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# Assessing Hedge Fund Leverage and Liquidity Risk

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# Liquidity and Leverage

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- Asset liquidity (ability to sell or unwind positions)
- Funding liquidity (ability to meet obligations when due)
- Leverage (exacerbates both liquidity risks)
- Source: Improving Counterparty Risk Practices, Appendix A, 1999



# Presentation Outline

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- Importance of each measure
- Specific suggested measures
- Wish list



# Asset Liquidity - Importance

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- Unexpected adverse market conditions reduce the value of collaterals, force liquidations of large positions over short periods, which can lead to systemic events.
- The more illiquid the positions, the larger the price impact of forced liquidations, leading to a series of insolvencies and defaults.
- Moreover, in a framework where financial institutions have excessive leverage and belong to a network based on credit exposures, individual financial fragility can feed on itself, leading to a systemic shock (Battiston et al., 2009).



# Asset Liquidity Measure

- The more illiquid the portfolio, the more discretion the manager has in marking its value and smoothing returns, creating serial correlation (autocorrelation) in the process.
- Degree of serial correlation in an asset's returns can be viewed as a **proxy for the magnitude of the frictions**, and illiquidity is one of most common forms of such frictions. See Lo (2002) and Getmansky, Lo, and Makarov (2004).
- Getmansky, Lo, and Makarov (2004) developed an illiquidity and smoothing measure (theta):

$$R_t^0 = \theta_0 R_t + \theta_1 R_{t-1} + \theta_2 R_{t-2}$$

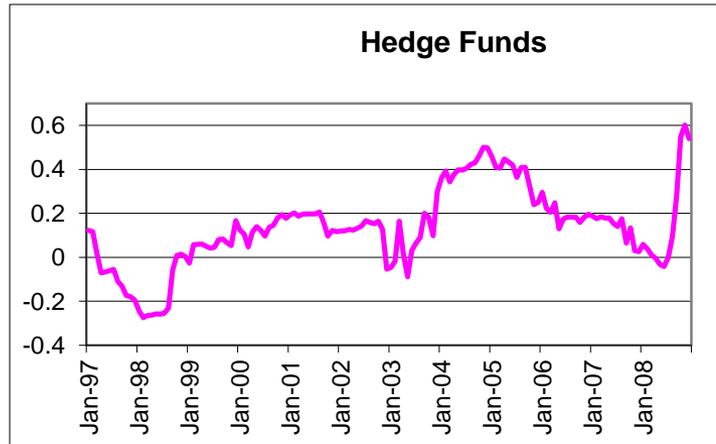
$$\theta_j \in [0,1], j = 0,1,2$$

$$\theta_0 + \theta_1 + \theta_2 = 1$$



# Autocorrelation

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- From 2005-2007, autocorrelation decreased
- Reasons:
  - Asset liquidity of hedge funds increased
  - Hedge funds decreased leverage



# Wish List

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- Leverage
  - Currently we have information on maximum and average leverage used by a hedge fund
  - Good to have time-series information on leverage used
- Asset liquidity
  - Calculate “net of leverage” measures
  - Need to reconcile asset liquidity and strategy liquidity. For example, convertible bond arbitrage strategy (fairly illiquid) consists of convertible bonds (fairly illiquid) and stocks (fairly liquid)
  - For each hedge fund, understand individual holding asset liquidity



# Don't Jump to Conclusions

- Are illiquid strategies more likely to be affected during liquidity crises? Think twice.

	1994 to 2000				2001 to 2008			
	Global Macro	Long/Short Equity	Illiquid	Liquid	Global Macro	Long/Short Equity	Illiquid	Liquid
Global Macro	1.00	0.45	0.47	0.24	1.00	0.56	0.67	0.48
Long/Short Equity	0.45	1.00	0.60	-0.15	0.56	1.00	0.85	0.30
Illiquid	0.47	0.60	1.00	-0.20	0.67	0.85	1.00	0.19
Liquid	0.24	-0.15	-0.20	1.00	0.48	0.30	0.19	1.00

- Implications for FOFs. Consistent with Khandani and Lo (2007)



# Funding Liquidity (Share Restrictions) - Importance

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- Share restrictions (restrictions on withdrawals and deposits of money) are essential to capture funding liquidity
- Fund flows are affected by share restrictions
- Flow behavior is important in understanding:
  - **Structure and survival characteristics of the hedge fund industry**
  - **Impact of hedge funds on markets (stabilizing or destabilizing?)**
  - **Investors' reaction to fund performance**



# Share Restrictions Measures

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- Restrictions on Inflows
  - Capacity/Style
  - Onshore/Offshore structures
  - Subscription frequency
- Restrictions on outflows
  - Lockup
  - Redemption frequency
  - Advance notice period



# Asset Liquidity Correlation with Share Restrictions

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	N	Low Liquidity		N	High Liquidity		Diff	
		Mean	Median		Mean	Median		
Subscription	460	41.55	30	434	37.41	30	4.14	**
Redemption	462	86.98	90	444	70.82	30	16.16	***
Adv. notice	474	35.10	30	475	23.37	20	11.73	***
Total redemption	462	122.79	120	444	95.74	60	27.05	***
Lockup	471	2.91	0.00	474	2.28	0.00	0.63	*
Onshore	475	0.37	0.00	475	0.45	0.00	-0.08	**
Cap. constraint	475	0.40	0.00	475	0.18	0.00	0.22	***

Source: Share Restrictions and Investor Flows in the Hedge Fund Industry (Ding, Getmansky, Liang, and Wermers, 2009)



# Effect of Restrictions on Flow-Performance Relationship

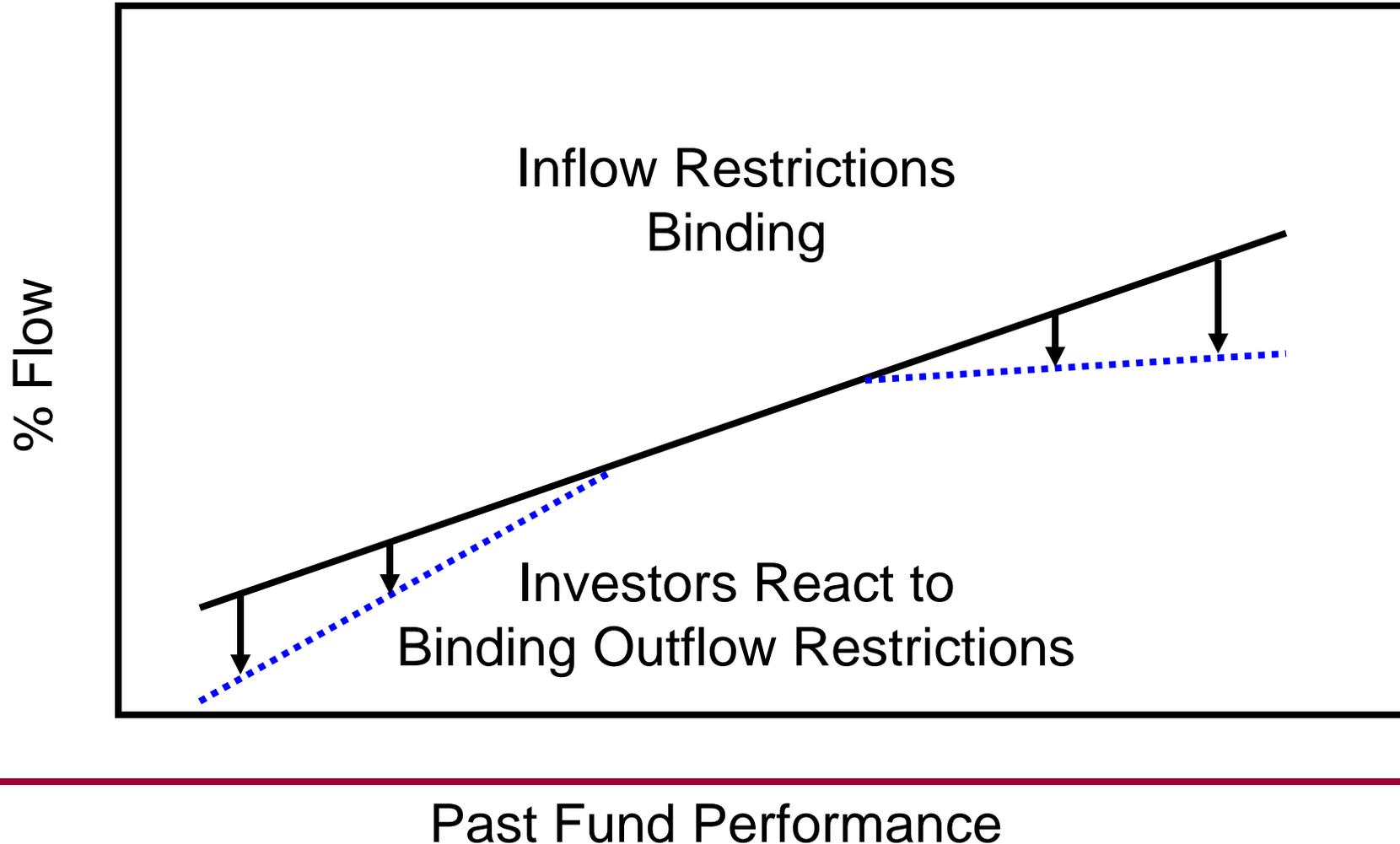
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Variable	Estimate	t-value		With Restrictions
Intercept	2.320	4.61	***	
Low Performance	0.602	1.36		1.651
Middle Performance	0.971	2.38	**	0.267
High Performance	1.055	4.08	***	0.592
Low Perf*Sum Restrictions	1.049	--		
Middle Perf*Sum Restrictions	-0.704	--		
High Perf*Sum Restrictions	-0.463	--		
Fund Characters	Yes			
Obs.	481			
Adj. R <sup>2</sup>	15.0%			



# Effect of Restrictions on Flow-Performance Relationship

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# Wish List

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- Time-series of share restrictions (currently only a snapshot is provided)



# Systemic Risk – Motivation

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- Contribution of hedge funds to systemic risk



# Creation of the Shadow Hedge Fund System

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- Focus on **hedge funds, banks, brokers, and insurers**, given the extensive business ties between them, many of which have emerged only in the last decade.
- As **insurance companies** began to move more aggressively into **insuring financial products** and **offering non-core activities (derivatives trading, credit-default swaps, and investment management)**, insurers created new business units that competed directly with banks, hedge funds, and broker/dealers.
- The banking industry has been transformed because financial innovations, like securitization, have blurred the distinction between loans, bank deposits, securities, and trading strategies.



# Systemic Risk Measures

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Unrealistic to expect that a single measure is sufficient. We construct measures based on:

**(1) Correlations**

**(2) Return illiquidity**

**(3) Principal components**

**(4) Regime-switching models**

**(5) Granger causality tests**



# Banks Are Important

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Results from linear Granger causality and principal components tests point to an **asymmetry in the connections**:

*Banks seem to have a more significant impact—in terms of Granger causality—on Hedge funds, Insurers, and Brokers than vice versa.*

This suggests that the “**shadow hedge fund system**”, i.e., banks that take hedge-fund types of risks is a more concern for systemic risk than the “shadow banking system.”



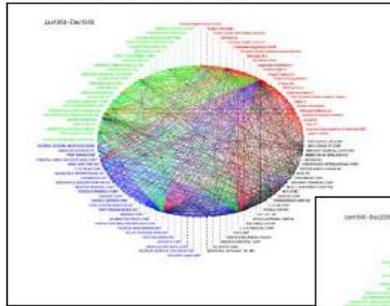
# Network Diagrams

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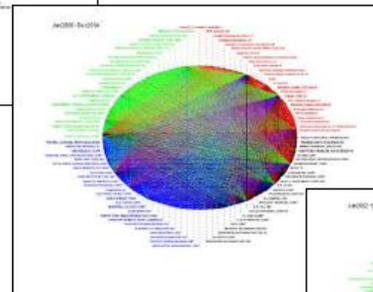
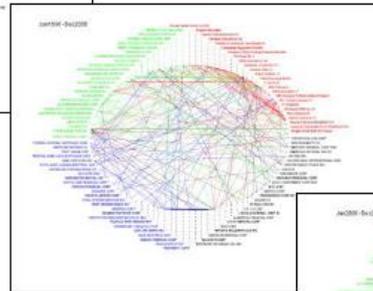
- Granger-causal relationships among 100 largest (by AUM) banks, hedge funds, insurers, and brokers
- Each financial and insurance sector is represented by the 25 largest (by AUM) individual institutions.
- Results:
  - Connections increase during financial crises
  - Liquidity decreases during financial crises
  - Connections decrease after financial crises (de-leveraging and risk reduction, need to differentiate)



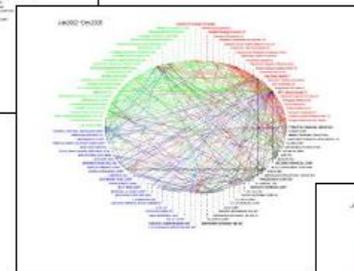
# Network Diagrams



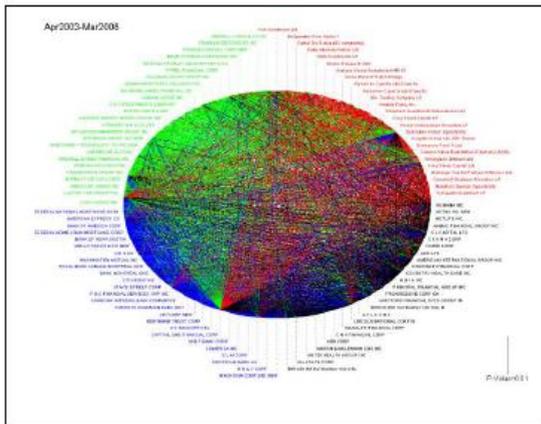
LTCM Crisis



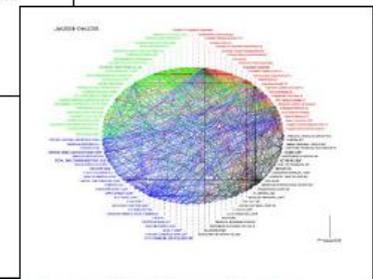
Internet Bubble Crash



Financial crisis 2007-2008



Apr 2003-Mar 2008





# Funding Liquidity and Network Wish List

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- The number of potential cash channels (so, we can form a network, and assess the stability of funding resources)
- The funding amount (cash) that can be obtained from each channel
- The number and size of lending relationships
- Note if all use VaR framework, then there is a cascade, leading to a systemic event
- Types of funding (repo market, swap agreements, cash, margin loans (haircuts and ability of lenders to increase the margin requirements), leveraged notes, term loans, reverse repurchase agreements, dealer repurchase agreements (repos) etc.).
- Exact business activities of banks, brokers, and insurance companies. The current crisis showed that the hedge fund activity was greatly amplified by the shadow hedge fund system.



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Thank you!

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