Università Commerciale Luigi Bocconi

What Do We Know About Hedge Funds?

## Prof. Massimo Guidolin

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The Systemic Effects of Hedge Funds: Good or Bad?

- Many believe that HFs' behavior can adversely impact the stability of the financial system since they are lightly regulated and opaque

- The financial crisis that erupted in Asia in mid-1997 led to sharp declines in the currencies, stock markets and other asset prices of a number of emerging countries

- HFs were blamed for their destabilizing actions during the crisis, particularly because of their massive short positions. According to Eichengreen, Mathieson, Chadha, Kodres and Sharma (1998) HFs sold between $7 billion and $15 billion worth of Thai baht in 1997

- The Market Dynamics Study Group of the Financial Stability Forum reported that HF positions accounted for at least 50% of the short open positions on the Hang Seng index in the summer of 1998

- Rankin (1999) claimed that hedge funds cornered and manipulated the Australian dollar market

- All these stories fuelled numerous press reports that vilified hedge fund managers as wild-eyed speculators operating outside government regulations

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The Systemic Effects of Hedge Funds: Good or Bad?

- Many believe that HFs' behavior can adversely impact the stability of the financial system since they are lightly regulated and opaque

- The search for explanations for the crisis of 2007–2009 has led many to wonder what role HF play in propagating systemic risks
  - Since HFs place bets on risky securities while maintaining low levels of capital, a shock to their funding may force them to fire sell assets

- HF activity may also have positive impact on mkts as they often take contrarian positions in illiquid securities, increasing both market liquidity and price efficiency while lowering asset volatilitys
  - In the plot, % figures do not sum to 100 to account for individuals

Quant Funds' Share of Trading Soars
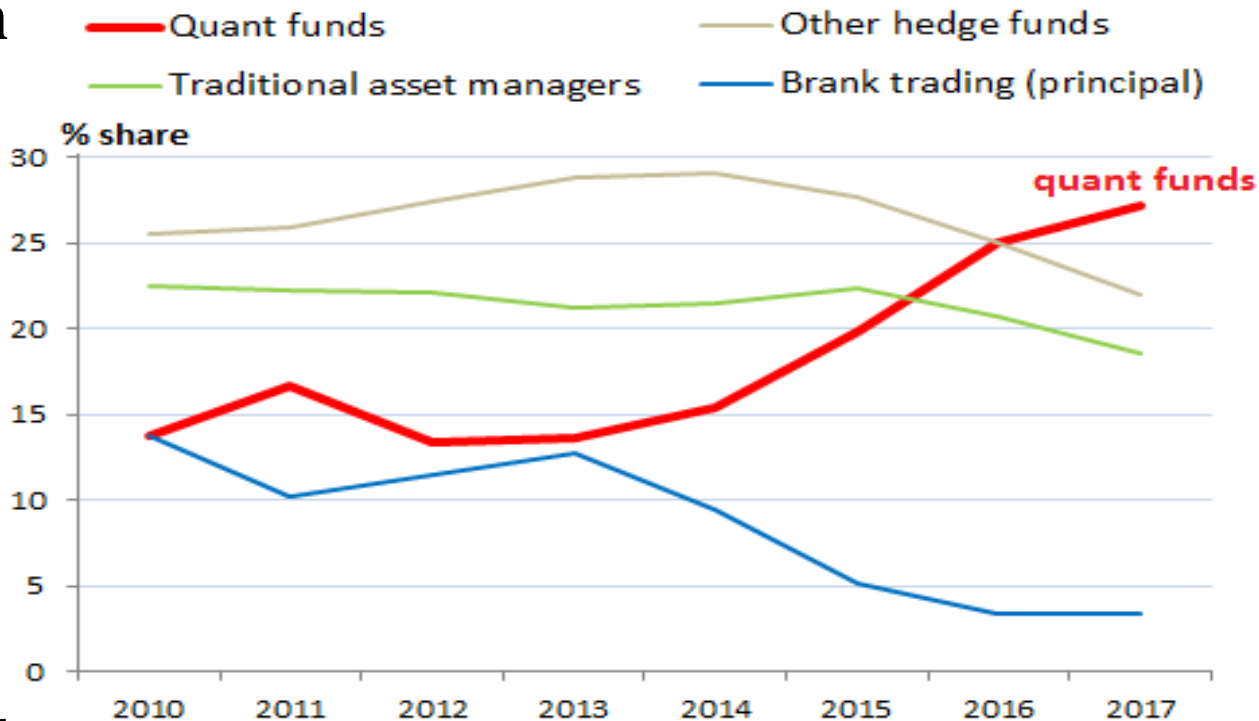
Sources: WSJ, Tabb Group   WOLFSTREET.com

The Systemic Effects of Hedge Funds: Good or Bad?

- There are rumors that the growth of quant funds has been fueled by HFs specializing in algorithmic trading based on data science
  - Quant-focused HFs have been poring over private Chinese and Russian consumer surveys, illicit pharmaceutical sales on the dark web—a network of websites used by hackers and others to anony-mously share information—and hotel bookings by U.S. travelers
  - Today's algorithms can make continuous predictions based on analysis of past and present data while hundreds of real-time inputs bombard the computers with various signals
  - Some firms are pushing into machine learning, which allows computers to analyze data and come up with predictive algorithms
- Not that is leads to huge returns: Quant funds earned about 5.1% per year on average over the past five years; this beats average HF returns of 4.3% but it lags behind the 15% average annual total return (including dividends) of the S&P 500 over the same period
- What happens to mkts when a few machines rather than millions of humans make more and more decisions? When too many of them use the same formulas by the same PhDs from same schools?

The Systemic Effects of Hedge Funds: Good or Bad?

- The more investors flock to complicated algorithmic models, the more likely it is some algorithms will be similar to one another, possibly fueling larger market disruptions, some analysts say
    - Algos are programmed with a bias to buy: since everything always goes up, and even small dips are buying opportunities, machine learning teaches algos precisely that, and it becomes a self-propagating machine, until something trips a limit somewhere
- Early studies examined whether HFs' behavior caused major eco-nomic collapses and concluded that they did not cause them as they had no large positions, see Fung and Hsieh (2000, JEF)
- Chan, Getmansky, Haas, and Lo (2006) define systemic risk as the possibility of correlated defaults among institutions occurring over a short period that are caused by a single event
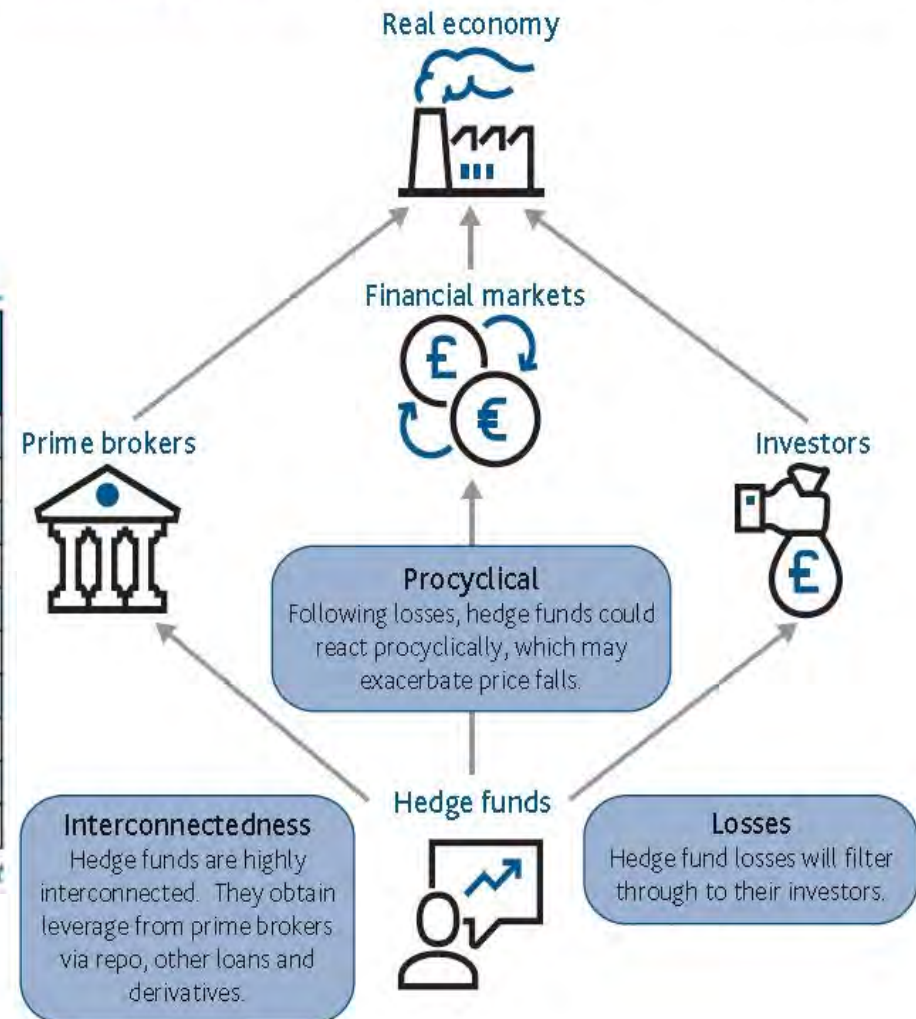- HF risk-taking leads to higher systemic risk as HFs have become dependent on banks to maintain funding

The Systemic Effects of Hedge Funds: Good or Bad?

- The combination of HFs' asset illiquidity and heavy use of leverage and nonlinear strategies are related to an increase in systemic risk

- King and Maier (2009, JFS) suggest that one way to mitigate systemic risk is to regulate prime brokers rather than HFs

Top 10 Prime Brokers Servicing Hedge Funds by Number of Known Funds Serviced

Prime Broker	No. of Known Funds Serviced as of May 2015
Goldman Sachs	2,240
Morgan Stanley Prime Brokerage	1,693
J.P. Morgan	1,462
Credit Suisse Prime Fund Services	1,214
Deutsche Bank Global Prime Finance	826
UBS Prime Services	789
Bank of America Merrill Lynch	530
Citi Prime Finance	488
Barclays	402
Interactive Brokers	255

Source: Preqin Hedge Fund Analyst

Summary figure Hedge fund transmission channels

Real economy

Financial markets

Prime brokers

Investors

Procyclical
Following losses, hedge funds could react procyclically, which may exacerbate price falls.

Hedge funds

Interconnectedness
Hedge funds are highly interconnected. They obtain leverage from prime brokers via repo, other loans and derivatives.

Losses
Hedge fund losses will filter through to their investors.

The Systemic Effects of Hedge Funds: Good or Bad?

- Prime brokers have attempted to lock HFs into exclusive relation-ships by offering them services such as research and reporting

- The desire to reduce counterparty risk and to preserve some privacy for their proprietary trades has persuaded the largest funds to use several prime brokers simultaneously

- This reduces the consequences of a major prime broker failure

- Billio, Getmansky, and Pelizzon (2010) examine the impact of financial crises on HF risk exposure using strategy indices

- They find that both HF return volatility and the average correlation among HF strategies almost double during financial crises

  o Volatilities almost doubled: 15% comes from the increase in the variance of systematic risk factors, 46% from the increase in exposures to factors, and 39% from higher idiosyncratic volatility

  o 34% of increase in correlation comes from the increase in the cova-riance of systematic risk factors, 33% from increase in exposures to factors, and 33% to an increase in correlation of idiosyncratic returns

  o The increases in idiosyncratic volatility are correlated during crises

The Systemic Effects of Hedge Funds: Good or Bad?

- Therefore assuming that only systematic factor exposures are important during crises underestimates their impact on HF risk

- Khandani and Lo (2007, JIM) find an increased correlation among HF styles in the crisis and conjecture it can be due to the increase in systematic linkages with market, liquidity, and credit factors

Panel A   The Joint Probability of High Idiosyncratic Volatility Regime for All Hedge Fund Strategies: January 1994 - December 2008

# The Systemic Effects of Hedge Funds: Good or Bad?

- Billio, Getmansky, Lo and Pelizzon (2012, JFE) develop econometric measures of sector connectedness

- They estimate significant linkages between banks, insurance companies, broker dealers, and HFs that are dynamic and increasing

- Granger-causality tests imply that i) the returns of the four parties have become more correlated over time, and ii) banks and insurance companies impact HFs, but not vice versa

The Systemic Effects of Hedge Funds: Good or Bad?

- The explanatory power of 10 principal components has increased over time to 83% during the recent crisis and the % of variation explained by the first PC also increases during major events

- Institutions' exposure to the first PC has predictive power for the loss the institution endures in the next period

- Yet, HFs are impacted by systemic risk but do not trigger it

- Boyson, Stahel, and Stulz (2010, JF) examine whether HF returns are correlated beyond a predicted level, i.e., if there is contagion

- After controlling for systematic risk factors, the returns of a given HF style are more likely to be in the lowest decile when the returns from other hedge fund styles are in their lowest decile

- They find no evidence that high returns for one style are predicted by high returns in other styles

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The Systemic Effects of Hedge Funds: Good or Bad?
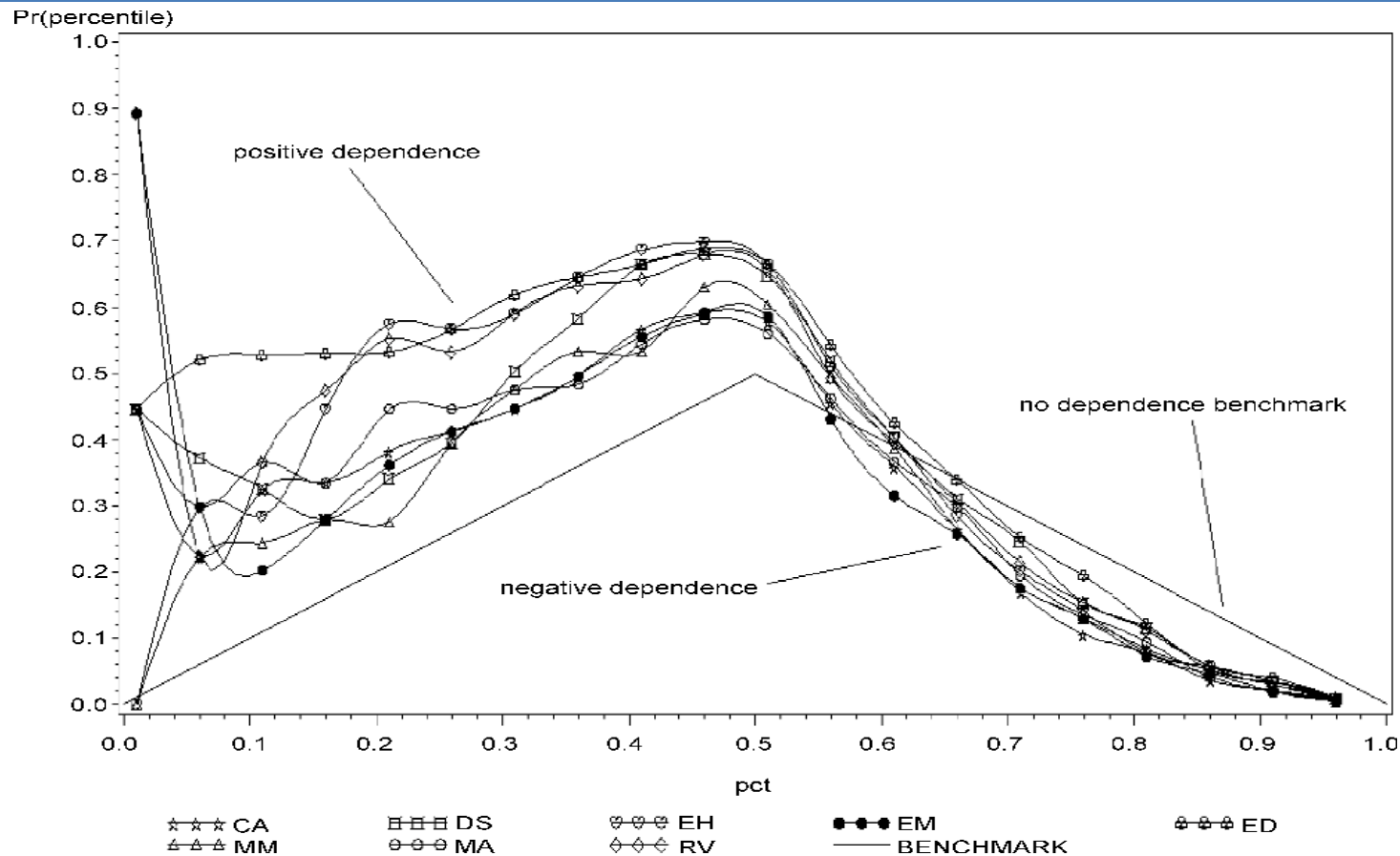
Co-movement box: Relationship between individual hedge fund index performance and average of all other hedge fund indices. The estimated co-dependence between the return on an individual hedge fund index and the equally weighted average return on all other hedge fund indices is estimated using a quantile regression approach, and the results are plotted in a co-movement box. This box is a square of unit side that plots the conditional probability that a hedge fund index has a return below or above a certain percentile conditional on the same event occurring in an equally weighted average of all other hedge funds. This plot of conditional probability is graphed for each index at 5th percentile increments. When the plot of the conditional probability lies above (below) the 45 ° line, which represents the unconditional probability of no dependence between the variables, there is evidence of positive (negative) co-movement between the two variables.

The Systemic Effects of Hedge Funds: Good or Bad?

- There is research that examines the impact of HFs on asset prices

- On the one hand, hedge funds are viewed as classic arbitrageurs and are thus assumed to correct mispricing

- HFs often undertake longer-term strategies since they often restrict investors' ability to withdraw their capital

- Funds pursuing activist strategy exploit this flexibility by investing in firms over a longer period in hopes of convincing the mgmt at these firms to take actions that increase shareholder values

  o But Brunnermeier and Nagel (2004, JF) find that HFs bene-fitted by riding the technology bubble of the late 1990s rather than taking measures to correct stock prices

Chart 1
Number of News Articles Referencing Hedge Fund Activism, 1990-2015

Source: Dow Jones Factiva, as of September 20, 2015

- On the other hand, because HFs must outperform their peers to attract capital, they have incentives to manipulate stock prices
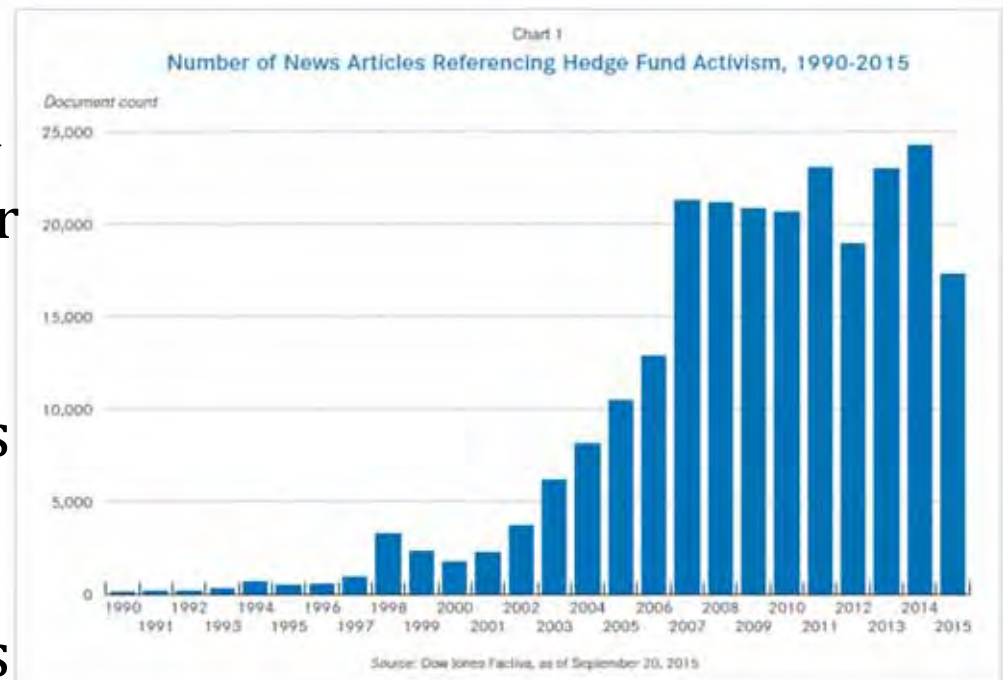
# The Systemic Effects of Hedge Funds: Good or Bad?

- Cao, Chen, Goetzmann, and Liang (2013) examine if HFs act as arbitrageurs who help correct stock prices and find that, compared to other institutional investors, HFs are more likely to hold stocks that have positive alpha and higher idiosyncratic volatility

- HF holdings and purchases (but not sales) are informative as larger holdings and purchases predict higher future stock returns
  - Other institutions' portfolios have no such predictive power

- Although many HFs were unsuspecting victims of the Financial Crisis, several studies have considered the possibility that HFs played a significant role in causing the crisis

- A 2011 survey by the Financial Crisis Inquiry Commission (FCIC) of >170 HFs encompassing over $1.1 trillion in AUM found they were one of largest purchasers of equity tranches of CDO securities
  - > 1/2 of the equity tranches were purchased by HFs that simultane-ously shorted other tranches, thus engaging in a correlation trade
  - However, many used CDSs to take offsetting positions in different tranches of the same CDOs and funds would profit if mkt crashed

The Systemic Effects of Hedge Funds: Good or Bad?

- Griffin and Xu (2009, RFS), find that HFs' portfolio holdings have little forecasting power for future stock returns

- Cao, Liang, Lo, and Petrasek (2014) note that while HFs' desire to exploit arb should reduce inefficiencies, if too many HFs adopt the same strategy, they may increase non-fundamental volatility and prices could become inefficient (e.g., the overcrowding hypothesis)
  - If funds experience a negative shock to their funding liquidity, the resulting liquidation of their positions may destabilize prices

- Using HFs holdings and 3 measures of efficiency (i.e., pricing error variance, return autocorrelation, and variance ratio), they find that stocks purchased by HFs experience an improvement in efficiency

The Systemic Effects of Hedge Funds: Good or Bad?

$$s(b_t, j_t) = \frac{\sum_{k=1}^{K} w_{b,k,t} w_{j,k,t}}{\sqrt{\sum_{k=1}^{K} w^2_{b,k,t}} \sqrt{\sum_{k=1}^{K} w^2_{j,k,t}}}. \qquad (2)$$
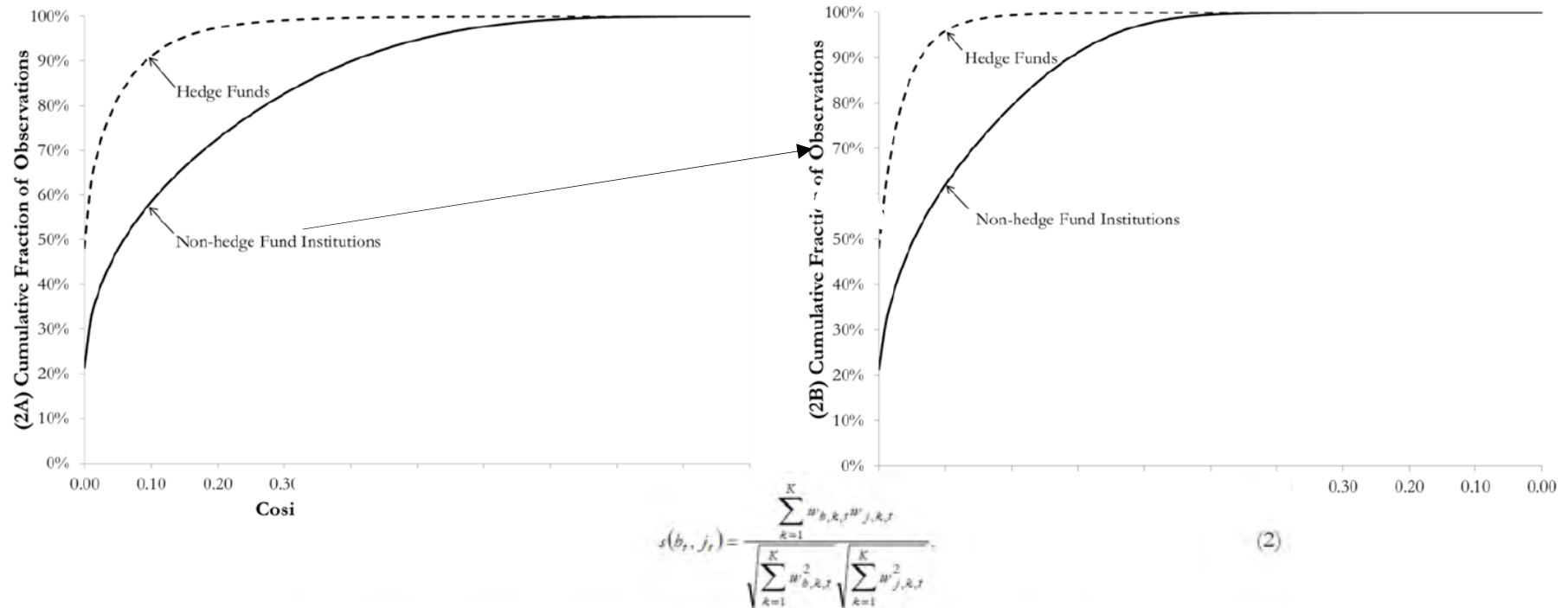
Eq. (2) is bound between zero and one. If two hedge funds hold the same portfolio, the cosine similarity will equal one; whereas, if two hedge funds hold none of the same securities, cosine similarity will equal zero. In contrast to active share, a higher value for cosine similarity means greater portfolio overlap.

- However, HFs' ability to impound information depends on their funding liquidity as during the recent financial crisis, stocks owned by hedge funds experienced a decline in informational efficiency
- However, Reca, Sias, and Turtle (2015, MS) find that HF trades are not very crowded, subject to the limitations of 13F data

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The Systemic Effects of Hedge Funds: Good or Bad?

- o This finding is particularly true for stocks held by hedge funds using Lehman Brothers as their prime broker
- Ben-David, Franzoni, Landier, and Moussawi (2013, JF) use 13F filings to show that HFs manipulate stock prices
- Stocks in the 1st quartile holdings exhibit 0.30% abnormal returns in the final day of a quarter and a reversal of 0.25% the next day
- Much of abnormal return attributed to final minutes of the day
- Funds with fewer stocks in their portfolios, with high year-to date performance (e.g. exploiting a convex flow-performance relation), and funds with a poor month of performance manipulate more
- Hedge funds are also believed to play an important role in providing liquidity to other market participants
- Choi, Getmansky, and Tookes (2009, JFE) demonstrate that CA funds – and by implication other funds that hedge equity risk through delta-neutral portfolios – serve as liquidity providers
- A delta-neutral strategy requires a greater short position in a stock when its price rises –when demand from others is high

The Systemic Effects of Hedge Funds: Good or Bad?

- Agarwal and Meneghetti (2011, RDR) provide evidence of a "last resort" hypothesis by looking at HF in the primary loan market

- The firms that borrow from HFs are shown to be disproportionately unprofitable and have lower credit quality

- HFs monitor the firms they give loans to and these firms display improvements in profitability and creditworthiness; the market anticipates these improvements as the stock prices of the borrowing firms increase on announcement of the loans

- In contrast to the view about HFs being short-term arbitrageurs, the literature on activist HFs provides a different perspective

- Using the 13D filings, Klein and Zur (2011, RFS) find that bondholders do worse after the arrival of activist HFs

- The reasons are the same as those for an increase in equity value: firms pay more dividends, hold less cash, and increase leverage
  - Bonds experience a negative 3.9% return around a 13D filing and another 4.5% decline in the following year

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The Systemic Effects of Hedge Funds: Good or Bad?

- Moreover, firms targeted by activist shareholders are more likely to experience a downgrade in their credit ratings

Panel A: Mergent Fixed Income Securities Database (Mergent FISD)

	Hedge Fund Target Firms Mean [Median] (1)	Control Firms Mean [Median] (2)	t-statistic [Z-statistic] for difference between Columns (1) and (2) (3)
Short-Run Bond Returns	-4.95** [-2.13%]*	-1.03% [-0.23%]	-3.27*** [-2.43]**
Long-Run Bond Returns	-6.42%*** [-5.84%]***	-1.91%* [-1.45%]	-3.39*** [-2.52]**
Short-Run Abnormal Stock Returns	4.72%*** [3.67%]**	1.11% [0.84%]	4.40*** [3.82]***
Long-Run Abnormal Stock Returns	5.79%*** [4.62%]***	2.11%* [2.01%]*	2.17** [2.03]**
N (short-run/long-run)	189/193	189/193	

- Xu and Li (2010) find that firms targeted by HF pay higher spreads, have more covenants, and shorter maturities on bank loans

- These findings suggest that HF activists may benefit shareholders at the expense of bondholders

The Systemic Effects of Hedge Funds: Good or Bad?

- Lim (2015, JFQA) finds that distressed firms where hedge funds are involved have a higher probability of restructuring, quicker resolution of distress, and decrease in leverage

- Brav, Jiang, Partnoy, and Thomas (2008, JF) use a large hand-collected data set from 2001 to 2006, to find that activist HFs propose strategic, operational, and financial remedies and attain success or partial success in two-thirds of the cases

- Even though HFs seldom seek control and in most cases are nonconfron-tational, the abnormal return around the announcement of acti-vism is approximately 7%, with no reversal during the subsequent year
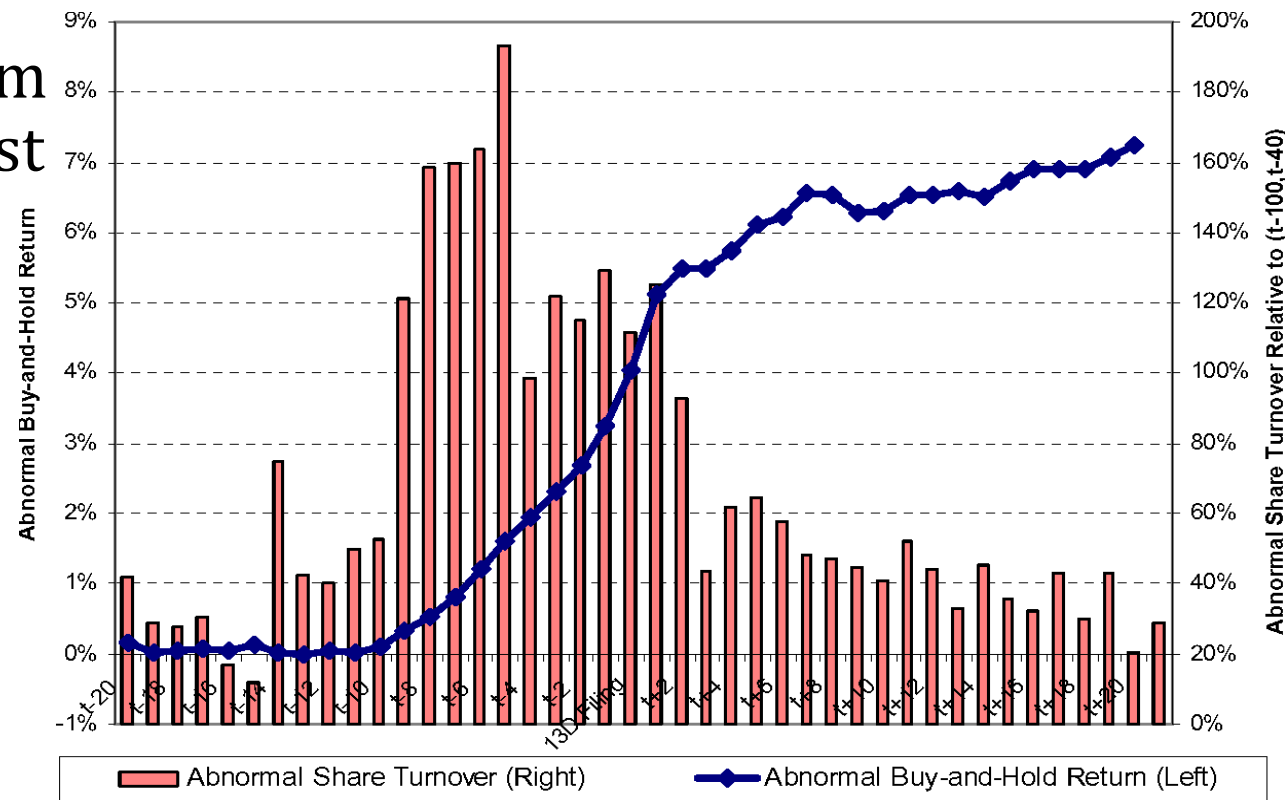
The Systemic Effects of Hedge Funds: Good or Bad?

2015 Activist Hedge Fund Reputation Study

Favorable Media Sentiment (vertical axis, HIGH)
Media Presence (horizontal axis, HIGH)

ValueAct
Blue Harbour Group
Jana Partners
Sandell Asset Management
Relational Investors
Southeastern Asset Management
Marcato International
Glenview Capital Management
Starboard Value
Fairholme Capital Management
Barrington Capital
Greenlight Capital
Trian Fund Management
Gabelli Asset Management
Tracinda
Elliott Management
Icahn Enterprises
Third Point
Pershing Square

Source: Factiva by Dow Jones, proprietary analysis
For more information contact: apoidas@mindspring.com or financialpennonitoc.wordpress.com

Growing concerns [1]
Activist fund assets under management, $bn

2007 08 09 10 11 12 13 14
Source: Hedge Fund Research

Occupy boardroom
Global activist hedge funds
Assets under management, $bn

2003 04 05 06 07 08 09 10 11 12 13*
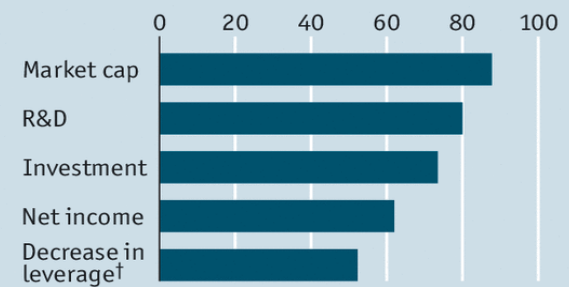Source: Hedge Fund Research   *At end of Q1

No harm done [4]
Top 50 activist-held companies* showing improvement, Q4 2009-Q3 2014, % of total

0 20 40 60 80 100

Market cap
R&D
Investment
Net income
Decrease in leverage†

Sources: Whalewisdom; Bloomberg; The Economist

*With the largest stakes by activists in the past five years
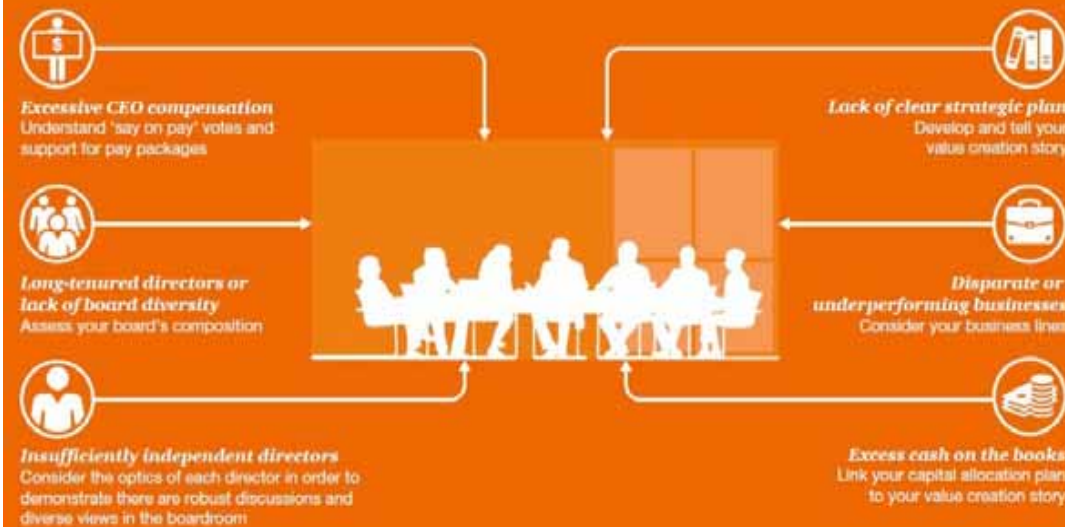†Excluding financial companies

The Systemic Effects of Hedge Funds: Good or Bad?

- Target firms experience increases in payout, operating performance, and higher CEO turnover after activism

- Brav, Jiang, and Kim (2015, RFS) report an increase in plant-level efficiency for target firms; employees become more productive despite a decrease in wages and hours worked
  - Less productive plants are sold following the arrival of an activist fund, evidence they interpret as more efficient capital deployment

- Critics of HF activism argue that this improvement may be evidence of myopic behavior

- Scholars have also documen-ted that hedge funds' activism efforts may impact firms other than those they target

- Aslan and Kumar (2015, JF) examine the potential impact on targets' customers, sup-pliers, and rivals: activism efforts adversely impact these parties

At a glance
What risks make your company a target for a hedge fund activist attack?

Excessive CEO compensation
Understand 'say on pay' votes and support for pay packages

Long-tenured directors or lack of board diversity
Assess your board's composition

Insufficiently independent directors
Consider the optics of each director in order to demonstrate there are robust discussions and diverse views in the boardroom

Lack of clear strategic plan
Develop and tell your value creation story

Disparate or underperforming businesses
Consider your business lines

Excess cash on the books
Link your capital allocation plan to your value creation story

The Systemic Effects of Hedge Funds: Good or Bad?

- Specifically, rival firms' experience decreased cash flows and profits three years after the activist effort commences; rival firms also experience negative abnormal stock returns

- Customers and suppliers are adversely affected by activism as targeted firms extract a greater portion of the surplus

- Gantchev, Gredil, and Jotikasthira (2017) find that firms make governance changes after a competitor is targeted by a HF

- Overall, these recent papers on HF activism further corroborate the positive impact on target firms

- Moreover, HF activists have effects beyond the target firms to other non-target firms, suggesting industrywide implications

- Because HFs are not required to biases in HF databases: self-selection bias, instant history or back-fill bias, survivorship, stale price, and multi-period sampling bias

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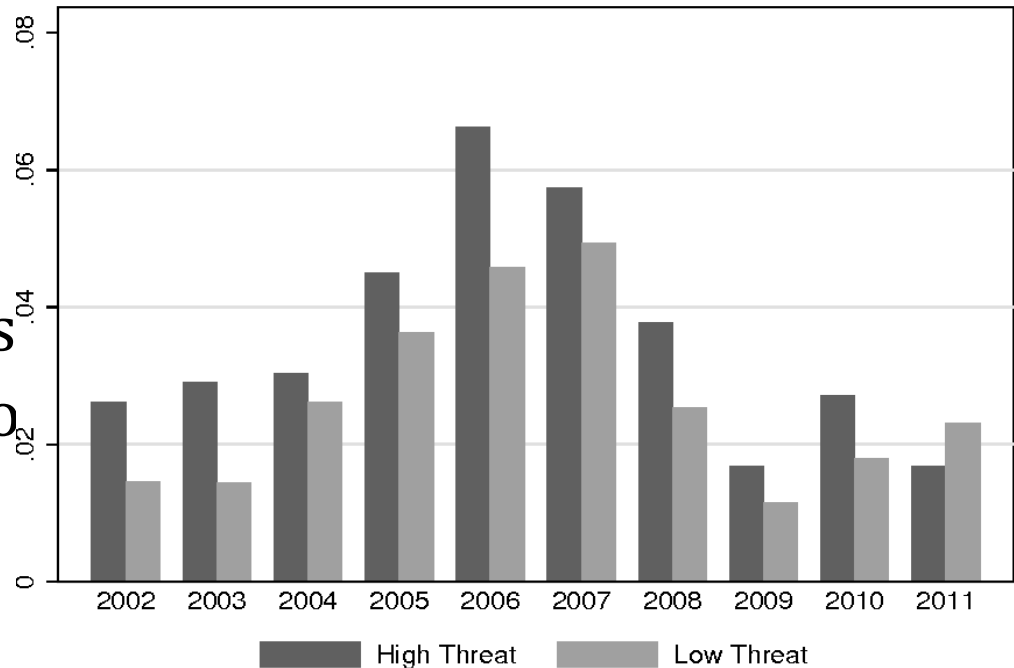
The Curse of HF Research: Opaque Data

- Joenväärä, Kosowski, and Tolonen (2016) emphasize the impact that database choice can have on the conclusions researchers make

- They aggregate the BarclayHedge, TASS, Hedge Fund Research, EurekaHedge, and Morningstar databases after adjusting for biases

- They then investigate whether findings made based on a single database continue to hold when tested using aggregated databases

- In some cases, the results can differ

- Patton, Ramadorai, and Streatfield (2015, JF) document that funds often revise their returns subsequent to their initial reporting to the commercial databases

- HFs that routinely revise previously reported returns can mislead their current and potential investors and subsequently underperform, though Liang and Qiu (2015) find the opposite
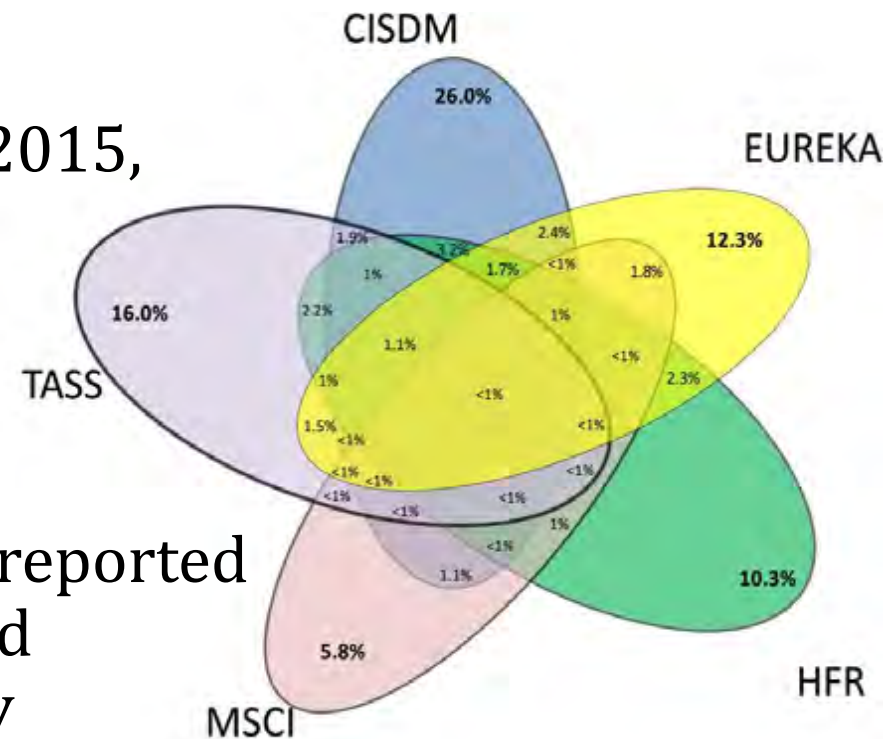
The Curse of HF Research: Opaque Data

- Survivorship bias occurs when a database only retains information on "surviving" funds – i.e., HFs that continue to report

- Because both well- and poor-performing HFs have reasons to stop reporting to databases, it is not obvious whether survivorship bias has an upward or downward bias on average returns

- Consistent with the high attrition rates of HFs, estimates of the bias range from 2 percent to 3.6 percent per year and can be higher for smaller and younger funds, see Fung and Hsieh (2000, JFQA)

  - Aggarwal and Jorion (2010, FAJ) identify a "hidden" source of survivorship bias in the TASS database as at a change of ownership, 60% of the funds were added if they had survived until March 1999

  - They estimate that the magnitude of this bias is 5% per year

Category	Definition	Number of TASS Funds In:		
		Live	Graveyard	Combined
1	Convertible Arbitrage	127	49	176
2	Dedicated Short Bias	14	15	29
3	Emerging Markets	130	133	263
4	Equity Market Neutral	173	87	260
5	Event Driven	250	134	384
6	Fixed-Income Arbitrage	104	71	175
7	Global Macro	118	114	232
8	Long/Short Equity	883	532	1,415
9	Managed Futures	195	316	511
10	Multi-Strategy	98	41	139
11	Fund of Funds	679	273	952
	Total	2,771	1,765	4,536

The Curse of HF Research: Opaque Data

- Jorion and Schwarz (2014, JAI) examine the bias from HF delisting , given that managers have incentives to delist their funds near the end of their lives if they have no desire to attract additional assets

- They suggest a lower bound for the delisting bias is 35 bp per year

- Hodder, Jackwerth, and Kolokolova (2014, JFQA) use estimated portfolio holdings for funds-of-funds to back out estimated HF delisting returns, when they stop reporting

- For all exiting funds, the estimated mean delisting return is insignificantly different from avg. monthly return for live HFs

- However, funds with poor prior performance and no clearly stated delisting reason had a significantly negative estimated mean delisting return of -5.97%

Hedge-Fund Returns Dragged Down by 'Hidden Bias' — Bloomberg

Hedge-fund returns are worse than industry figures would suggest because many funds on the brink of failure stop reporting on their performance, according to a new academic study. These omissions create a "hidden survivorship bias" because no funds in their last 12 months of existence are left out of the data, the study found.

Average monthly differential in returns for each year

Source: Seton Hall University study
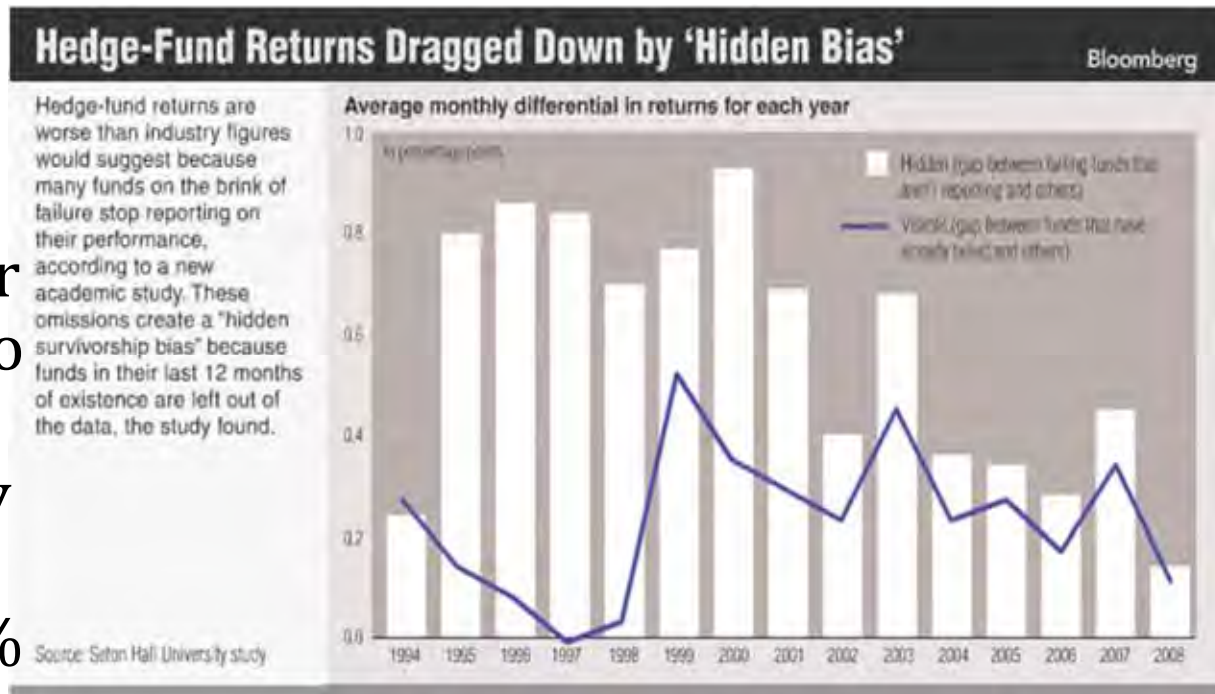
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- Consistent with the high attrition rates of HFs, estimates of the bias range from 2 to 3.6% and can be higher for smaller/younger HFs

- Aggarwal and Jorion (2010, FAJ) find a "hidden survivorship bias", which they attribute to a merge btw. Lipper TASS and Tremont data: 60% of funds added to TASS btw. April 1999 and November 2001 are likely to be survivors
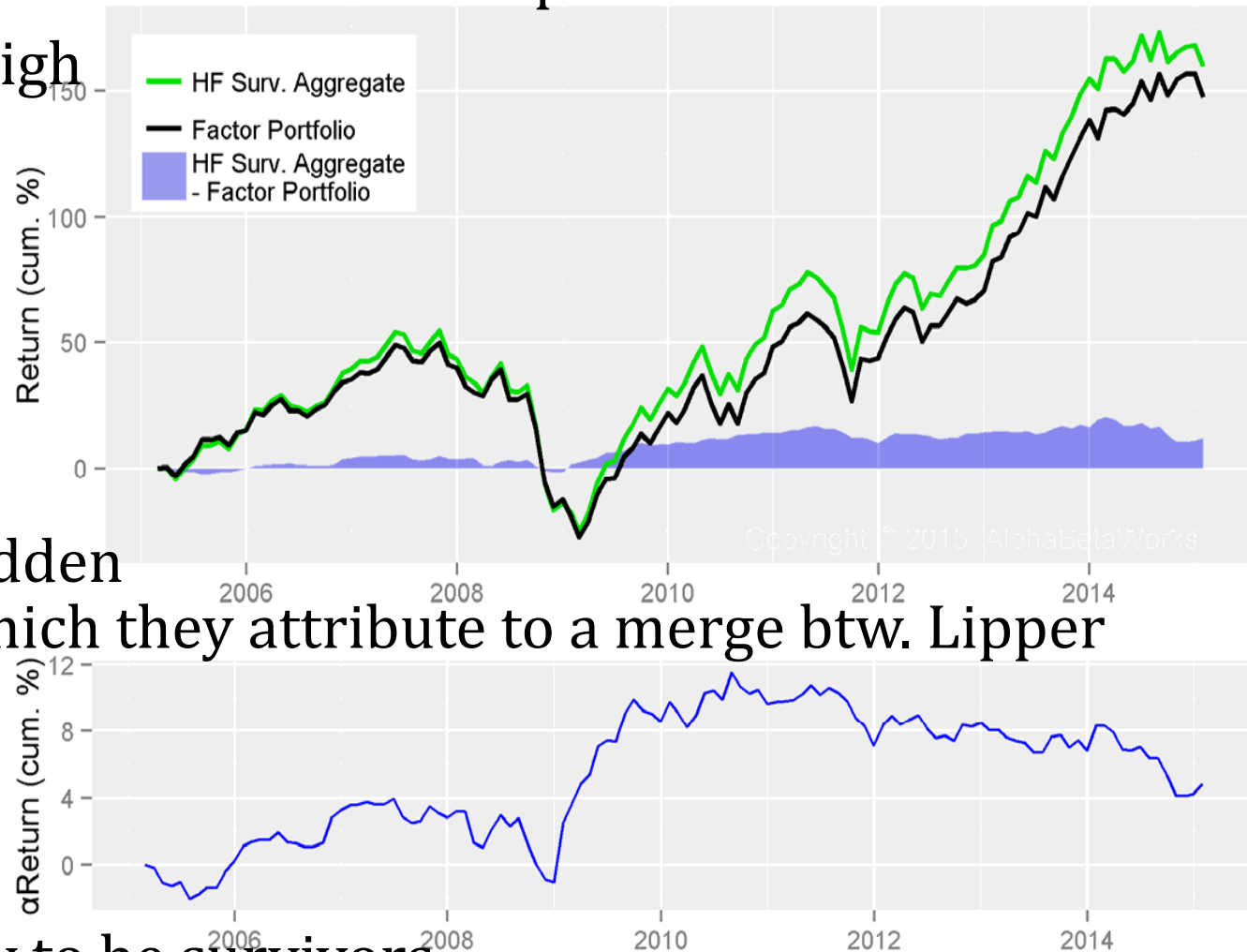
The Curse of HF Research: Opaque Data

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- o They estimate that the magnitude of this bias is 5% per year

- HFs differentiate themselves from other investment vehicles by investing in illiquid assets but also often value them using the most recent price of the security, see Appendix B

- Using these prices leads to a potential stale price bias which may artificially reduce estimates of volatility and correlation with traditional indices, as in Getmansky, Lo, and Makarov (2004, JFE)

- Another concern is self-selection bias: because HFs choose whether to report to vendors, the returns in these databases may be biased upward if funds with good performance primarily comprise the group choosing to be included in a database

- Agarwal, Fos, and Jiang (2013, MS) compare returns from funds' 13F filings to those reported in the commercial databases and show that, on average, unconditional self selection is negligible

The Curse of HF Research: Opaque Data

- However, unconditional result masks much conditional variation: HFs report when their performance (or the market) has been strong and cease reporting when their returns have been weak

- Edelman, Fung, and Hsieh (2013, JFE) examine mega HF firms that together manage more than 50% of the HF industry's assets, and do not report their performance to commercial databases

- They find that there is no significant difference between the performance of non-reporting mega firms and performance of firms that report to commercial databases $\Rightarrow$ no selection bias if researchers rely on commercial databases
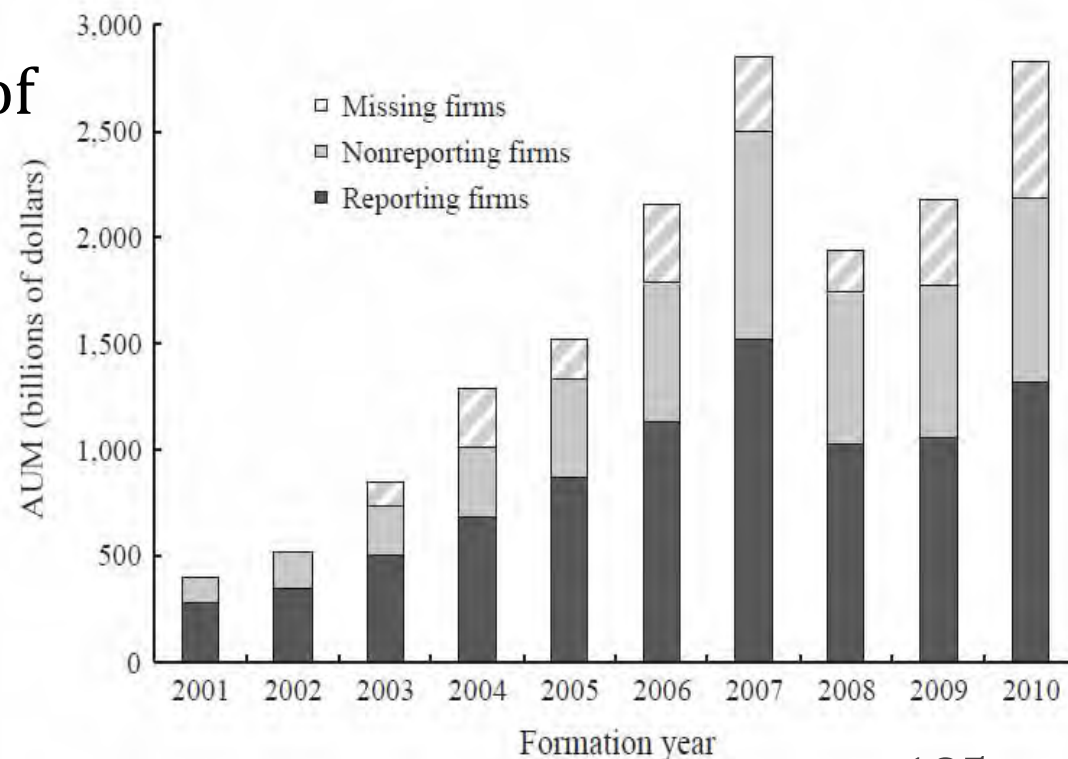
Fig. 2. Assets under management (AUM) in hedge fund firms by year. The black bars represent the AUM of reporting firms in the three commercial databases [BarclayHedge, Hedge Fund Research Inc. (HFR), and Lipper TASS (Trading Adviser Selection System)]. The gray bars represent the AUM of the nonreporting firms, which are the firms in the *Institutional Investor* "Hedge Fund 100" list and the *Absolute Return+Alpha* "Billion Dollar Club" list outside the three commercial databases. The stripped bars represent the missing assets under administration (AUA) in the *HFN Hedge Fund Administrator Survey*. Data are from *Institutional Investor*, *Absolute Return+Alpha*, BarclayHedge, HFR, Lipper TASS, and HFN Hedgefund.net.

The Curse of HF Research: Opaque Data

- Aiken, Clifford, and Ellis (2013, RFS) use the N-CSR, N-CSRS, and N-Q filings of FOFs to examine self-selection bias
  - Since 1978, all institutions with over $100 million must report stock holdings in excess of $200,000 or holdings of more than 10,000 shares and HFs are not exempt from this requirement
  - The requirement does not apply to derivatives and short positions
  - Further, institutions can ask that their positions be kept confidential for one year and hedge funds have been known to do so aggressively
  - They argue that this database is free from selection bias since these FOFs are required to report all of their positions
- Using their "unbiased" database of 1,445 individual HF, they find that the average alpha is insignificantly different from zero and far different than the typical 3% to 5% per year estimate
- Backfill bias is caused by a manager electing to "backfill" the returns from his fund's inception date to the date of its entry into a database if his fund's performance is good
- This behavior can lead to upward bias in average reported returns, estimated by Fung and Hsieh (2000, JFQA) to be btw. 1.2 and 1.4%

The Curse of HF Research: Opaque Data

Database versus Nondatabase Returns

Panel A: Market-adjusted returns around the initial reporting date

- Excess return
- Average excess return before the initial reporting date
- Average excess return after the initial reporting date
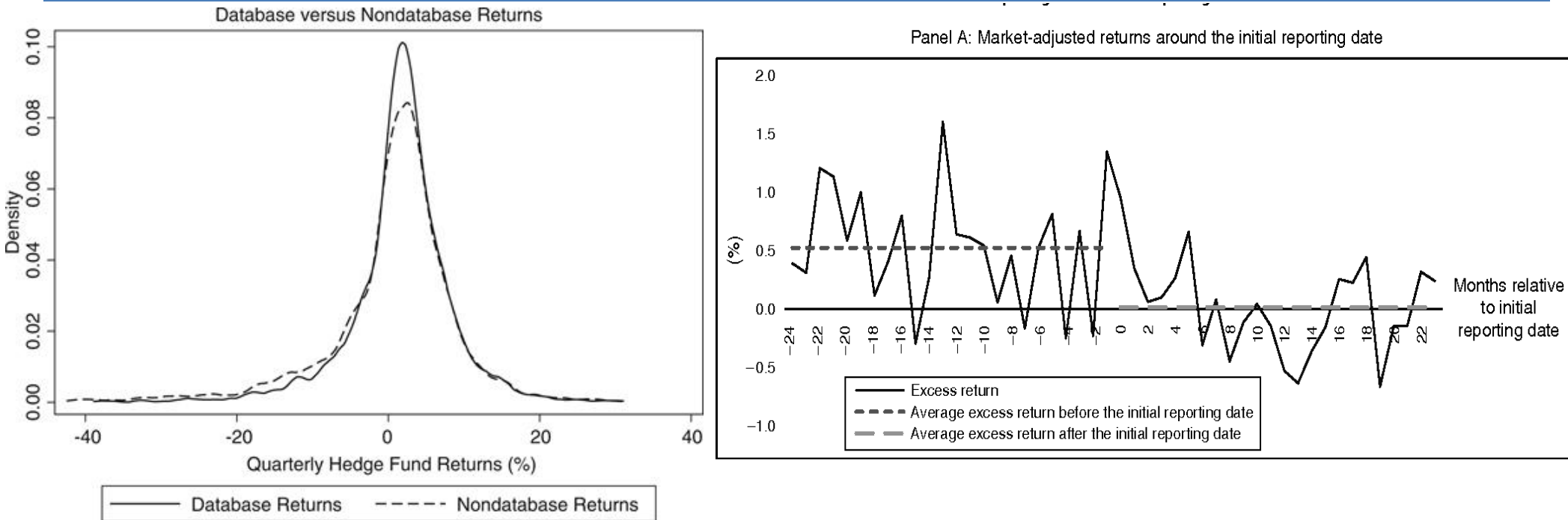
- ▪ Ibbotson, Chen, and Zhu (2011, FAJ) find that adjusting for backfill and survivorship biases reduces average return from 14.3 to 7.6%

- ▪ Although single sponsors often provide the fund's initial capital, there are cases in which a fund family may start several new funds: those that are successful in this incubation period go on to report ⇒ upward incubation bias

- ▪ Fung and Hsieh (2009, FAJ) argue that simply removing data can give rise to other errors and loss of important information

The Curse of HF Research: Opaque Data

- A small literature has discussed the biases of commercial data sets for the estimation of higher-order moment, starting from variance

From 1996 to 2014	# fund-months	Annualized Mean	Annualized Volatility	Skewness	Kurtosis	Maximum DD	ac(1)	Box-Q(3) p-value
Naive Estimate	351364	12.6%	5.9%	-0.25	4.41	-14.9%	0.28	0.00003
Remove Survivorship Bias	927690	9.7%	5.6%	-0.22	4.96	-15.0%	0.26	0.00009
Remove Backfill Bias	195816	11.5%	8.1%	-0.54	9.02	-19.9%	0.32	0.00000
Remove Both Biases	505844	6.3%	6.3%	-0.50	5.72	-20.5%	0.25	0.00056

Source: Getmansky, M., Lee, P. A., & Lo, A. W. (2015). Hedge funds: A dynamic industry in transition. *Annual Review of Financial Economics*, 7, 483-577.

Table 2: Summary statistics for cross-sectionally averaged returns from the Lipper TASS database with no bias adjustments, adjustments for survivorship bias, adjustments for back-fill bias, and adjustments for both biases during the sample period from January 1996 through December 2014. For each database sample the number of fund-months, annualized mean, annualized volatility, skewness, kurtosis, maximum drawdown, first-order autocorrelation, and *p*-value of the Ljung-Box *Q*-statistic with three lags are reported.

- The biases make HFs look misleadingly attractive w.r.t. their average return, volatility, skewness, kurtosis, and maximum drawdown

- Skewness, kurtosis, and maximum drawdowns increase significantly after both bias adjustments

- Volatility increases slightly, and the 1st order AC stays almost the same

Hedge Fund Indices and their Limitations

- Frequently, a HF reports its performance to only one database and the result is little overlap of funds covered by the different indices

- With little overlap between their constituents, different global indices may reflect very different performance for the industry over the same period of time.

- Much research is currently based on hedge fund indices

- The main indices are:
  - CISDM of U. Mass., based on managers reporting to the CISDM data-bases and covering a broad set of HF and managed futures trading strategies; publication of returns in each style classification began in 1994 with data beginning in 1990
  - Credit Suisse/Tremont, covering more than 10 strategies and based on more than 400 funds selected from TASS data

HOW A HEDGE FUND INDEX IS CONSTRUCTED

Hedge fund manager

Hedge fund manager opts not to report hedge fund to database

Hedge fund manager voluntarily reports hedge fund to database

Hedge fund database

Hedge fund database filters funds according to selection criteria

Hedge fund index provider

Hedge fund index provider filters its universe of open and closed hedge funds and categorizes into sub indices
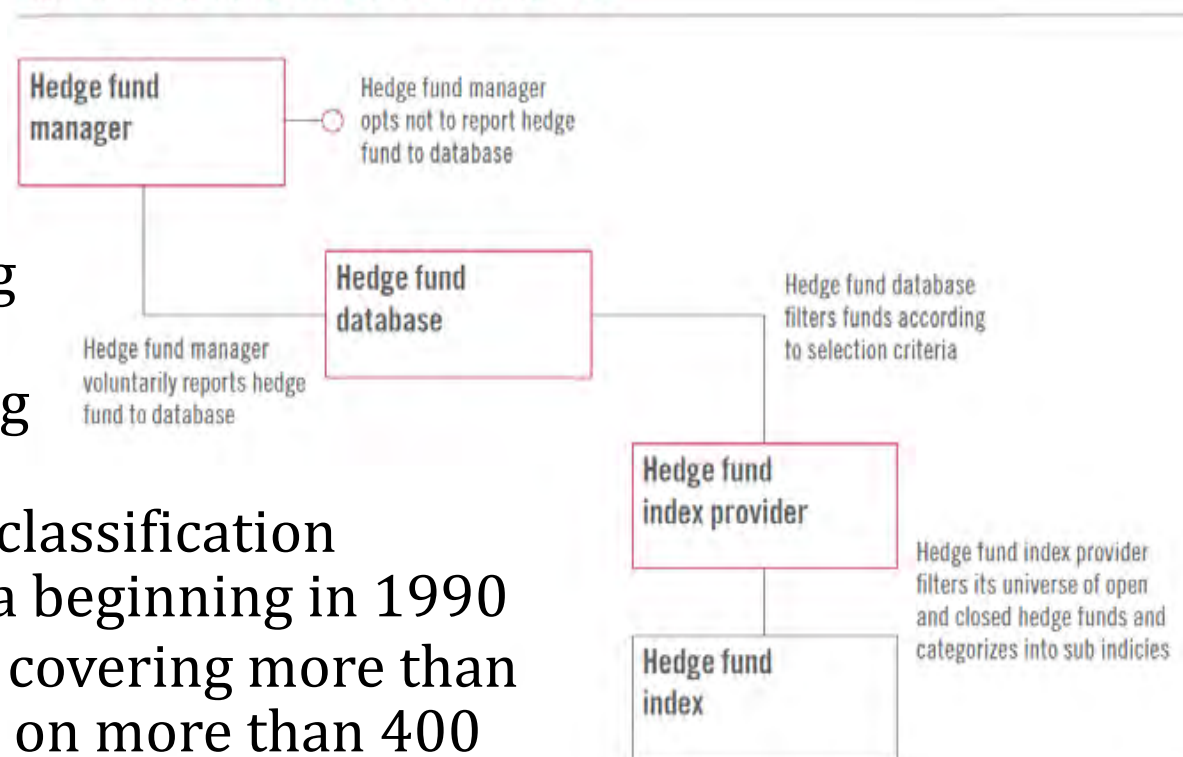
Hedge fund index

Hedge Fund Indices and their Limitations

HEDGE FUND INDEX PROVIDERS AND THEIR CHARACTERISTICS

	Start date	Number of sub-indices	Equal or asset weighted	Investable or non-investable
Barclay Hedge Fund Indices	1980	27	equal	both
Dow Jones Credit Suisse Indices	1994	10	asset	both
EDHEC Alternative Indices	1997	13	equal	non-investable
Eurekahedge	2000	10	equal	non-investable
Hedge Fund Intelligence Indices - HFI	1998	61	equal	non-investable
HFR Hedge Fund Indices	1990	28	equal	both

Source: Pictet Alternative Investments; *An introduction to Core Topic in Alternative Investments*, Mark J. Anson

o CS accepts funds with a minimum of US$10 mil AUM and an audited statement; launched in 1999 with data from 1994, it is asset weighted

o HFRX indices, comprising all eligible HF strategies; constituent strategies are asset weighted on the basis of asset distribution within the industry; funds are assigned to categories based on the descriptions in their offering memoranda

o EACM100® Index, equally weighted composite of 100 HFs selected representative of 5 broad strategies; names in the funds are not disclosed; launched in 1996 with data beginning in 1990

o Hedge Fund Intelligence, that supplies the EuroHedge and HSBC AsiaHedge equally weighted indices

Hedge Fund Indices and their Limitations

o The EuroHedge series consists of HFs that are at least 50% managed in developed European countries or that are solely invested in developed European countries; the series began in 2002

o MSCI equally weighted indices classified according to 5 categories and include a composite; within a category, indices are segregated on the basis of asset class and geography; funds included need to minimum AUM of US$15 million in AUM, although there is no restriction on whether a fund is open or closed

o MSCI Hedge Invest Index, similar but investable

o Dow Jones Hedge Fund Strategy benchmarks, covering 6 strategies; funds in each category meet size, years in existence, and statistical style purity constraints; the DJ indices are available in an investable form

o Standard & Poor's Hedge Fund Indices, equally weighted and covering three styles with three strategies each; S&P discloses the method and the number of funds in each strategy; it performs due diligence on all funds in the indices; S&P Hedge Fund Indices are available in an investable form

A List of Hedge Fund Indexes

Index Type	Index Provider	Includes Total Industry Index	Includes Category Indexes
Monthly	Credit Suisse/Dow Jones	Yes	Yes
	Hedge Fund Research	Yes	Yes
	Eurekahedge	Yes	Yes
	Hennessee	Yes	Yes
	Barclay Hedge	Yes	Yes
	MSCI	Yes	Yes
	Morningstar	Yes	Yes
	CISDM	Yes	Yes
Daily	Hedge Fund Research	Yes	Yes
	Credit Suisse/Dow Jones	Yes	Yes
	Barclay Hedge	No	CTAs Only
Replication	Credit Suisse/Dow Jones	Yes	Yes

Hedge Fund Indices and their Limitations

- However, investing in a HF index from 1994 to 2006 would have been very difficult: index funds of the HF universe do not exist

- The general distinguishing feature of various hedge fund series is whether they report monthly or daily series, are investable or noninvestable, and list the funds used in benchmark construction

- Value weighting may result in a particular index taking on the return characteristics of the best-performing hedge funds in a particular time period

- Equal-weighted indices may reflect potential diversification of hedge funds better than value-weighted indices

- For funds designed to track equal-weighted indices, however, the costs of rebalancing to index weights make it difficult to create an investable form

- Construction of investable indices only involved open funds and it is usually concentrated so that an index provider can replicate the index to meet client needs ⇒ even smaller HF universe

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Hedge Fund Indices and their Limitations

- Hedge Fund Research (HFR) currently publishes over 70 investable hedge fund indices, under the acronym HFRX

- A non-investable index is constructed using open and closed HFs

- Non-investable indices, while still representing a subset of the industry, are intended to give a fairer representation of the wider performance of HFs generally

INVESTABLE AND NON-INVESTABLE HEDGE FUND INDEX CHARACTERISTICS

Investable	Non-investable
• Constituents must be open to new investments	• Constituents can include open or closed hedge funds
• Suffer from database biases	• Suffer less from database biases than investable indices
• Must be easily replicable	• Larger universe to select from
• Increased biases due to tougher selection criteria (some undergo a full due diligence)	Better estimators of the hedge fund universe
• Construction more concentrated therefore have higher degree of heterogeneity	

Poor estimators of the hedge fund universe

Hedge Fund Indices and their Limitations

- Such differences may lead to considerable dispersion btw. the investable and non-investable versions of the same index

- Recent research has argued that reporting FoHF indices may be superior to standard indices as they include HFs that may not otherwise be reported

- Further, when an underlying HF liquidates or blows up the investing FoHF does not restate historical performance

Dec 1999 = USD100

——	HFRI Fund of Funds Composite index
——	EDHEC Funds of Funds
——	InvestHedge Composite index
——	Eurekahedge Fund of Funds index
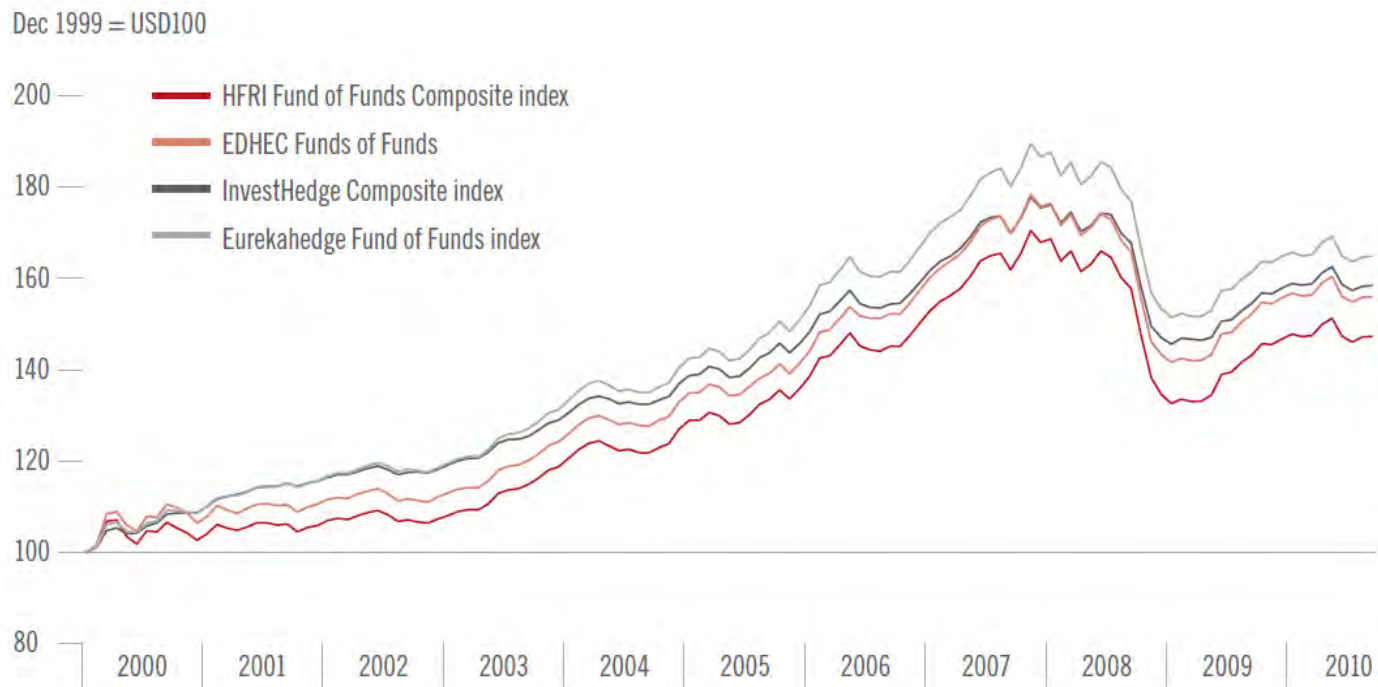
Source: Pictet Alternative Investments

Hedge Fund Indices and their Limitations

- Yet a FoHF typically undertakes thorough due diligence and would therefore invest in top performing HFs

- The funds in which FoHFs invest in include tactical cash allocations, whereas HF indices are typically 100% invested

- FoHFs incur a double layer of fees which dilutes performance

- Access to HF via index products offers a cost efficient alternative

- They are resource efficient, as they eliminate the need for a dedicated HF selection team; index products also usually offer daily liquidity with no lock-ups and typically have lower fraud risk, as they replicate HF returns via traditional financial instruments such as futures or ETFs

Dec 2003 = USD100

HFRI FOF: Diversified index

HFRX Class A Global Tracker Fund Series B
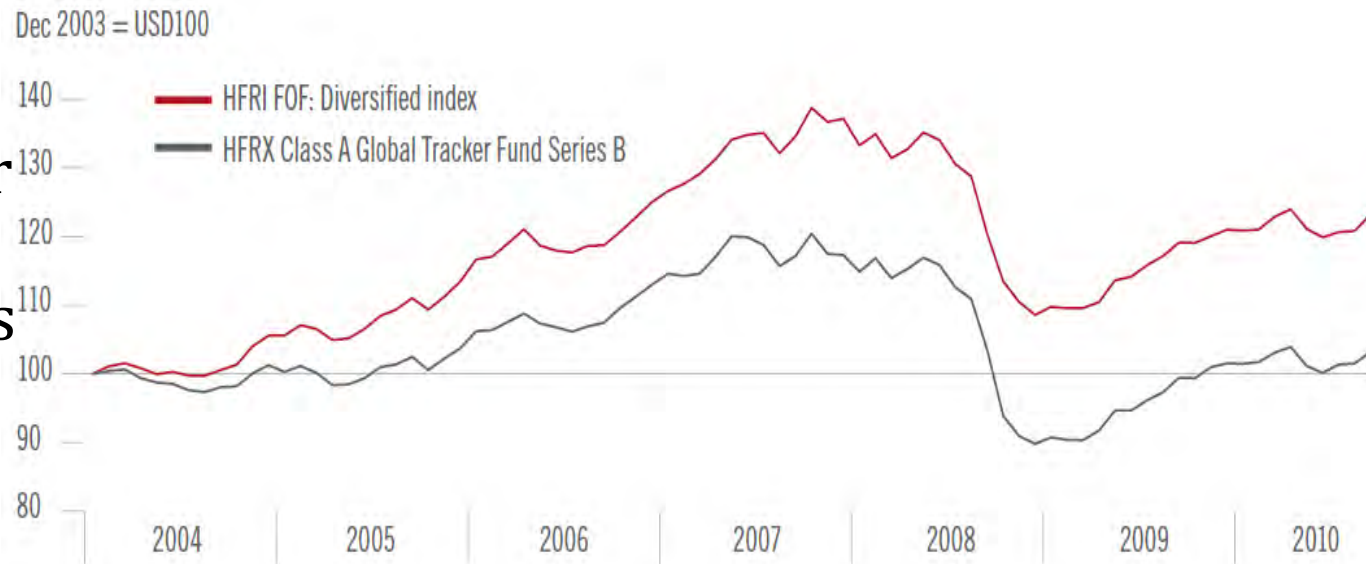
Source: Pictet Alternative Investments

Hedge Fund Indices and their Limitations

- Asset owners should be wary of HF indexes: the average investor cannot obtain the returns reported in these indexes because HF indexes generally are not investable

- Nor can asset owners invest in every HF in most HF indexes—some are closed, some have minimums that are too high, and in any case there are just too many of them

- Since investors cannot hold all funds in a HF index, they face more idiosyncratic risk investing in HFs than is measured by the HF index, which diversifies away much more risk than an investor can

- Some firms have desi-gned investable HF indices (trackers), but there is a large selection bias in the HFs wil-ling to be included

Traditional Hedge Fund Indices and HFRX Global Hedge Fund Index: Comparison Rates of Return (1998-2010)

	CSFB/Tremont Hedge Fund Index	HFRI Fund Weighted Composite Index	CISDM Equal Weighted Hedge Fund Index	Barclay Hedge Fund Index Hedge Fund	HFRX Global Hedge Fund Index
Average Annual Return	8.1%	8.8%	10.5%	10.6%	7.3%
IRR (Internal Rate of Return)	6.6%	6.6%	7.9%	7.3%	2.1%
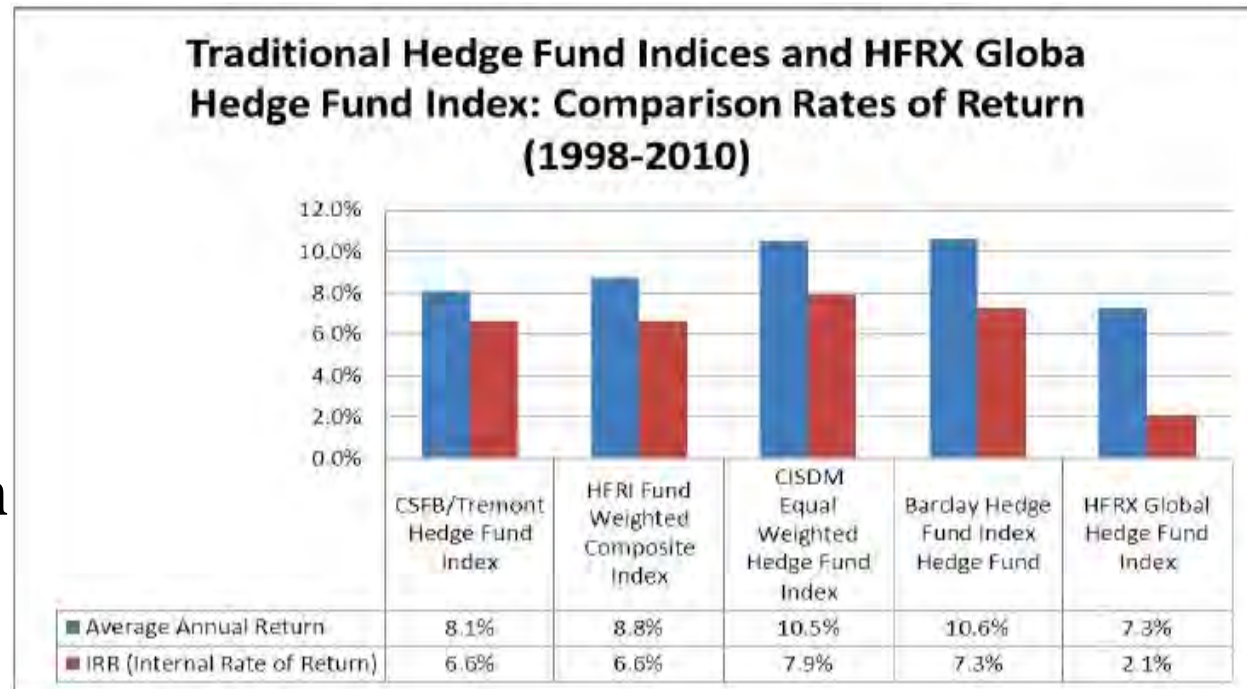
Hedge Fund Indices and their Limitations

- Individual investors often seek returns that are high in absolute terms; institutional investors are more likely to measure performance relative to benchmarks such as indices

- As benchmarks become more important, it becomes less advanta-geous for a HF to take risks that could lead to a performance that greatly exceeds the benchmark if doing so entails a substantial risk

- As HFs are held to a similar standard of performance, performance will become more similar across funds

- Perhaps most strikingly, there is increasing evidence that the performance of hedge fund indices can largely be replicated by machines (Kat and Palaro, 2006)

- Managed futures (MFs) have been used as an investment alternative since the late 1960s; they are private pooled investment vehicles that can invest in cash, spot, and derivatives and can use leverage in a variety of trading strategies

- MFPs are also structured as limited partnerships open to accredited investors (institutions and high-net-worth individuals)

Managed Futures Programmes

- Compensation arrangements for MFPs are also similar to HFs

- The distinguishing difference vs. HFs is that, for the most part, MFs trade in derivative markets but are similar to macro HFs

- The MF industry is probably somewhat less than 10 percent the size of the HF industry as judged by assets under management

- One can view HFs as concentrating on inefficiencies in micro (security) stock and bond markets whereas managed futures look for return op-portunities in macro (index) stock and bond markets

- In addition, in some juris-dictions, managed futures programs have been histo-rically more highly regulated than hedge funds

CTA Industry

Assets Under Management - Historical Growth of Assets

Billions

Year	Value
2009	213.6
2010	267.6
2011	314.3
2012	329.6
2013	331.2
2014	317.9
2015	326.4
2016	339.7
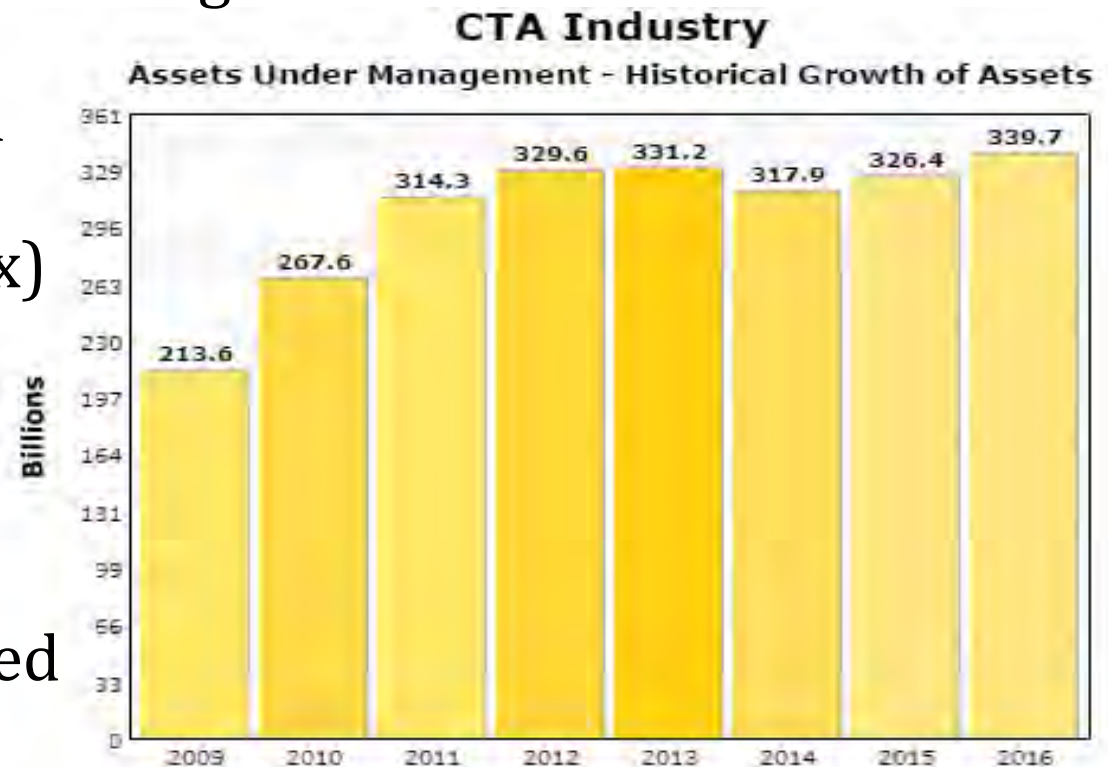
Source: Barclay Hedge

Managed Futures Programmes

- o In the US, the commodity trading advisors (CTAs) are registered with the Commodity Futures Trading Commission & National Futures Ass. ⇒ stronger government and self-regulatory oversight
- MFs may be classified according to investment style (e.g., systematic or discretionary), markets traded (e.g., currency, commodeties, financial), or strategy (e.g., trend following/ contrarian)
- The volatility of the CTA$ Index is typically less than that of either the S&P 500 but greater than that of US or global bonds

Distribution of 3-year trailing equity beta

Multi-strategy   Managed futures

Greater than 0.4
0.3 to 0.4
0.2 to 0.3
0.1 to 0.2
0 to 0.1
Less than 0

~80% multi-strategy managers below 0.4

~80% managed futures managers below 0.1

Source: Morningstar and Bloomberg as of 31 May 2016

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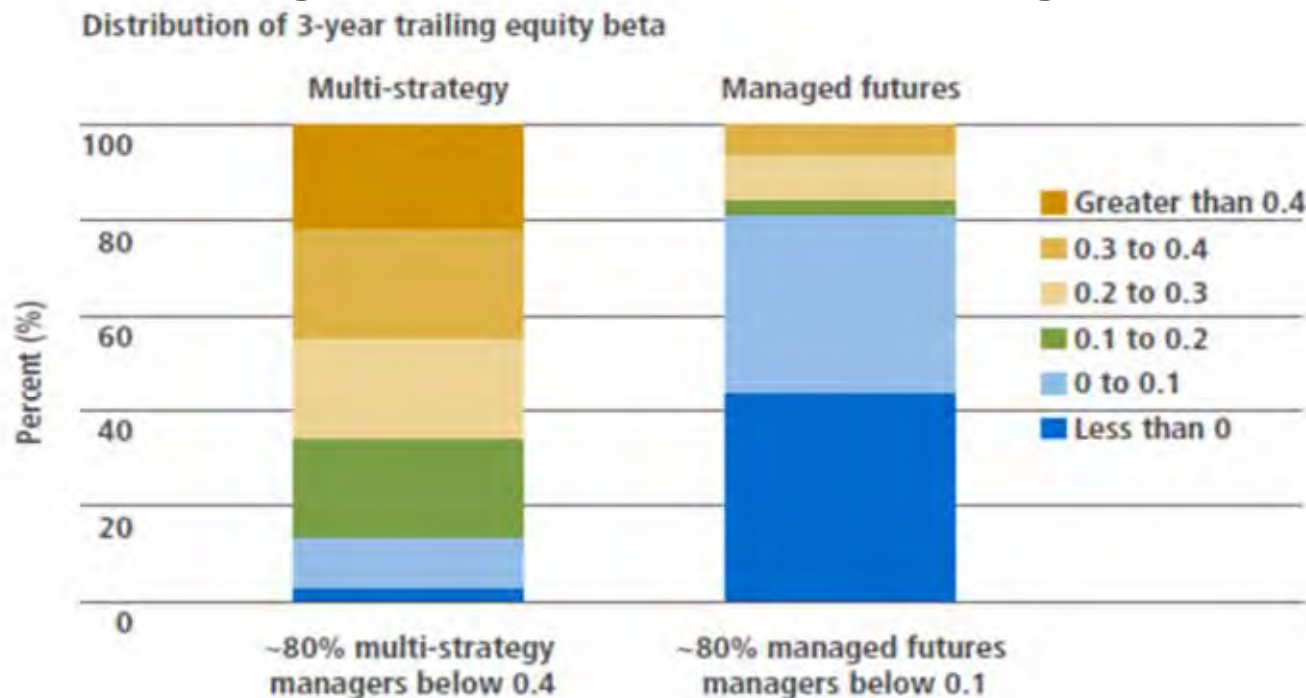
Managed Futures Programmes

- Noteworthy is that the correlations of the CISDM CTA$ with the equity indices are slightly negative; the correlations of the CISDM CTA$ with US and global bonds are similar at 0.42 and 0.46

Measure	CISDM CTA$	HFCI	S&P 500	Lehman Gov./Corp.	MSCI World	Lehman Global
Annualized return	10.85%	13.46%	10.94%	7.77%	7.08%	8.09%
Annualized std. dev.	9.96%	5.71%	14.65%	4.46%	14.62%	5.23%
Sharpe ratio	0.66	1.61	0.45	0.78	0.19	0.73
Minimum monthly return	−6.00%	−6.92%	−14.46%	−4.19%	−13.32%	−3.66%
Correlation w/CTA$	1.00	0.19	−0.10	0.29	−0.11	0.27

	CTA$	CTAEQ	Currency	Discretionary	Diversified	Financial	Trend Following
CTA$	1.00						
CTAEQ	0.94	1.00					
Currency	0.66	0.62	1.00				
Discretionary	0.63	0.54	0.44	1.00			
Diversified	0.94	0.93	0.54	0.60	1.00		
Financial	0.93	0.88	0.59	0.47	0.84	1.00	
Trend following	0.96	0.95	0.64	0.51	0.92	0.93	1.00

Managed Futures Programmes

- What are the market opportunities that may be exploited by CTAs?

- Derivative markets are zero-sum games and as a result, the long-term return to a passively managed, unlevered futures position should be the risk-free return less fees and transaction costs

- For derivative-based investment strategies like managed futures to produce excess returns, on average, there must be a sufficient number of hedgers or other users of the markets who systematically earn less than the risk-free rate

   o Hedgers, for example, may pay a risk premium to liquidity providers for the insurance they obtain

- The zero-sum nature of derivatives does not restrict CTAs from attempting to conduct arbitrage trades

- CTAs may attempt to exploit opportunities in trending markets; government policy intervention in interest rate and currency markets may cause trending in currency and fixed-income markets

- Access to options markets permits MFs to exploit changes in market volatility of the underlying asset

Managed Futures Programmes

- MFP/CTAs are also well-known for a feature: they are negatively correlated with the market when the latter performs the worst and mildly positively correlated in up-markets

- Other alternative strategies, such as equity-sensitive HFs, often have higher, positive correlation with equity mkts when these are falling vs. when rising

- These properties derive from modest correlations with factors

- However, it emerges that on net CTAs are net buyers of volatility, contrary to HFs (see Ang, 2014)
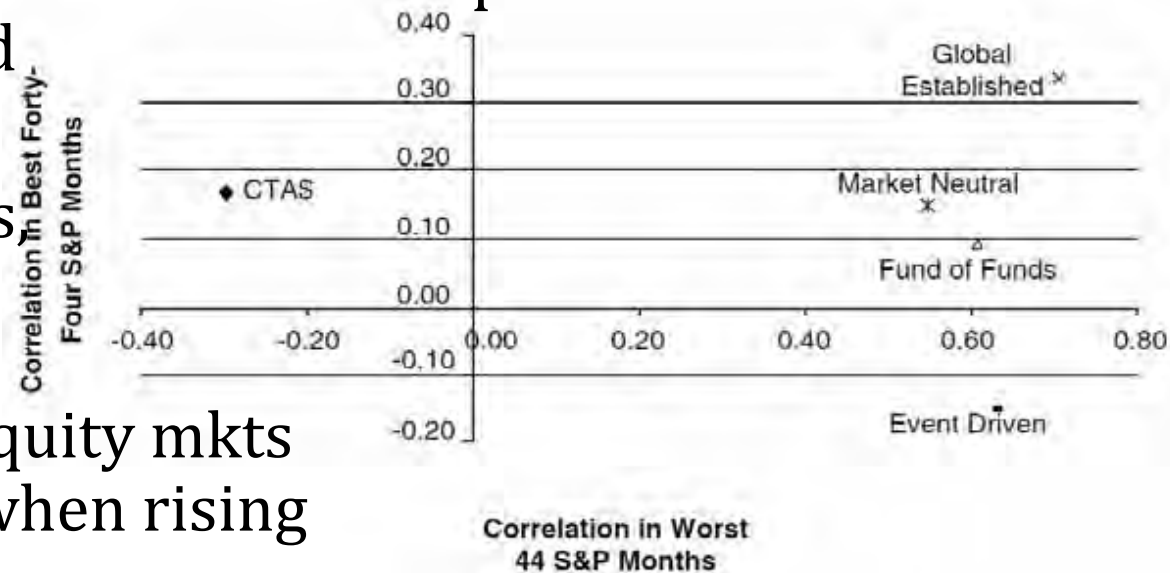
	S&P 500	Leh. Bros. Bond	Change in Credit Spread Moody's (Baa-Aaa)	Change in VIX
Managed Futures				
Zurich CTA$	−0.06	0.24	−0.06	0.15
Zurich CTAEQ	−0.09	0.20	−0.03	0.17
Zurich Currency	0.00	0.16	−0.05	0.06
Zurich Discretionary	−0.05	0.18	−0.07	0.09
Zurich Diversified	−0.09	0.23	−0.05	0.21
Zurich Financial	−0.02	0.32	−0.08	0.13
Zurich Trend-Following	−0.07	0.25	−0.07	0.18
Hedge Funds				
Zurich Event Driven Univ.	0.47	0.11	−0.33	−0.45
Zurich HF FOF Univ.	0.52	0.20	−0.16	−0.35
Zurich Global Est. Univ.	0.78	0.20	−0.29	−0.48
Zurich Mkt. Neutral Univ.	0.31	0.11	−0.21	−0.15
Traditional Assets				
S&P 500	1.00	0.37	−0.09	−0.63
Leh. Bros. Bond	0.37	1.00	−0.02	−0.15

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Hedge Funds Through Hard Times?

- The GFC and following pe-riod have been tough on HFs

- Barclays calculates that the avg. monthly alpha has declined to -0.07% from 2011 to May 2016 compared to an average of +0.48% for the period 1993–2016

FIGURE 2: HF Performance – Excess Returns (I / III)

Cumulative HF Alpha / Excess Returns (1993 – May 2016)[1]

Peak cumulative alpha: 139%

1. HFR, S&P 500, Barclays Strategic Consulting analysis. Performance is calculated net of different exposures. Between 1993 – May 2016 exposures were 0.21 to S&P 500, (0.08) to Barclays Aggregate and 0.30 to Barclays HY Index.

- Below, we plot the relationship between the 36-month trailing excess returns versus the 36-month st. dev. over various mkt cycles ('93 – '98, '99 – '02, '03 –'07, '08 –'11, '12 –'16)

- Apart from the 1st mkt cycle in the early to mid '90s, avg. returns have been decreasing steadily

FIGURE 3: HF Performance – Excess Returns (II / III)

HF 36-Month Trailing Excess Returns and Standard Deviation (1993 – May 2016)[1]

Early to mid 1990s

Dot com bubble

Early to mid 2000s

Financial crisis and recovery

Recent 5 years

Average 36-Month Trailing Excess Returns (Monthly)

Standard Deviation of 36-Month Trailing Excess Returns

'93 – '98   '99 – '02   '03 – '07   '08 – '11   '12 – '16

1. HFR, S&P 500, Barclays Strategic Consulting analysis. Performance is calculated net of different exposures; Between 1993 – May 2016 exposures were 0.21 to S&P 500, (0.08) to Barclays Agg and 0.30 to Barclays HY Index; Risk is standard deviation of 36-month rolling Alpha

Hedge Funds Through Hard Times?

Mastered by the universe

Assets under management — Worldwide, $trn (1): Hedge funds; Exchange-traded funds and products
Source: ETFGI and Hedge Fund Research

Hedge-fund returns* — Five-year rolling average, % (2)
*Hedge Fund Research's weighted index of 2,200 funds   †To June
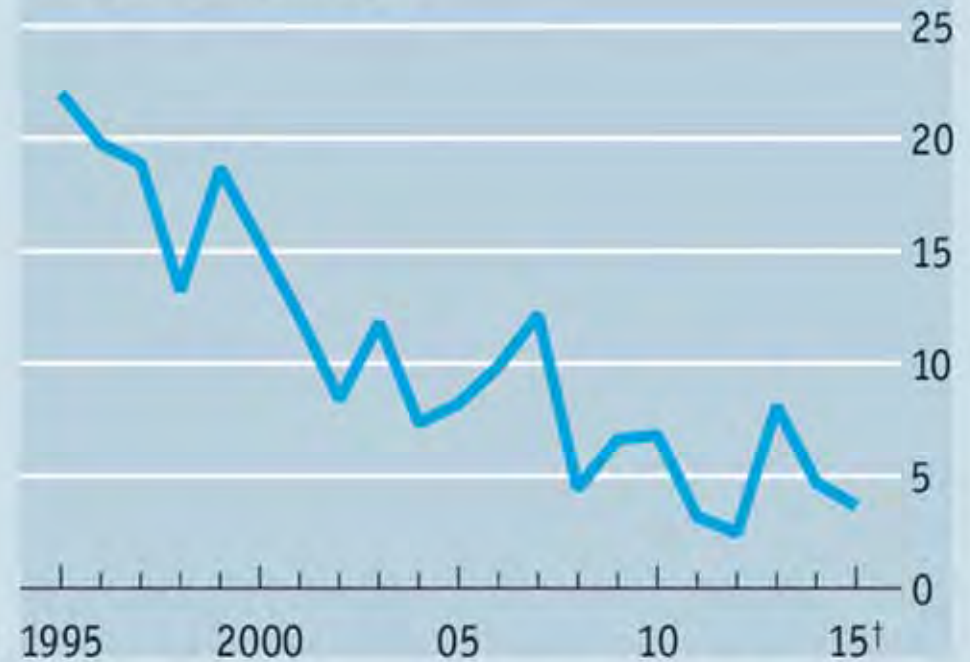
Economist.com

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Hedge Funds Through Hard Times?

- What do HFs blame their own underperformance on?

FIGURE 5: Drivers of Recent HF Underperformance

The size of the industry and macro conditions are the most often-cited reasons by investors for recent HF underperformance

Drivers of Recent HF Underperformance

Drivers of Poor Performance	Illustrative Investor Quotes
Q: What do you think are the main reasons why HFs, on average, have underperformed relative to investor expectations recently? (Select all that apply) HF industry is too big relative to opportunities — 74% Macro conditions — 57% Market behaviour has changed — 37% Fees are too high relative to returns — 5% Other — 26%	"Investor expectations are still rooted in historically extraordinary returns for HFs from the 1990s to early 2000s; if we can barely sustain beta returns without unprecedented monetary (and soon, fiscal) intervention, while insisting on increasing regulatory and operational burdens (and costs), alpha expectations will suffer." – $20bn Private Pension "Best practices have become widely followed reducing historic alpha opportunities." – $30bn+ FoHF "Systematic / quant managers with tons of data are starting to be better positioned than typical fundamental HFs." – $2bn+ Family Office "Fees are too high relative to risk free rates and return expectations." – $30bn+ Endowment

Source: Barclays Strategic Consulting analysis

- The overall CAGR for HF AUM of 2009–2015 was 10% and that the individual strategy components each went up by btw. 9% and 12%

- On average, asset growth in the individual funds account for two-thirds of the overall growth by strategy while the number of new funds accounts for only one-third

Hedge Funds Through Hard Times?

- Despite the HF industry's significant growth since 2009, it is still very small relative to the pool of global financial assets
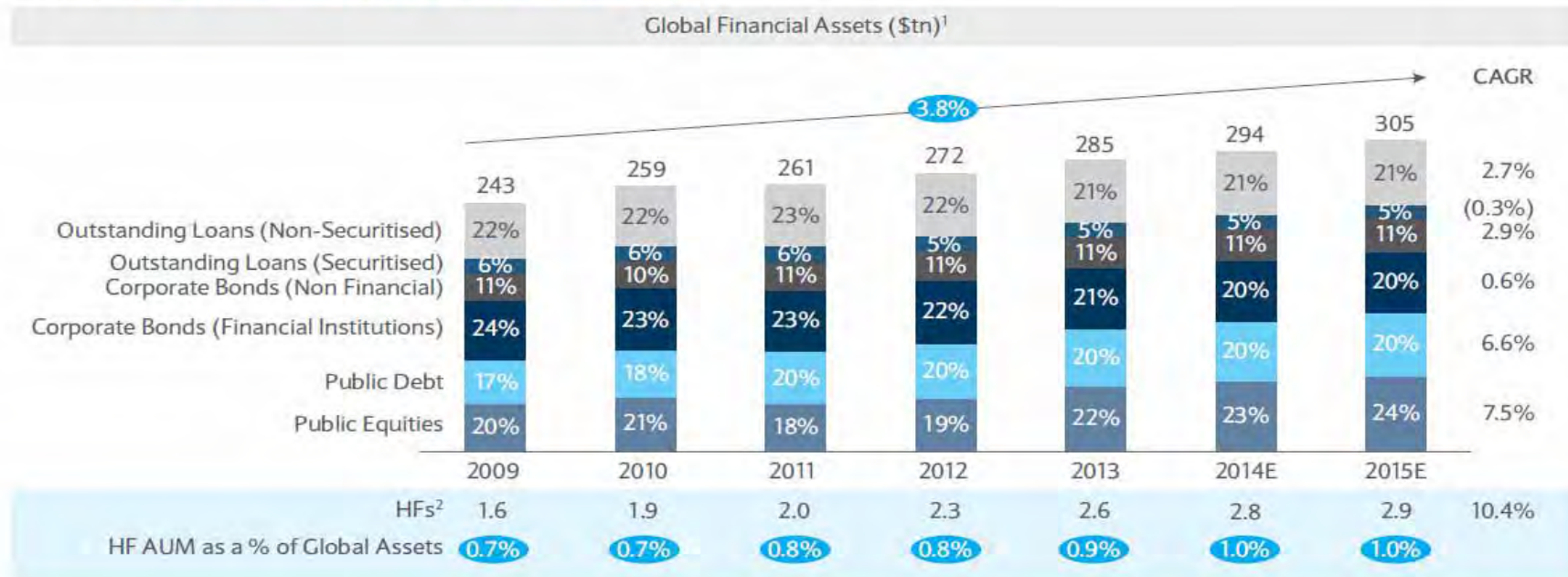

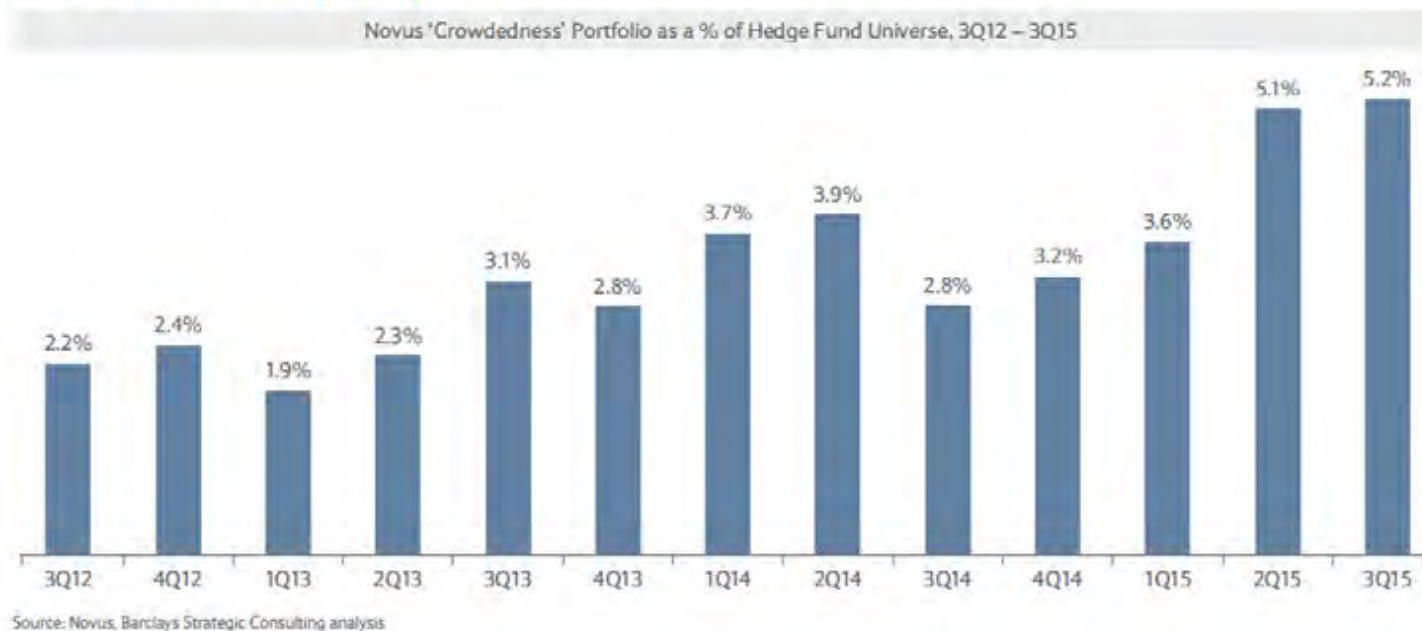FIGURE 7: AUM Growth – Global Financial Assets vs. HFs

Global Financial Assets ($tn)[1]

	2009	2010	2011	2012	2013	2014E	2015E	CAGR
Total	243	259	261	272	285	294	305	3.8%
Outstanding Loans (Non-Securitised)	22%	22%	23%	22%	21%	21%	21%	2.7%
Outstanding Loans (Securitised)	6%	6%	6%	5%	5%	5%	5%	(0.3%)
Corporate Bonds (Non Financial)	11%	10%	11%	11%	11%	11%	11%	2.9%
Corporate Bonds (Financial Institutions)	24%	23%	23%	22%	21%	20%	20%	0.6%
Public Debt	17%	18%	20%	20%	20%	20%	20%	6.6%
Public Equities	20%	21%	18%	19%	22%	23%	24%	7.5%
HFs[2]	1.6	1.9	2.0	2.3	2.6	2.8	2.9	10.4%
HF AUM as a % of Global Assets	0.7%	0.7%	0.8%	0.8%	0.9%	1.0%	1.0%	

1. Business Insider, 'The $64 trillion question, Convergence in asset management,' McKinsey & Company; Barclays Strategic Consulting Analysis; 2. HFR

- The issue may be, however, the growth in size of many individual HFs, which are pursuing similar strategies leading to crowding

- As HFs become larger, their investable universe can often be diminished (e.g., due to position limits) as it is often not 'worth it' to invest in smaller situations that can hardly move the P&L needle

Hedge Funds Through Hard Times?

- The figure illustrates how since the middle of 2012 position crowding in US Equities has increased significantly

- Historically, investing in crowded names has generated positive returns, particularly in stable, rising markets. However, when the reverse happens, it tends to be sharp and painful

FIGURE 8: Position Crowding in US Equities

Novus 'Crowdedness' Portfolio as a % of Hedge Fund Universe, 3Q12 – 3Q15

Source: Novus, Barclays Strategic Consulting analysis

  - This coincides with a significant underperformance of larger funds, evident in the difference between the 12-month rolling returns of the HFRI Fund Weighted (i.e., equally weighting all funds) and Asset Weighted (e.g., all funds are not counted equally) indices

Hedge Funds Through Hard Times?

- The 2nd commonly mentioned driver of underperformance by investors was that macro conditions worked against HFs

- HFs generate almost 10% of alpha when dispersion is high and correlation is low, conversely, when dispersion is low and correlation is high HFs only generate 0.8% of alpha

FIGURE 9: Recent Performance by Hedge Fund Size

2H11 – 1H16: HFRI Asset vs. Fund Weighted Index, 12-Month Rolling Performance Differential

FIGURE 10: Equity Alpha as a Function of Macro Conditions

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Hedge Funds Through Hard Times?

- Getmansky, Lee, and Lo (2015, ARF) also note that the avg. volatility of HFs' returns was lower in the post-crisis period, damping absolute returns even as risk-adjusted returns remained strong

- The volatility of the cross-sectionally averaged HF returns in Lipper TASS dropped from 6.5% to 4.2% before and after the crisis

- Among the individual categories, only Convertible Arbitrage funds have higher average volatilities in the post-crisis period

- This decline in volatility is likely due to lower amounts of leverage being deployed in the HF industry for several reasons:

  1 a decrease in risk appetite among investors in the aftermath of the financial crisis

  2 more stringent capital requirements on the part of regulators

  3 fewer market opportunities due to central banking interventions that have changed traditional risk/reward relations among assets, including the fact that if HFs earn a portion of their return from cash holdings, their post-crisis returns will definitely be affected by the low-interest-rate policies

Hedge Funds Through Hard Times?

- Berglund, Guidolin and Pedio (2018) examine the effects of US monetary policy during and after the Financial Crisis on HF alphas for industry as a whole and of a range of hedge strategy indices

- Formal break point tests show that for all but one strategies as well as the overall index, there is evidence of five breakpoints

- For the overall index and most of the sub-indices many of the endogenously determined breaks closely match a list of policy surprise dates that were singled out (by GSAM) as they had strongly affected financial markets

- Esp. for long-short equity, fixed income arb, dedicated short-bias, and global macro, there is a significant tendency for alphas to decline over time, following policy surprises

Bai-Perron's tests of 1 through M globally determined breaks: Hedge fund index

Sample months:	2007-01 to 2016-05
Breaking parameters:	$\alpha_i, \beta_{i,MKT}, \beta_{i,SMB}, \beta_{i,HML}, \beta_{i,MOM}, \beta_{i,\Delta10y}$, and $\beta_{i,\Delta spread}$

Test	No.
Sequential F-statistic determined breaks	5
Significant F-statistic largest breaks	5

Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value
1 *	8.3887	58.7211	58.7211	22.62
2 *	7.5215	52.6502	59.4286	20.04
3 *	5.0500	35.3502	43.3340	18.45
4 *	4.2585	29.8093	39.2254	17.19
5 *	4.5682	31.9771	44.8155	16.14

* Significant at the 0.05 level.
** Bai-Perron's (Econometric Journal, 2003) critical values.

Estimated break dates

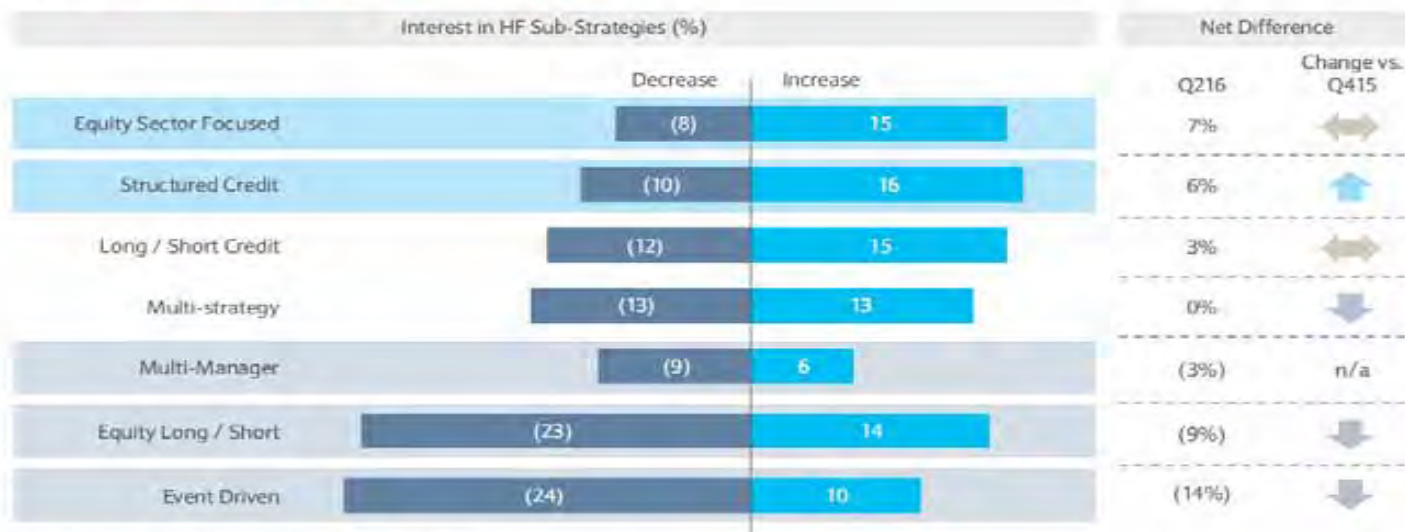|					
1:	2008-01				
2:	2008-01	2009-02			
3:	2008-01	2009-05	2011-10		
4:	2008-01	2009-05	2011-10	2013-02	
5:	2008-01	2009-05	2011-10	2013-02	2015-06

Hedge Funds Through Hard Times?

- Not all HF styles are suffering in the same way...

FIGURE 19: Investors' HF Strategy Preferences (I / II)

| | Interest in HF Sub-Strategies (%) | | Net Difference | |
	Decrease	Increase	Q216	Change vs. Q415
Systematic / CTA	(2)	27	25%	⬆
Quant Equity	(3)	27	24%	⬆
Distressed Credit	(7)	24	17%	⬆
Equity Market Neutral	(9)	25	16%	⬇
Equity Emerging Market	(3)	18	15%	⬌
Macro	(10)	25	15%	⬌
Fixed Income Relative Value	(6)	15	9%	⬌

Source: All figures refer to Barclays Strategic Consulting analysis

FIGURE 20: Investors' HF Strategy Preferences (II / II)

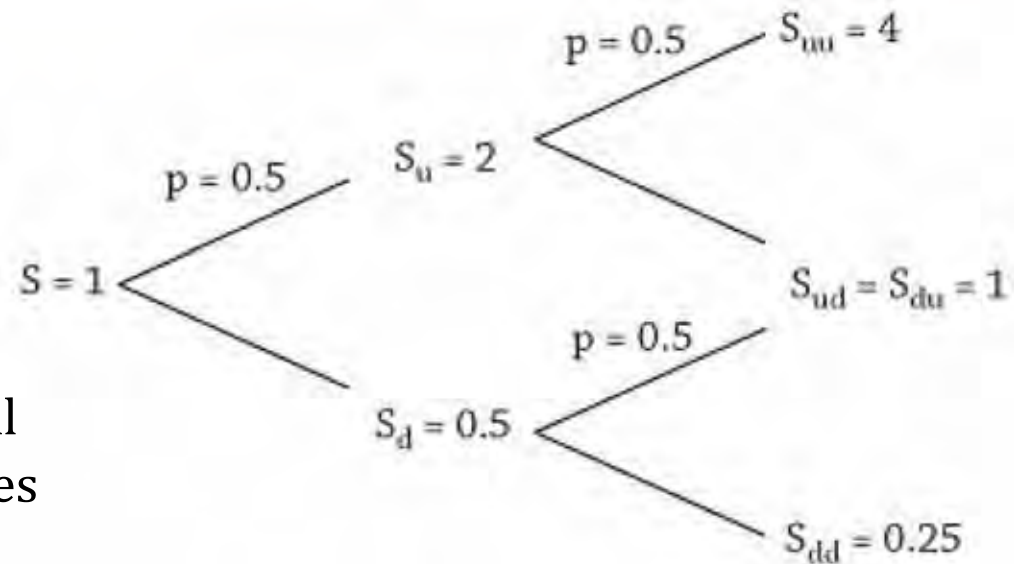| | Interest in HF Sub-Strategies (%) | | Net Difference | |
	Decrease	Increase	Q216	Change vs. Q415
Equity Sector Focused	(8)	15	7%	⬌
Structured Credit	(10)	16	6%	⬆
Long / Short Credit	(12)	15	3%	⬌
Multi-strategy	(13)	13	0%	⬇
Multi-Manager	(9)	6	(3%)	n/a
Equity Long / Short	(23)	14	(9%)	⬇
Event Driven	(24)	10	(14%)	⬇

Source: All figures refer to Barclays Strategic Consulting analysis

Appendix A: Portfolio Rebalancing is a Short Put
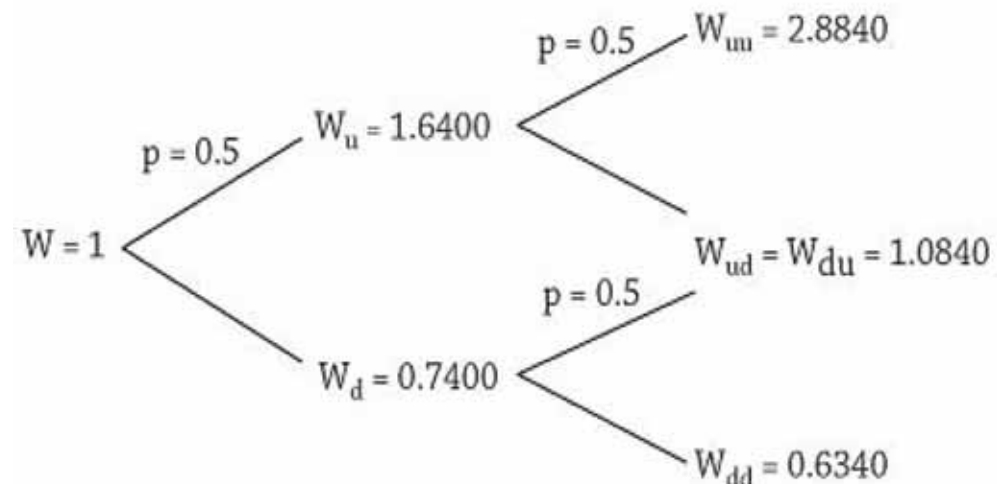
- Suppose that a stock follows a binomial tree

  - Each period the stock can double, with prob. 0.5, or halve starting from an initial value of S = 1

  - There are two periods, so there are three final nodes

  - At maturity, there are three potential payoffs of the stock have probabilities of 0.25, 0.5, and 0.25, respectively

  - In addition, the investor can hold a risk-free bond that pays 10%

  - Let us first consider a buy-and-hold strategy that starts out with 60% equities and 40% in the risk-free asset

  - At the end of the 1st period, the wealth of this investor can increase or decrease to which is shown by branching of the tree

Stock Dynamics

$S = 1$

$p = 0.5$ — $S_u = 2$

$p = 0.5$ — $S_{uu} = 4$

$S_{ud} = S_{du} = 1$

$p = 0.5$

$S_d = 0.5$

$p = 0.5$

$S_{dd} = 0.25$

Wealth of the Buy-and-Hold Strategy

$W = 1$

$p = 0.5$ — $W_u = 1.6400$

$p = 0.5$ — $W_{uu} = 2.8840$

$W_{ud} = W_{du} = 1.0840$

$p = 0.5$

$W_d = 0.7400$

$p = 0.5$

$W_{dd} = 0.6340$

What Do We Know About Hedge Funds? – Prof. Guidolin
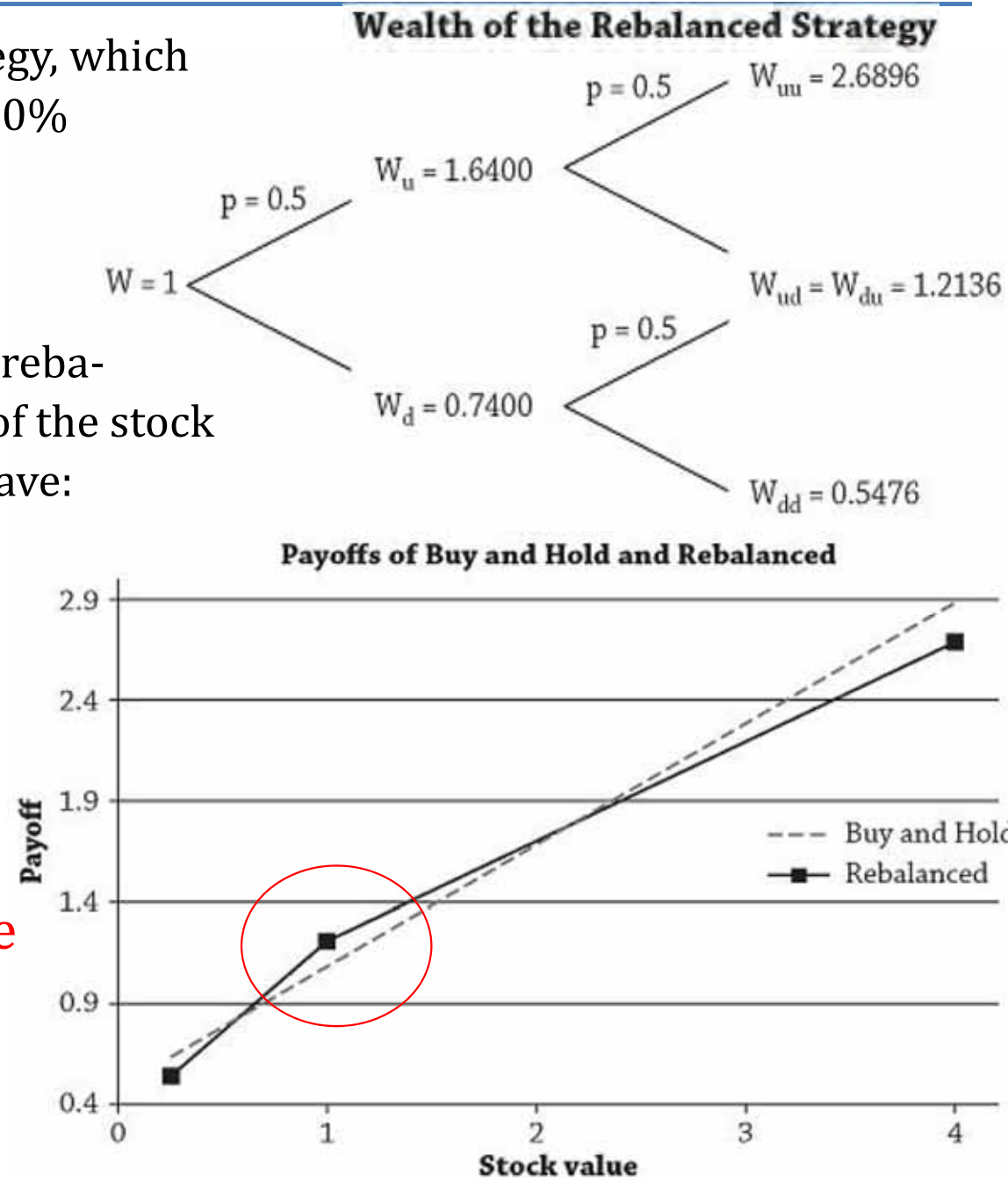
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Appendix A: Portfolio Rebalancing is a Short Put

- The optimal rebalanced strategy, which rebalances at time 1 back to 60% equities and 40% bonds gives the following tree

- If we plot the payoffs of the buy-and-hold strategy vs. the reba-lanced strategy as a function of the stock value at maturity time 2 we have:

- The gains and losses on the buy-and-hold position are linear in the stock price

- The payoffs of the rebalanced strategy are concave over the stock price

- **This nonlinear pattern of the rebalancing strategy can be equivalently generated by short option positions**

Wealth of the Rebalanced Strategy

$W = 1$

$p = 0.5$ → $W_u = 1.6400$

$p = 0.5$ → $W_{uu} = 2.6896$

$W_u = 1.6400$, $p = 0.5$ → $W_{ud} = W_{du} = 1.2136$

$W_d = 0.7400$

$p = 0.5$ → $W_{dd} = 0.5476$

Payoffs of Buy and Hold and Rebalanced

- - - Buy and Hold
- ■ - Rebalanced

Payoff (y-axis): 0.4, 0.9, 1.4, 1.9, 2.4, 2.9

Stock value (x-axis): 0, 1, 2, 3, 4

Appendix A: Portfolio Rebalancing is a Short Put

- If we add a
  _ short European call (with strike $3.6760 maturing at time 2),
  _ a short European put (with strike $0.4660),
  _ the long bond position, and
  _ the buy-and-hold strategy,
  we get identical payoffs to the rebalancing strategy at time 2:

Strategy	time 0	time 2		
		$S_{uu} = 4$	$S_{ud} = S_{du} = 1$	$S_{dd} = 0.5$
Sell Put	+0.0643	0	0	−0.2160
Sell Call	+0.0428	−0.3240	0	0
Buy Bonds	−0.1071	0.1296	0.1296	0.1296
Buy-and-Hold Strategy	1.0000	2.8840	1.0840	0.6340
Short Volatility + Bonds + Buy and Hold	1.0000	2.6896	1.2136	0.5476
Rebalanced Strategy	1.0000	2.6896	1.2136	0.5476

- **A short volatility position that is financed by bonds together with the buy-and-hold strategy is identical to the rebalanced strategy**
  - The rebalancing strategy is an active strategy that transfers payoffs from the extreme low and high realizations to middle stock realization

Appendix A: Portfolio Rebalancing is a Short Put

- o Rebalancing does this by selling when stock prices are high and buying when stock prices are low

- o Short volatility positions do exactly the same

- o A short call option can be dynamically replicated by a short stock position and a long bond position: this buys equity when stock prices fall and sells equity when stock prices rise.

- o Likewise, a short put is also dynamically replicated by selling equity when prices rise and buying when prices fall

- o These are exactly the same actions as rebalancing.

- ■ **The benefit to rebalancing is investor specific: moving the payoffs from the extreme stock positions back to the center is optimal for the investor because it cuts back on risk**

  - o Because rebalancing is short volatility, it automatically earns the (negative) volatility risk premium; shorting negative premium $\Rightarrow > 0$

  - o In moving the payoffs to the center, rebalancing increases the losses during extreme low markets, and underperforms the buy-and-hold strategy during extreme high markets and profits from reversals

Appendix B: Autocorrelation of Returns and Illiquidity

- In an efficient market, returns should be approximately serially uncorrelated: past returns should contain little information on future

- Otherwise information can be exploited via trading strategies that buy (shortsell) securities with positive (negative) return forecasts
  - The very process of exploiting this information will tend to reduce, if not eliminate entirely, any return autocorrelation

- The only two reasons such information cannot be exploited and, therefore, eliminated, are: (1) if the autocorrelation is due to time-varying equilibrium expected returns; and (2) if the autocorrelation cannot be exploited due to trading frictions, i.e., illiquidity

- (1) is unlikely for shorter-horizon holding periods such as monthly or daily returns given the definition of equilibrium expected returns

- Hence (2) is the likely explanation for significant return autocorrelation: because information about the underlying asset diffuses over time and investors with early access to this information cannot exploit it because the asset cannot be traded quickly, and/or cannot be traded in large size, and/or cannot be traded without moving the price significantly

Appendix B: Autocorrelation of Returns and Illiquidity

- Khandani and Lo (2011, QJF) establish a link between illiquidity and positive autocorrelation in asset returns among a sample of HFs, MFs, and various equity portfolios

- For HFs, this link can be confirmed by comparing the return auto-correlations of funds with shorter vs. longer redemption-notice periods

- They also document significant positive return-autocorrelation in portfolios of securities that are generally considered less liquid, e.g., small-cap stocks, corporate bonds, mortgage-backed securities, and emerging-market investments

- They construct autocorrelation-sorted long/short portfolios and conclude that illiquidity premia are generally positive and significant, ranging from 2.74% to 9.91% per year

- They do not find evidence for this premium among equity and MFs, or among the 100 U.S. equity portfolios

Asset class returns versus illiquidity

Average return (y-axis: 0 to 18)

illiquity estimate (increasing illiquidity to the right -->) (x-axis: 0 to 6)

Labeled points: HY bonds, Emerging debt, US FI, Global sovereigns, Emerging equity, Cash, Commodities, Small cap, Hedge, Global infra., Global REITs, Dev'd Market Equity, Venture capital, Buyouts, Timber, FoF, US RE