Can Hedge Funds Time Market Liquidity?

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Abstract

This paper examines how hedge funds manage their liquidity risk by responding to the aggregate liquidity shock. Using a large sample of hedge funds over the period of 1994-2008, we find strong evidence that hedge fund managers possess liquidity timing ability at both investment strategy level and the individual fund level. They increase (decrease) their portfolios' market exposure when the equity market liquidity is high (low). More importantly, the liquidity timing evidence is particularly significant among funds with illiquid holdings. In contrast, hedge fund managers who hold liquid assets tend to react to past liquidity conditions strongly. The liquidity timing ability is also asymmetric, depending on market liquidity conditions: it is more pronounced when the market liquidity is low than when it is high. Our results are robust even after we control for return- and volatility-timing abilities.

1. Introduction

The latest financial market crisis, rooted from the subprime mortgage problems, has resulted in a drastic liquidity squeeze and poses significant challenges to the hedge fund industry. Poor performance, along with heavy investor redemptions, has impacted the industry adversely. In 2008 alone, total investor redemptions reached nearly $400 billion, and the assets under management by the hedge fund industry have shrunk from a peak of $2.2 trillion in mid-2008 to $1.3 trillion by the end of 2008.[1] While hedge funds can be affected by market liquidity conditions, it is not a priori clear whether hedge funds change market exposure when market liquidity changes. In this paper, we address this previously unexplored research question: can hedge fund managers time market liquidity?

Several recent papers have studied the liquidity risk in the context of hedge funds. For example, Brunnermeier and Pedersen (2009) model an asset's market liquidity and a trader's funding liquidity jointly and stress that the two types of liquidity can mutually reinforce each other and even cause marketwide liquidity to dry up. Aragon and Strahan (2009) use the event of Lehman bankruptcy as an exogenous liquidity shock and show that the Lehman-connected hedge funds lost funding liquidity, and failed twice as much as other funds. They also find that the liquidity of stocks held by Lehman-related funds fell more than other funds. It is well documented that hedge funds in general provide market liquidity through heavy trading and currently account for about 25 percent of NYSE daily trading volume. However, the liquidity of hedge fund portfolios largely depends on the market liquidity condition as shown by Brunnermeier and Pedersen (2009). For example, the near collapse of the LTCM in August 1998 triggered a market-wide liquidity crisis, which further hindered many hedge funds from

[1] Bloomberg, March 24, 2009.

unwinding their positions and blocked them from further borrowing. In addition, in August 2007, a few quantitative long/short equity hedge funds suffered unexpected losses; their initial unwinding put tremendous pressure on others and caused further losses for other hedge funds. Khandani and Lo (2007) conclude that, even without market crisis, the losses to hedge funds in August 2007 were due to the fire sale liquidation of similar portfolios held by other quantitative hedge funds.

Obviously, market-wide liquidity risk has a significant impact on hedge fund performance and funding availability. Therefore, it is important for hedge fund managers to manage liquidity risk and, in particular, time market liquidity. If managers can correctly forecast future market liquidity, then they can adjust their portfolio exposure accordingly to avoid significant losses. Despite the recent boom in hedge fund research, liquidity risk has been explored less than market risk, systemic risk, and operational risk.[2] To the best of our knowledge, none of the existing papers have studied whether hedge fund managers have liquidity timing ability; nor have they explicitly investigated the interaction among market liquidity, fund level liquidity, and the underlying asset level liquidity, although this topic is clearly of interest to both investors and academics.

To better understand liquidity risk in the hedge fund industry, we distinguish three levels of liquidity risk that hedge funds can expose: the market level, the fund level and the individual security level of liquidity risk from a top-down point of view. First, at the

[2] Chan, Getmansky, Haas and Lo (2005) study systemic risk and conclude that systemic risk is rising while the hedge fund industry is heading to a challenging period of lower expected returns. Bollen and Whaley (2008) emphasize the implication of hedge fund risk dynamics on the evaluation of fund performance. Brown, Goetzmann, Liang, and Schwarz (2008a, 2008b) examine operational risk and find that this risk is related to leverage, manager ownership, and conflict of interest issues. They also find that operational risk can largely contribute to the failure of hedge funds even after controlling for investment risk.

aggregate level, hedge funds can be affected by the market wide liquidity condition. Deteriorated market liquidity can cause a downward spiral and fire sale liquidation to the hedge fund portfolios. Sadka (2009) shows that market liquidity risk explains a significant portion of hedge fund returns in a cross-section. However, hedge funds' exposure to the aggregate liquidity may not be in line with the liquidity provided at the fund level such as the lock-up provision.

Next, hedge funds have imposed share restrictions on investors at the fund level such as redemption notices, lock-up provisions and other redemption penalties. Aragon (2007) finds that funds with a lock-up provision significantly outperformed those without lock-up periods by 4-7% on an annual basis. He attributes this outperformance to the holding of illiquid assets. Liang and Park (2009) demonstrate that due to the difference in legal structures, onshore hedge funds exhibit more share restrictions than their offshore counterparts. Nevertheless, imposing share restrictions may not necessarily mean that hedge fund managers hold only illiquid assets. Managers could impose share restrictions for other reasons, such as avoiding regulatory scrutiny.[3]

Third, hedge funds face liquidity risk at the underlying security level especially when managers hold illiquid and hard-to-price assets. Getmansky, Lo, and Makarov (2004) develop a model for illiquidity in hedge fund returns and use it to infer the liquidity condition at the asset level. Using a proprietary due diligences data, Cassar and Gerkos (2009) find that funds using less independent pricing sources and funds with greater manager discretion in pricing portfolios are more likely to smooth returns. Although the above papers regarding hedge fund

[3] For example, hedge funds can extend lock-up periods for over two years in order to avoid the required US SEC registration in 2006.

liquidity focus on issues such as aggregate liquidity, return illiquidity or share redemption restrictions individually, none of the above studies distinguish the three different levels of liquidity risk explicitly and study the dynamics among them.

In this paper, we investigate whether hedge fund managers can time the aggregate equity market liquidity by increasing (decreasing) their portfolios' market exposure when the market liquidity is high (low). Given the nature of their dynamic trading strategies and lucrative fee structure, hedge funds provide a natural platform for testing liquidity timing ability. The dynamic trading strategies employed by hedge fund managers may cause the funds' market exposure to be time-varying in anticipation (or, in response) to changes in liquidity conditions. Further, we explore the differential timing abilities across investment strategies which display different share restrictions and asset illiquidity. In summary, we investigate three levels of liquidity risk and provide economic explanations for why hedge fund managers of certain strategies possess liquidity timing skills.

Using a large sample of hedge funds from the Lipper TASS database, we find strong evidence that hedge funds exhibit liquidity timing ability, i.e., fund managers adjust their portfolios' market exposure according to market liquidity conditions. In particular, when the market liquidity deviates from its mean level by one standard deviation, a typical hedge fund changes its market exposure by 15% accordingly. We also find evidence of heterogeneity among fund strategies with regard to strategically adjusting their market exposures. For example, the evidence of liquidity timing is strong for strategies such as emerging market, event driven, and convertible arbitrage, as these strategies tilt their investments towards illiquid securities. We attribute this result to the fact that funds with illiquid assets are more keen in managing aggregate liquidity risk. Because of higher illiquidity risk, it is a necessity for these funds to have better liquidity timing abilities. In contrast, hedge fund managers in strategies such as global macro and long/short equity tend to react to the past liquidity condition strongly as they hold relatively liquid securities. This finding allows us to provide an economic explanation for liquidity timing and to relate the aggregate liquidity risk to the asset level liquidity risk. Finally, our results reveal that the liquidity timing ability is asymmetric, depending on market liquidity conditions. Hedge fund managers reduce their portfolios' market exposure significantly when the market liquidity is extremely low. In contrast, they do not increase their market exposure when liquidity is unusually high. Our evidence is robust after we control for alternative specification of benchmark models including option factors, various data biases, illiquid assets holdings, and market return and volatility timing abilities.

We also conduct tests of liquidity timing ability at the individual fund level, and find that the proportion of funds with liquidity timing ability is significantly different from zero. Furthermore, we examine the cross-sectional relation between various fund characteristics and liquidity timing ability. Our results indicate that funds' liquidity timing ability is positively associated with better auditing services, leverage usage, and managers' personal capital invested, but negatively associated with share redemption restrictions and management fees. Finally, we show that identifying hedge funds with superior liquidity timing ability has practical investment value in that a portfolio consisting of top liquidity-timing funds outperforms the portfolio consisting of all sample funds. This finding should be particularly relevant to investors of funds of hedge funds, which strive to invest in superior hedge funds.

This paper contributes to the hedge fund literature in several aspects. First, we provide new evidence on the dynamics of hedge funds' market exposure. Fung and Hsieh (1997) present evidence to show that hedge funds employ dynamic trading strategies that differ from those used by traditional mutual funds. Agarwal and Naik (2004) find that hedge fund returns exhibit exposure to factors built on the payoffs of market index options. Chen and Liang (2007) illustrate that the market exposure of self-claimed market-timing hedge funds varies with changes in the market return and volatility. More recently, Bollen and Whaley (2008) highlight the importance of recognizing hedge fund risk dynamics in evaluating fund performance. Patton and Ramadorai (2009) characterize time varying risks using high frequency conditional information. Our work extends this literature by showing that hedge funds adjust their market risk exposure according to changes in market liquidity.

Second, the findings of our paper suggest another determinant of hedge fund performance. Given the documented superior performance delivered by hedge funds (e.g., Ackermann, McEnally and Ravenscraft (1999), Brown, Goetzmann, and Ibbotson (1999), Liang (1999), and Kosowski, Naik, and Teo (2007)), it is important to identify the sources of fund performance since the findings can help hedge fund investors and funds of hedge funds locate their investment opportunities. Extant studies find positive association between hedge fund performance and incentive fees (Ackermann, McEnally, and Ravenscraft, 1999), redemption restrictions (Aragon, 2007), and managerial incentives (Agarwal, Daniel, and Naik, 2008). Our results suggest that some hedge fund managers have the ability to enhance performance through forecasting and timing market liquidity, especially during periods of extremely low market liquidity (e.g., a market-level liquidity crisis).

The rest of this paper proceeds as follows. Section 2 presents research methodology for testing hedge funds' liquidity timing ability. Section 3 describes the hedge fund data, market liquidity measure and benchmark factors that determine hedge fund returns. We present evidence of liquidity timing ability at the aggregate and investment strategy levels in Section 4. Section 5 presents results of liquidity timing at the individual fund level. In Section 6 we assess fund managers' reaction to the past liquidity condition. Concluding remarks are provided in Section 7.

2. Research Design

2.1. Estimation of the Market Liquidity

Liquidity has long been recognized as an important determinant of asset returns. Liquid markets are generally viewed as those which allow rapid trading with the least impact on asset prices. We use the equity market liquidity measure developed by Pastor and Stambaugh (2003) to perform empirical tests. In this subsection, we briefly discuss the procedure of obtaining the market liquidity.

The market liquidity measure is a cross-sectional average of individual stock liquidity measures. For each stock listed on the New York Stock Exchange and American Stock Exchange, we estimate its liquidity using its daily return and daily volume. Specifically, the following regression model is estimated for each stock i in each month t:

$$r_{i,d+1,t} = \theta_{i,t} + \phi_{i,t} r_{i,d,t} + \eta_{i,t} sign(r_{i,d,t}) \times vol_{i,d,t} + \varepsilon_{i,d+1,t}, \quad d = 1,..., D_t, \qquad (1)$$

where $r_{i,d,t}$ is the excess return on stock i on day d in month t, $vol_{i,d,t}$ is the dollar volume (in million dollars) for stock i on day d in month t, and D_t is the number of trading days in month t. Two filters are imposed to compute liquidity measure in each month: (1) A stock should have at least 15 observations in a month; and (2) A stock should have a share price between \$5 and \$1000 at the end of the previous month. The liquidity measure, which is the coefficient $\eta_{i,t}$, measures the expected price reversal for a given dollar volume. When a stock's liquidity is lower, $\eta_{i,t}$ is expected to be negative and large. The Pastor-Stambaugh market liquidity in month t is calculated as the average of individual stock's liquidity:

$$\overline{\eta}_t = \frac{1}{N_t}\sum_{i=1}^{N_t}\eta_{i,t} \qquad (2)$$

where N_t is the number of stocks available in month t. Since the coefficient $\eta_{i,t}$ measures an individual firm's liquidity cost of trading $1 million of the stock, the market liquidity measure can be interpreted as the cost of a $1 million trade distributed equally across all sample stocks. To take into account the fact that the size of the equity market increases over time, each month's liquidity measure is scaled by using the size of the market at the beginning of the CRSP daily sample:

$$L_{m,t} = (m_t / m_1) * \overline{\eta}_t \qquad (3)$$

where m_t is the total dollar value of all sample stocks at the end of month t-1, and month 1 refers to August 1962. The scaled and aggregated market liquidity measure, $L_{m,t}$, is used in subsequent analysis to evaluate hedge funds liquidity timing ability.

2.2. Factors in the Benchmark Model

We employ the seven-factor model proposed by Fung and Hsieh (2004) as our benchmark model for evaluating hedge fund returns. Among these factors are two equity-oriented, two bond-oriented and three primitive trend following strategy (PTFS) – related risk factors. These factors include: (1) the excess return on Center for Research in Security Prices (CRSP) value-weighted market portfolio of all NYSE, AMEX and Nasdaq stocks (MKT), (2) the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return (SCMLC), (3) change in the constant maturity yield on the 10-year Treasury bond (YLDCHG), (4) change in the credit spread between Moody's Baa and the 10-year Treasury bond

(BAAMTSY), (5) return of PTFS bond lookback straddle (PTFSBD), (6) return of PTFS currency lookback straddle (PTFSFX), and (7) return of PTFS commodity lookback straddle (PTFSCOM).[4] We use our sample fund returns to estimate the seven-factor model, and confirm Fung and Hsieh (2004)'s finding that these factors explain a significant portion of variation in hedge fund returns.

2.3. Tests of Liquidity Timing Ability

Among the Fung and Hsieh seven factors, the most important factor for equity-oriented hedge funds is the market portfolio excess return (MKT). For the equal-weighted portfolio consisting of all 3,156 sample funds, we show that the adjusted R^2 from the one-factor model with MKT being the only factor is 0.59, while the adjusted R^2 from the seven-factor model is 0.69. The ratio of the two R^2s is about 85% (These results are reported in Table 2 and will be discussed in a later section). We also find that the ratio of R^2s between one-factor and seven-factor models is above 70% for portfolios in each strategy (except for Global Macro). These results suggest that majority hedge funds have large exposure to equity market risk. For this reason, we focus our tests on the ability of hedge fund managers to time equity market liquidity.

The starting point of our study of liquidity timing is the Fung and Hsieh (2004) seven-factor model for hedge fund returns. We assume that hedge funds' exposure to the market (MKT) is time varying and specify hedge fund returns as the following:

[4] We thank David Hsieh for providing us the three PTFS factors. The data are downloaded from David Hsieh's website http://faculty.fuqua.duke.edu/~dah7/HFRFData.htm. See Fung and Hsieh (2001) for a description of these factors.

$$r_{p,t} = \alpha_p + \beta_{p,1,t} MKT_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t$$
$$+ \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t}, \tag{4}$$

where $r_{p,t}$ is excess return on fund *p* in month *t*. In the spirit of Shanken (1990), Ferson and Schadt (1996), and Busse (1999), we use a Taylor series expansion and specify a fund's timing varying market beta as a linear function of market liquidity from its mean level:

$$\beta_{p,1,t} = \beta_{p,1} + \gamma_p (L_{m,t} - \overline{L}_m), \tag{5}$$

where $L_{m,t}$ is market liquidity in month *t* and $\overline{L}_m$ is the mean level of market liquidity. Combining equations (4) and (5), we obtain the liquidity timing model:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \gamma_p (L_{m,t} - \overline{L}_m) MKT_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t$$
$$+ \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t}, \tag{6}$$

The liquidity-timing measure is the coefficient γ from the above model. We perform our main test of hedge fund liquidity timing ability using both portfolio-level and individual fund-level returns.

3. Data Description

3.1. Hedge Fund Data

We assess hedge funds liquidity timing ability using two data sets: the Lipper TASS hedge fund database and the CRSP daily return file. TASS constitutes one of the most comprehensive hedge fund databases and provides data on both live and defunct funds beginning in 1994. The hedge fund literature has identified several biases associated with hedge-fund databases, including self-selection bias, survivorship bias, and backfill bias (e.g., Brown, Getzmann and Ibbotson (1999), Fung and Hsieh (2000), and Liang (2000)). To minimize the impact of these biases, we construct a subsample of available hedge funds by selecting those funds that satisfy the following criteria.

First, we start our sample from 1994 and analyze both live and defunct funds. The inclusion of dissolved or dead funds mitigates the impact of survivorship bias. Second, to address the concern that database vendors may backfill funds' performance when new funds are added instead of only including their returns on a going forward basis, we exclude the first 12-month return data for each fund. This criterion ensures that our findings are robust to backfill bias. Finally, we include funds that report monthly net-of-fee returns denominated in U.S. dollars and funds that have assets under management (AUM) of more than $10 million. Smaller funds with AUM less than $10 million are of less concern from institutional investors' perspective and have less impact on the market. For example, Credit Suisse/Tremont used a minimum AUM of $10 million as one criterion to determine its hedge fund index constituents in late 1990s. Our sample period extends from January 1994 through September 2008, and the selection criteria yield 3,156 hedge funds: 1,703 live funds and 1,453 defunct funds.

TASS classifies hedge funds into eleven strategies designed to reflect the primary hedge fund investment styles. These strategies include convertible arbitrage, dedicated short bias, event driven, emerging markets, equity market neutral, fixed income arbitrage, funds of funds, global macro, long-short equity, managed futures, and multi-strategy. Since this paper is on hedge fund managers' ability to time equity market liquidity, the analysis is focused on equity-oriented hedge funds only. Thus, funds in fixed income arbitrage and managed futures strategies are excluded. We also drop funds in dedicated short bias strategy category from our analysis because this strategy contains a very small number of funds.[5]

We construct equal-weighted portfolios of (1) all 3,156 hedge funds (ALL); (2) all funds excluding fund of funds (ALL-FoF); (3) fund of funds (FoF) only; and (4) funds in each respective investment strategy, and evaluate hedge funds' liquidity timing ability at portfolio as well as at individual fund levels.

Panel A of Table 1 provides the descriptive statistics of fund returns at the portfolio level. Over the period of 1994 through 2008, all hedge funds, including funds of funds, realize an average return of 0.89% per month (about 11% per year) with a monthly standard deviation of 1.98%. Typical hedge funds have higher average monthly return (0.98%) in comparison to funds of hedge funds (0.65%). Of different hedge fund strategies, long/short equity realizes the highest average monthly return (1.11%) while convertible arbitrage delivers the lowest average monthly return of 0.62%.

According to Getmansky, Lo and Makarov (2004), the first-order autocorrelation of a hedge fund's returns can be used as a proxy for the fund's illiquidity. Panel A also reports the first-order autocorrelation of each portfolio's monthly returns. It reveals that convertible arbitrage, event driven, and emerging market strategies exhibit relatively high level of the first-order autocorrelation in monthly returns. This result is consistent with the well-documented fact that these strategies invest in relatively illiquid securities. We call these strategies "illiquid strategies". In contrast, the strategies of global macro and long/short equity

[5] The TASS data does not include managed accounts and side-pockets, with the latter usually containing illiquid assets.

have relatively low first-order autocorrelations, implying that they invest in relatively liquid securities.[6] We call these strategies "liquid strategies".

Panel B of Table 1 reports summary statistics of monthly liquidity measure. The mean (median) level of the market liquidity is -3.2% (-2.4%) per month over the period of 1994-2008, indicating a 3.2% average liquidity cost. To confirm that our measure of market liquid is similar to previous measures, we overlay our time series for the period of 1962-2008 on the top of the Pastor and Stambaugh (2003) measure which runs from 1962 to 2000 and find consistent patterns. The correlation between our liquidity measure and the Pastor and Stambaugh (2003) measure is 0.98 for the overlapping time period from 1962 to 2000.

Summary statistics and correlation matrix of the Fung-Hsieh seven factors are presented in Panels C and D, respectively. The average market portfolio return is 0.77% per month over 1994–2008, with a standard deviation of 4.25%., while the lowest monthly market excess return is -15.8% in August 1998, and the highest is 8.4% in April 2001. For robustness check, we also consider an alternative benchmark model that contains the Fama-French-Carhart four factors (see Carhart, 1997) and the Agarwal and Naik (2004) option factors built on returns of the S&P 500 Index options.

4. Empirical Results at the Portfolio Level

4.1. Liquidity Timing Ability

Table 3 contains our main results based on liquidity-timing model provided in equation (6). Overall, hedge funds exhibit the ability to adjust their market exposure to changes in

[6] However, global macro funds can invest in securities of both developed and developing countries. In the latter case, fund assets could be illiquid.

market liquidity. The liquidity timing coefficient of the equal-weighted portfolio of all funds (ALL) is 0.66 and significant at the 1% level. To put this coefficient in perspective, we compare it with the estimated market beta (i.e., the coefficient on MKT) from the seven-factor model, which is 0.30.[7] Suppose the market liquidity is above (or, below) its mean level by one standard deviation (i.e., 0.066 from Table 1), then a typical hedge fund would increase (or, decrease) its market exposure accordingly by about 0.044 (0.66×0.066), which is approximately 15% of the fund's overall market beta based on the seven-factor model. The result for the portfolio of all hedge funds excluding funds of funds (ALL-FoF) is qualitatively similar: the timing coefficient is 0.74 with a *t*-statistic of 2.81. Table 3 also reveals that liquidity timing coefficient is positive and significant for all strategies except for equity market neutral. These results provide strong evidence that hedge funds have liquidity timing ability and that liquidity timing is economically significant. In particular, the three illiquid strategies, convertible arbitrage, event driven, and emerging markets, are among the top five strategies (the other two strategies are global macro and multi-strategy) with significant liquidity timing coefficients at 5% level, indicating that there is a need to manage liquidity risk in these illiquid strategies and managers in these strategies indeed possess the ability to time market liquidity.

4.2. Liquidity Timing in Extreme Market Liquidity Conditions

If a hedge fund manager possesses liquidity timing ability and changes the fund's market exposure accordingly based on the forecast of market liquidity, then a related question is whether it is more important for the fund manager to reduce market exposure during time

[7] To conserve space, we do not report the estimation results from the seven-factor model.

periods with extremely negative liquidity shocks (e.g., a market-level liquidity crunch) than to increase market exposure when the market liquidity level is high. Our next test is designed to examine whether hedge funds show differential timing ability under extreme liquidity conditions (e.g., bad versus good liquidity conditions). We create two indicator variables, $D(Low\_LIQ)_t$ and$D(Hi_LIQ)_t$ and include interactive terms between market return and each indicator variable in our tests. $D(Low\_LIQ)_t$ (or, $D(Hi\_LIQ)_t$) is a 0/1 indicator variable for whether the market liquidity in month *t* belongs to the bottom (or, the top) quintile during the sample period. The liquidity-timing regression model estimated is:

$$r_{p,t} = \alpha_p + \beta_{p,1}MKT_t + \gamma_{p,1}MKT_t * D(Low\_LIQ)_t + \gamma_{p,2}MKT_t * D(Hi\_LIQ)_t + \beta_{p,2}SCMLC_t$$
$$+ \beta_{p,3}YLDCHG_t + \beta_{p,4}BAAMTSY_t + \beta_{p,5}PTFSBD_t + \beta_{p,6}PTFSFX_t + \beta_{p,7}PTFSCOM_t + \varepsilon_{p,t}, \quad (7)$$

where the coefficients γ_1 and γ_2 measure timing ability during extremely low and high liquidity months.

Table 4 shows that hedge fund managers adjust their market exposure asymmetrically during low- and high-liquidity months. For the equal-weighted portfolio of all sample funds, the estimated coefficient on the interactive term of the market return with the dummy of low-liquidity month (γ_1) is -0.15 and significant at the 1% level. When the market liquidity in month *t* belongs to the bottom quintile, a typical fund decreases its market exposure by a significant portion and the net market beta is 0.17 (=β_1 - γ_1 = 0.32 – 0.15). The coefficient on the interactive term of the market return with the dummy of high-liquidity month (γ_2), however, is not significant. This finding holds for the portfolio of all hedge funds excluding funds of funds and for seven out of eight strategy portfolios.[8] Our result is consistent with previous findings on return and volatility timing ability where self-claimed market timing

[8] The liquidity timing coefficient is only marginally significant but with a wrong sign for funds of funds.

hedge funds display better timing skill when the market condition is deteriorated (e.g., Chen and Liang (2007)). In sum, hedge funds on average tend to reduce market exposure when market liquidity is rarely poor, and such adjustment in funds' market exposure provides investors with a protection against downside losses from negative liquidity shocks.

4.3. Evidence from Alternative Benchmark Models

In Sections 4.1 and 4.2, we obtain our primary results relying on benchmark risk factors proposed by Fung and Hsieh (2004). This subsection contains an assessment of the impact of alternative benchmark models on our results. Specifically, we consider benchmark factors proposed by Agarwal and Naik (2004). They construct option-return factors using liquid at-the-money and out-of-the-money options on the S&P 500 index, and find these option factors, together with the Fama-French three factors (e.g., the market, the size and value factors) and a momentum factor by Carhart (1997), strongly explain returns on equity-oriented hedge funds. Now we specify liquidity timing model based on the Agarwal and Naik (2004) benchmark factors:

$$\begin{aligned} r_{p,t} &= \alpha_p + \beta_{p,1} MKT_t + \gamma_p (L_{m,t} - \overline{L}_m) MKT_t + \beta_{p,2} SMB_t + \beta_{p,3} HML_t + \beta_{p,4} UMD_t \\ &+ \beta_{p,5} OTMCALL_t + \beta_{p,6} OTMPUT_t + \varepsilon_{p,t}, \end{aligned} \tag{8}$$

where $r_{p,t}$ is the excess return in month *t* on portfolio *p*, SMB, HML and UMD are returns on value-weighted, zero-investment, factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns, OTMCALL is out-of-the-money call-option return factor and OTMPUT is out-of-the-money put option return factor. The option factors constructed from the at-the-money and out-of-the-money options show high correlations, and thus we only employ out-of-the-money option factors to avoid potential collinearity among these option factors.

The results reported in Table 5 suggest that our main evidence of liquidity timing remains significant when using an alternative benchmark model in equation (8). The liquidity timing coefficient is 0.74 and significant at the 1% level for the equal-weighted portfolio of all sample funds. This estimate is comparable to that reported in Table 3 (0.66) which relies on the Fung and Hsieh (2004) seven-factor benchmark model. Furthermore, the returns on the portfolio show significant exposure to most risk factors in the model.[9] The timing coefficient on the equal-weighted portfolio of all hedge funds excluding funds of funds is 0.82 with a *t*-statistic of 2.62. Among the eight strategy portfolios, four of them have significant γ coefficients and demonstrate liquidity timing ability after we control for option-related risk factors. We also experiment with other proxies of risk factors that have been used in the literature to explain hedge fund returns and find qualitatively similar results. Therefore, our subsequent analysis relies on the seven-factor model.

4.4. The Impact of Illiquid Holdings

Asness, Krail and Liew (2001) and Getmansky, Lo, and Makarov (2004) point out that hedge funds, to various degrees, hold illiquid exchange-traded securities (e.g., Small Cap and Mid Cap stocks). These illiquid securities do not necessarily trade at the end of each month and can lead to non-synchronous price reaction. In the absence of end-of-month security transaction prices, fund managers may use the last transaction price of the month, or have the

[9] For simplicity, we do not report estimated coefficients of all risk factors from the model, but these results are available upon request.

flexibility of marking their portfolio for month-end reporting. According to Scholes and Williams (1997), non-synchronous trading can bias the estimates of funds' market beta. If the bias is systematically related to the market liquidity condition, it could also bias our inferences of managers' ability on liquidity timing.

To alleviate this potential bias, we incorporate two lagged market returns, MKT_{t-1} and MKT_{t-2}, as additional control variables in the spirit of Scholes and Williams (1977), and estimate the following regression model:

$$r_{p,t} = \alpha_p + \beta_{p,11} MKT_t + \gamma_p (L_{m,t} - \bar{L}_m) MKT_t + \beta_{p,12} MKT_{t-1} + \beta_{p,13} MKT_{t-2} + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t + \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t}, \tag{9}$$

Table 6 contains the results of this test. For the equal-weighted portfolio of all funds, the estimate of liquidity timing coefficient is positive and significantly, and MKT_{t-1} enters the regression strongly, indicating that hedge funds in general hold relatively illiquid securities. In comparison to the results reported in Table 3, the equal-weighted portfolios of all funds, all funds excluding funds of funds, and funds in six strategy categories (among eight) still have significant liquidity timing coefficients. Specifically, among fund strategies, emerging market, event drive, fund of funds, global macro, long/short equity, and multi-strategies still have significant timing coefficients. Overall, we see that our basic results of liquidity timing ability are robust to controlling for non-synchronous trading and illiquid holdings.

4.5. Controlling for Return Timing and Volatility Timing

Our measure of liquidity timing, or the coefficient γ, allows us to examine whether hedge funds' market exposure varies with contemporaneous market liquidity condition.

However, managers may adjust funds' market exposure based on other information. There is a large body of literature on market-return timing ability of professional money managers, dating back to Treynor and Mazuy (1966) and Henriksson and Merton (1981). The idea of market-return timing is that fund managers strategically adjust market exposure based on their forecast about market returns – they increase their portfolio's market exposure before market return goes up and decrease market exposure before market return goes down.

The evidence on mutual fund managers' market-return timing ability is somewhat mixed. Ferson and Schadt (1996) study 67 U.S. equity funds from 1968 to 1990. They use both unconditional and conditional models to assess fund managers' market-return timing ability and conclude that fund managers do not possess market-return timing ability. Jiang, Yao and Yu (2007) propose a new measure of market timing based on mutual fund holdings. They apply the holding-based tests and find actively managed U.S. equity funds, on average, have positive timing ability. Busse (1999) investigates mutual fund managers' volatility timing ability and finds strong evidence - mutual funds' market exposure is negatively associated with market volatility. Recently, Chen and Liang (2007) document evidence of successful return and volatility timing using a sample of 221 funds from a special group of hedge funds – self-declared market timing hedge funds.

Motivated by these studies, we re-evaluate hedge funds liquidity timing ability controlling for market return timing and volatility timing. We follow Treynor and Mazuy (1966) to control for market return timing and Busse (1999) for volatility timing, using the following regression:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \gamma_p (L_{m,t} - \overline{L}_m) MKT_t + \lambda_p MKT_t^2 + \delta_p MKT_t * (Vol_t - \overline{Vol}) + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t \\ + \beta_{p,4} BAAMTSY_t + \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t}, \quad (10)$$

where Vol_t is the market volatility measured as the S&P 100 index option' implied volatility index (VIX) from the Chicago Board Options Exchange, $\overline{Vol}$ is the time-series mean of market volatility over our sample period, and the coefficients γ, λ, and δ measure liquidity timing, market return timing and volatility timing, respectively.

In Table 7 the columns labeled "liquidity timing", "return timing" and "volatility timing" contain the results of each timing coefficient. For hedge fund portfolios, on average, there is no evidence of market return timing or volatility timing ability. Take the equal-weighted portfolio of all hedge funds excluding funds of funds as an example, its market return timing coefficient is -0.29 with a *t*-statistic of -0.55 and its volatility timing coefficient is 0.99 with a *t*-statistic of 0.76. Further, the market return timing and volatility timing coefficients are not significant for any strategy except for event driven (with a significant return timing coefficient but a wrong sign). After controlling for market return timing and volatility timing, we still find the coefficient of liquidity timing is significant for the portfolio of all sample funds, the portfolio of all hedge funds excluding fund of funds and the seven out of eight strategy portfolios. For example, the timing coefficient γ is 0.91 (with a *t*-statistic of 3.20) and significant at 1% for the equal-weighted portfolio of all funds excluding fund of funds.

As a robustness check, we re-estimate the timing model in equation (10) using other proxies for market volatility. These include realized volatility calculated by using daily market returns, and conditional volatility from GARCH(1,1) model. Our results overwhelmingly suggest that there is evidence of liquidity timing ability, even after we take market return timing and volatility timing into account.

5. Empirical Evidence at the Individual Fund Level

Our analysis so far has focused on the evidence of hedge funds liquidity timing ability at portfolio level. In this section, we turn to the evaluation of liquidity timing ability at individual fund level and present additional evidence that some individual hedge funds possess the ability to time market liquidity. We also perform a test to examine the cross-sectional relation between liquidity timing ability and hedge fund characteristics, and explore the investment value of identifying hedge funds with superior liquidity timing skill. To ensure our results are meaningful, we require each hedge fund to have at least 24 consecutive monthly return records.[10] Since the first 12 return observations are eliminated in the data section in order to minimize the impact of backfilling bias, each fund effectively has at least 36 consecutive monthly observations for the current test. This additional requirement reduces the number of sample funds from 3,156 to 2,358.

5.1. Liquidity Timing of Individual Hedge Funds

We estimate liquidity timing model in equation (6) for each hedge fund and report cross-sectional distributions of the estimated coefficients and their associated *t*-statistics. Before discussing these results, we examine the percentage of funds with significant liquidity timing coefficients (γ) in order to get a sense of the timing ability at individual fund level.

The results in Table 8 suggest that, among 2,358 sample funds, 11% of the funds have positive and significant γ coefficients at the 5% level where the null hypothesis is $H_0: \gamma = 0$ and the alternative hypothesis is $H_a: \gamma > 0$. For the sample of all funds excluding funds of funds, a similar percentage of funds show significant timing ability (11%). Across the eight

[10] We also require each fund to have at least 36 consecutive monthly returns, and find our result is unaffected.

strategies, except for equity market neutral, all strategies have more than 8% of funds with positive and significant liquidity timing coefficients. In particular, convertible arbitrage, emerging market, event drive, fund of funds, and long/short equity funds show stronger results with more than 10% of funds having significant timing coefficients at 5% level.

To examine cross-sectional distribution of the estimated timing coefficients, we present the 5th, 10th, 15th and 20th percentiles of individual funds' timing coefficients on both sides of the distribution in Table 8. The top 5% funds with liquidity timing ability have large timing coefficient. For example, the 5th percentile of the timing coefficient is 3.15 for the overall sample of 2,358 funds and 3.51 for the sample of 1,706 funds excluding funds of funds. The category of fund of funds contains 652 funds and its top 5% liquidity timing fund has the smallest timing coefficient (1.29) among the eight strategy categories. This result may be explained by the fact that funds of funds charge two-tier fees. Among various strategies' top 5% timing funds, we note that the emerging market strategy has the largest timing coefficient (6.97). This strategy also contains the largest percentage of funds with positive and significant timing coefficients (15%). Overall, more than 10% of funds have positive and significant timing coefficients at the 5% level and these coefficients reveal significant timing ability.

5.2. Liquidity Timing and Fund Characteristics

Now we turn to the analysis of the cross-sectional relation between various fund characteristics and liquidity timing ability to explore what kinds of funds are more likely to possess liquidity timing ability. Specifically, we regress liquidity timing coefficients estimated from regression (6) on fund characteristics and fund strategy dummies.

In particular, we consider eight fund attributes that have been shows to be associated with hedge fund performance (e.g., Brown, Goetzmann, and Liang (2003)) and Liang (2003)). These attributes include minimum investment requirement, management fee, incentive fee, lock-up period, advance notice period, a dummy variable for effective auditing services, a dummy variable for leverage, and a dummy variable indicating whether the fund has its manager's personal capital invested, as well as dummy variables for various strategy categories.[11]

Table 9 reports the results of cross-sectional regression. We find that liquidity timing coefficients are positively associated with fund attributes including better auditing services, leverage usage, and fund managers' personal capital invested, while negatively associated with attributes such as advance notice period and management fees. Management fee serves as a dead-weight loss so it is negatively related to the timing ability; stricter redemption restrictions hinder managers' ability from moving money around quickly to react to the market liquidity shock so it has a negative sign. Effective auditing, leverage and manager's personal investment may imply better manager quality and better liquidity timing skills.

5.4. Investment Value of Liquidity Timing

In this subsection, we explore whether identifying liquidity timing ability has investment value. Specifically, in each month we rank hedge funds based on their liquidity timing coefficients which are estimated by using the past three-year return data, and then form

[11] We do not include funds' age and size variables in this test to avoid look-ahead bias.

a hypothetical portfolio consisting of the top 5% of liquidity timers.[12] We hold this portfolio for one month and rebalance it by repeating the above procedure. Consequently we obtain a time-series of returns on this portfolio. Next, we compare the returns from this hypothetical portfolio with those from the corresponding equal-weighted portfolio consisting of all sample funds. If the returns from the hypothetical portfolio including top liquidity timers are significantly higher than those from the equal-weighted portfolio of all funds, it indicates investment value associated with identifying hedge funds with successful liquidity timing ability. This test is done for all sample funds, all funds excluding funds of funds, and funds in each strategy.

Table 10 reports the results from such comparisons. We compare monthly average return and fund alpha between the two portfolios. Take the portfolios of hedge funds excluding funds of funds as an example. The equal-weighted portfolio of all the funds realizes an average return of 0.85% per month, but the portfolio consisting the top 5% of liquidity timers would realize an average return of 2.07%. When comparing the risk-adjusted performance as measured by the alpha from the seven-factor model, we find that the strategy of investing in top liquidity timers (alpha of 0.84% per month, *t*-statistic of 3.58) significantly outperform a simple strategy of holding an equal-weighted portfolio of hedge funds (alpha of 0.42% per month, *t*-statistic of 4.38). We also find a significant difference in alpha between liquidity timers and the overall portfolio among most strategies. Note that the three illiquid strategies including convertible arbitrage, emerging markets, and event driven are among strategies that generate the largest alphas. This finding should be particularly relevant to

[12] This hypothetical portfolio starts from January 1997 because we need to use return information from the past three years and our hedge fund sample begins in January 1994.

managers of funds of hedge funds who allocate assets among individual hedge funds and who make investment decision in selecting superior hedge funds.

6. Funds' Reaction to Lagged Liquidity Conditions

So far, we investigate hedge funds' ability to forecast market liquidity and to adjust their market exposure accordingly, i.e., liquidity timing ability. In this section, we seek to answer the question of whether hedge funds also react to the past market liquidity condition. Specifically, we use the following regression to test whether fund managers react to the previous month's market liquidity.

$$\begin{aligned} r_{p,t} &= \alpha_p + \beta_{p,1} MKT_t + \theta_p (L_{m,t-1} - \overline{L}_m) MKT_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t \\ &+ \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t}, \end{aligned} \tag{11}$$

where $L_{m,t-1}$ is one-month lagged market liquidity measure.

Table 11 presents evidence at the portfolio level that hedge funds react to the recent market liquidity condition by changing their market exposure. The regression coefficient on the interaction term between the market return and lagged market liquidity is 0.88 for the equal-weighted portfolio of all funds, with a *t*-statistics of 3.42. In comparison to the results reported in Table 3, none of the three illiquid strategies (convertible arbitrage, emerging market, and event driven) shows significant reaction to the previous month market liquidity. The two liquid strategies (global macro and long/short equity) display large and significant coefficients of 1.53 and 0.98, and both are significant at the 1% level, indicating that hedge funds holding liquid assets tend to react to past liquidity shocks strongly. Funds with illiquid holdings tend to time the current market liquidity actively due to the need of managing liquidity risk.

Table 12 reports evidence of individual funds' reaction to lagged market liquidity conditions. In this test, a large proportion (37%) of the funds shows the ability to respond to past market liquidity conditions. The percentage of funds showing significantly negative coefficients is really low (3%). The evidence of reacting to market liquidity is particularly strong for funds of hedge funds, among which 63% of funds have positive and significant coefficient of θ. The cross-sectional distribution of the estimated timing coefficients shows that the global macro strategy has the largest top 5% reaction coefficient (7.88).

7. Conclusions

In this paper, we employ a large sample of hedge funds from Lipper TASS over the period of 1994-2008 to examine whether hedge funds managers have the ability to time market liquidity. Collectively, hedge fund managers possess strong liquidity timing ability – they increase (decrease) funds' market exposure when equity market liquidity is high (low). We find supporting evidence at the equally-weighted portfolio level, investment strategy level, and the individual fund level. Our empirical evidence indicates that hedge funds invested in illiquid securities, such as emerging market, event driven, and convertible arbitrage funds, demonstrate strong liquidity timing ability and have large timing coefficients. These funds face greater liquidity risk when there is an aggregated liquidity shock, and hence their managers manage liquidity risk more actively and effectively. In contrast, funds with relatively liquid holdings (such as global macro and long/short equity funds) react to the past liquidity condition strongly - their market exposure is significantly associated with lagged market liquidity. According to estimates of timing coefficients using months with extremely low or high market liquidity, liquidity timing ability is asymmetric: it is more pronounced when the market liquidity is low than when it is high. Finally, we find that a strategy of investing in top liquidity timers can generate economically significant profit. Our results are robust after we control for alternative benchmark models, various data biases, return and volatility timing abilities, and illiquid holdings.

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Table 1
Summary Statistics of Hedge Fund Returns

Panel A presents summary statistics of monthly hedge fund returns for equal-weighted portfolios of all 3,156 hedge funds (ALL), all hedge funds excluding funds of funds (ALL-FoF), and funds in each investment strategy . Returns are in percent per month, and ρ_1 is the first-order autocorrelation in returns. Among the 3,156 hedge funds in our sample, 1,703 are live and 1,453 are defunct funds. Panel B reports summary statistics of the Pastor-Stambaugh (2003) market liquidity measure. In Panel C, we present summary statistics of the Fung and Hsieh (2004) benchmark factors. MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). Panel D presents correlation matrix of the benchmark factors. The hedge fund data are from the Lipper TASS database and the sample period extends from 1994 through 2008.

Portfolio	Mean	Median	STD	Min	Max	ρ_1
Panel A: Hedge Fund Returns (% per month)						
ALL	0.89	1.04	1.98	-8.98	7.33	0.25
ALL-FoF	0.98	1.23	2.17	-10.43	7.95	0.25
Convertible arbitrage	0.62	0.86	1.76	-10.04	5.47	0.35
Emerging market	1.09	1.77	4.60	-26.54	15.68	0.30
Equity market neutral	0.94	0.81	1.11	-2.47	6.65	0.25
Event driven	0.89	1.15	1.42	-6.70	3.82	0.35
Fund of funds	0.65	0.67	1.57	-6.00	5.52	0.26
Global macro	0.91	0.73	2.21	-5.79	8.68	0.05
Long/short equity	1.11	1.27	2.60	-9.63	9.36	0.19
Multi-strategy	0.85	0.93	1.51	-5.95	5.92	0.27

Table 1, Continued

	Mean	Median	STD	Min	Max
Panel B: Liquidity Measure (%)					
P-S liquidity measure	-3.22	-2.38	6.56	-27.44	19.24
Panel C: Fung and Hsieh Benchmark Factors					
MKT	0.77	1.41	4.25	-15.77	8.39
SCMLC	0.11	-0.02	3.10	-15.11	15.39
YLDCHG	-0.01	-0.04	0.23	-0.53	0.65
BAAMTSY	0.01	-0.02	0.21	-0.47	1.57
PTFSBD	-1.22	-3.86	14.53	-25.36	68.86
PTFSFX	0.41	-2.93	19.34	-30.13	90.27
PTFSCOM	-0.04	-2.54	13.91	-24.20	64.75

Panel D: Correlation Matrix of the Benchmark Factors

MKT	SCMLC	YLDCHG	BAAMTSY	PFTSBD	PTFSFX	PTFSCOM
1.00						
0.16	1.00					
0.12	0.17	1.00				
-0.21	0.09	0.70	1.00			
-0.15	-0.03	0.04	0.15	1.00		
-0.12	0.03	-0.11	0.06	0.19	1.00	
-0.11	-0.01	-0.02	0.13	0.18	0.33	1.00

Table 2
Ratios of Adjusted R^2s from One-factor and Seven-factor Models for Hedge Fund Returns

Time series regression of one-factor and seven-factor models for hedge fund excess returns:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \varepsilon_{p,t},$$

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t + \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t}.$$

The dependent variable is the monthly excess return on an equal-weighted portfolio of all the sample hedge funds (ALL), all the hedge funds excluding funds of funds (ALL-FoF), or funds in each investment strategy. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). The *t*-statistics of market beta are calculated using White (1980) heteroskedasticity-robust standard errors.

Portfolios	β_1 (1-factor model)	*t*-statistic	Adj. *R*-square (1-factor model)	Ratio of *R*-squares (1-factor/7-factor)
ALL	0.36	10.90	0.59	0.85
ALL-FoF	0.41	11.43	0.64	0.86
Convertible arbitrage	0.24	5.87	0.34	0.72
Emerging market	0.67	6.33	0.37	0.85
Equity market neutral	0.08	4.70	0.10	0.70
Event driven	0.23	7.38	0.48	0.76
Fund of funds	0.22	7.85	0.36	0.74
Global macro	0.19	5.46	0.13	0.48
Long/short equity	0.51	17.03	0.71	0.86
Multi-strategy	0.26	9.97	0.52	0.89

Table 3
Test of Liquidity Timing Ability: Portfolio-Level Evidence

This table presents results from the liquidity timing regression model:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \gamma_p (L_{m,t} - \overline{L}_m) MKT_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t + \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t},$$

where r_{pt} is the excess return in month t on an equal-weighted portfolio of all the sample hedge funds (ALL), all the hedge funds excluding funds of funds (ALL-FoF), or funds in each investment strategy. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). $L_{m,t}$ is the Pastor-Stambaugh (2003) market liquidity measure in month t, and $\overline{L}_m$ is the mean level of market liquidity over the sample period. The coefficient γ measures liquidity timing ability. The *t*-statistics (in parentheses) are calculated using White (1980) heteroskedasticity-robust standard errors. *, **, and *** indicate that the liquidity timing confidents are significant at the 10%, 5%, and 1% levels, respectively.

Portfolio	α	β_1	γ	β_2	β_3	β_4	β_5x100	β_6x100	β_7x100	R^2
ALL	0.35	0.33	0.66	0.18	1.01	-1.53	-1.55	0.70	0.74	0.71
	(4.31)	(12.45)	(2.64)***	(5.04)	(1.49)	(-1.99)	(-2.24)	(1.55)	(1.16)	
ALL-FoF	0.41	0.38	0.74	0.20	1.00	-1.31	-1.77	0.64	0.46	0.75
	(4.86)	(13.39)	(2.81)***	(5.10)	(1.48)	(-1.74)	(-2.37)	(1.40)	(0.69)	
Convertible arbitrage	0.20	0.18	0.59	0.08	3.07	-4.01	-1.67	-0.06	-0.05	0.49
	(2.16)	(6.19)	(1.97)**	(2.09)	(3.48)	(-3.42)	(-2.15)	(-0.13)	(-0.08)	
Emerging market	0.32	0.61	1.76	0.27	3.91	-2.65	-5.38	-0.03	0.39	0.45
	(1.11	(7.15)	(2.03)**	(2.67)	(2.30)	(-1.75)	(-2.05)	(-0.02)	(0.20)	
Equity market neutral	0.57	0.07	0.18	0.05	-0.05	-0.96	-0.71	0.43	0.41	0.14
	(7.76	(3.78)	(0.85)	(2.53)	(-0.10)	(-1.72)	(-1.44)	(1.21)	(0.79)	
Event driven	0.44	0.19	0.63	0.11	1.85	-2.52	-1.75	0.46	0.04	0.64
	(6.69)	(8.39)	(2.63)***	(3.69)	(3.51)	(-4.02)	(-3.21)	(1.37)	(0.08)	
Fund of funds	0.21	0.20	0.47	0.14	1.05	-2.18	-1.00	0.86	1.54	0.50
	(2.51)	(7.88)	(2.02)**	(4.50)	(1.47)	(-2.56)	(-1.63)	(1.75)	(2.38)	
Global macro	0.38	0.22	0.98	0.10	-0.87	-1.54	-1.39	2.96	2.22	0.29
	(2.77)	(5.19)	(2.48)**	(1.76)	(-1.07)	(-2.23)	(-1.42)	(2.89)	(1.76)	
Long/short equity	0.49	0.49	0.50	0.28	0.28	-0.57	-0.89	0.68	0.42	0.82
	(6.17)	(17.81)	(1.93)*	(6.52)	(0.38)	(-0.65)	(-1.56)	(1.43)	(0.67)	
Multi-strategy	0.37	0.24	0.66	0.10	1.13	-1.74	-0.75	0.19	0.62	0.60
	(4.97)	(10.03)	(2.33)**	(2.73)	(1.75)	(-2.49)	(-1.25)	(0.53)	(1.12)	

Table 4
Test of Liquidity Timing in Extreme Market Liquidity Conditions

This table presents results of hedge funds' liquidity timing ability in extreme market liquidity conditions based on the following regression model:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \gamma_{p,1} MKT_t * D(Low\_LIQ)_t + \gamma_{p,2} MKT_t * D(Hi\_LIQ)_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t + \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t,}$$

where r_{pt} is the excess return in month t on an equal-weighted portfolio of all the sample hedge funds (ALL), all the hedge funds excluding funds of funds (ALL-FoF), or funds in each investment strategy. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). $D(Low\_LIQ)_t$ (or, $D(Hi\_LIQ)_t$) is a dummy variable indicating whether the liquidity in month t belongs to the bottom (or, the top) quintile over the sample period. The coefficients γ_1 and γ_2 measure liquidity timing ability during high and low liquidity months. The *t*-statistics are calculated using White (1980) heteroskedasticity-robust standard errors. *, **, and *** indicate that the liquidity timing confidents are significant at the 10%, 5%, and 1% levels, respectively.

Portfolio	γ_1	γ_2
ALL	-0.15	-0.08
	(-3.58)***	(-1.42)
ALL-FoF	-0.15	-0.07
	(-3.51)***	(-1.20)
Convertible arbitrage	-0.09	-0.07
	(-1.67)*	(-0.97)
Emerging market	-0.38	-0.08
	(-2.64)***	(-0.46)
Equity market neutral	-0.05	-0.07
	(-1.62)	(-1.34)
Event driven	-0.10	-0.04
	(-2.53)***	(-0.65)
Fund of funds	-0.13	-0.10
	(-3.36)***	(-1.79)*
Global macro	-0.20	-0.05
	(-3.22)***	(-0.57)
Long/short equity	-0.12	-0.09
	(-2.68)***	(-1.38)
Multi-strategy	-0.11	-0.05
	(-3.04)***	(-0.81)

Table 5
Evidence from an Alternative Benchmark Model

This table presents results from the following liquidity timing regression model:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \gamma_p (L_{m,t} - \overline{L}_m) MKT_t + \beta_{p,2} SMB_t + \beta_{p,3} HML_t + \beta_{p,4} UMD_t + \beta_{p,5} OTMCALL_t + \beta_{p,6} OTMPUT_t + \varepsilon_{p,t},$$

where r_{pt} is the excess return in month t on an equal-weighted portfolio of all the sample hedge funds (ALL), all the hedge funds excluding funds of funds (ALL-FoF), or funds in each investment strategy. The independent variables include the Agarwal and Naik (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SMB and HML are the Fama-French size and value factors, UMD is the Carhart momentum factor, OTMCALL is out-of-the-money call option return factor and OTMPUT is out-of-the-money put option return factor. $L_{m,t}$ is the Pastor-Stambaugh (2003) market liquidity measure in month *t*, and $\overline{L}_m$ is the mean level of market liquidity over the sample period. The coefficient γ measures liquidity timing ability. The *t*-statistics are calculated using White (1980) heteroskedasticity-robust standard errors. *, **, and *** indicate that the liquidity timing confidents are significant at the 10%, 5%, and 1% levels, respectively.

Portfolios	γ	*t*-statistic
ALL	0.74	2.50**
ALL-FoF	0.82	2.62***
Convertible arbitrage	0.54	1.38
Emerging market	1.89	1.79*
Equity market neutral	0.08	0.34
Event driven	0.40	1.43
Fund of funds	0.49	1.92*
Global macro	0.68	1.54
Long/short equity	0.72	2.34**
Multi-strategy	0.63	1.95*

Table 6
The Impact of Illiquid Holdings

Regression coefficients are from the following liquidity timing model where the lagged market portfolio return is used to control for the impact of illiquid holdings on the results:

$$r_{p,t} = \alpha_p + \beta_{p,11}MKT_t + \gamma_p(L_{m,t} - \overline{L}_m)MKT_t + \beta_{p,12}MKT_{t-1} + \beta_{p,13}MKT_{t-2} + \beta_{p,2}SCMLC_t + \beta_{p,3}YLDCHG_t + \beta_{p,4}BAAMTSY_t + \beta_{p,5}PTFSBD_t + \beta_{p,6}PTFSFX_t + \beta_{p,7}PTFSCOM_t + \varepsilon_{p,t},$$

where r_{pt} is the excess return in month t on an equal-weighted portfolio of all the sample hedge funds (ALL), all the hedge funds excluding funds of funds (ALL-FoF), or funds in each investment strategy. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). $L_{m,t}$ is the Pastor-Stambaugh (2003) market liquidity measure in month t, and $\overline{L}_m$ is the mean level of market liquidity over the sample period. The coefficient γ measures liquidity timing ability. The *t*-statistics are calculated using White (1980) heteroskedasticity-robust standard errors. *, **, and *** indicate that the liquidity timing confidents are significant at the 10%, 5%, and 1% levels, respectively.

Portfolio	γ	*t*-statistic	β_{12}	*t*-statistic	β_{13}	*t*-statistic	R^2
ALL	0.54	2.27**	0.07	3.77	0.07	3.55	0.75
ALL-FoF	0.61	2.48**	0.07	3.94	0.06	3.35	0.78
Convertible arbitrage	0.36	1.19	0.10	4.40	0.03	0.97	0.54
Emerging market	1.40	1.75*	0.15	2.62	0.05	0.79	0.46
Equity market neutral	0.17	0.82	0.03	1.59	0.06	4.22	0.20
Event driven	0.41	1.99**	0.09	6.52	0.04	3.16	0.73
Fund of funds	0.41	1.68*	0.05	2.85	0.07	3.34	0.56
Global macro	1.09	2.53**	0.00	0.05	0.12	3.08	0.34
Long/short equity	0.43	1.74*	0.05	3.15	0.07	4.03	0.85
Multi-strategy	0.55	2.21**	0.06	3.24	0.04	2.22	0.63

Table 7
Market Timing, Volatility Timing and Liquidity Timing

The test of market timing, volatility timing and liquidity timing is based on the following model:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \gamma_p (L_{m,t} - \overline{L}_m) MKT_t + \lambda_p MKT_t^2 + \delta_p MKT_t * Vol_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t + \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t},$$

where r_{pt} is the excess return in month t on an equal-weighted portfolio of all the sample hedge funds (ALL), all the hedge funds excluding funds of funds (ALL-FoF), or funds in each investment strategy. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). $L_{m,t}$ is the Pastor-Stambaugh (2003) market liquidity measure in month t, and $\overline{L}_m$ is the mean level of market liquidity over the sample period. *Vol* is the market volatility, proxied by the implied volatility index VIX from the Chicago Board Options Exchange. The coefficients γ, λ, and δ measure liquidity timing, market timing and volatility timing, respectively. The *t*-statistics are calculated using White (1980) heteroskedasticity-robust standard errors. *, **, and *** indicate that the liquidity timing confidents are significant at the 10%, 5%, and 1% levels, respectively.

	Liquidity timing			*Return timing*		*Volatility timing*	
Portfolio	γ	*t*-statistic		λ	*t*-statistic	δ	*t*-statistic
ALL	0.78	2.95	***	-0.26	-0.51	0.65	0.52
ALL-FoF	0.91	3.20	***	-0.29	-0.55	0.99	0.76
Convertible arbitrage	0.75	2.35	**	-0.04	-0.10	1.25	0.92
Emerging market	2.60	2.77	***	-1.46	-1.01	4.82	1.16
Equity market neutral	0.16	0.70		0.07	0.18	-0.08	-0.09
Event driven	0.78	3.09	***	-0.77	-2.50	-0.02	-0.02
Fund of funds	0.43	1.85	*	-0.25	-0.47	-0.74	-0.63
Global macro	0.87	2.23	**	-0.28	-0.33	-1.47	-0.76
Long/short equity	0.50	1.72	*	0.10	0.17	0.17	0.15
Multi-strategy	0.68	2.44	**	-0.44	-0.98	-0.59	-0.49

Table 8
Test of Liquidity Timing Ability: Evidence at the Individual Fund Level

This table presents cross-sectional distribution of individual funds' liquidity timing coefficients. For each fund with at least 24 monthly return observations, we estimate the liquidity timing model:

$$r_{i,t} = \alpha_i + \beta_{i,1} MKT_t + \gamma_i (L_{m,t} - \overline{L}_m) MKT_t + \beta_{i,2} SCMLC_t + \beta_{i,3} YLDCHG_t + \beta_{i,4} BAAMTSY_t + \beta_{i,5} PTFSBD_t + \beta_{i,6} PTFSFX_t + \beta_{i,7} PTFSCOM_t + \varepsilon_{i,t},$$

where r_{it} is the excess return on fund *i* in month *t*. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). $L_{m,t}$ is the Pastor-Stambaugh (2003) market liquidity measure in month *t*, and $\overline{L}_m$ is the mean level of market liquidity over the sample period. The coefficient γ measures liquidity timing ability.

# of funds	Bottom of γ coefficient				Top of γ coefficient				% of *t*-statistic negative and significant at 5%	% of *t*-statistic positive and significant at 5%
	5%	10%	15%	20%	20%	15%	10%	5%		
					All funds					
2358	-4.70	-3.03	-2.18	-1.72	0.93	1.27	1.86	3.15	15.35	10.94
					All funds excluding Funds of Funds					
1706	-5.61	-3.39	-2.38	-1.84	1.15	1.58	2.28	3.51	14.77	11.02
					Convertible arbitrage					
75	-4.72	-2.04	-1.52	-1.07	0.44	0.68	0.93	2.66	10.67	10.67
					Emerging market					
171	-7.66	-4.88	-2.91	-2.14	2.02	2.56	4.99	6.97	13.45	14.62
					Equity market neutral					
133	-3.81	-3.13	-2.37	-1.97	0.58	0.70	1.12	1.42	15.04	3.01
					Event driven					
251	-3.28	-2.10	-1.71	-1.34	0.75	0.95	1.15	2.40	14.74	11.16
					Fund of funds					
652	-3.23	-2.34	-1.88	-1.51	0.52	0.67	0.89	1.29	16.87	10.74
					Global macro					
107	-5.42	-3.04	-2.08	-1.42	1.87	2.50	2.97	3.68	11.21	8.41
					Long/short equity					
789	-6.59	-4.18	-2.91	-2.19	1.39	1.85	2.66	3.69	15.08	12.55
					Multi-strategy					
175	-4.37	-2.84	-2.07	-1.81	0.69	0.92	1.14	2.75	17.71	8.57

Table 9
Cross-Sectional Regression Analysis of Liquidity Timing Ability

This table reports the results from a cross-sectional regression where the dependent variable is the liquidity timing coefficient for each sample fund and the independent variables include fund characteristics and strategy dummies. Minimum investment is the minimum required investment from an investor in millions of dollars; Management fee is in percent of assets under management; Incentive fee is in percentage of the profits; Lock-up period is the period which investors' money is locked up; Advanced notice period is time needed for investors to notify managers before they can withdraw money; Effective auditing dummy=1 if a fund has both auditor's name and audit date and 0 otherwise; Leverage dummy=1 if a fund uses leverage and 0 otherwise; Personal capital dummy=1 if the fund manager invests own money in the fund and 0 otherwise. The *t*-statistics are calculated using White (1980) heteroskedasticity-robust standard errors. *** indicates significance at the 1% level. The number of funds in this test is 2330, smaller than 2358, since some variables are not available to all the funds.

Variable	Coefficient	*t*-statistic
Constant	-0.039	-0.19
Minimum investment ($million)	0.018	0.21
Management fee	-0.390	-4.72***
Incentive fee	0.002	0.47
Lock-up period (month)	0.002	0.35
Advance notice period (month)	-0.112	-2.95***
Effective auditing dummy	0.201	2.33***
Leverage dummy	0.198	3.11***
Personal capital dummy	0.223	3.27***
Strategy dummies	Yes	
Number of funds	2,330	
Adjusted R^2	0.038	

Table 10
The Economic Value of Liquidity Timing

This table presents the evidence of the investment value of liquidity timing ability. Specifically, in each month we rank hedge funds, from the overall sample or various fund categories, based on their liquidity timing coefficients in the past three years, and then form hypothetical portfolios consisting of the top 5% of liquidity timers. We rebalance these portfolios every month by repeating the fund sorting and selecting procedure, and consequently we obtain a return time-series of such portfolios. Next, we compare the returns from these hypothetical portfolios, denoted as "Timers" in the table below, with those from the corresponding equal-weighted portfolios consisting of all the funds, denoted as "Overall." Funds' monthly mean returns and monthly alphas from the Fung and Hsieh seven-factor model are in percentage.

	Monthly Mean Return in %		Monthly Alpha in % (*t*-statistic)			
Portfolio	Overall	Liquidity timers	Overall		Liquidity timers	
ALL	0.85	1.37	0.42	(4.38)	0.84	(3.58)
ALL-FOF	0.92	1.48	0.47	(4.66)	0.94	(3.34)
Convertible arbitrage	0.57	1.51	0.29	(2.68)	1.14	(3.07)
Emerging market	1.04	1.84	0.49	(1.60)	1.43	(1.69)
Equity market neutral	0.81	0.96	0.49	(8.82)	0.75	(2.99)
Event driven	0.84	1.29	0.48	(6.13)	0.71	(2.22)
Fund of funds	0.67	0.75	0.30	(3.27)	0.34	(2.08)
Global macro	0.86	1.30	0.45	(3.49)	0.70	(1.77)
Long/short equity	1.02	1.42	0.52	(5.29)	1.01	(3.76)
Multi-strategy	0.84	1.02	0.48	(5.81)	0.59	(2.31)

Table 11

Test of Reaction to Past Liquidity Conditions: Portfolio-Level Evidence

This table presents results from the following regression model:

$$r_{p,t} = \alpha_p + \beta_{p,1} MKT_t + \theta_p (L_{m,t-1} - \overline{L}_m) MKT_t + \beta_{p,2} SCMLC_t + \beta_{p,3} YLDCHG_t + \beta_{p,4} BAAMTSY_t + \beta_{p,5} PTFSBD_t + \beta_{p,6} PTFSFX_t + \beta_{p,7} PTFSCOM_t + \varepsilon_{p,t},$$

where r_{pt} is the excess return in month t on an equal-weighted portfolio of all the sample hedge funds (ALL), all the hedge funds excluding funds of funds (ALL-FoF), or funds in each investment strategy category. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). $L_{m,t-1}$ is the Pastor-Stambaugh (2003) market liquidity measure in month *t*-1, and $\overline{L}_m$ is the mean level of market liquidity over the sample period. The coefficient θ measures reaction to past liquidity conditions. The *t*-statistics (in parentheses) are calculated using White (1980) heteroskedasticity-robust standard errors. *, **, and *** indicate that the liquidity reaction confidents (θ) are significant at the 10%, 5%, and 1% levels, respectively.

Portfolio	α	β_1	θ	β_2	β_3	β_4	β_5x100	β_6x100	β_7x100	R^2
ALL	0.42	0.33	0.88	0.18	1.13	-1.42	-1.46	0.78	0.72	0.71
	(5.54)	(11.90)	(3.42)***	(4.87)	(1.66)	(-1.92)	(-2.11)	(1.82)	(1.20)	
ALL-FoF	0.49	0.37	0.83	0.20	1.12	-1.21	-1.68	0.72	0.43	0.75
	(6.17)	(12.60)	(3.08)***	(4.90)	(1.63)	(-1.65)	(-2.24)	(1.63)	(0.69)	
Convertible arbitrage	0.26	0.16	0.04	0.08	3.12	-4.03	-1.67	-0.01	-0.09	0.48
	(2.77)	(5.28)	(0.13)	(2.04)	(3.46)	(-3.43)	(-2.09)	(-0.02)	(-0.14)	
Emerging market	0.50	0.57	1.04	0.27	4.14	-2.57	-5.29	0.14	0.30	0.44
	(1.91)	(6.09)	(1.20)	(2.60)	(2.29)	(-1.55)	(-1.98)	(0.11)	(0.16)	
Equity market neutral	0.59	0.08	0.44	0.05	0.00	-0.90	-0.66	0.46	0.41	0.16
	(8.27)	(4.13)	(2.14)**	(2.38)	(-0.01)	(-1.67)	(-1.35)	(1.29)	(0.78)	
Event driven	0.50	0.18	0.37	0.11	1.93	-2.50	-1.72	0.52	0.00	0.63
	(7.74)	(7.61)	(1.63)	(3.52)	(3.52)	(-3.93)	(-3.05)	(1.60)	(0.01)	
Fund of funds	0.26	0.20	1.08	0.14	1.17	-2.02	-0.87	0.93	1.54	0.53
	(3.39)	(8.29)	(3.68)***	(4.47)	(1.69)	(-2.54)	(-1.44)	(2.13)	(2.59)	
Global macro	0.49	0.22	1.53	0.09	-0.68	-1.34	-1.22	3.07	2.20	0.32
	(3.69)	(5.28)	(2.62)***	(1.69)	(-0.82)	(-1.81)	(-1.16)	(3.25)	(1.87)	
Long short equity	0.55	0.49	0.98	0.27	0.39	-0.43	-0.77	0.75	0.42	0.83
	(7.30)	(18.90)	(3.58)***	(6.35)	(0.54)	(-0.53)	(-1.40)	(1.64)	(0.71)	
Multi-strategy	0.45	0.23	0.64	0.10	1.23	-1.66	-0.69	0.26	0.59	0.60
	(6.51)	(8.97)	(2.77)***	(2.61)	(1.83)	(-2.39)	(-1.06)	(0.78)	(1.13)	

Table 12

Test of Reaction to Past Liquidity Conditions: Evidence at the Fund Level

This table presents cross-sectional distribution of individual funds' reaction to past liquidity conditions. For each fund with at least 24 monthly return observations, we estimate the following regression model:

$$r_{i,t} = \alpha_i + \beta_{i,1} MKT_t + \theta_i (L_{m,t-1} - \overline{L}_m) MKT_t + \beta_{i,2} SCMLC_t + \beta_{i,3} YLDCHG_t + \beta_{i,4} BAAMTSY_t + \beta_{i,5} PTFSBD_t + \beta_{i,6} PTFSFX_t + \beta_{i,7} PTFSCOM_t + \varepsilon_{i,t},$$

where r_{it} is the excess return on fund i in month t. The independent variables include the Fung and Hsieh (2004) factors: MKT is the Center for Research in Security Prices (CRSP) value-weighted market portfolio excess return, SCMLC is the Wilshire Small Cap 1750 index return minus the Wilshire Large Cap 750 index return, YLDCHG is change in the constant maturity yield on the 10-year Treasury bond, BAAMTSY is change in the credit spread between Moody's Baa and the 10-year Treasury bond, PFTSBD is return of PTFS bond lookback straddle, PFTSFX is return of PTFS currency lookback straddle, and PFTSCOM is return of PTFS commodity lookback straddle (PTFS refers to primitive trend following strategy). $L_{m,t-1}$ is the Pastor-Stambaugh (2003) market liquidity measure in month t-1, and $\overline{L}_m$ is the mean level of market liquidity over the sample period. The coefficient θ measures reaction to past liquidity conditions.

# of funds	Bottom of θ coefficient				Top of θ coefficient				% of t-statistic negative and significant at 5%	% of t-statistic positive and significant at 5%
	5%	10%	15%	20%	20%	15%	10%	5%		
All funds										
2358	-1.89	-0.84	-0.29	-0.04	2.70	3.07	3.86	5.57	3.01	37.40
All funds excluding Funds of Funds										
1706	-2.36	-1.14	-0.58	-0.27	2.68	3.08	4.00	5.84	3.99	27.49
Convertible arbitrage										
75	-2.36	-1.43	-1.20	-1.12	1.70	1.91	2.92	3.67	9.33	16.00
Emerging market										
171	-1.13	-0.40	-0.16	-0.03	3.86	4.47	5.67	7.40	1.17	28.07
Equity market neutral										
133	-2.71	-1.25	-0.86	-0.51	1.46	2.34	2.72	3.65	6.77	24.06
Event driven										
251	-1.15	-0.49	-0.29	-0.14	1.82	2.24	2.51	3.89	2.79	27.49
Fund of funds										
652	-0.18	0.22	0.38	0.50	2.74	3.02	3.69	4.87	0.46	63.34
Global macro										
107	-4.26	-1.81	-1.29	-0.79	4.66	5.60	6.52	7.88	7.48	28.04
Long short equity										
789	-3.05	-1.40	-0.80	-0.28	2.77	3.20	3.97	5.85	3.42	27.50
Multi-strategy										
175	-2.16	-0.73	-0.36	-0.15	2.76	3.14	3.97	5.49	4.57	33.71