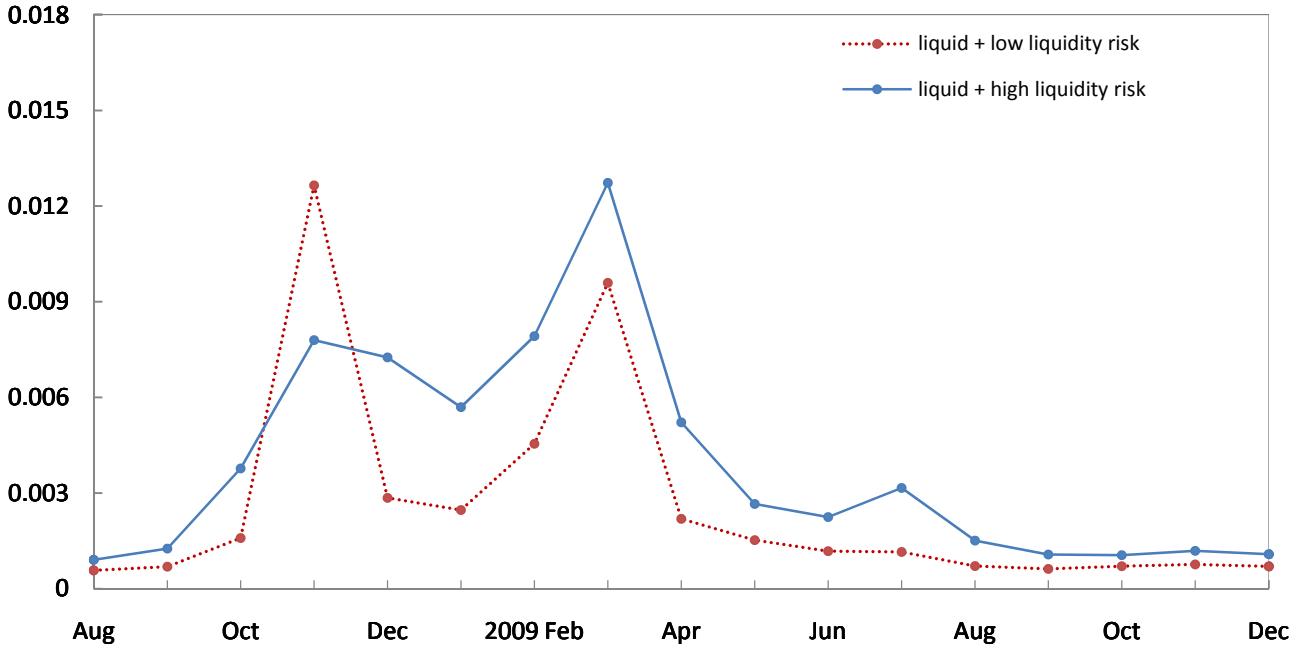




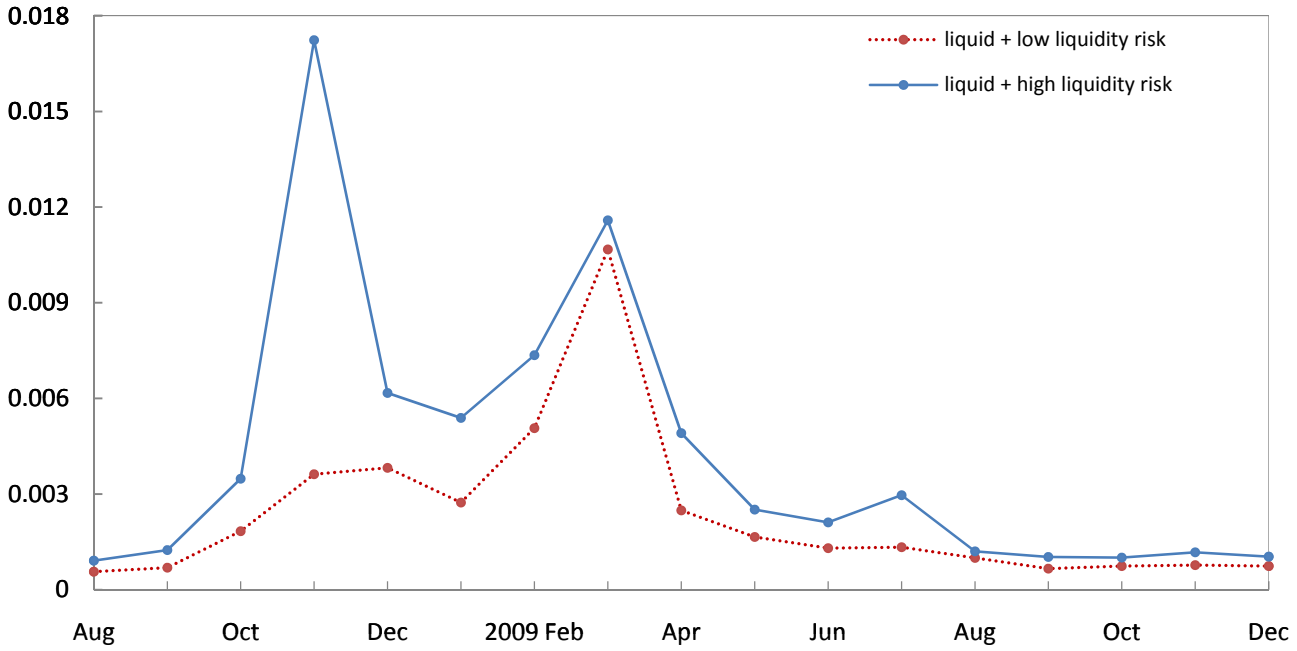
Notes: This figure plots the difference in monthly returns between the high liquidity beta portfolio and the low liquidity beta portfolio. At the beginning of 2008, two portfolios are formed based on the liquidity beta, estimated using monthly data from January 2003 to December 2007 by regressing a firm's monthly excess returns on market excess returns and a liquidity factor, either the Pástor and Stambaugh (2003) factor or the Sadka (2006) factor. Only firms with at least 24 monthly return observations to estimate liquidity beta are included in the portfolios. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

Figure 3. Liquidity of Portfolios Sorted by Liquidity Level and Liquidity Risk, September 2008 -- December 2009

A. Pástor and Stambaugh (2003) Liquidity Factor



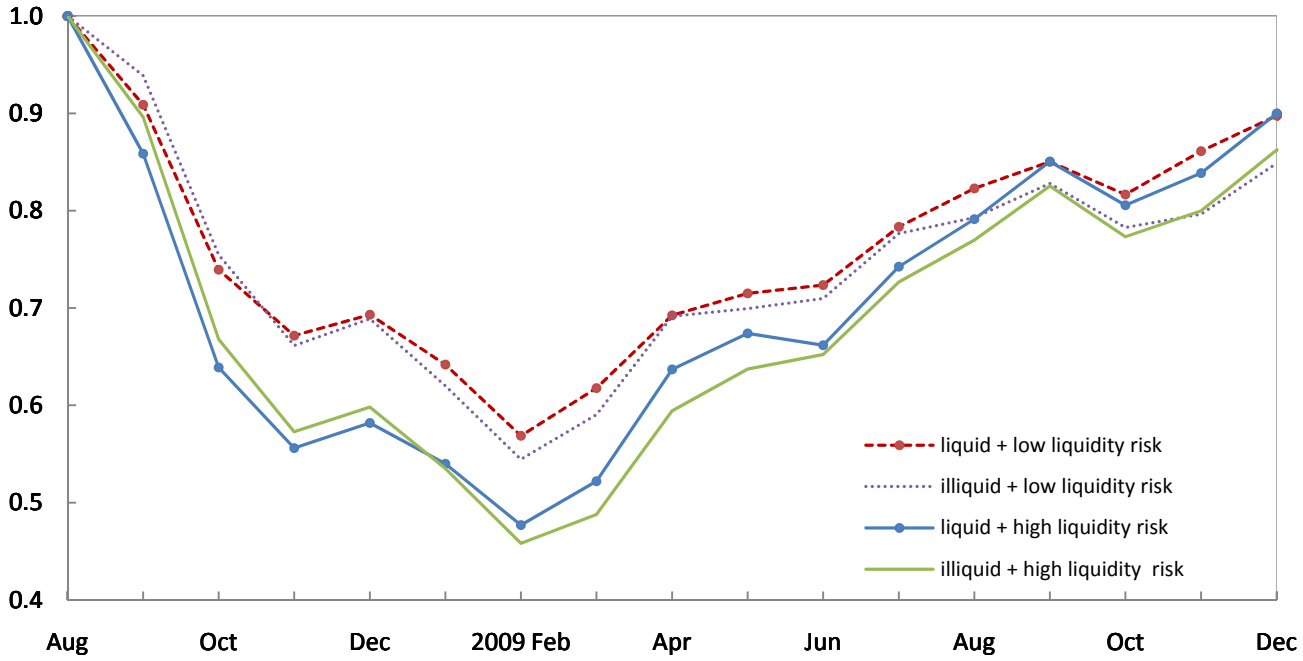
B. Sadka (2006) Liquidity Factor



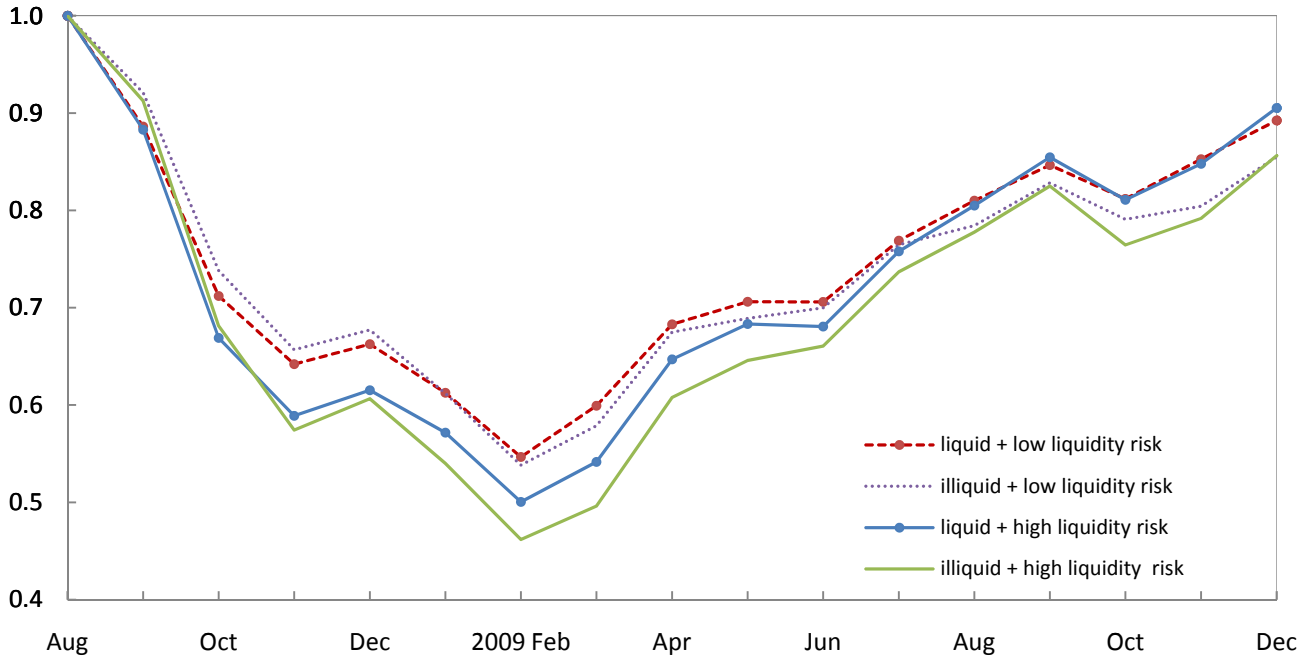
Notes: This figure plots the monthly Amihud (2002) measure of liquidity (scaled by 10^{-6}) for four portfolios formed based on liquidity level and liquidity risk. Liquidity level is measured by the average daily Amihud (2002) measure over the year of 2007 for firms with at least 100 non-missing daily observations. Liquidity risk is estimated using monthly data from January 2003 to December 2007 by regressing a firm's monthly excess returns on market excess returns and a liquidity factor, either the Pástor and Stambaugh (2003) factor or the Sadka (2006) factor. Only firms with at least 24 monthly return observations to estimate liquidity beta are included in the portfolios. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.

Figure 4. Gross Cumulative Returns of Portfolios Sorted by Liquidity Level and Liquidity Risk

A. Pástor and Stambaugh (2003) Liquidity Factor



B. Sadka (2006) Liquidity Factor



Notes: This figure plots the cumulative gross returns of four portfolios formed based on liquidity level and liquidity risk. The returns are computed over expanding time intervals beginning September 2008 through each of the months until December 2009. Liquidity level is measured by the average daily Amihud (2002) measure over the year of 2007 for firms with at least 100 non-missing daily observations. Liquidity risk is estimated using monthly data from January 2003 to December 2007 by regressing a firm's monthly excess returns on market excess returns and a liquidity factor, either the Pástor and Stambaugh (2003) factor or the Sadka (2006) factor. Only firms with at least 24 monthly return observations to estimate liquidity beta are included in the portfolios. Our sample includes NYSE/AMEX common stocks whose price is between five and 1000 dollars at the end of 2007.