Crisis, Hedge Funds and the Role of Volatility

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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

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DO I NEED TO CARE ABOUT RISK IF I HOLD A FUND OF HEDGE FUNDS?
Correlations
Risk exposures
Diversification
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

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

<table>
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<tr>
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<th>Convertible Bond Arb</th>
<th>Dedicated Short Bias</th>
<th>Emerging Markets Neutral</th>
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Hedge Fund Risk Exposures

Risk Factors

- S&P 500
- Large-Small
- Value-Growth
- USD
- Change in VIX
- Credit Spread
- MSCIEMS
- Momentum Factor

Number of strategies

- Normal
- Crises

Risk Factors
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)
To investigate the presence of a latent (idiosyncratic) factor, we characterize 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.
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
- Idiosyncratic risk is characterized by a switching mean and volatility with a two state Markov chain $(\ldots)$, latent factor proxy $l_{Z_{i,t}}$
- Capture “commonality” (latent factor exposure) by determining the joint high volatility regime

$$J_p = \prod_{i=1}^{m} \text{Prob} (Z_{i,t} = 1 | R_{i,t})$$
Hedge Fund Idiosyncratic Risk

Joint High Volatility Probability of Idiosyncratic Risk Factor

- Tequila Crisis
- Asian Crisis
- Internet Crash
- September 11
- LTCM
- Merger, defaults, Worldcom
- Global financial/banking
- Subprime mortgage
- Jan-94
- Oct-94
- Jul-95
- Apr-96
- Jan-97
- Oct-97
- Jul-98
- Apr-99
- Jan-00
- Oct-00
- Jul-01
- Apr-02
- Jan-03
- Oct-03
- Jul-04
- Apr-05
- Jan-06
- Oct-06
- Jul-07
- Apr-08
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
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

Marginal VaR Contribution

ConvARb  DedSB  EmMkts  EMN  LSEquity  Distressed  EventDrivenMS  RiskArb
Tail risk strategy contribution
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

Joint High Volatility Probability of Idiosyncratic Risk Factor
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
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
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

\[ \Delta VIX_t = \mu_{\Delta VIX} (L_t) + \sigma_{\Delta VIX} (L_t) \epsilon_t \]
\[ TED_t = \mu_{TED} (L_t) + \sigma_{TED} (L_t) \epsilon_t \]
\[ PSL_t = \mu_{PSL} (L_t) + \sigma_{PSL} (L_t) \xi_t \]

with \( \epsilon_t, \epsilon_t, \xi_t \) 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 \( P_L \).
CLIQ Factor

PROBABILITY ($L_t = 1$)
Adjusting for CLIQ

Joint Probability of High Idiosyncratic Volatility Regime

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
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!