Flight-to-Liquidity in the Equity Markets during Periods of Financial Crisis

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- Learn about *price adjustments* and *investors' trading decisions* during periods when liquidity is most needed.
- ***Empirical*** examination of the flight-to-liquidity phenomenon. More specifically, *how* a possible change in preferences for holding illiquid stocks *is reflected* in stock returns and investors' holding positions.

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1. Regarding stock returns:
   - How does the return difference between illiquid and liquid stocks evolve during crises?
2. Regarding stock holding positions:
   - Are there any groups of investors who *change* their illiquid stocks' holding positions during crises?
   - What is the reason for these trades?

Main Findings

- Using:
  - ***Ten periods*** of financial crisis during 1986-2008, defined by a large positive monthly jump in the VIX measure.
  - Common stocks in the U.S.
  - Conventional stock liquidity measures (the Amihud (2002) and Hasbrouck's EHBAS measures).

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- For example, the four-factor alpha return difference between illiquid and liquid stocks accumulates to -4% for the NASDAQ, over these months.
- These return differences *revert back* in the *following* three month (on average).

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  - ▷ ***driven by the mutual fund customers*** $\rightarrow$ A result of larger *customer withdrawals* from funds with less liquid stocks.
  - ▷ Funds with less liquid stocks experienced *lower returns*, which may explain the mutual fund customers' withdrawal decisions.

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  - ▷ The changes in holding positions seem to be the result of customer withdrawals that *force* managers to trade $\rightarrow$ **Not a strategic decision by the fund managers**.
  - ▷ The fact that fund managers are "forced" to trade, might suggest that illiquid stocks also experience a *price pressure* (beyond the valuation effect).

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  - Vayanos (2004, *WP*) - Mutual fund managers reduce the exposure to illiquid stocks when they expect to experience ***customer withdrawals***.
  - Brunnermeier and Pedersen (2009, *RFS*) - Arbitrageurs reduce the exposure to illiquid stocks due to higher ***margin requirements***.

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  - Ben-Rephael, Kandel and Wohl (2011, *JFE-forthcoming*) - Mutual fund customers induce "noise" in ***aggregate*** market prices which are subsequently corrected.

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- Additional data:
  - CRSP's Survivor-Bias Free Mutual Fund Database - Monthly returns and Total Net Assets (TNA).

Stock Sample

To be included in year *t*, a stock must comply with the following criteria:

- Traded on the NYSE or NASDAQ.
- Common stock (share code 10 or 11).
- At least 36 months for systematic risk loadings estimation.
- End of year *t-1* price $\geq$ \$2.
- At least 60 trading days during year *t-1*.

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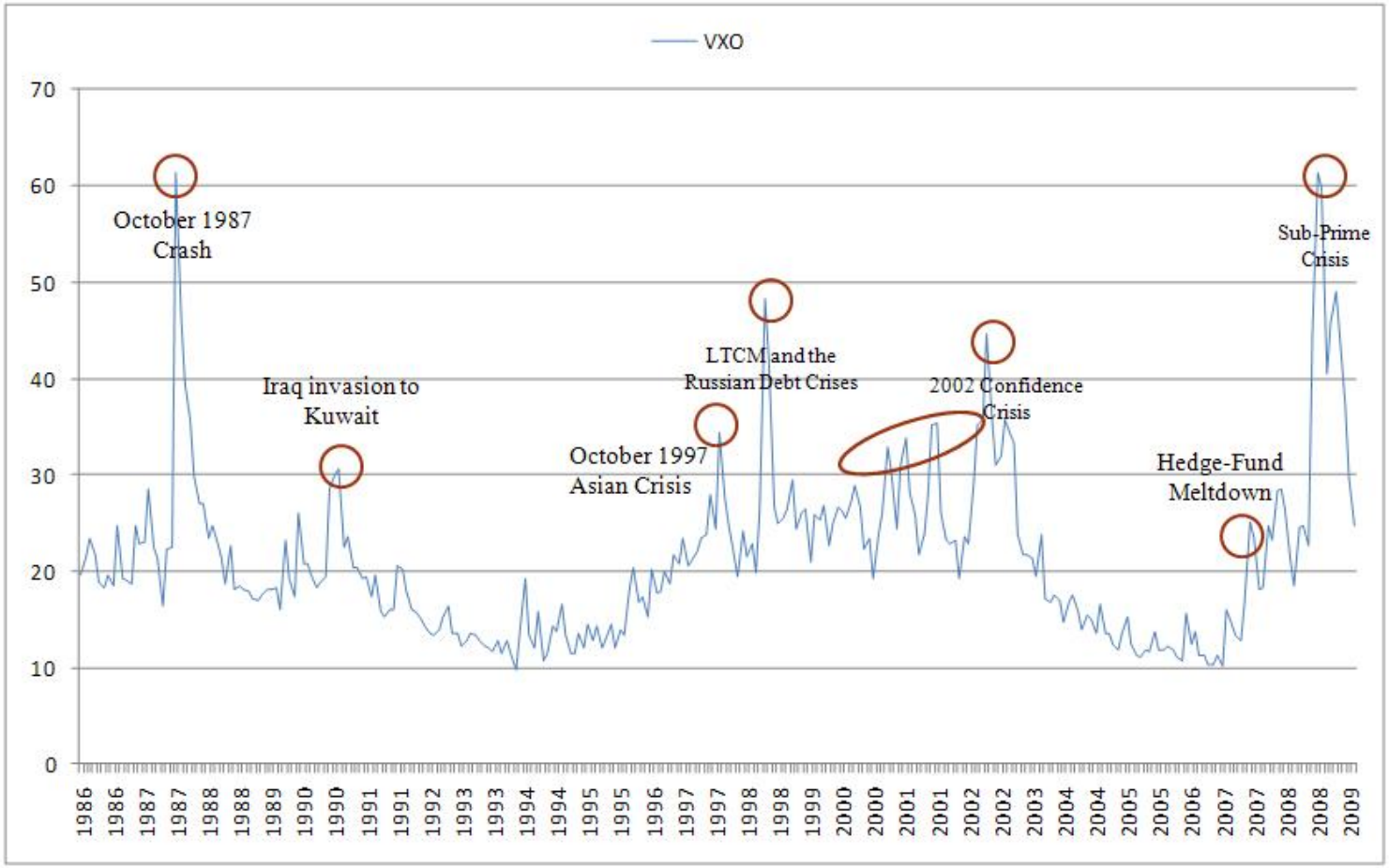
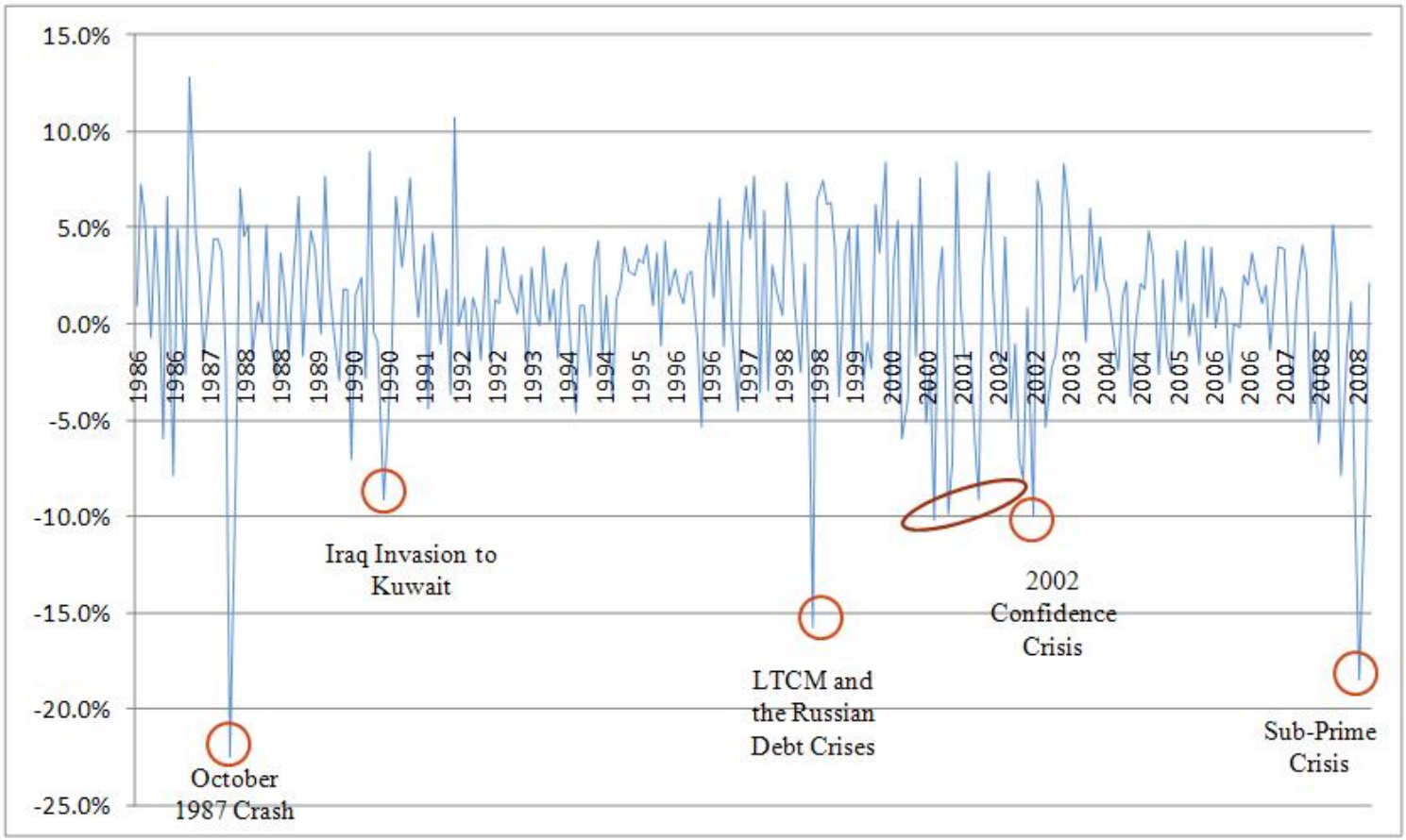
- Major events vs. statistical power.
- I focus on the 10 largest monthly jumps in the VXO measure (in the presentation, also termed as "VIX") during 1986-2008 (a good cutoff).
- High spikes in market volatility coincide with negative shocks to the market return, and liquidity "dry-ups."

Figure 1A - VXO Spikes 1986-2009



Monthly levels of the VXO measure (implied volatility of the S&P100).

Figure 1B - CRSP value weighted Total Return 1986-2009



These events are also defined by negative monthly returns.

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  - Calculated based on three months of daily data.

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- Hasbrouck's (2009) measure, which measures the ***effective half bid-ask spread***.
  - A Bayesian version of Roll's (1984) model, estimated by the Gibbs sampler (henceforth, "HR").
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- If, in periods of crisis, illiquid stocks have lower returns, these strategies should have a negative outcome.

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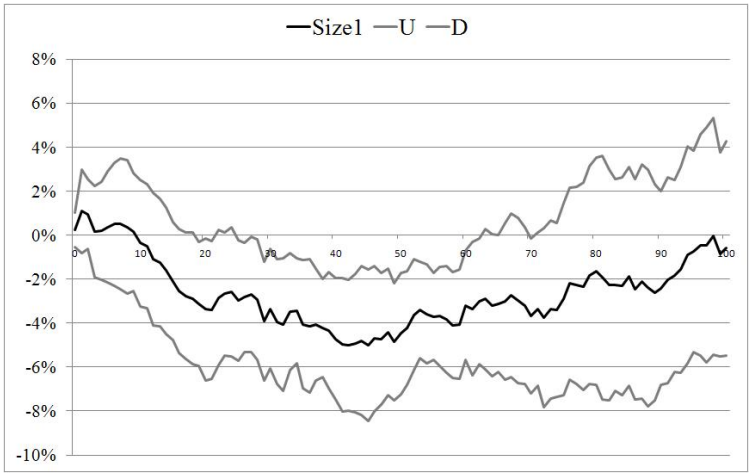
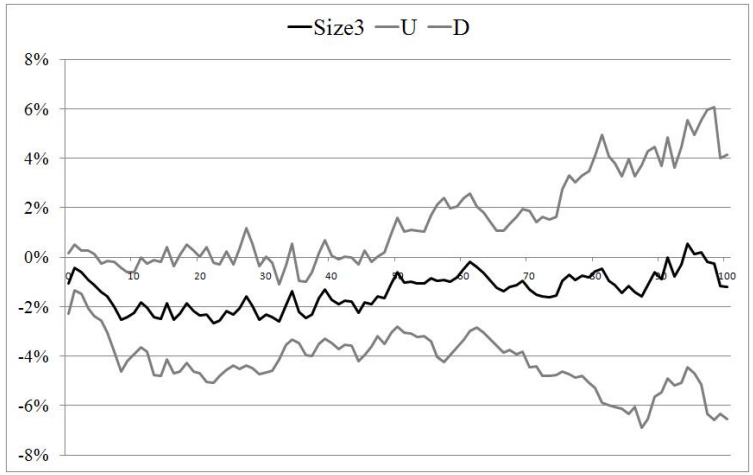
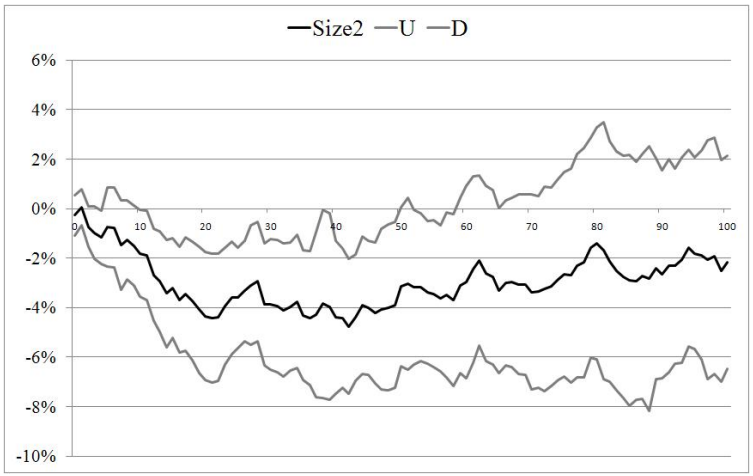
- Stocks are sorted into three size groups, and within each size group into five liquidity quintiles (15 portfolios).
- For each portfolio *p*, I calculate the *Out-of-Sample Alpha* for the accumulated daily returns, over the 100 days from the jump in the VIX.
- As in Brennan, Chordia and Subrahmanyam (1998):

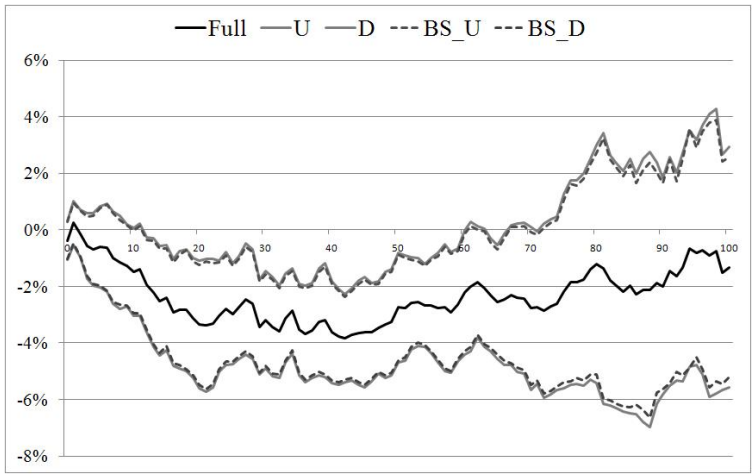
$$AlphaRet_{p,j,[1,D]} = (Ret_{p,j,[1,D]} - Rf_{j,[1,D]}) - \hat{\beta}_{MktRf,p,j} MktRf_{j,[1,D]}$$
$$-\hat{\beta}_{SMB,p,j} SMB_{j,[1,D]} - \hat{\beta}_{HML,p,j} HML_{j,[1,D]} - \hat{\beta}_{UMD,p,j} UMD_{j,[1,D]}$$

Figure 4 - NASDAQ-HR-Strategies









Main result: **A negative return difference between illiquid and liquid stocks that basically reverts back.**

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- Another explanation - the effect of trades on prices:
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  - Frictions that force investors to trade.
  - Both can lead to actual trades.

Stock Level Explanatory Variables

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Systematic risk:

- Fama-French-Carhart four-factor loadings.

Idiosyncratic Volatility:

- Conditional volatility using daily EGarch (1,1) model.

Other explanatory variables:

- LnSize, dividend yield, three momentum variables, and LnBM (Pontiff and Woodgate (2008)).

Other issues:

- Standardization - average coefficients with the same economic meaning.
- Pre-event explanatory variables.

Aggregate Share Holdings

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- Other institutional investors may step in and provide liquidity.
  - Using the 13*F* institutional investors' holdings, the aggregate institutional investor holdings are calculated, for each stock i and event j.
  - The aggregate mutual fund holdings are subtracted from the aggregate institutional holdings (henceforth, "OII").

Aggregate Share Holdings (Cont.)

- *Changes in holding positions* $\rightarrow$ are calculated, for each group (MF, OII), as in Sias, Starks and Titman (2006):

$$CngFrac_{i,j} = \frac{AggHoldings_{i,j,q} - AggHoldings_{i,j,q-1}}{ShareOut_{i,j}}$$

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$$CngFrac_{i,j} = Const_j + \sum_{c=1}^{C} \delta_{c,j} Z_{c,i,j} + \gamma_j LIQ_{i,j} + \epsilon_{i,j}$$

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A *negative* coefficient for the liquidity variable means a *reduction* in illiquid stock share holdings (relative to liquid stocks).

Table 4B - NASDAQ
Cross-Sectional Regressions of Aggregate Changes in Shares

Measure	MF	OII	Diff
Amihud			
Coef	-0.40%	0.70%	-1.10%
BS *t* -Statistic	-2.29	2.30	-2.33
HR			
Coef	-0.50%	0.66%	-1.16%
BS *t* -Statistic	-4.38	3.35	-3.66

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Can account for 15% of the monthly turnover over the crisis quarter.

Aggregate Share Holdings (Cont.)

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- Two possible effects:
  - Fund manager trading decisions.
  - Customer withdrawal decisions.

Fund Managers' Trading Activity

- For each stock i in fund f, a trading measure is defined by:

$$Sell_{i,f,j} = \frac{DollarTrade_{i,f,j}}{\sum_{i=b}^{B} |DollarBuy_{i,f,j}| + \sum_{i=s}^{S} |DollarSell_{i,f,j}|}$$

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- The measure is adjusted for a benchmark (deviations from a benchmark's "null"):

$$CapBgnSell_{i,f,j} = Sell_{i,f,j} - Sign_{(B+S)} CapBmk_{i,f,j}$$

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$$Sell_{i,f,j} = \frac{DollarTrade_{i,f,j}}{\sum_{i=b}^{B} |DollarBuy_{i,f,j}| + \sum_{i=s}^{S} |DollarSell_{i,f,j}|}$$

- The measure is adjusted for a benchmark (deviations from a benchmark's "null"):

$$CapBgnSell_{i,f,j} = Sell_{i,f,j} - Sign_{(B+S)} CapBmk_{i,f,j}$$

- The cross-sectional regression is given by:

$$CapBmkSell_{i,f,j} = Const_{f,j} + \sum_{c=1}^{C} \delta_{c,f,j} Z_{c,i,j} + \gamma_{f,j} LIQ_{i,j} + \epsilon_{i,f,j}$$

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A *negative* coefficient for the liquidity variable means a *larger* sell of illiquid stocks in the portfolio.

Table 5
Cross-Sectional Regressions of the Fund Managers' Trading Activity

Panel A – Distribution of the Cross-Sectional Regression Liquidity Coefficients

	All Coef		Coef at 10% level	
Measures	Neg	Pos	Neg	Pos
Amihud	52.3%	47.7%	6.8%	6.1%
HR	50.7%	49.3%	5.5%	4.7%

Panel C – T.S. Average of the Cross-Sectional Regression Liquidity Coefficients

Measures	Coef	T-stat	AveLiq	T-stat
Amihud	-0.07%	-1.15	-0.02%	-1.20
HR	-0.02%	-2.22	-0.03%	-1.76

Main results

The distributions of the coefficients (Panel A) seem as a result of a random sample.

The average results (Panel C) are marginally significant and economically negligible.

Trading Activity Revised - A Panel Regression Estimation

- These results suggest that the aggregate fund outcome may be a result of differences between the funds and not within the funds.

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  - Fund level explanatory variables - include the average liquidity level, number of assets, log of the fund size and flows.

Trading Activity Revised - A Panel Regression Estimation

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- A panel regression allows for the inclusion of both stock level and fund level explanatory variables:
  - Flows are estimated for each fund f as in Frazzini and Lamont (2008):

$$FundMonNormFlow_{m,j} = \frac{TNA_{m,j} - (1 + R_{m,j})\,TNA_{m-1,j} - MRG_{m,j}}{TNA_{m-1,j}}$$

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- Two panel regressions (Dollar Trade and Share Trade):

$$Sell_{i,f,j} = Const_j + \sum_{c=1}^{C} \delta_{c,j} Z_{c,i,j} + \gamma_j LIQ_{i,j} + \sum_{k=1}^{K} \theta_{k,j} F_{k,f,j} + \epsilon_{i,f,j}$$

$$CngFrac_{i,f,j} = Const_j + \sum_{c=1}^{C} \delta_{c,j} Z_{c,i,j} + \gamma_j LIQ_{i,j} + \sum_{k=1}^{K} \theta_{k,j} F_{k,f,j} + \epsilon_{i,f,j}$$

Table 6A and 6B - Trading Activity Panel Regressions

Panel A – Dollar Trade Activity

	Amihud		HR	
Variables	Coef	T-stat	Coef	T-stat
Stock Level Controls	YES		YES	
Stock Liquidity	**-0.001**	**-0.98**	**0.000**	**-1.11**
Fund Liquidity	0.002	1.47	0.000	-0.18
FundAssets	0.000	-1.76	0.000	-1.32
FundLnBgnCap	0.000	0.59	0.000	0.71
FundQrtNormFlow	**0.045**	**10.33**	**0.045**	**10.54**

Panel B – Share Trade Activity

	Amihud		HR	
Variables	Coef	T-stat	Coef	T-stat
Stock Level Controls	YES		YES	
Stock Liquidity	**-0.013**	**-1.00**	**-0.002**	**-1.26**
Fund Liquidity	0.065	1.85	0.010	0.86
FundAssets	0.000	-1.44	0.000	-1.38
FundLnBgnCap	0.002	1.74	0.002	1.84
FundQrtNormFlow	**0.145**	**6.45**	**0.144**	**6.36**

***Main result:* Stock liquidity is not significant, while fund flows are highly significant.**

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Panel B – Share Trade Activity

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Variables	Coef	T-stat	Coef	T-stat
Stock Level Controls	YES		YES	
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***Main result:* Stock liquidity is not significant, while fund flows are highly significant.**

A 1 std. change in the fund flows affects the share holdings by 0.56% (similar to T4 results).

Fund Flows and Liquidity Analysis

- Relate fund outflows to the reduction in aggregate holding of illiquid stocks:

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- Fund level cross-sectional regressions of monthly fund flows:

$$FundNormFlow_{f,m,j} = Const_{m,j} + Controls + AveFundLiq + \epsilon_{f,m,j}$$

Target - funds with less liquid stocks experience larger withdrawals

Table 7A - Monthly Fund Flows

Panel A - Monthly Flows

	RISK			FULL		
Period	0	1	2	0	1	2
Amihud	-0.33	-0.62	-0.60	-0.49	-0.48	-0.24
BS *t*-Statistic	-1.74	-2.06	-1.62	-3.39	-2.31	-0.40
HR	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02
BS *t*-Statistic	-2.01	-3.20	-1.99	-2.01	-2.35	-0.86

***Main result:* Funds with less liquid stocks experience larger withdrawals.**

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HR	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02
BS *t*-Statistic	-2.01	-3.20	-1.99	-2.01	-2.35	-0.86

***Main result:* Funds with less liquid stocks experience larger withdrawals.**

A 1 std. change in the fund liquidity affects the fund ***normalized*** flows by -1.00%.

Fund Returns and Liquidity Analysis

- Monthly fund returns and fund liquidity:

$$FundRet_{f,m,j} = Const_{m,j} + Controls + AveFundLiq + \epsilon_{f,m,j}$$

***Main result:* Funds with less liquid stocks experience lower returns.**

Panel B - Monthly Return

	RISK			FULL		
Period	0	1	2	0	1	2
Amihud	-0.62	-0.38	-0.13	-0.43	0.02	-0.27
BS t-Statistic	-2.43	-2.38	-0.39	-1.81	0.02	-0.54
HR	-0.05	-0.02	0.03	-0.04	-0.02	0.01
BS t-Statistic	-3.52	-1.55	3.08	-3.83	-1.96	1.21

Robustness and Extensions

- Market volatility risk factor.
- Systematic liquidity measures.

Conclusion

- Evidence for flight-to-liquidity in ***both*** illiquid stock returns and holding positions:

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    - Revert back during the following three months (on average).

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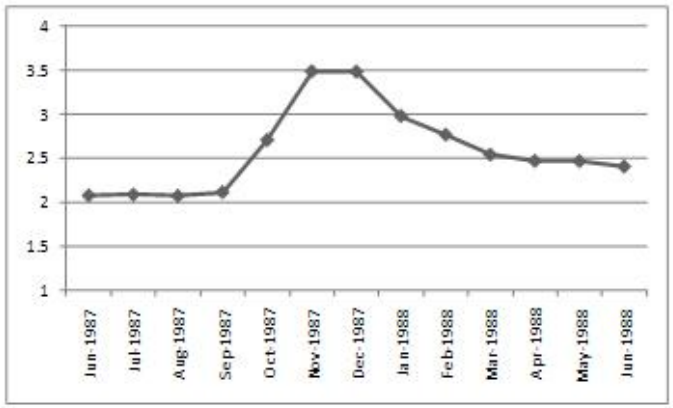
  - ▷ Negative return differences between illiquid and liquid stocks (as expected)
    - Accumulate over a period of three months after the beginning of the crises.
    - Revert back during the following three months (on average).
  - ▷ The changes in holding positions seem to be the result of customer withdrawals that *force* managers to trade $\rightarrow$ **Not a strategic decision by the fund managers**.
  - ▷ The fact that fund managers are "forced" to trade, might suggest that illiquid stocks also experience a *price pressure* (beyond the valuation effect).

Conclusion

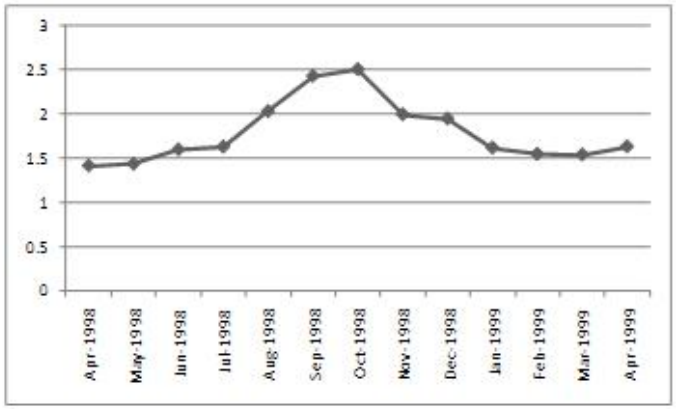
Thank You!

Market Illiquidity (EW Average) during the Identified Crises

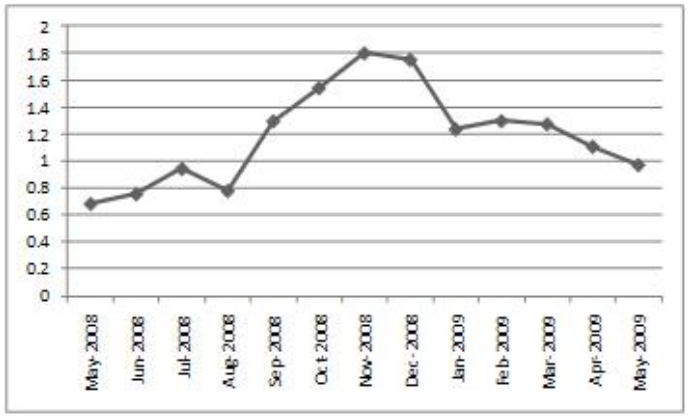
Graph A – NASDAQ, October 1987



Graph B – NASDAQ, August 1998



Graph C – NASDAQ, September 2008



Graph D – NYSE, September 2008

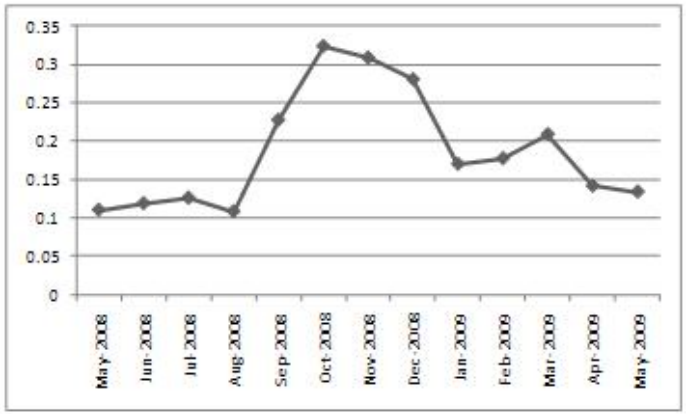
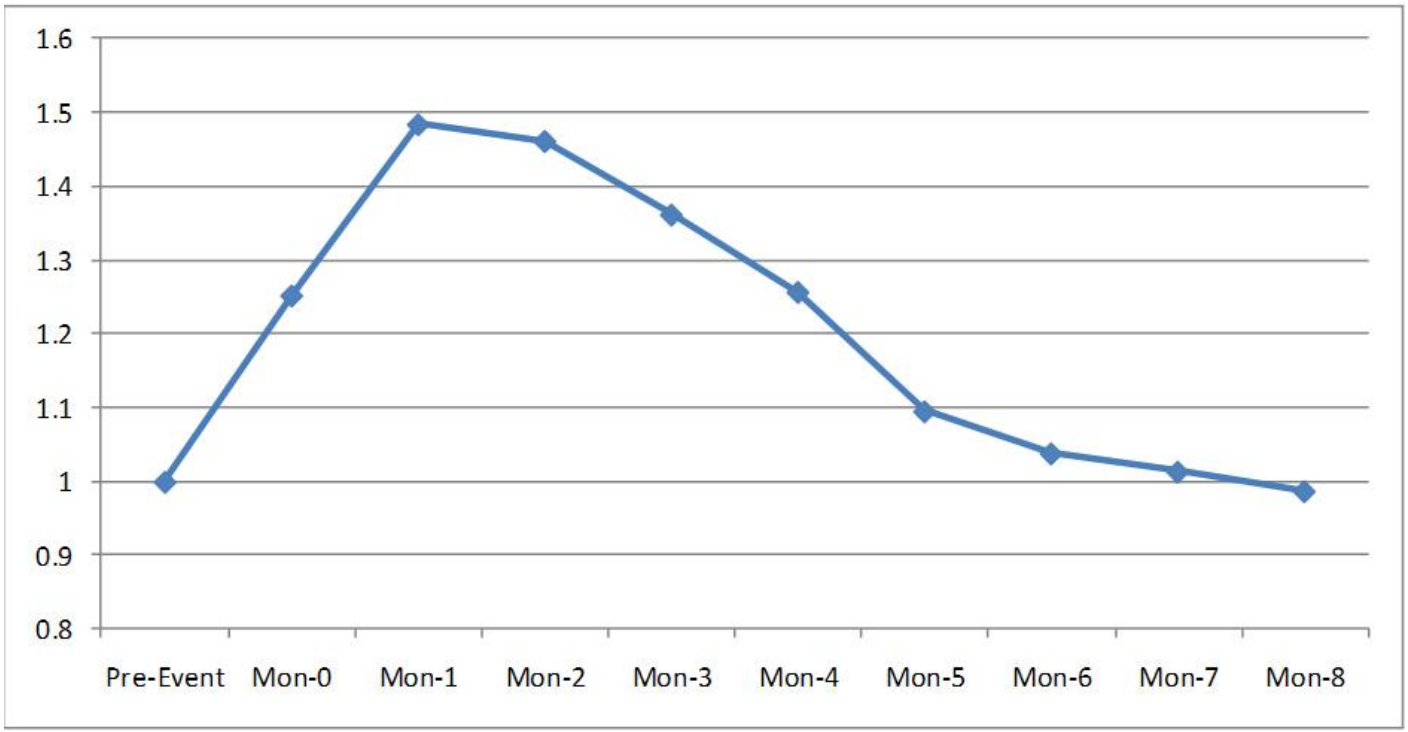


Figure 2A - Market Illiquidity (EW Average) during the Identified Crises



Pre-Event average market liquidity level is normalized to be 1.
Month 0 is the month of the jump in the VIX.

Based on the CRSP's *monthly average* of the end-of-day bid-ask quotes for the sample of stocks traded on the NASDAQ.

Table 3 - NASDAQ
Cross Sectional Regressions of Change in Turnover

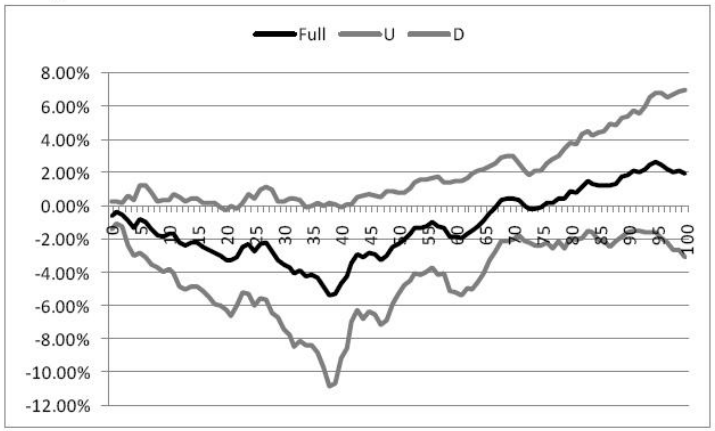
	NASDAQ			
Measures	0	1	2	3
Amihud				
Coef	0.041	0.065	0.040	-0.012
BS t-statistic	4.03	5.70	2.39	-0.45
HR				
Coef	0.014	0.050	0.032	0.000
BS t-statistic	1.04	2.75	1.46	0.02

$$CngTurnover_{i,m,j} = Const_{m,j} + \sum_{c=1}^{C} \delta_{c,m,j} Z_{c,i,j} + \gamma_{m,j} LIQ_{i,j} + \epsilon_{i,m,j}$$

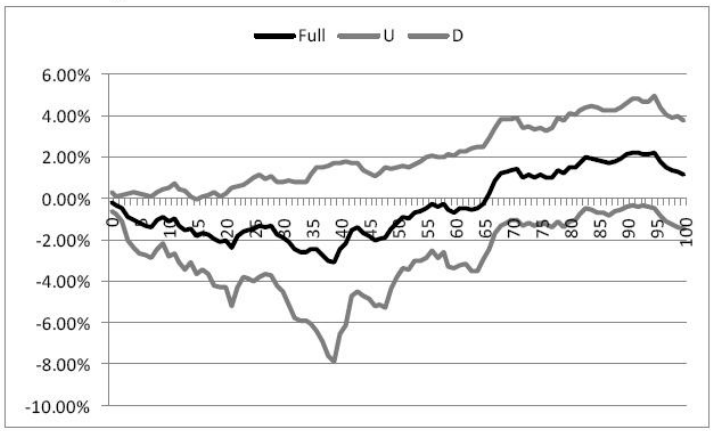
Main result: Significant increase in the turnover of illiquid stocks relative to liquid stocks $\rightarrow$ indication for excessive trades in illiquid stocks.

Systematic Liquidity-based Trading Strategies Ů Pre-sorted by Size

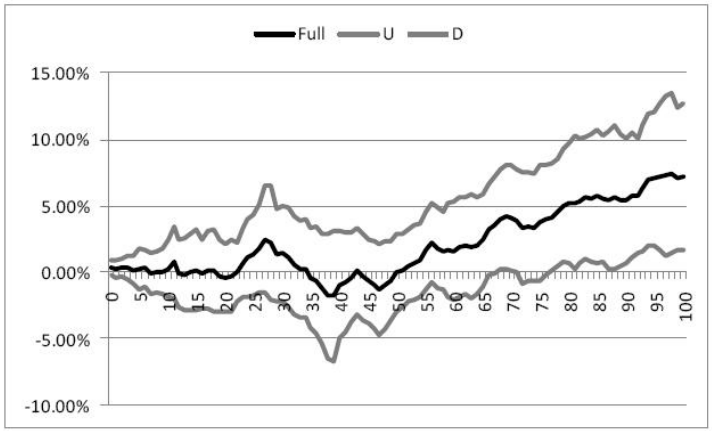
Graph A.1 – NYSE – ASB Measure



Graph A.2 – NYSE – HRSB Measure



Graph B.1 – NASDAQ – ASB Measure



Graph B.2 – NASDAQ – HRSB Measure