Crisis, Hedge Funds and the Role of Volatility

Loriana Pelizzon
Universita’ Ca’ Foscari Venezia

Where Do You Search For Alpha?

- Traditional Model:
  - Establish strategic allocation among major asset classes
  - Identify benchmarks
  - Alpha (extra value due to active management) is pursued within an asset class
  - Beta (benchmark risk exposure) and alpha are dependent
- Alternative Model:
  - Separate alpha from beta
  - Divide a total portfolio into beta and alpha drivers
  - Alpha drivers should be in less efficient markets: hedge funds, managed futures, commodities, real estate, private equity, and credit derivatives

Asset Management

Passive

Active within traditional benchmarks

Active outside of traditional benchmarks

Unique Features of Hedge Funds

- Invest in illiquid assets
- Can short sell
- Use leverage
- Use options and other exotic derivatives
- Often operate in inefficient markets
- Some strategies have capacity constraints
- Encompass variety of strategies and markets
- In addition to management fees (1%) charge incentive fees (20% of upside)
- Partners invest their capital

Hedge Fund Categories

- Market Directional
  - Equity Long/Short
  - Emerging Markets
  - Short Selling
  - Activist Investors
- Corporate Restructuring
  - Distressed securities
  - Merger Arbitrage
  - Event Driven
  - Regulation D
- Convergence Trading
  - Fixed Income Arbitrage
  - Convertible Bond Arbitrage
  - Equity Market Neutral
  - Fixed Income Yield Alternative
  - Relative Value Arbitrage
- Opportunistic
  - Global Marco
  - Fund of Funds

Attractiveness of Hedge Funds

- Generate alpha
- Exhibit low correlation and beta with standard stock and bond indices
- Provide diversification benefits
  - With standard stock and bond indices
  - Across different hedge fund strategies

1. IS THE ABOVE TRUE?
2. DO I NEED TO CARE ABOUT RISK IF I HOLD A FUND OF HEDGE FUNDS?

Summary Statistics

Strategy	N	$\beta_{S\&P500}$	Ann. Mean Return (%)	Ann. SD (%)	Min. Return (%)	Med. Return (%)	Max. Return (%)	Skew	Kurt	JB p-value
Convertible Bond Arbitrage	180	0.16	1.31	6.76	-12.81	0.55	3.05	-3.61	19.55	0.00
Dedicated Short Bias	180	-0.84	-3.33	16.96	-9.14	-0.62	22.24	0.74	1.57	0.00
Emerging Markets	180	0.55	3.54	15.88	-23.50	1.02	16.01	-0.77	4.48	0.00
Equity Market Neutral	180	0.08	4.81	2.84	-2.05	0.38	2.79	0.00	0.76	0.14
Long/Short Equity	180	0.18	8.11	10.53	-11.99	0.77	10.11	-0.11	2.94	0.00
Distressed	180	0.27	6.18	6.71	-12.92	0.78	3.79	-2.43	12.73	0.00
Event Driven MS	180	0.24	5.22	6.06	-12.24	0.69	3.42	-2.77	15.30	0.00
Risk Arbitrage	180	0.14	2.68	4.23	-6.62	0.19	3.34	-1.19	5.55	0.00
S&P 500	180	1.00	4.86	15.09	-16.69	0.95	9.37	-0.75	1.25	0.00

Attractiveness of Hedge Funds

DO I NEED TO CARE ABOUT RISK IF I HOLD A FUND OF HEDGE FUNDS?

Tranquil vs. Crisis Periods

- Correlations
- Risk exposures
- Diversification

Correlation and Risk

Panel A Average Rolling Correlation Among Hedge Fund Strategy Returns

During Crises:

- Average correlation among hedge fund strategies increased by 33%
- Average volatility of hedge fund returns jumped by 90%

Objective

- Main Question: What are the effects of financial crises on hedge fund risk?

- During financial crises:
  - Do hedge fund strategies exhibit different (larger/smaller) exposures to risk factors compared to tranquil times?
  - Are there any common factor exposures for different hedge fund strategies?
    - Classical risk factor exposures
    - Latent (hidden) risk factor exposures
    - When did they occur?

Significance and Implications

- "Commonality" in classical and latent risk factor exposures during financial crises can lead to:
  - Demise of the hedge fund industry
  - Systemic risk (spillover to other financial institutions)
- May help investors and risk managers to avoid naive reliance on diversification and traditional risk models:
  - Diversification across HF styles as a source of downside protection
  - Diversification for traditional portfolios by including HF
  - Uncover missing risk factors

HF and Crises

- HF role: provide liquidity to the market and improve risk sharing but largely fragile because of financial frictions, i.e. illiquidity
- Crisis Transmission Mechanisms (Khandani and Lo (2007), Krishnamurthy (2008) and Brunnermeier (2009)):
  - Direct exposure
  - Market liquidity:
    - Bid-ask spreads, market depth
  - Funding liquidity:
    - Margin funding risk, rollover risk (short term debt), redemption risk
  - Margin spirals
  - Runs on HF

Factors

Variable	Abbreviation	Definition
S&P500	SP	Monthly return of the S&P 500 index including dividends
Large-Small	LS	Monthly return difference between Russell 1000 and Russell 2000 indexes
Value-Growth	VG	Monthly return difference between Russell 1000 Value and Growth indexes
USD	USD	Monthly return on Bank of England Trade Weighted Index
Lehman Government Credit	LGC	Monthly return of the Lehman U.S. Aggregated Government/Credit index
Term Spread	TS	10-year T Bond minus 6-month LIBOR
Change in VIX	dVIX	Monthly change in implied volatility based on the CBOE's OEX options.
Credit Spread	CS	The difference between BAA and AAA indexes provide by Moody's
Gold	Gold	Monthly return using gold bullion $/Troy Oz. Price
Lehman Emerging Bond	LEHMEMD	Monthly return of the Lehman Emerging Markets Bond Index
MSCI Emerging Stock	MSCIEMS	Monthly return of the MSCI Emerging Markets Stock Index
Momentum Factor	UMD	Momentum factor

Linear Model with a Crisis Dummy

$$R_{i,t} = \alpha_i + \sum_{k=0}^{K} \beta_{i,k} F_{k,t} + \sum_{k=0}^{K} \beta_{i,D,k} D_t F_{k,t} + \omega_i u_{i,t}$$

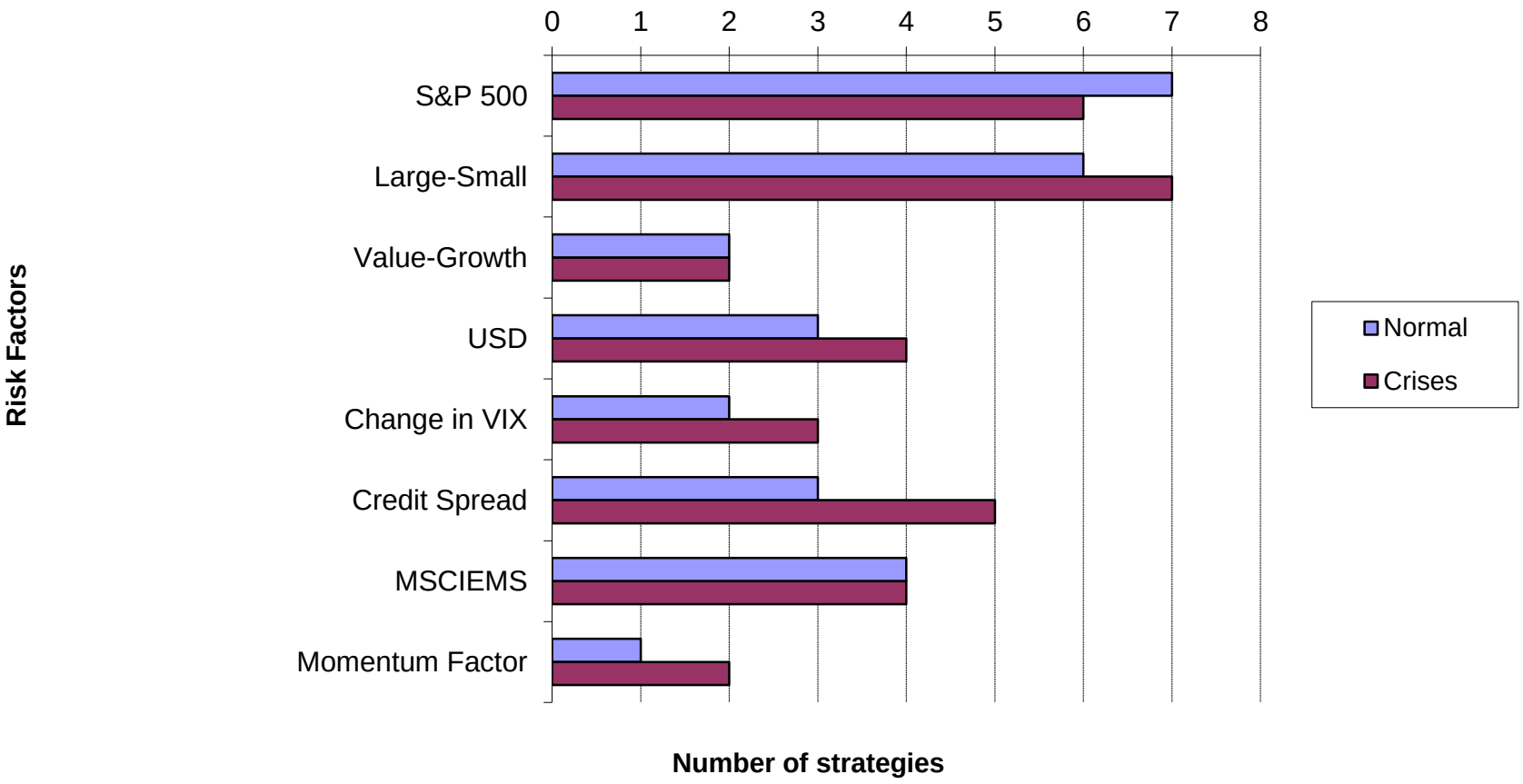
A crisis dummy is equal to one during the following crises:

- Mexican (December 1994 - March 1995),
- Asian (June 1997 - January 1998),
- **Russian and LTCM (August 1998 - October 1998),**
- Brazilian (January 1999 - February 1999),
- Internet Crash (March 2000 - May 2000),
- Argentinean (October 2000 - December 2000),
- September 11, 2001,
- Drying up of merger activities, and WorldCom accounting problems crises (middle 2002),
- **Subprime (August 2007 - January 2008),**
- **Global financial crisis (September 2008 - November 2008).**

Linear Factor Model with a Crisis Dummy

	Convertible Bond Arb		Dedicated Short Bias		Emerging Markets		Equity Market Neutral		Long/Short Equity		Distressed		Event Driven Multi-Strategy		Risk Arb	
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
α	**1.40**	**4.18**	**1.50**	**2.59**	-0.88	-1.07	**0.52**	**3.18**	0.62	1.00	**0.99**	**3.37**	**0.60**	**2.06**	0.12	0.63
β_0 (S&P 500)	0.07	1.46	**-1.01**	**-12.46**	**0.61**	**5.59**	**0.06**	**2.63**	**0.34**	**3.81**	**0.24**	**5.79**	**0.19**	**4.85**	**0.12**	**4.23**
β_1 (Large-Small)	**-0.12**	**-2.93**	**0.61**	**8.41**					0.01	0.14	**-0.15**	**-3.94**	**-0.16**	**-4.32**	**-0.12**	**-4.88**
β_2 (Value-Growth)	0.04	1.09	**0.14**	**2.00**					0.08	0.99	**0.09**	**2.45**			0.04	1.52
β_3 (USD)			0.07	0.60	0.00	0.00							-0.04	-0.65		
β_4 (Lehman Gov. Credit)	**0.21**	**2.04**									0.15	1.64				
β_5 (Term Spread)							**-0.15**	**-2.79**	-0.19	-0.96						
β_6 (Change in VIX)	0.02	0.35	**-0.24**	**-2.65**	**0.23**	**1.76**	-0.00	-0.07	0.05	0.55	**0.08**	**1.65**	**0.09**	**1.96**	0.05	1.53
β_7 (Credit Spread)	**-1.29**	**-3.40**	**-1.14**	**-1.73**	**1.76**	**1.89**	0.17	0.88	0.28	0.39	-0.35	-1.06	-0.03	-0.10	0.20	0.89
β_8 (Momentum Factor)									**0.13**	**2.69**						
β_0 (S&P 500) dummy	**-0.14**	**-1.77**	0.00	-0.01	**-0.38**	**-2.02**	0.05	1.41	**-0.28**	**-1.90**	-0.02	-0.24	0.02	0.30	-0.03	-0.60
β_1 (Large-Small) dummy	**0.22**	**2.85**	**-0.23**	**-1.71**					0.01	0.06	0.02	0.29	0.02	0.23	0.01	0.32
β_2 (Value-Growth) dummy	0.03	0.36	0.05	0.37					**0.35**	**2.04**	**-0.13**	**-1.77**			0.06	1.15
β_3 (USD) dummy			-0.22	-0.91	0.32	0.94							**0.47**	**3.92**		
β_4 (Leh. Gov. Credit) dummy	**0.39**	**2.02**									-0.26	-1.52				
β_5 (Term Spread) dummy							**0.28**	**1.83**	0.91	1.54						
β_6 (Change in VIX) dummy	**-0.23**	**-3.13**	0.09	0.69	**-0.60**	**-3.31**	0.02	0.50	-0.21	-1.57	**-0.16**	**-2.40**	**-0.24**	**-3.62**	**-0.18**	**-4.13**
β_7 (Credit Spread) dummy	**-1.18**	**-3.72**	**-1.10**	**-2.05**	**-2.25**	**-3.20**	**-0.48**	**-2.07**	**-2.25**	**-2.39**	**-0.72**	**-2.57**	**-0.48**	**-1.76**	-0.22	-1.25
β_8 (Mom. Factor) dummy									**0.28**	**2.39**						
ω	**1.47**	**6.42**	**2.53**	**3.83**	**3.64**	**1.82**	**0.73**	**6.67**	**2.67**	**3.50**	**1.28**	**6.75**	**1.29**	**6.74**	**0.88**	**6.92**
Adj. R^2	0.39		0.71		0.34		0.37		0.20		0.56		0.52		0.47	

Hedge Fund Risk Exposures



Hedge Fund Risk Exposures

- During crises, hedge fund risk exposures to:
  - Stock Market (S&P 500) (reduced)
  - Large-Small (liquidity risk) (increased)
  - Credit Spread (credit risk) (increased)
  - Change in VIX (volatility risk) (increased)

Idiosyncratic Risk Estimation

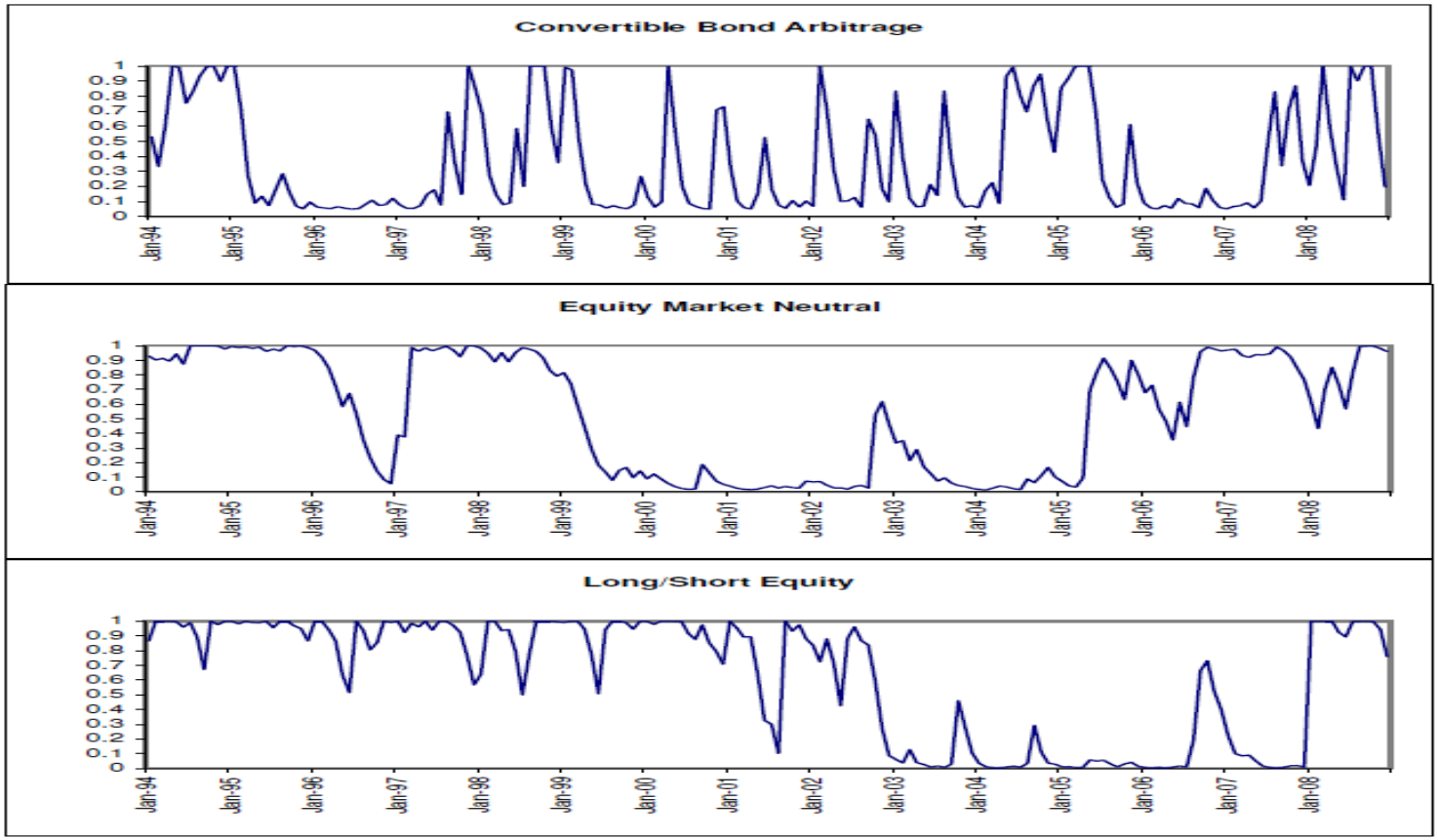
To investigate the presence of a latent (idiosyncratic) factor, we charcaterize the idiosynratic returns of a hedge fund strategy by a switching mean and volatility model.

Evidence of a Latent Risk Factor Exposure

- **Dynamics** of the idiosyncratic risk factor
- **"Commonality"** in the idiosyncratic volatility behaviour.

Dynamics of Idiosyncratic Volatility Risk

Two distinct regimes: high and low volatility



Looking for "Commonality"

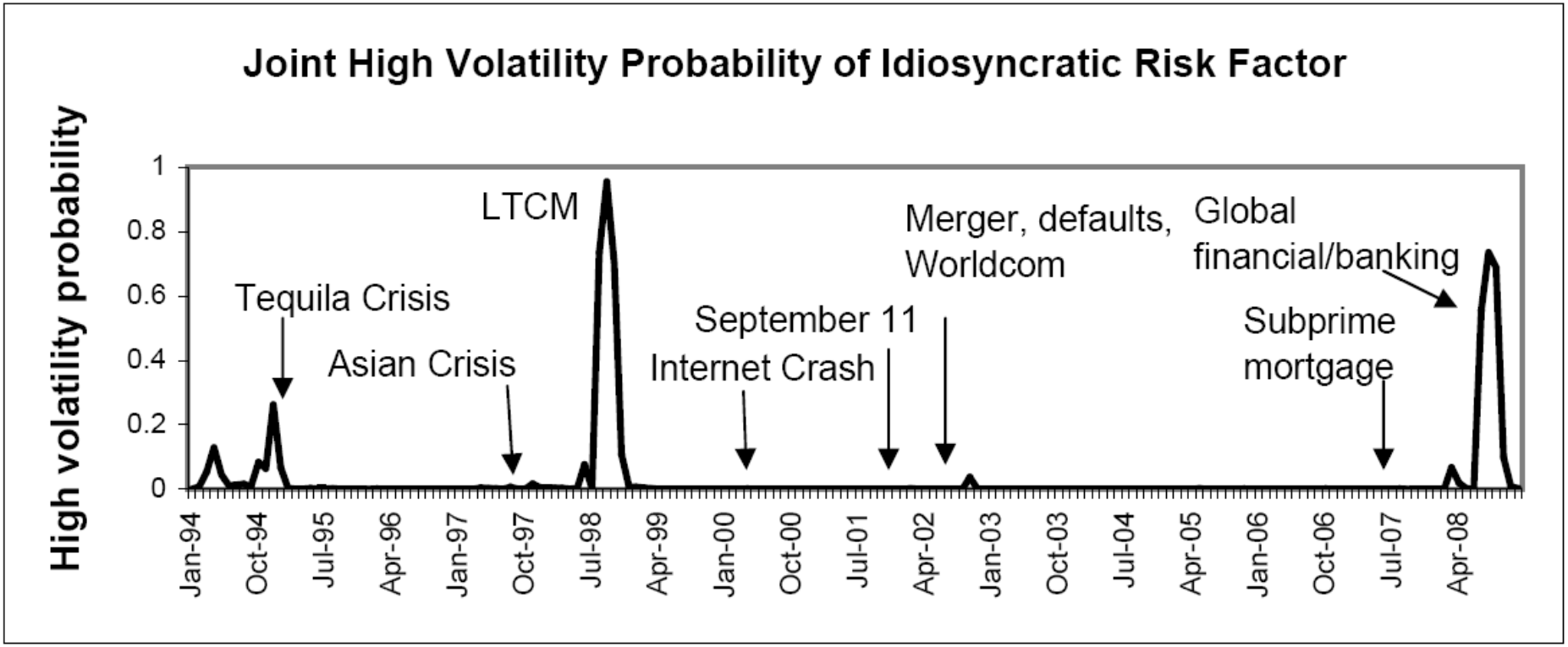
- Novel way in looking for a latent risk factor exposure: A significant change in the joint probability that all hedge funds are in the high volatility state for the idiosyncratic risk factor
- Why is this important? Good proxy for:
  - increase in volatility for the idiosyncratic risk of funds of funds (or for the HF industry)
  - extent to which diversification across hedge funds works
  - missing risk factor
  - illiquidity tensions/fund run

Common Latent Factor Exposure

- Idiosyncratic risk is characterized by a switching mean and volatility with a two state Markov chain ( ), l$Z_{i,t}$nt factor proxy
- Capture "commonality" (latent factor exposure) by determining the joint high volatility regime

$$J_p = \prod_{i=1}^{m} \text{Prob}\left(Z_{i,t} = 1 | \mathcal{R}_{i,t}\right)$$

Hedge Fund Idiosyncratic Risk



Hedge Fund Idiosyncratic Risk

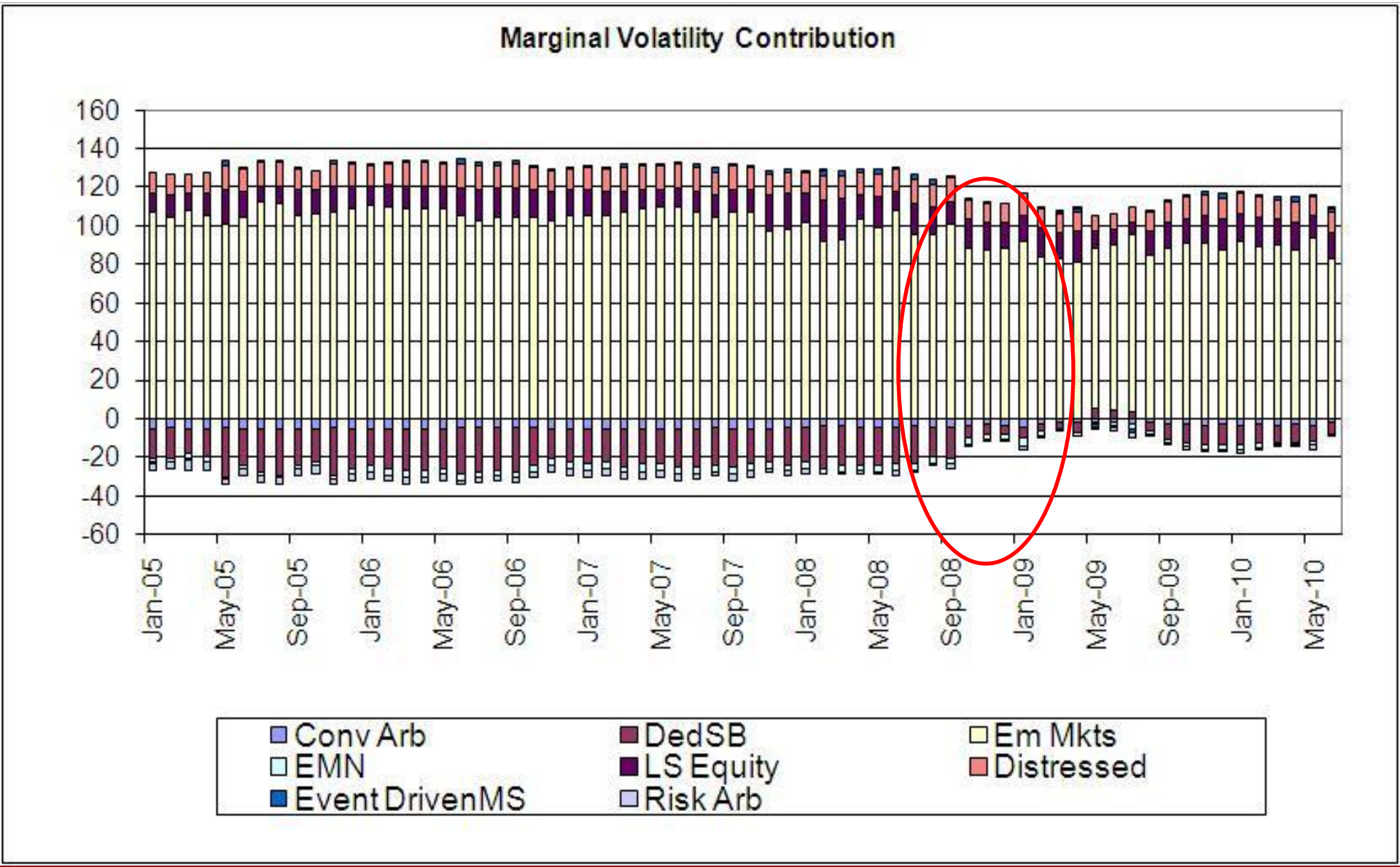
- Related to:
  - Market liquidity risk
    - Bid-ask spread
    - Market depth
    - Volume
  - Funding liquidity risk
    - Margin call
    - Inability to borrow
    - Investor and FoF redemptions

Diversification Limits

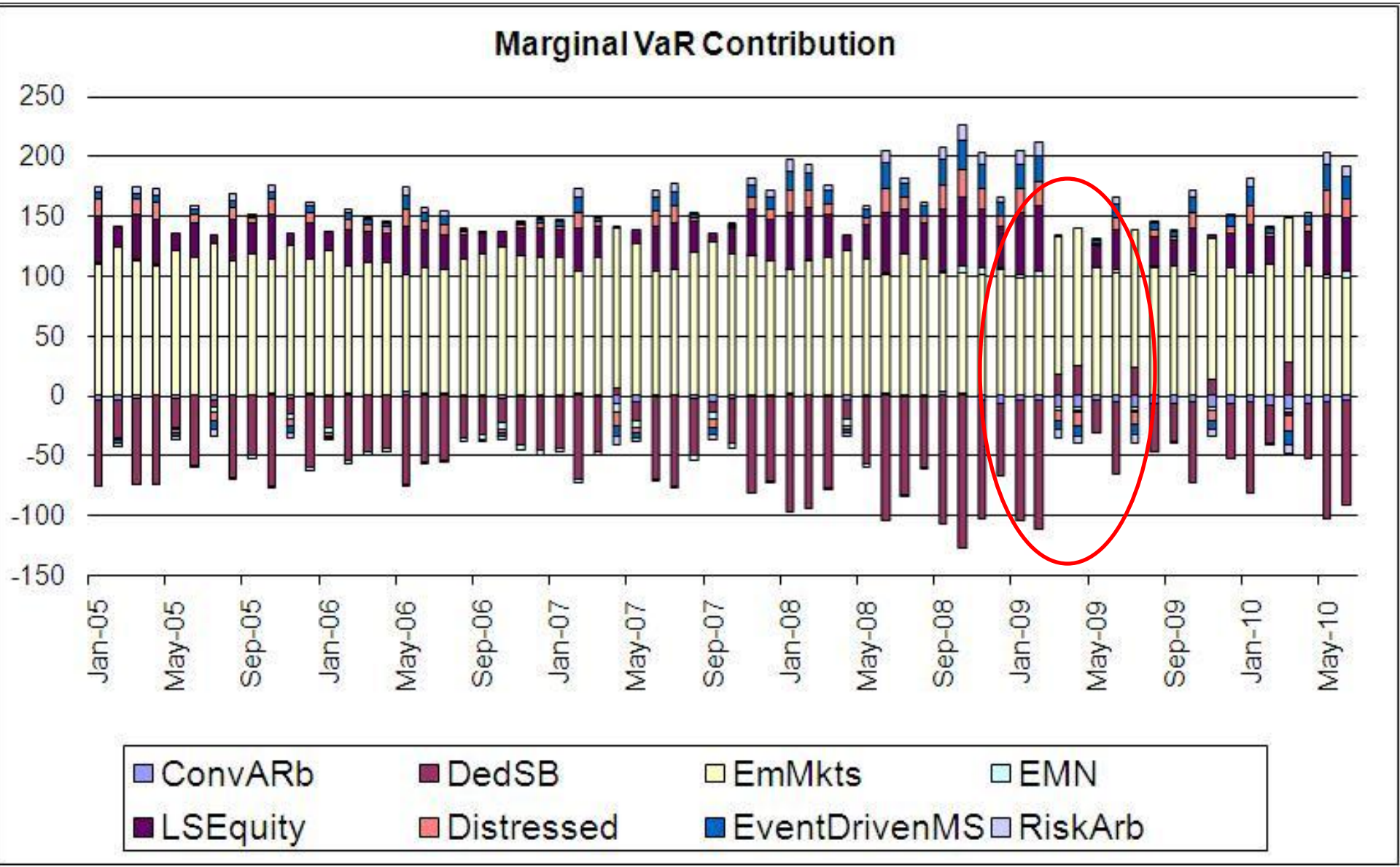
- The presence of common risk factor exposure in the residuals of HF returns means that residuals are correlated
  - Evidence of the presence of the latent factor exposure
- The sign of the exposure is related to the sign of
  - Positive correlations

  Result: Diversification Limits

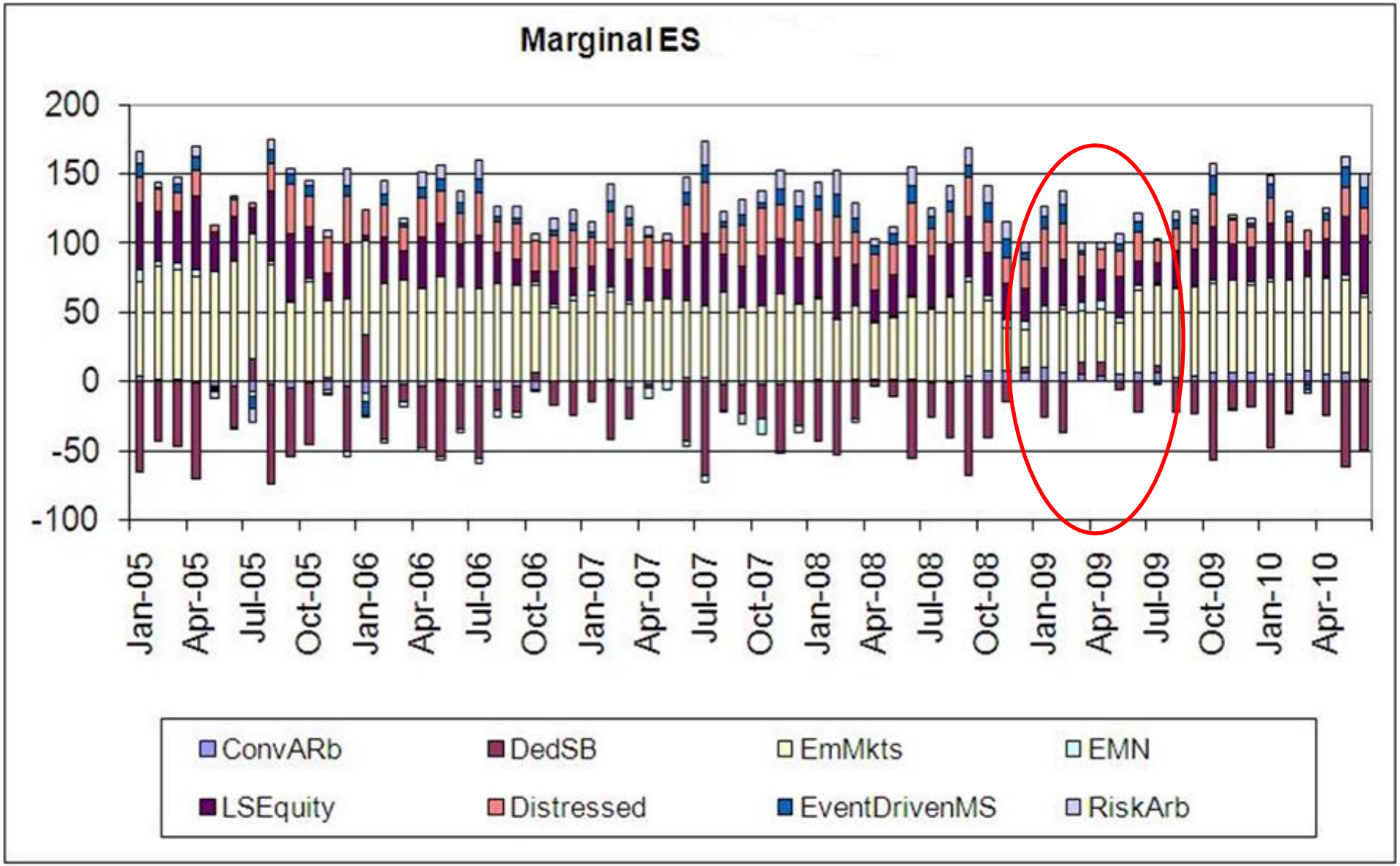
Tail risk strategy contribution



Tail risk strategy contribution



Tail risk strategy contribution



Mutual Funds

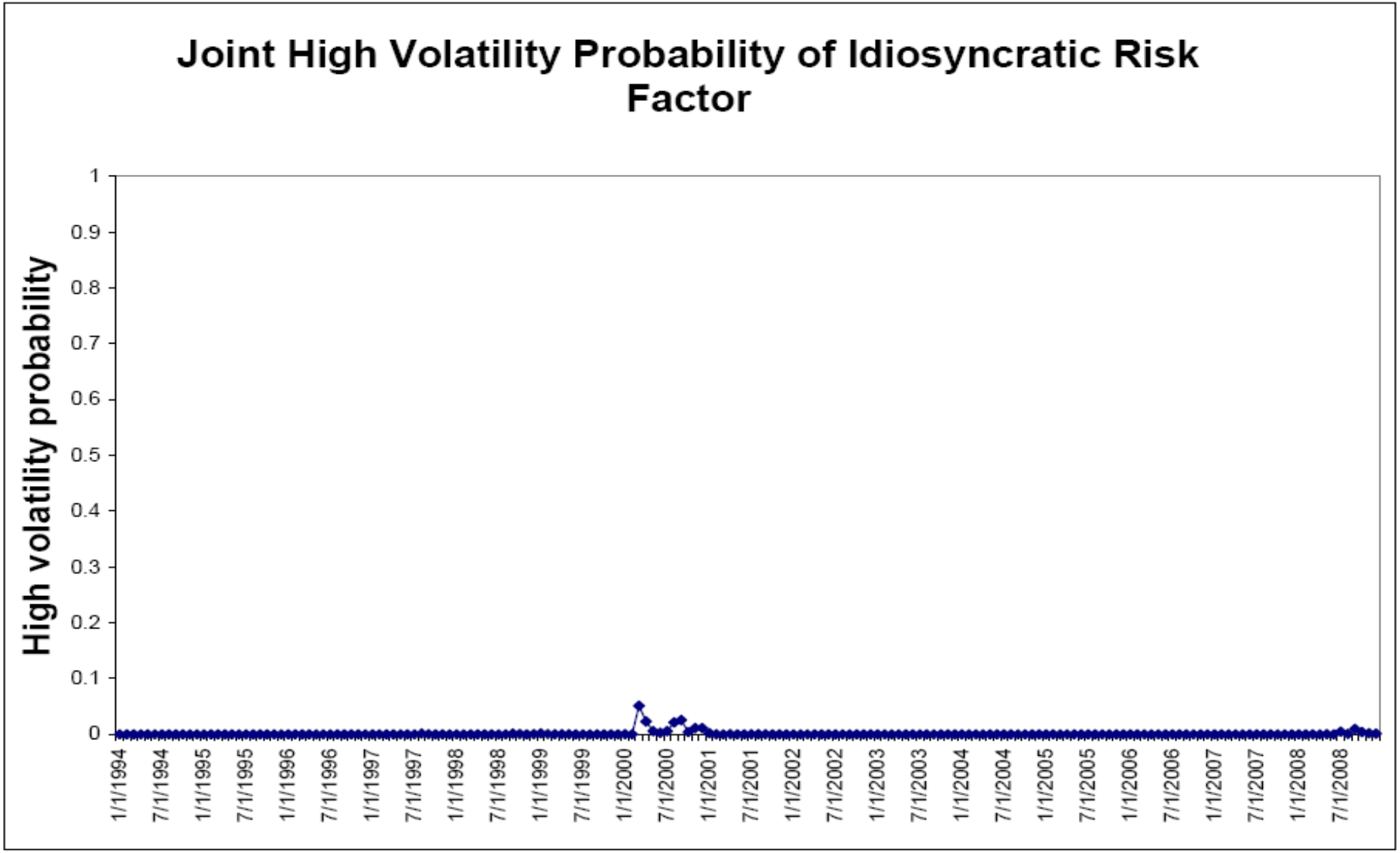
ARE WE OBSERVING THE SAME IN THE MF INDUSTRY?

Same sample period (1994-2008)

U.S. open-ended mutual fund indices from Morningstar:

- Large Blend
- Large Growth
- Large Value
- Mid-Cap Blend
- Mid-Cap Growth
- Mid-Cap Value
- Small Blend
- Small Growth
- Small Value

Common Latent Factor Exposure: Mutual Funds



What is generating this commonality in HF?

- Traded Liquidity Factors:
  - Bank Index
  - Datastream Bank Index
  - Libor – T Bill
  - Libor US – Libor UK
  - Prime Broker Index
  - RepoRe – T Bill
- Non-traded Liquidity Factors
  - Pastor and Stambaugh level and innovations in aggregate liquidity
  - Sadka transitory fixed and permanent variable
- Traded Volatility Factors:
  - Straddle
  - Variance Swap

Uncovering Latent Factor

- Why LTCM and global financial crises are so special?
- What are the main differences with other crises, i.e. subprime mortgage crisis, currency, and market crashes?
- Potential channels:
  - Funding liquidity - Runs on HF
  - Margin funding - Margin Spirals
  - Rollover of debt - Interconnectedness
  - Redemptions

Non-Linear Measure

- Linear channels and proxies do not capture the latent factor
- Propose non-linear liquidity measure
  - Funding liquidity
  - Asset liquidity
  - Volatility

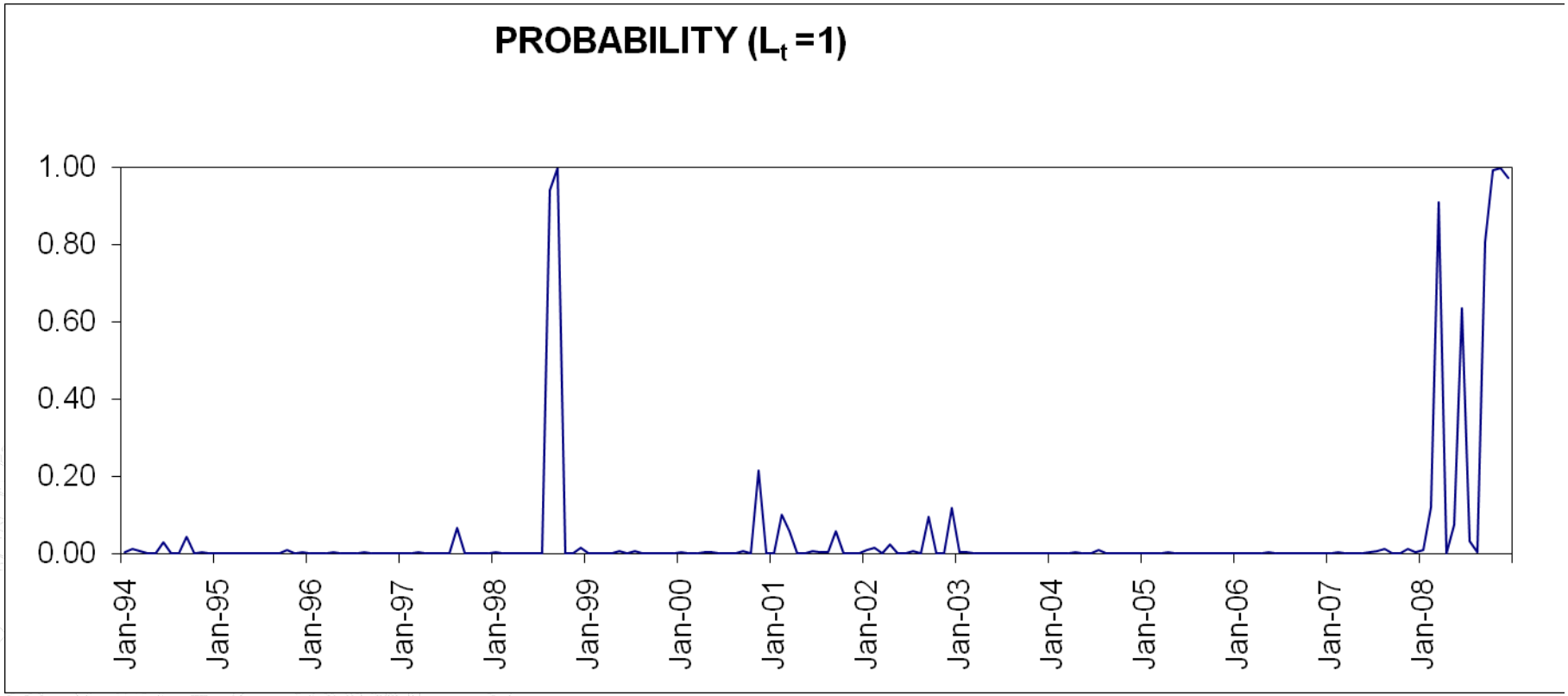
Funding Liquidity Latent Factor

We have estimated a common chain for three proxies of liquidity: the change in VIX , the TED spread, and the Pastor and Stambaugh (2003) liquidity factor

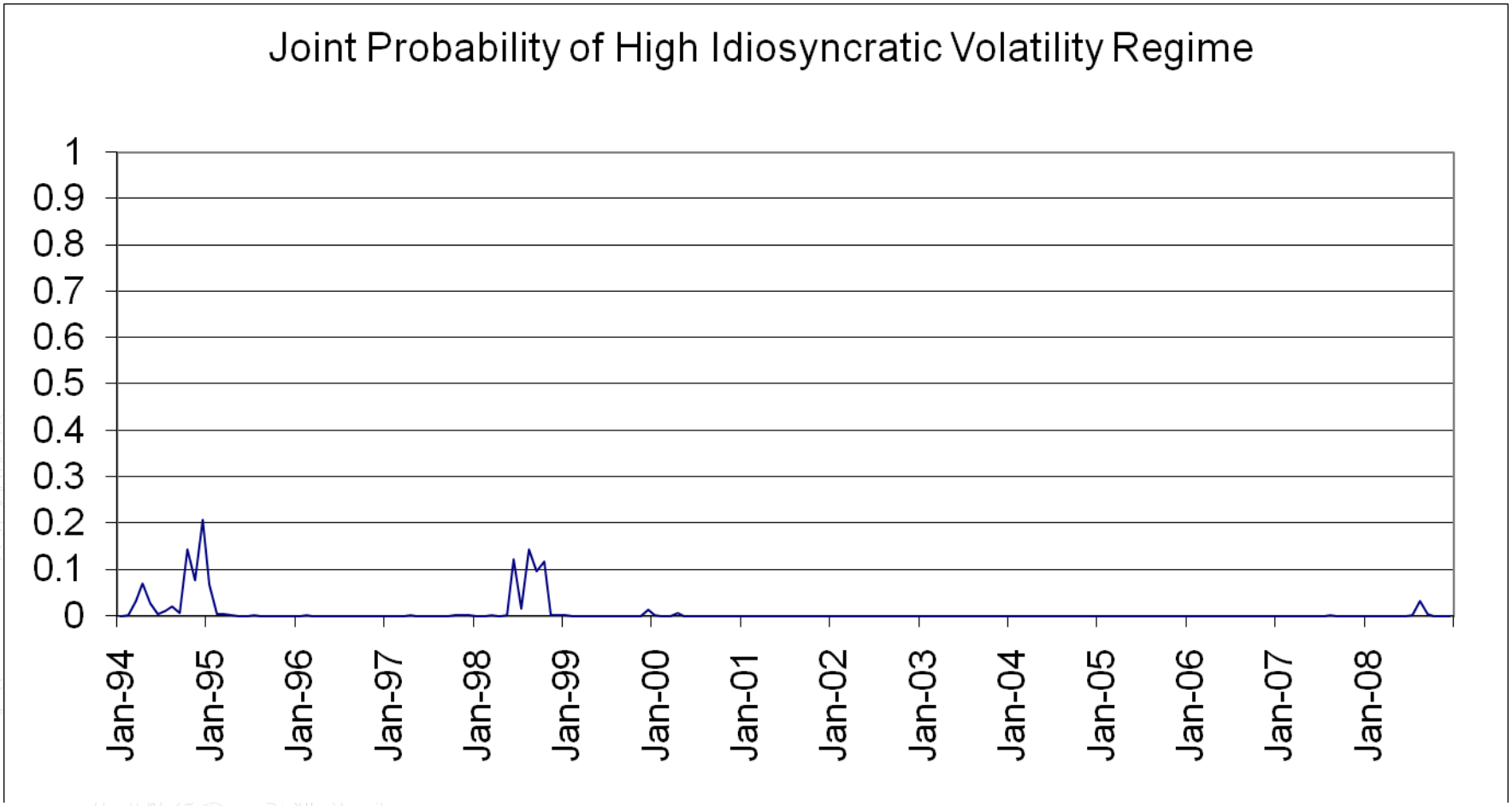
$$\begin{aligned} \Delta VIX_t &= \mu_{\Delta VIX}(L_t) + \sigma_{\Delta VIX}(L_t)\,\epsilon_t \\ TED_t &= \mu_{TED}(L_t) + \sigma_{TED}(L_t)\,\varepsilon_t \\ PSL_t &= \mu_{PSL}(L_t) + \sigma_{PSL}(L_t)\,\xi_t \end{aligned} \tag{1}$$

with $\epsilon_t, \varepsilon_t, \xi_t$ are IID, and L_t is a Markov chain with 2 states (0 = low volatility state and 1 = high volatility state) and a transition probability matrix $\mathbf{P}_L$.

CLIQ Factor


PROBABILITY (L_t =1)
1.00
0.80
0.60
0.40
0.20
0.00
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08

Adjusting for CLIQ



Conclusions

- Alternative investments provide benefits and supplement traditional asset allocation
- Need to do due-diligence
  - Understand where alpha comes from
  - Understand risks (beta, idiosyncratic, systematic)
  - Assess market conditions
  - Understand under which conditions diversification, correlation, and risk exposures change

Conclusions

- Need to do due-diligence
  - Understand where alpha comes from
  - Understand risks (beta, idiosyncratic, systematic)
  - Assess market conditions
  - Understand under which conditions diversification, correlation, and risk exposures change
  - Understand risks hided on the tails!