Challenges and opportunities in quantitative equity investing

CCFEA 10th Anniversary

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Quant equity landscape 10 years ago

> Generic paradigm

> > Stock forecasts based on simple and widely used measures (value and momentum)

> > Highly standardized and commercially available risk models

> > Mean-variance portfolio optimisation

> > Fixed monthly rebalancing

> > Static models

> > See Foley(2010) for more details

> These investment strategies were very profitable and exhibited low volatility

> Behavioural finance arguments were used to explain why these profits existed:

> > behavioural biases in human traders create inefficiencies in markets, which can be exploited using a quantitative investment process

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Value: buying cheap stocks, shorting expensive ones

Europe Quintile portfolios - 31Jan00 to 31Jul07
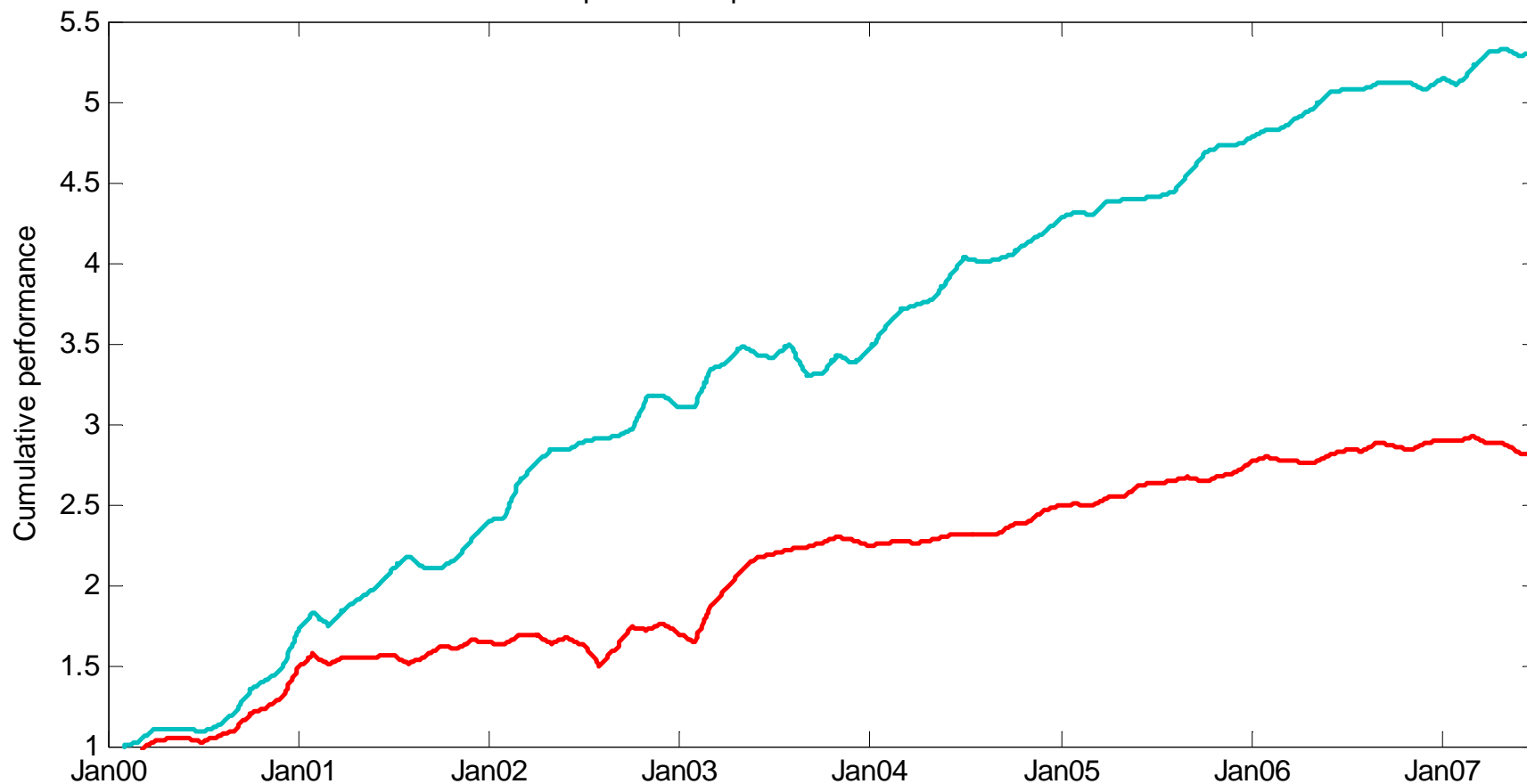
	Return	Risk	Sharpe
Book to Price	13.71%	12.95%	1.06
Forward Earnings Yield	22.21%	13.14%	1.69

Source: OMAM

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Momentum: buying winners, shorting losers

Europe Quintile portfolios - 29Aug03 to 31Jul07

	Return	Risk	Sharpe
Momentum 12m	12.02%	7.13%	1.69

Source: OMAM

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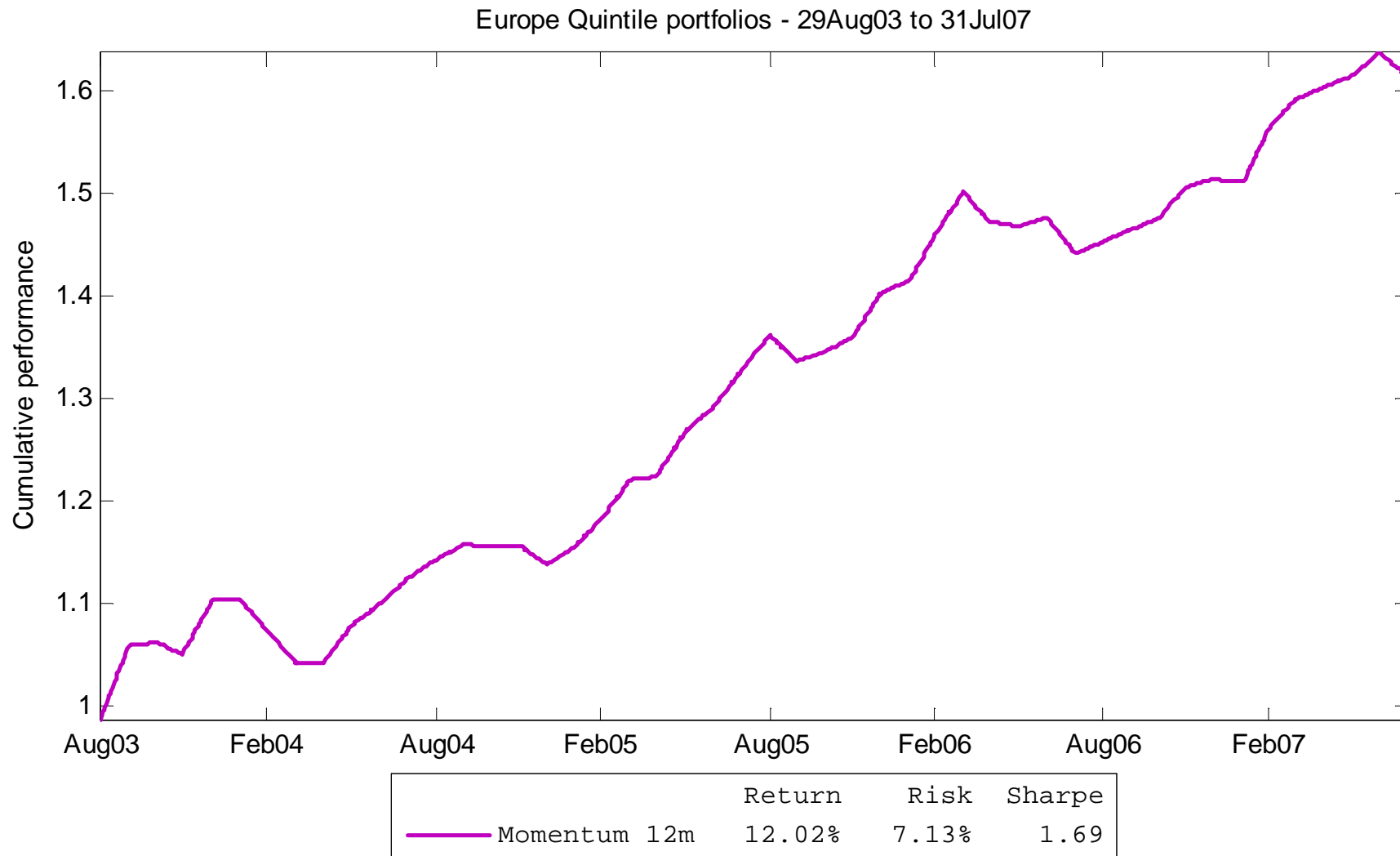
Growth of equity hedge funds
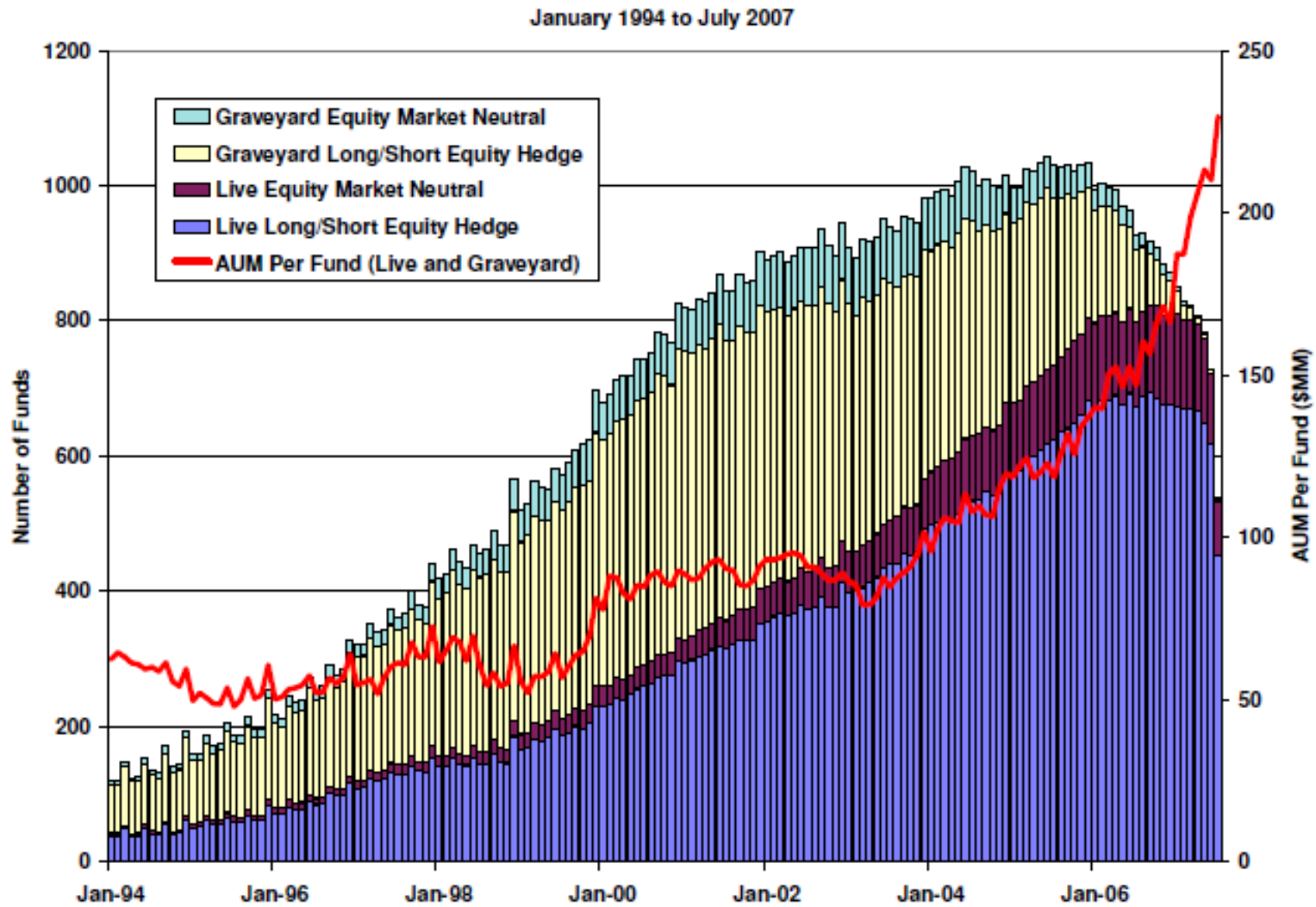
Source: TASS hedge fund database, in Khandani and Lo (2007)

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# Reduced profitability as assets grew. Sign of over-crowding?
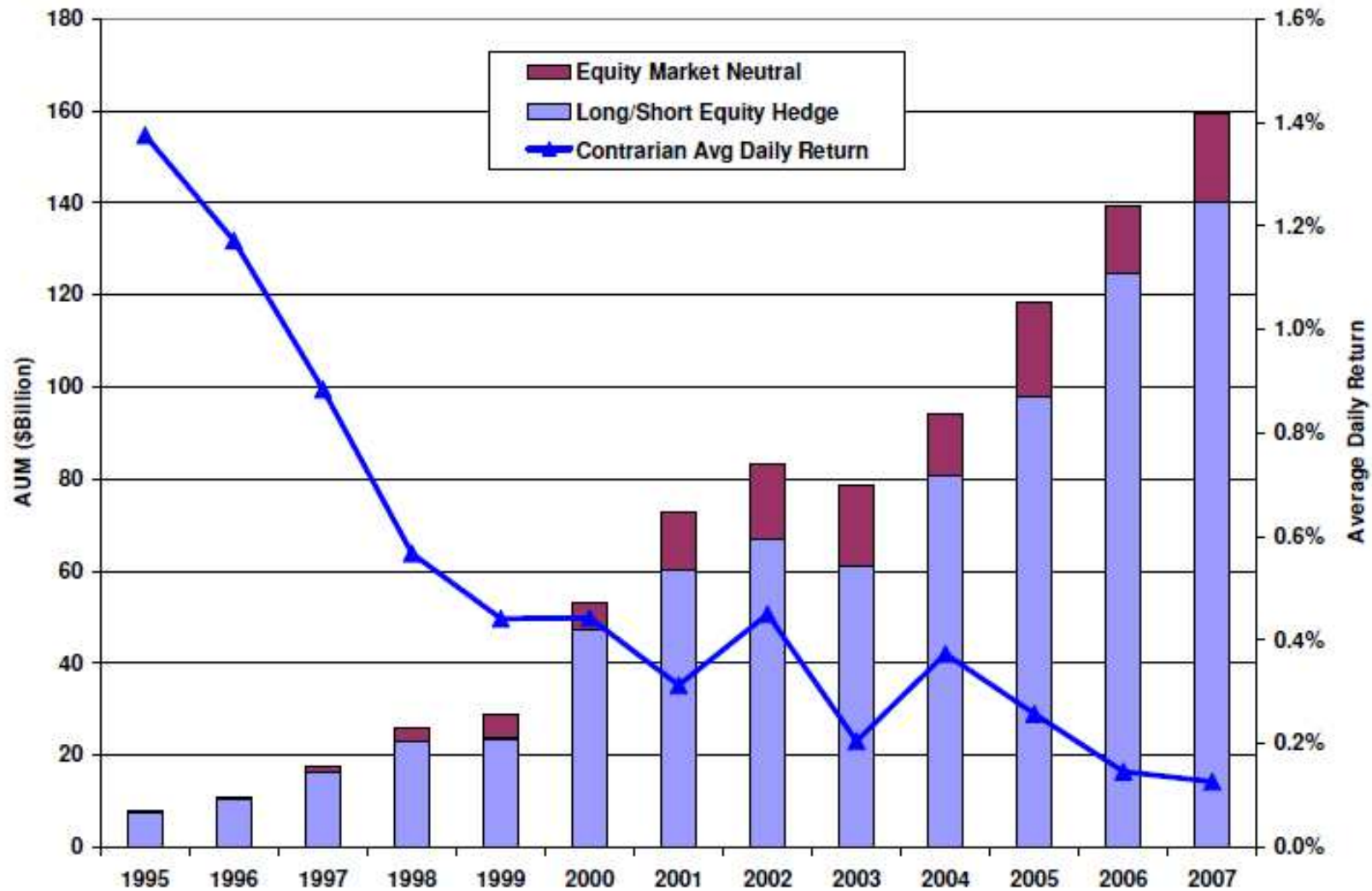
Source: Khandani and Lo (2007)

August 2007

> Turning point for quant managers, known as "Quantmare"

> During the week 6th Aug 2007, a number of very successful quant hedge funds suffered unprecedented losses

> > 25-standard deviation moves, several days in a row" (Goldman Sachs CFO)

> Hypothesis of a sudden liquidation of quant equity market neutral funds. (Khandani and Lo, 2007)

> Initial losses put pressure on a broader set of funds, triggering stop-loss and de-leveraging policies, causing a spiral of further losses

> Large losses during three consecutive days (7th to 9th August)

> Strategy sharply recovered on 10th August

> Those with the courage and credit lines to maintain positions ended the month roughly flat

> But those who de-leveraged, crystallized huge losses.

> Sudden realisation by the quant community of how crowded the space had become

August 2007 daily returns: cumulative loss of -25%
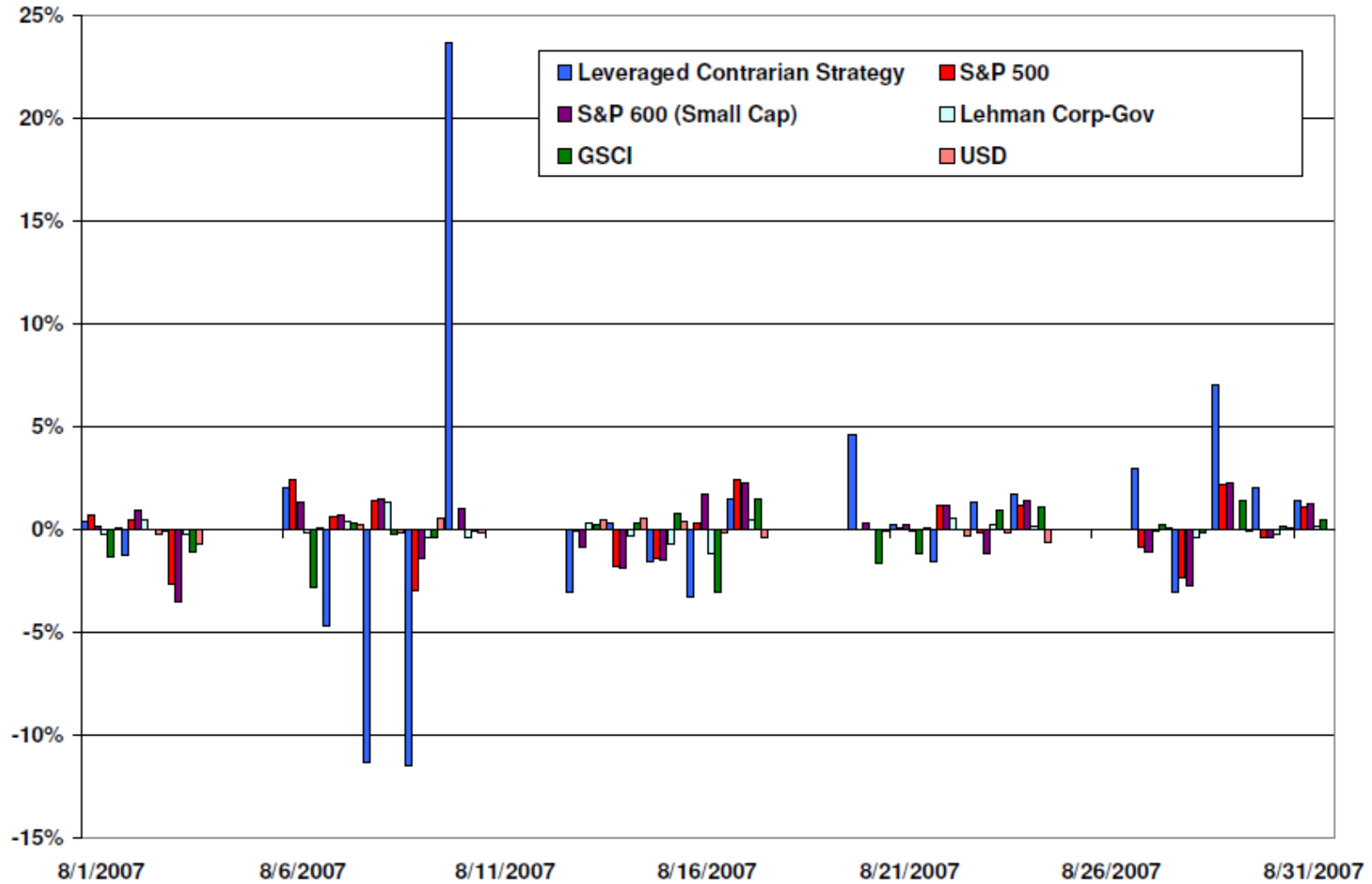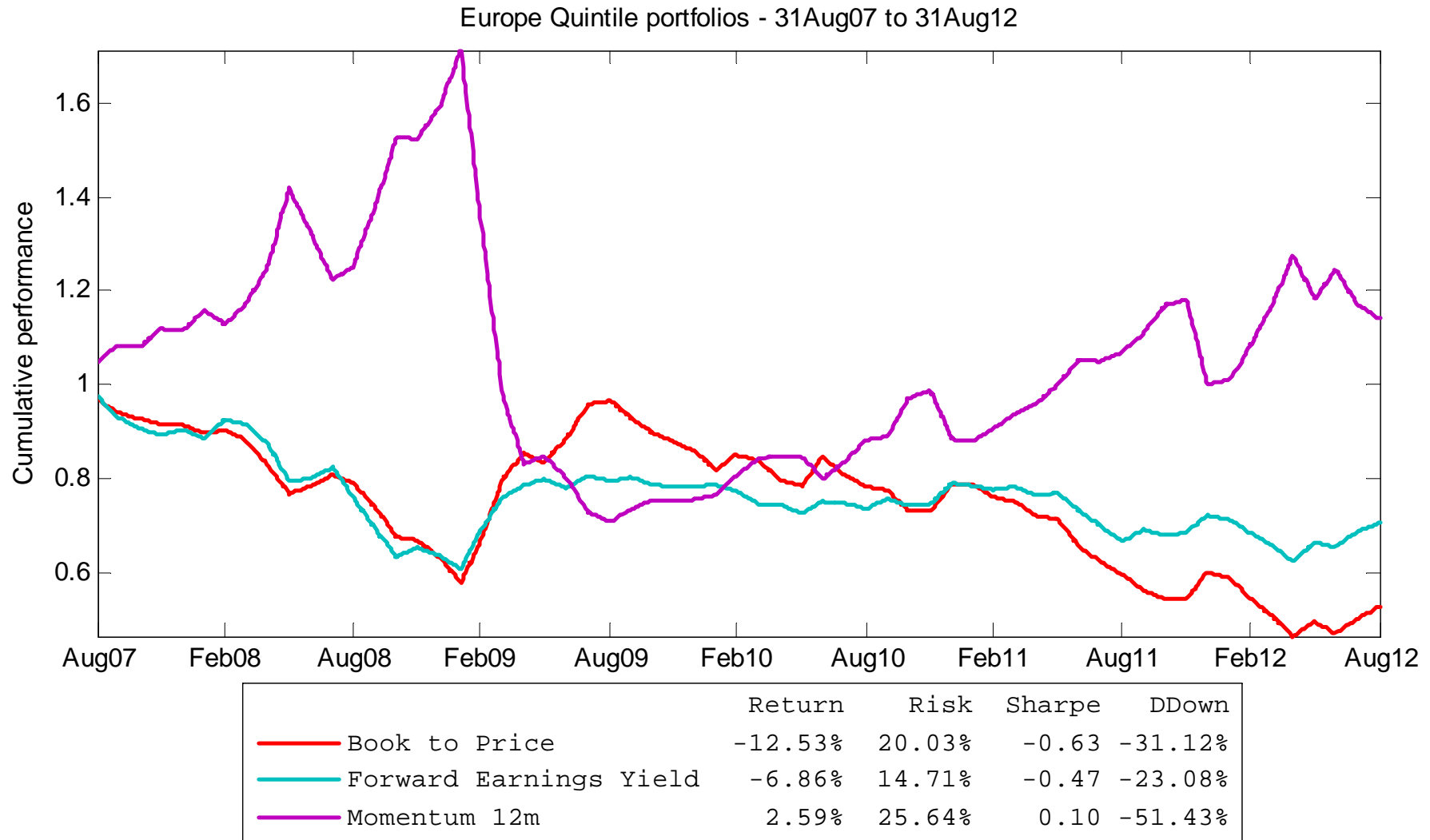

Source: Khandani and Lo (2007)

Consequences of the financial crisis?

> The Quantmare may have been an indirect consequence of the financial crisis:

> > No obvious link between what was happening in the sub-prime mortgage market, which should have an effect on equity market neutral investments

> > But likely that multi-strategy funds, suffering losses in credit related strategies, had to unwind their equity market neutral holdings to provide liquidity

> A more direct consequence of the financial crisis was the long and damaging decline of the profitability of value factors, to which most quants were heavily exposed as:

> > It had been a very profitable strategy

> > It had performed with low risk, so attractive for risk models

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Post August 2007: Performance of quant strategies

Europe Quintile portfolios - 31Aug07 to 31Aug12

	Return	Risk	Sharpe	DDown
Book to Price	-12.53%	20.03%	-0.63	-31.12%
Forward Earnings Yield	-6.86%	14.71%	-0.47	-23.08%
Momentum 12m	2.59%	25.64%	0.10	-51.43%

Source: OMAM

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With the benefit of hindsight, what went wrong?

> Mistaking risk factors by alpha strategies

>> profits from popular quant strategies were actually cyclical risk premiums that can be profitable during long periods of time, but become positively correlated as markets fall

>> For example, value returns were part compensation from bearing distress risk

>> Diversification failed you when you most needed it

> Over-reliance in behavioural finance

>> It has been a great challenger of traditional finance and market efficiency

>> But, can we believe investors in aggregate so naïve?

> A disconnect between what computational finance can do, and financial theory

>> Having the quant tools is not enough, there needs to be a good understanding of risk and return associated with an investment strategy, and what are its fundamental drivers

>> Over-reliance on historical backtests

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Quant landscape post 2007 – adaptation and evolution

> Managers that survived have had to evolve:

> > Higher Frequency Trading (HFT) strategies

> > Dynamic models

> > Exploring new datasets

> > Usage of quantitative skills to offer different products

> > – Minimum variance

> > More sophisticated modelling
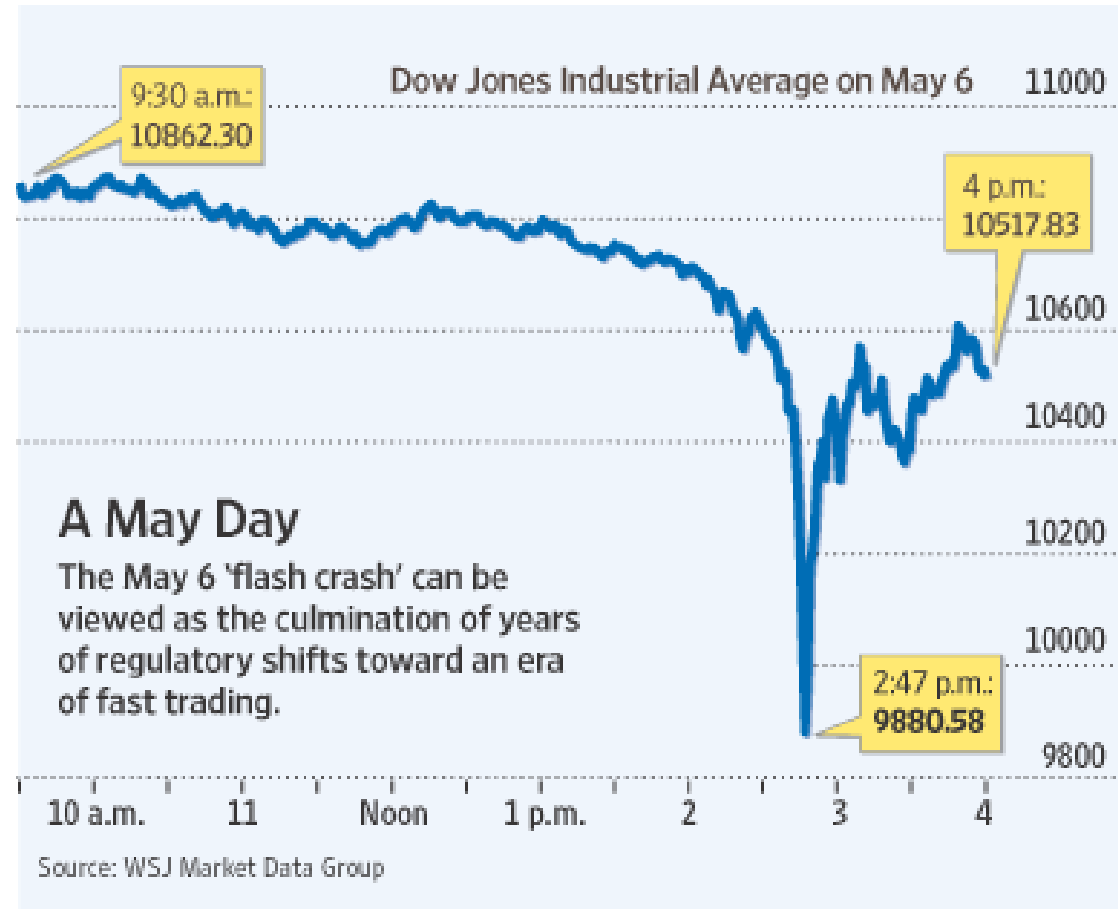
> > – Non linear approaches

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High Frequency Trading (HFT)

> Some quant managers moved from traditional medium term stock selection strategies to higher frequency trading, which are significantly less risky

>> Attractiveness of working with large datasets

>> Able to mitigate traditional sources of risk

>> Resulting in very high Sharpe ratios

> However, HFT comes with its own challenges:

>> Over-crowding

>> Capacity constraints

>> Arms race towards low latency

>> Pressure from regulators

>> Falling equity volumes

>> Risk of large losses in a flash crash event

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Flash crash: different "scale" and players, but similarities with Aug07

> Dow Jones fell by 1000 points, but losses reversed within minutes

> Some similarities to August 2007, many players using similar strategies may create instability

> According to SEC report:

  > "under stressed market conditions… interaction between automated execution programs and algorithmic trading strategies can result in disorderly markets"

> According to Foresight report:

  > "HFT actually improves liquidity, reduces transaction costs and leads to more efficient pricing."

Dow Jones Industrial Average on May 6

9:30 a.m.: 10862.30

4 p.m.: 10517.83

2:47 p.m.: 9880.58

A May Day

The May 6 'flash crash' can be viewed as the culmination of years of regulatory shifts toward an era of fast trading.

10 a.m.   11   Noon   1 p.m.   2   3   4

Source: WSJ Market Data Group

11000
10600
10400
10200
10000
9800

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Moving from Static models to Dynamic models
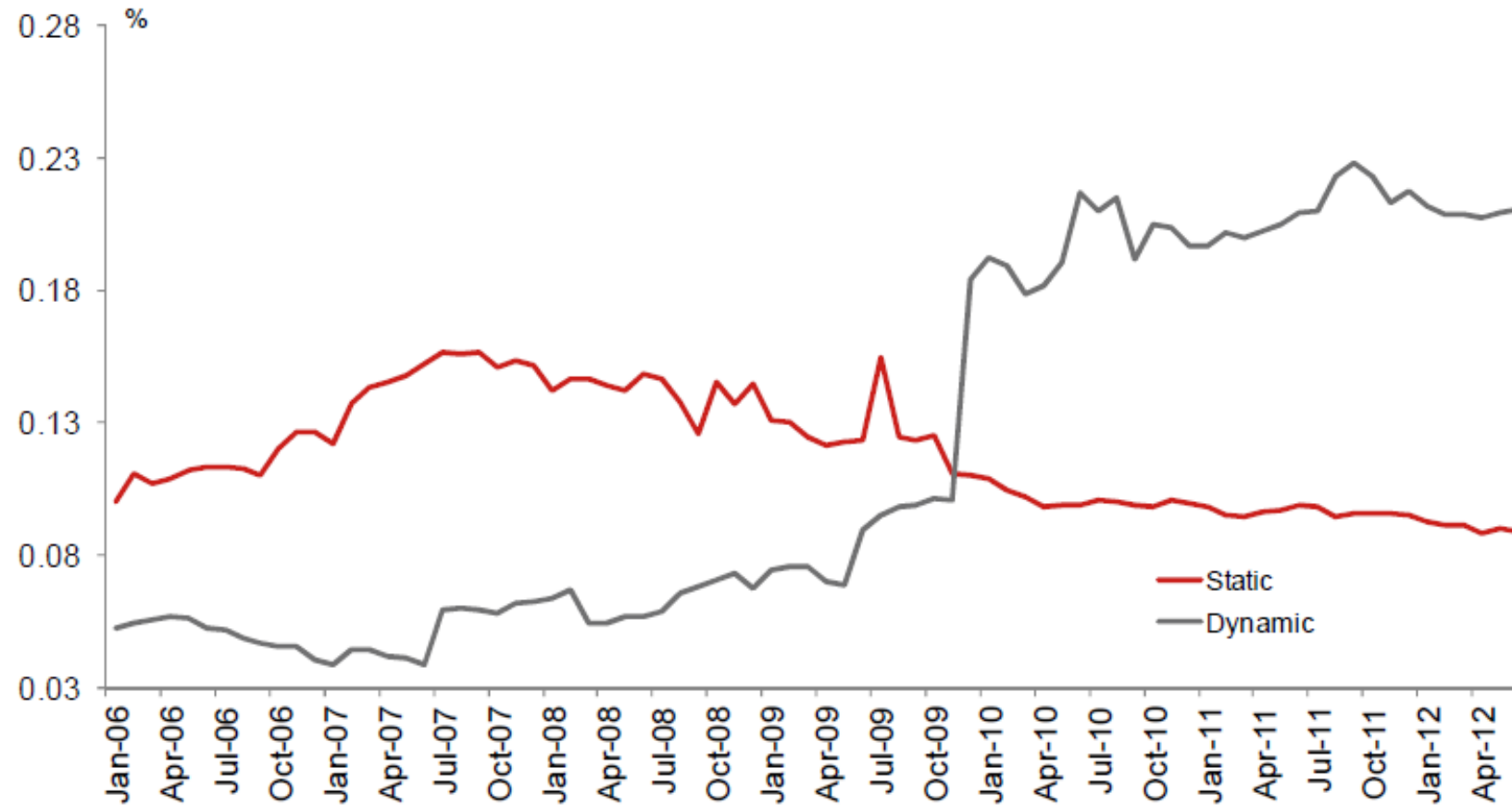
Percentage AUM as a share of active equity funds

Source: Nomura Strategy research

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Exploring new datasets

> Traditional quant models are build using:

> > Stock prices

> > Accounting data

> > Analyst estimates

> After August 2007, managers started looking for new data sources to help avoid overcrowding

> Examples of new datasets:

> > Short selling data

> > Director's dealings

> > Real time measurement of retailers sales from foot traffic in malls

> > Daily inflation index (The Billion Prices Project @MIT)

> > News analytics

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Exploring new datasets. Example: news analytics

> Company news plays an important role on movements of a stock price

> There is a limits on how many news stories a human trader can read in a given day.

  > Only feasible if a trader is following a small number of stocks

> Statistical algorithms (such as Natural Language Processing) can compute numeric scores for a story almost in real time

  > Sentiment, Relevance, Novelty, etc

> Opens up a new data source – textual data – that was previously impossible to use in a systematic fashion

> Originally used in-house by high frequency traders, with high data costs and technology costs

> Now specialist providers, such as Ravenpack, make this data widely available

> Mixed evidence to date of whether it can add value to low frequency investing, but promising

> As always, danger of over-crowding and alpha being arbitraged away

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Opportunity to offer new products

> Opportunity to apply quantitative techniques to provide new investment products

> Traditional quant investing mostly focused on alpha generation

> A recent success story (in terms of asset gathering) has been minimum variance

> There are different approaches, but generally involves holding stocks with lowest volatility.

>> Moving away from market capitalisation based indeces

>> Studies have shown low volatility stocks outperform in the long run

>> Most of the benefit may come from avoiding high volatility stocks?

>> But Finance 101 tells us that high risk should be compensated by high return?

>> Lack of academic understanding/consensus of why it should work

> But this strategy has attracted many investors looking to shelter away from equity volatility

> Size of funds in this space estimated to be $50 to $100bn, even ETFs available.

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Minimum variance – an accident waiting to happen?

> Historically, low volatility (boring) stocks have traded at low valuations, while high volatility (glamour) stocks have traded at high valuations

> But currently, low volatility stocks are trading at very high relative valuations, due to the high demand from minimum variance funds.

> Risk of overcrowding?
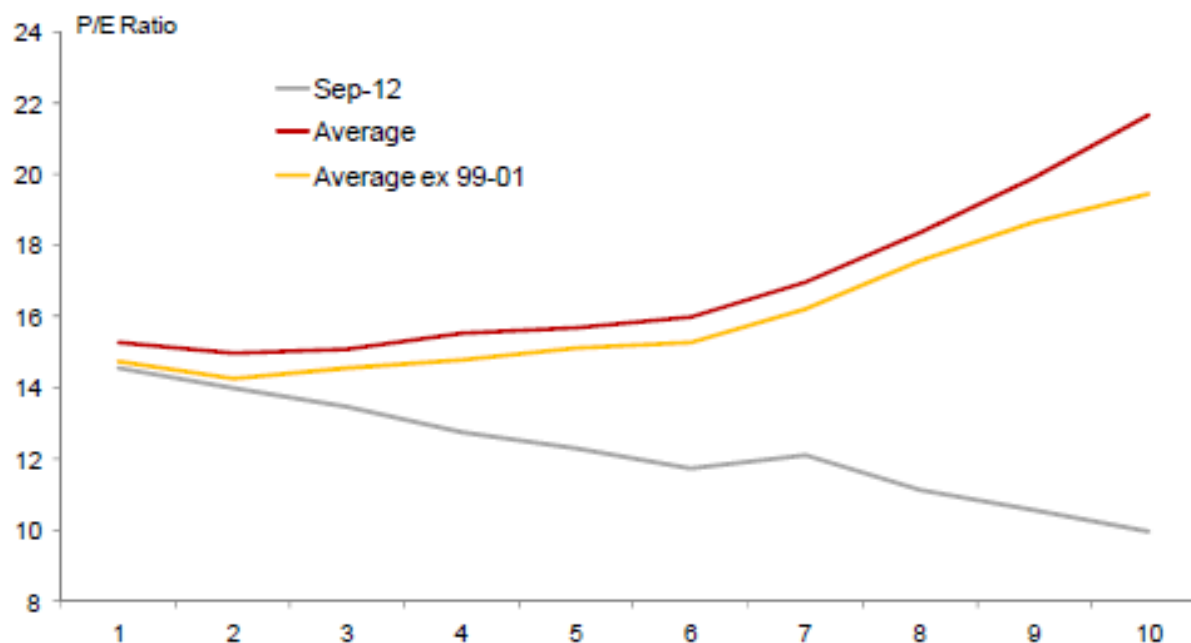
Source: Nomura

More sophisticated modelling: moving away from linear models

> Most traditional academic models assume relationships are linear:

> > Stock returns are linearly related to risk premiums through their factor sensitivities

> CAPM: security market line describes a LINEAR relation between the beta of a stock and the stock expected rate of return

> This linear approach was then used in multi-factor models (Fama French, Fama McBeth), and was widely adopted by quants when modelling stock returns

> > Beta, Size, Value, Momentum, Liquidity, etc

> Multivariate linear modelling has very attractive econometric properties, but investment decisions tend to happen at the tails of the distribution

> Linear assumptions are hard to justify

> > Finding factors that behave monotonically is already difficult

> > On top of that, enforcing linearity?

The failure of linear assumptions in asset pricing models?

Europe Quintile portfolios - 31Jan00 to 31Aug12
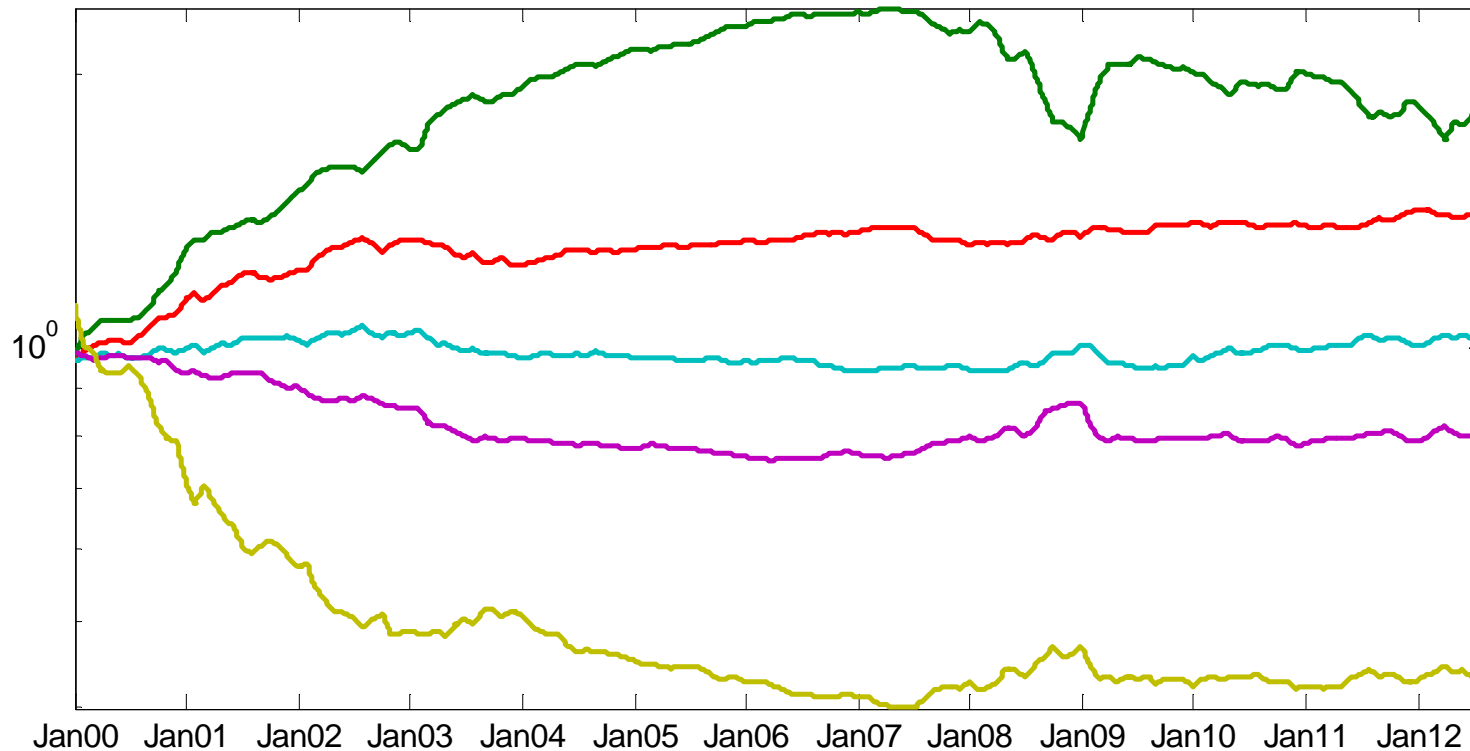
		Retu	Risk	Shar	Sort
—	1 – Very cheap	21.0	15.9	1.3	2.2
—	2 – Cheap	11.9	7.7	1.6	2.6
—	3 – Neutral	0.6	6.9	0.1	0.1
—	4 – Expensive	-8.2	7.8	-1.1	-1.3
—	5 – Very expensive	-28.9	17.4	-1.7	-1.9

Source: OMAM

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More sophisticated modelling: non-linear models

> Some non-linear models, such as Artificial Neural Networks (ANN), while highly successful in some real life applications, such as hand writing recognition, have had little traction in finance due to lack of transparency.

> Decision tree based models, such as Regression Trees or Genetic Programming, are more suitable for financial modelling, as the rules are transparent to user, and allow expert knowledge

> CCFEA pioneered some of the research in this area, with EDDIE, a genetic programming based approach to forecasting in finance (see Tsang, Li, Butler (1998) and Tsang, Markose, Er (2005)

> These modelling approaches have had some traction within the industry, but their application is still quite niche.

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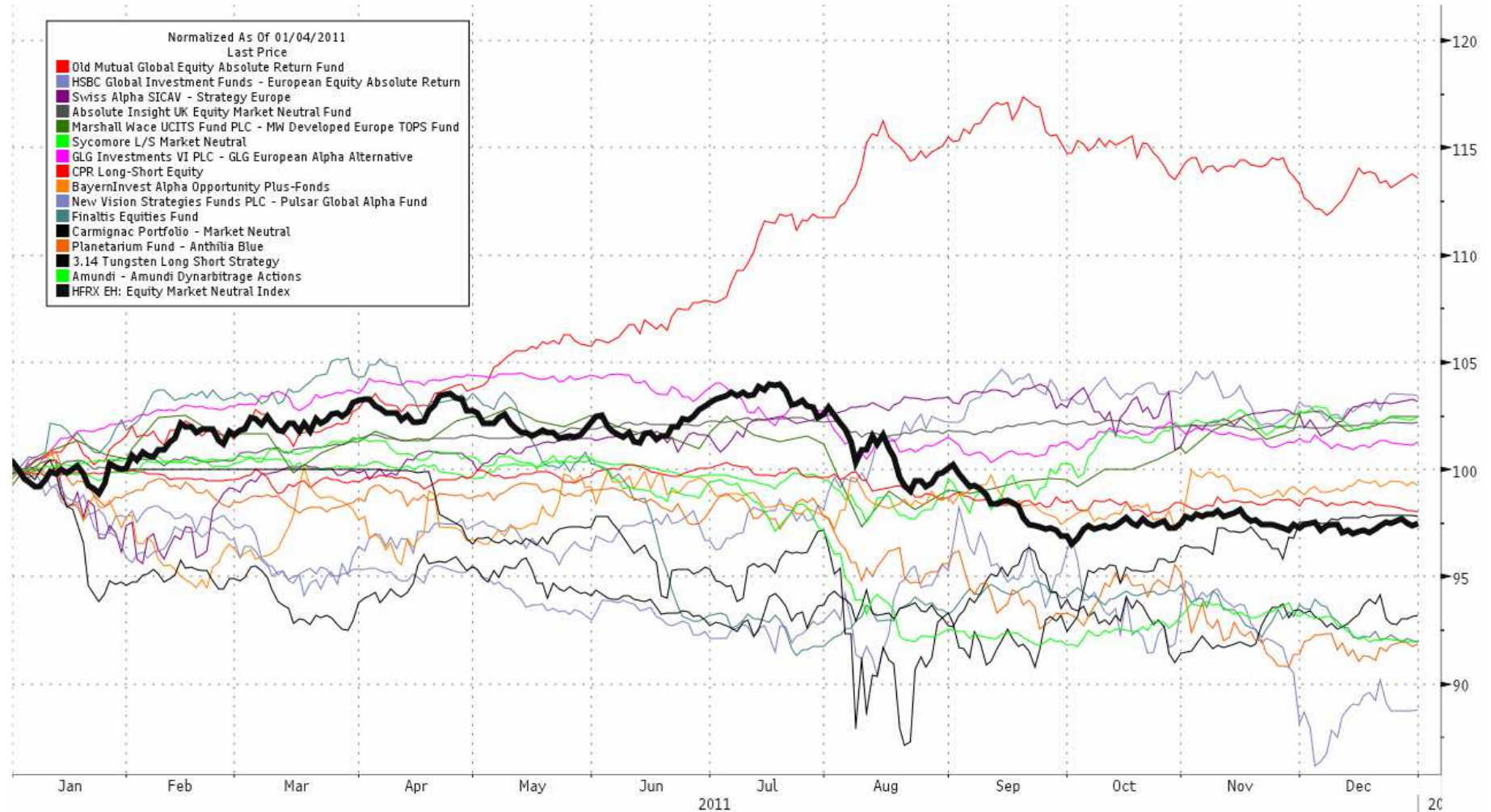# Example: stock selection decision tree for tech stocks
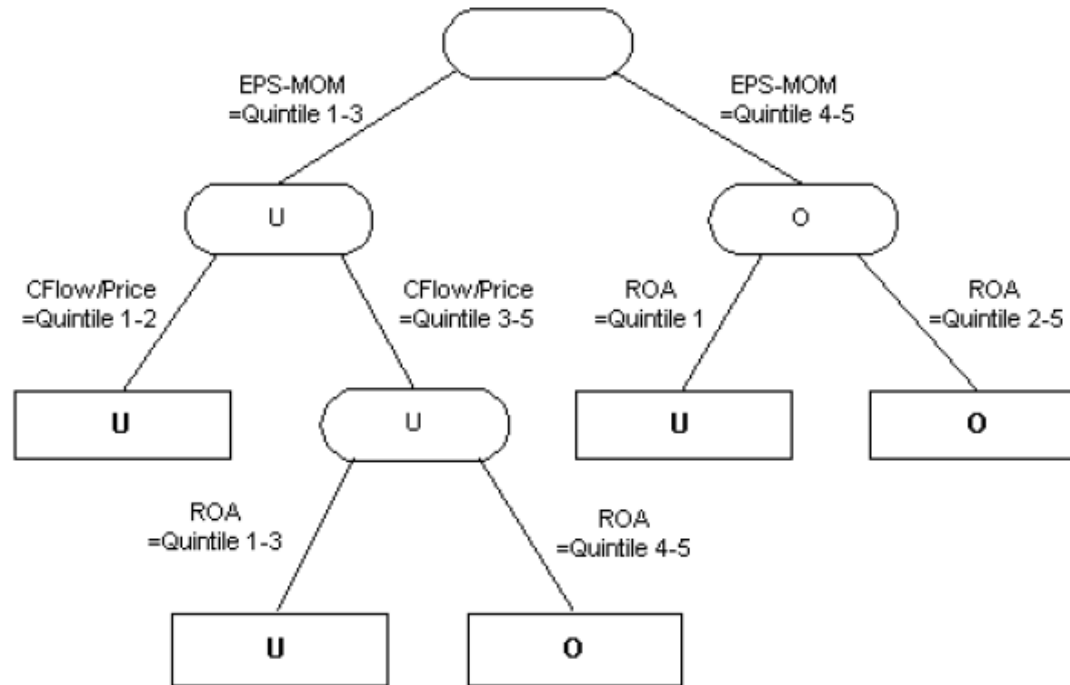
Key:
U : Underperformance
O : Outperformance

Definition of Terms:
EPS-MOM: 12-Week Change in Consensus Forecasted Earnings
ROA: % Change in ROA
CFlow/Price: Cash Flow to Price Ratio

Source: Citi Investment Research and Analysis

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Today: adaptation has resulted in a more diverse "ecosystem"

Normalized As Of 01/04/2011
Last Price

- Old Mutual Global Equity Absolute Return Fund
- HSBC Global Investment Funds - European Equity Absolute Return
- Swiss Alpha SICAV - Strategy Europe
- Absolute Insight UK Equity Market Neutral Fund
- Marshall Wace UCITS Fund PLC - MW Developed Europe TOPS Fund
- Sycomore L/S Market Neutral
- GLG Investments VI PLC - GLG European Alpha Alternative
- CPR Long-Short Equity
- BayernInvest Alpha Opportunity Plus-Fonds
- New Vision Strategies Funds PLC - Pulsar Global Alpha Fund
- Finaltis Equities Fund
- Carmignac Portfolio - Market Neutral
- Planetarium Fund - Anthilia Blue
- 3.14 Tungsten Long Short Strategy
- Amundi - Amundi Dynarbitrage Actions
- HFRX EH: Equity Market Neutral Index

Source: Bloomberg

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To summarise…

> Opportunities

  > Focus on original and proprietary ideas, to avoid correlation with other quant managers

  > Identify and control systematic risks (alpha vs beta)

  > Ability to constantly innovate and challenge own assumptions

  > Consider macroeconomic environment

  > More sophisticated models

> Challenges

  > Successful strategies will attract new managers and will risk becoming crowded

  > Ever present risk of over-fitting history and over-reliance in past performance

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References

> Foley, T. (2010) "Programmed Obsolence: The generic paradigm in Quantitative Equity Investing and why it's in trouble". DE Shaw white paper.

> Khandani, A. E. and Lo, A. W. (2007) "What Happened to the Quants in August 2007?", MIT working paper

> SEC (2010) "Findings regarding the market events of May 6, 2010"
http://www.sec.gov/news/studies/2010/marketevents-report.pdf

> Tsang, E.P.K., Li, J. & Butler, J.M., (1998). EDDIE beats the bookies, International Journal of Software, Practice & Experience, Wiley, Vol.28 (10), 1033-1043.

> Tsang, E.P.K., Markose, S., Er, H. (2005) "Chance discovery in stock index option and future arbitrage", New Mathematics and Natural Computation, World Scientific, Vo. 1, No. 3

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Thank you!