
Liquidity Risk and the Cross-Section of Hedge-Fund Returns

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Motivation

- Hedge-fund assets increased exponentially
- The literature focuses on risk-return
 - Fung and Hsieh (2001, 2004)
- The battle between alpha and beta
 - Recent financial crisis
- Liquidity risk as an alpha factor
 - Liquidity risk versus liquidity level

This paper

- Liquidity risk explains part of the cross-section of hedge-fund returns (6% annually)
- The effect is independent of hedge-fund liquidity provision to investors
- Results are robust to risk controls, rebalancing frequency, and return smoothing
- Additional discussion:
Different investment styles, liquidity crises

Data

● Hedge funds

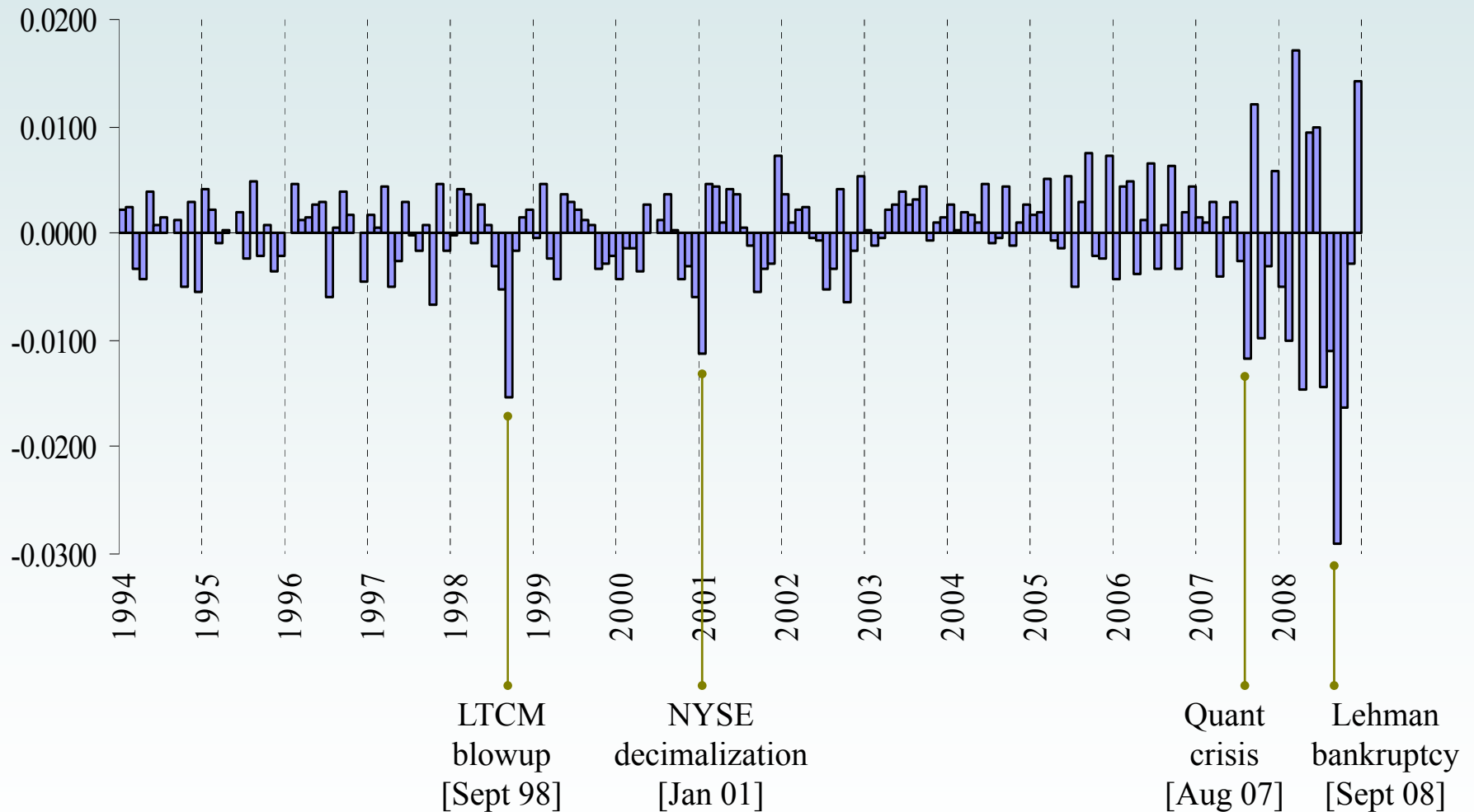
- TASS (1994-2008)
- Funds: 1,095 (1994) up to 8,542 (2008) – 12,929 overall
- 11 investment styles

● Liquidity

- TAQ, NYSE-listed firms
- Estimation by firm, by month
- Aggregate, AR(3)-adjusted

Time Series of Liquidity Shocks

Figure 1



Correlations

Table 2

	MKT-RF	SMB	Δ TERM	Δ CREDIT	PTFSBD	PTFSFX	PTFSCOM
SMB	0.21 [0.00]						
Δ TERM	0.03 [0.66]	0.05 [0.48]					
Δ CREDIT	-0.38 [0.00]	-0.23 [0.00]	-0.48 [0.00]				
PTFSBD	-0.17 [0.02]	-0.03 [0.71]	-0.13 [0.04]	0.15 [0.03]			
PTFSFX	-0.19 [0.01]	0.02 [0.79]	-0.17 [0.00]	0.29 [0.42]	0.19 [0.01]		
PTFSCOM	-0.15 [0.05]	-0.01 [0.89]	-0.08 [0.01]	0.19 [0.66]	0.18 [0.02]	0.36 [0.00]	
Liquidity	0.13 [0.08]	0.07 [0.33]	0.08 [0.28]	-0.34 [0.00]	-0.01 [0.89]	-0.10 [0.16]	-0.08 [0.27]

How to Measure the Liquidity Risk of a Fund?

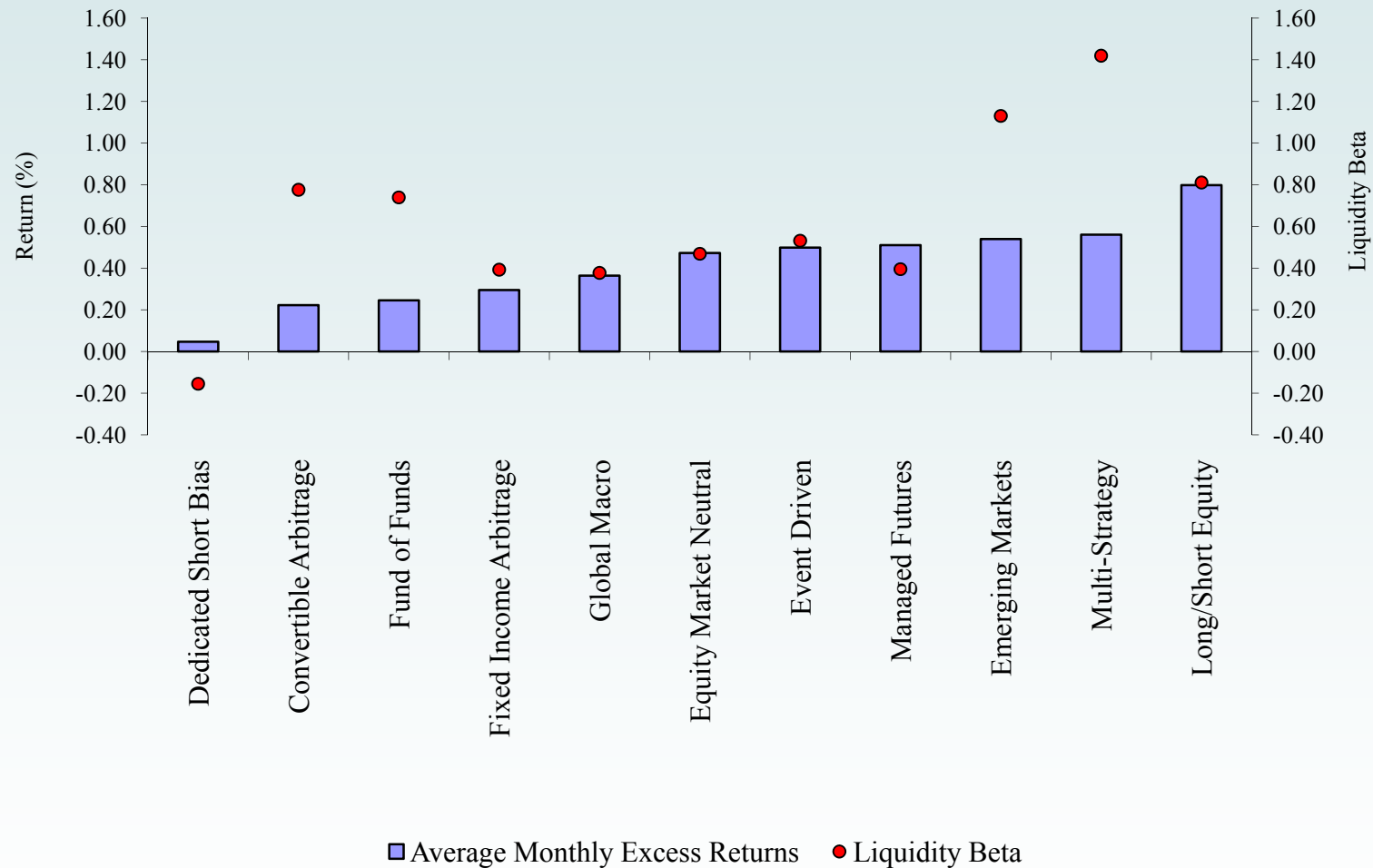
- Liquidity risk is measured through a regression of fund returns on the liquidity factor
- The coefficient, liquidity beta, measures fund sensitivity to aggregate liquidity shocks
- A high liquidity beta signifies outperformance during liquid periods and underperformance during illiquid periods

Liquidity Risk of HF Styles (Table 3)

Investment Style	Intercept	MKT-RF	SMB	Δ TERM	Δ CREDIT	PTFSBD	PTFSFX	PTFSCOM	Liquidity	R-Square / Adj. R-Square
Convertible Arbitrage	0.00 [2.80]	0.12 [5.40]	0.02 [0.92]	-0.03 [-6.15]	-0.06 [-8.00]	-0.01 [-1.09]	-0.01 [-1.13]	-0.01 [-0.76]	0.78 [4.17]	0.61 0.59
Dedicated Short Bias	0.01 [3.54]	-0.97 [-26.06]	-0.42 [-10.14]	-0.02 [-2.45]	-0.07 [-6.07]	0.00 [0.18]	0.00 [0.48]	0.01 [0.49]	-0.16 [-0.51]	0.85 0.84
Emerging Markets	0.00 [1.67]	0.54 [9.45]	0.19 [2.96]	0.00 [-0.30]	-0.04 [-2.01]	-0.03 [-2.08]	0.00 [-0.02]	0.00 [0.09]	1.13 [2.41]	0.54 0.52
Equity Market Neutral	0.00 [7.54]	0.07 [4.11]	-0.02 [-0.98]	-0.02 [-5.11]	-0.03 [-6.32]	0.00 [-0.25]	0.01 [1.43]	0.00 [0.33]	0.47 [3.59]	0.45 0.42
Event Driven	0.00 [7.43]	0.19 [11.97]	0.07 [4.05]	-0.01 [-2.49]	-0.04 [-7.37]	-0.02 [-4.06]	0.00 [1.10]	0.00 [-0.60]	0.53 [4.10]	0.76 0.74
Fixed Income Arbitrage	0.00 [4.92]	0.03 [1.58]	-0.02 [-0.83]	-0.03 [-7.18]	-0.06 [-10.66]	0.00 [-0.78]	0.00 [-1.09]	0.00 [0.25]	0.39 [2.51]	0.57 0.55
Fund of Funds	0.00 [2.29]	0.18 [7.39]	0.07 [2.69]	-0.02 [-4.25]	-0.05 [-6.11]	-0.01 [-0.85]	0.01 [2.36]	0.01 [1.77]	0.74 [3.71]	0.58 0.56
Global Macro	0.00 [2.70]	0.16 [5.68]	0.02 [0.61]	-0.01 [-2.56]	-0.02 [-2.56]	-0.01 [-0.86]	0.03 [5.49]	0.01 [1.65]	0.38 [1.69]	0.37 0.34
Long/Short Equity	0.01 [5.73]	0.45 [16.75]	0.22 [7.38]	-0.01 [-1.24]	-0.01 [-0.98]	-0.01 [-0.87]	0.00 [0.78]	0.01 [1.21]	0.81 [3.73]	0.76 0.75
Managed Futures	0.01 [2.55]	-0.02 [-0.34]	0.00 [-0.04]	-0.03 [-2.63]	-0.02 [-1.56]	0.03 [2.43]	0.04 [3.64]	0.05 [3.53]	0.39 [0.99]	0.27 0.24
Multi-Strategy	0.00 [3.19]	0.24 [6.80]	0.08 [2.00]	-0.04 [-5.76]	-0.03 [-2.37]	0.01 [0.95]	0.00 [0.54]	0.01 [1.27]	1.42 [4.89]	0.49 0.46

HF Style Return and Liquidity Beta

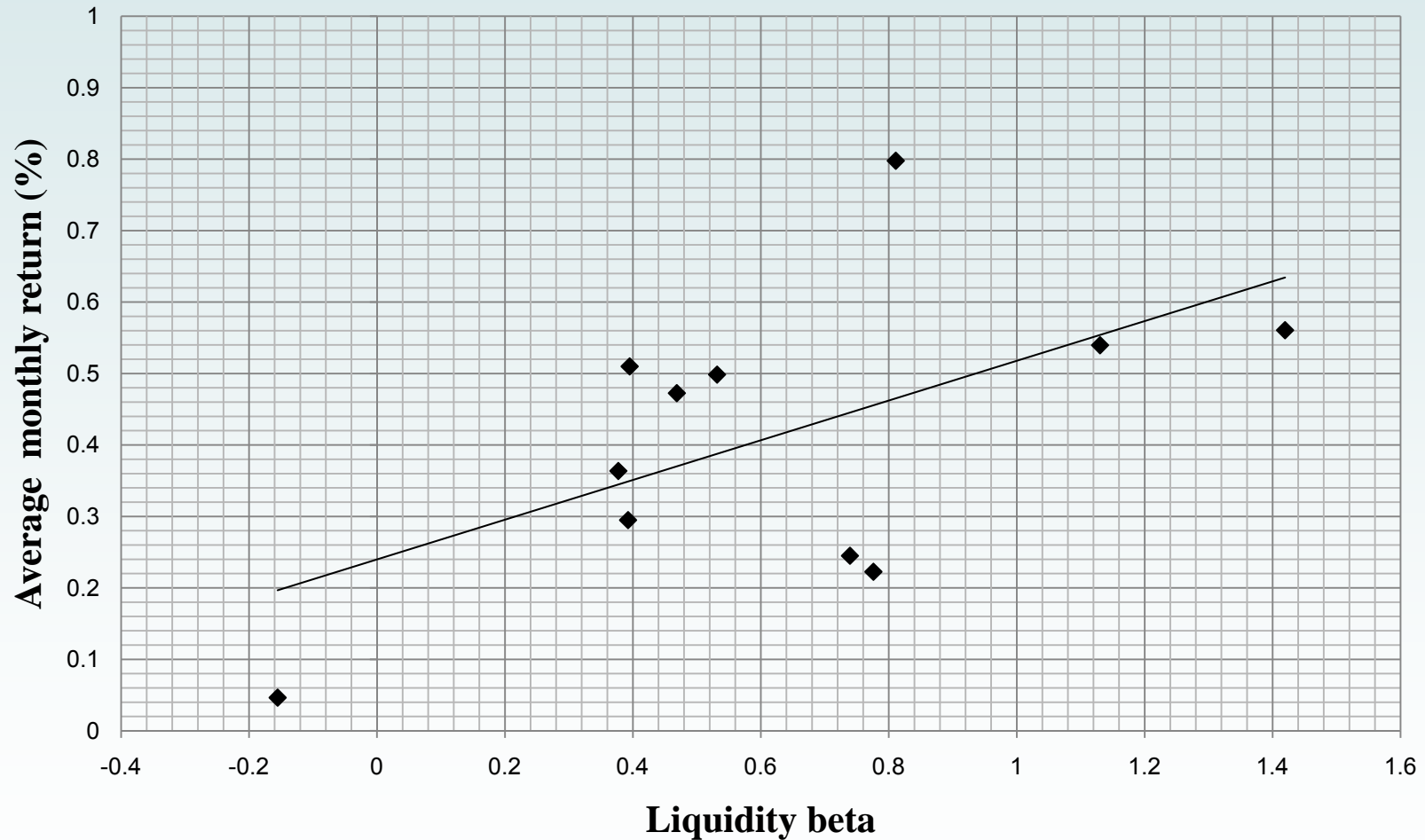
(Figure 2)



Investment styles with high liquidity exposures outperform low-exposure styles

HF Style Return and Liquidity Beta

(scatter plot)

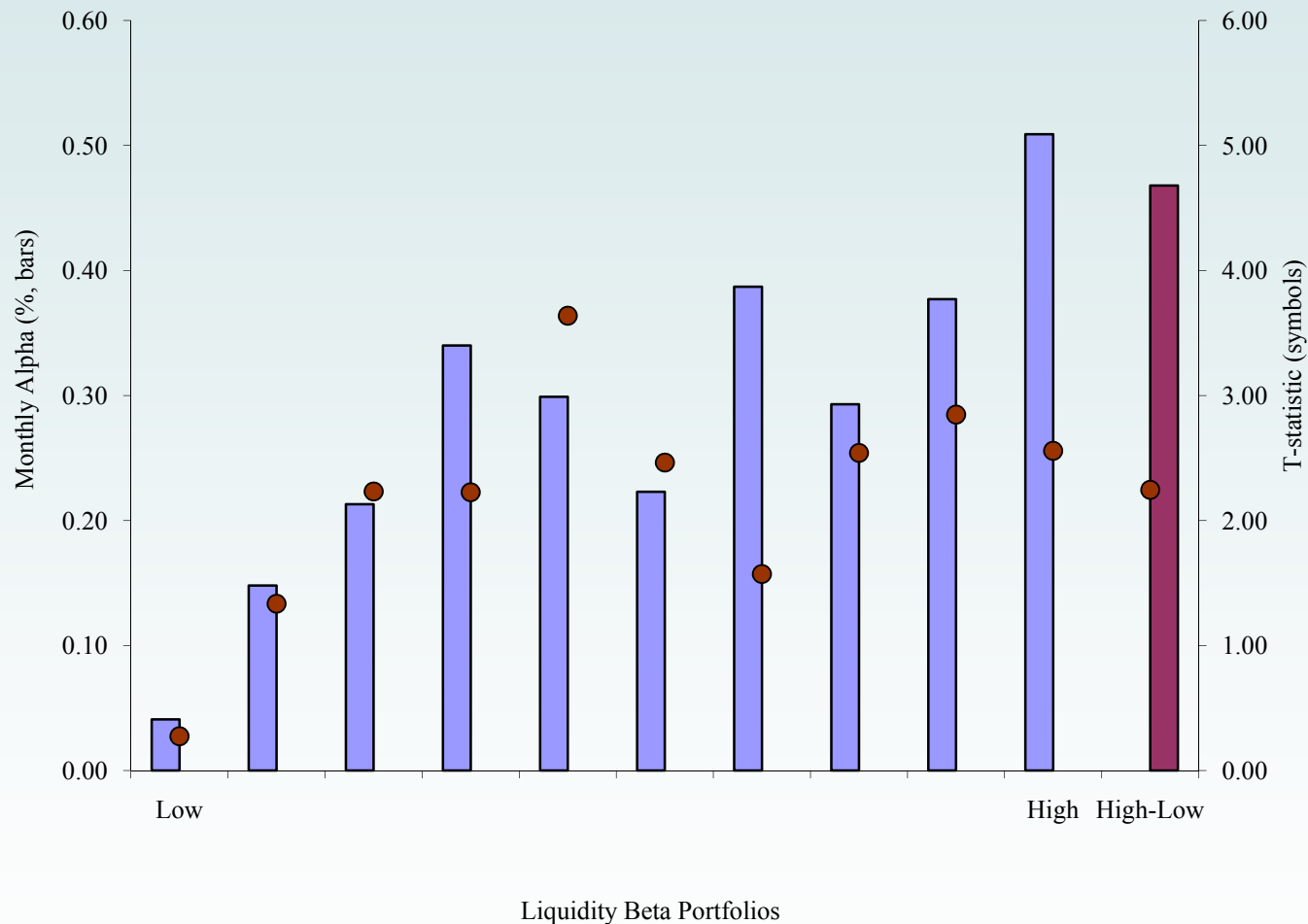


What have we learned so far?

- HF styles suggest liquidity beta is priced
- Fama and MacBeth (1973) regressions using HF style portfolios yield a coefficient of 1.43% on liquidity beta (t -stat of 2.24)
- What about out-of-sample liquidity-beta-sorted portfolios?

HF Liquidity-Beta Sorted Portfolios

(Figure 3)



High-liquidity-beta funds outperform low-liquidity-beta funds

Beta-Sorted Portfolios (Table 4)

Factor	Factor Beta Deciles										
	1 [low]	2	3	4	5	6	7	8	9	10 [high]	10 - 1
MKT	0.44 [1.98]	0.32 [2.97]	0.35 [3.52]	0.28 [2.53]	0.29 [2.21]	0.58 [2.01]	0.37 [1.99]	0.44 [1.94]	0.41 [1.41]	0.45 [1.00]	0.02 [0.03]
SMB	0.34 [1.50]	0.42 [1.34]	0.28 [1.80]	0.29 [2.07]	0.32 [2.28]	0.47 [2.47]	0.40 [2.54]	0.45 [2.48]	0.47 [2.09]	0.48 [1.39]	0.13 [0.36]
ΔTERM	0.67 [2.63]	0.42 [2.63]	0.38 [2.52]	0.35 [2.29]	0.36 [2.73]	0.33 [2.35]	0.36 [2.35]	0.32 [1.71]	0.47 [1.44]	0.26 [0.80]	-0.41 [-1.14]
ΔCREDIT	0.23 [0.68]	0.34 [1.47]	0.61 [1.88]	0.41 [2.41]	0.41 [2.66]	0.33 [2.58]	0.32 [2.56]	0.35 [2.73]	0.45 [2.53]	0.46 [2.72]	0.23 [0.75]
PTFSBD	0.31 [0.83]	0.21 [0.97]	0.39 [1.84]	0.27 [1.72]	0.33 [2.29]	0.36 [2.54]	0.47 [3.31]	0.52 [3.42]	0.51 [2.99]	0.56 [2.31]	0.25 [0.67]
PTFSFX	0.51 [1.80]	0.30 [1.51]	0.52 [1.67]	0.32 [2.23]	0.32 [2.30]	0.33 [2.29]	0.38 [2.48]	0.41 [2.31]	0.34 [1.77]	0.49 [2.01]	-0.02 [-0.06]
PTFSCOM	0.57 [2.14]	0.38 [2.02]	0.43 [2.10]	0.32 [2.18]	0.25 [1.83]	0.29 [2.06]	0.33 [2.10]	0.54 [1.84]	0.32 [1.75]	0.48 [1.60]	-0.09 [-0.26]
Liquidity											
Return	0.17 [0.88]	0.30 [1.92]	0.29 [2.12]	0.43 [2.32]	0.38 [2.91]	0.30 [2.01]	0.56 [1.89]	0.40 [2.10]	0.45 [2.10]	0.63 [2.16]	0.46 [1.99]
Alpha	0.04 [0.27]	0.15 [1.33]	0.21 [2.23]	0.34 [2.23]	0.30 [3.64]	0.22 [2.46]	0.39 [1.57]	0.29 [2.54]	0.38 [2.85]	0.51 [2.56]	0.47 [2.25]

Summary of HF Factors

- Commonly used hedge-fund factors largely explain time-series variation of returns, but do not predict performance
- Liquidity risk predicts performance in the cross-section of hedge funds

What's next?

- Is the liquidity risk of a fund related to its liquidity provision to investors?
- Is liquidity risk pricing an inter- or intra-investment style effect?
- Does liquidity risk predict long-run returns?
- Crisis versus non-crisis periods

Liquidity-Beta and Share Restriction (Table 5)

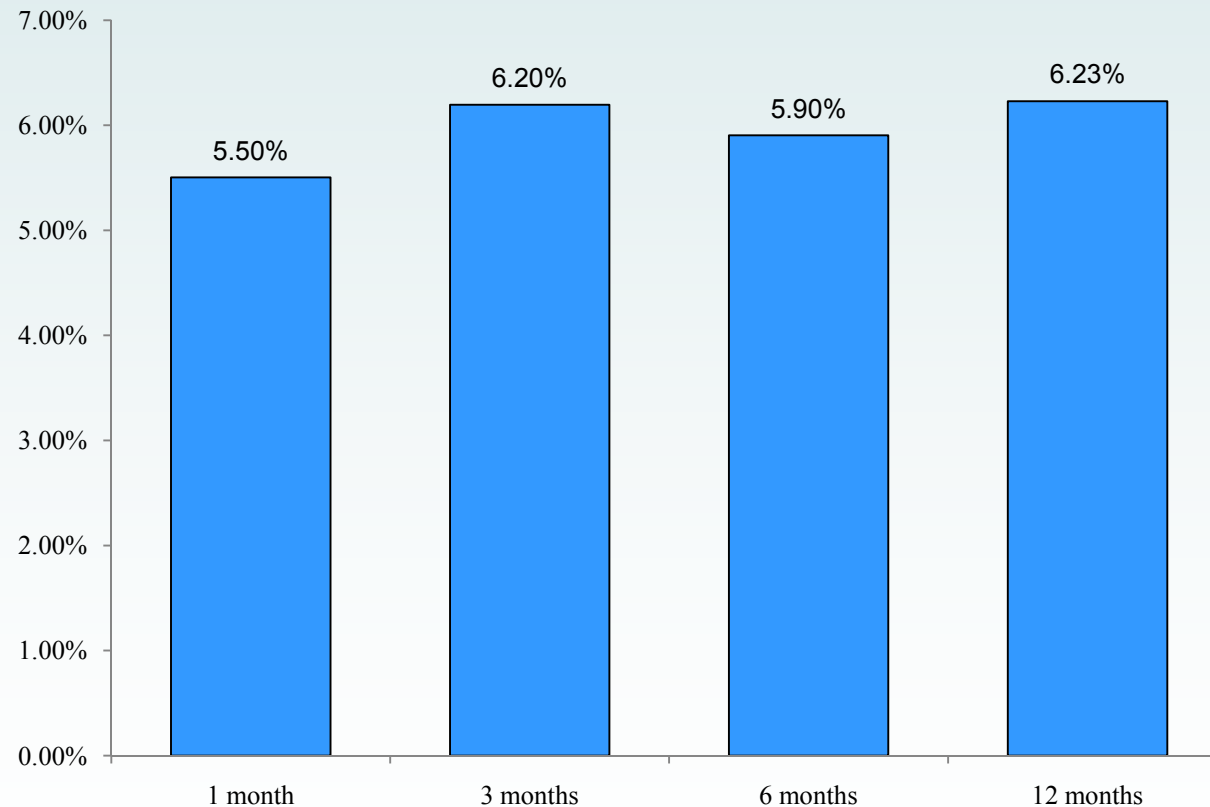
Share Restriction	Liquidity Beta Deciles										10 - 1
	1 [low]	2	3	4	5	6	7	8	9	10 [high]	
Panel A. Lockup Period											
0	-0.06	0.12	0.18	0.36	0.25	0.17	0.38	0.28	0.31	0.42	0.48
[N=9,693]	[-0.37]	[1.11]	[1.77]	[1.73]	[2.94]	[1.75]	[1.27]	[2.26]	[2.16]	[1.99]	[2.19]
1	0.57	0.36	0.39	0.42	0.52	0.41	0.48	0.42	0.64	1.00	0.43
[N=2,478]	[3.51]	[2.96]	[4.16]	[5.37]	[5.67]	[4.59]	[4.73]	[4.02]	[5.31]	[5.13]	[1.77]
Panel B. Redemption Notice Period (days)											
0	-0.41	-0.24	-0.05	0.09	-0.03	0.09	0.11	0.13	0.15	0.26	0.67
[N=2,351]	[-1.65]	[-1.52]	[-0.33]	[0.73]	[-0.24]	[0.71]	[0.78]	[0.81]	[0.77]	[1.05]	[2.30]
(0,30]	0.12	0.19	0.25	0.51	0.34	0.28	0.58	0.35	0.42	0.60	0.49
[N=5,324]	[0.68]	[1.72]	[2.43]	[1.73]	[3.93]	[2.99]	[1.08]	[3.00]	[3.06]	[2.83]	[2.15]
(30,60]	0.23	0.28	0.40	0.33	0.35	0.33	0.33	0.42	0.53	0.76	0.53
[N=2,866]	[1.48]	[2.50]	[4.08]	[3.79]	[4.15]	[3.40]	[2.91]	[3.62]	[3.89]	[3.80]	[2.35]
(60,90]	0.35	0.40	0.37	0.50	0.39	0.30	0.41	0.35	0.34	0.50	0.14
[N=1,294]	[1.94]	[3.55]	[3.55]	[5.81]	[4.32]	[2.95]	[3.43]	[2.99]	[2.17]	[1.63]	[0.43]
(90, 365]	0.27	0.37	0.01	0.35	0.47	0.34	0.35	0.42	0.15	1.66	1.39
[N=336]	[0.90]	[0.92]	[0.09]	[3.47]	[3.97]	[2.91]	[2.24]	[2.24]	[0.45]	[2.04]	[1.72]

Liquidity-Beta Portfolios within Style

(Table 6)

Investment Style	Decile Spreads 10 - 1		Investment Style	Decile Spreads 10 - 1	
	Returns	Alphas		Returns	Alphas
Convertible Arbitrage	-0.03 [-0.11]	-0.18 [-0.61]	Fund of Funds	0.33 [1.26]	0.38 [1.63]
Dedicated Short Bias	-0.44 [-0.50]	-0.16 [-0.19]	Global Macro	-0.56 [-1.51]	-0.63 [-1.90]
Emerging Markets	2.18 [3.87]	2.05 [3.55]	Long/Short Equity	-0.07 [-0.28]	-0.02 [-0.07]
Equity Market Neutral	0.22 [0.82]	0.24 [0.91]	Managed Futures	0.53 [1.35]	0.36 [0.91]
Event Driven	0.42 [1.94]	0.57 [3.00]	Multi-Strategy	-0.14 [-0.46]	0.24 [0.70]
Fixed Income Arbitrage	0.15 [0.54]	0.37 [1.10]	All	0.46 [1.99]	0.47 [2.25]

Long-Run Performance of Liquidity-Beta Portfolios (Table 7)



Crisis versus Non-Crisis Periods: Alternative Measures of Liquidity (Table 8)

Panel A. Monthly returns

Period	Months	Pástor-Stambaugh	Acharya-Pedersen	Sadka
Crises	9	-2.70 [-1.16]	-1.67 [-0.64]	-1.23 [-0.66]
Non-Crises	147	0.06 [0.20]	0.14 [0.49]	0.56 [2.59]
All	156	-0.10 [-0.29]	0.04 [0.12]	0.46 [1.99]

Panel B. Three-month cumulative returns

Period	Quarters	Pástor-Stambaugh	Acharya-Pedersen	Sadka
Crises	3	-5.32 [-0.85]	-1.81 [-0.25]	-3.69 [-1.78]
Non-Crises	46	1.26 [1.42]	1.29 [1.40]	1.88 [2.55]
All	52	-0.28 [-0.24]	0.18 [0.17]	1.55 [1.95]

Summary and Conclusions

- Systematic liquidity risk is priced in HF universe (6% annually)
- The effect is robust
- Implications
 - Liquidity risk pricing is robust
 - Tool for risk management
 - Improve asset allocation and manager selection
 - Liquidity risk is not a source of HF data biases