Discussion of:

Turning Alphas into Betas: Arbitrage and the Cross-Section of Risk

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2019 AFA Meetings
January 3, 2019

Columbia Business School

Model

- Three periods, $t \in \{1, 2, 3\}$; "rationality" at $t = 3$.
- *Agents:* (Risk Neutral) Behavioral Investors; RN Arbitrageurs
  - RN Arbs (in measure μ) have capital k_1 and (uncertain) k_2,
  - faces margin requirement of 1 on all positions,
  - must liquidate if wealth at $t = 2$ goes negative, which ...
  - ... induces effective risk-aversion.
- *Assets:* (1) $r_f = 0$, and (2) a continuum of risky anomaly assets $i \in [0, 1]$ in zero-net-supply
- Aggregate Behavioral Investor demand for i at t is:

$$B_{i,t} = \mathbb{E}_t[r^e_{i,t+1}] - \phi \cdot i$$

  - ϕ captures overall level of irrationality.

Model

- *When arbitrageurs are absent* (when $\mu = 0$):

$$r^e_{i,t+1} = \underbrace{\phi \cdot i}_{\alpha_i} + \tilde{\epsilon}_{i,t}$$

  where $\tilde{\epsilon}_{i,t}$ is mean-zero, idiosyncratic risk.
- *When arbitrageurs are unconstrained* ($k_1, k_2 \geq 1$, for $\mu = \frac{\phi}{2}$):

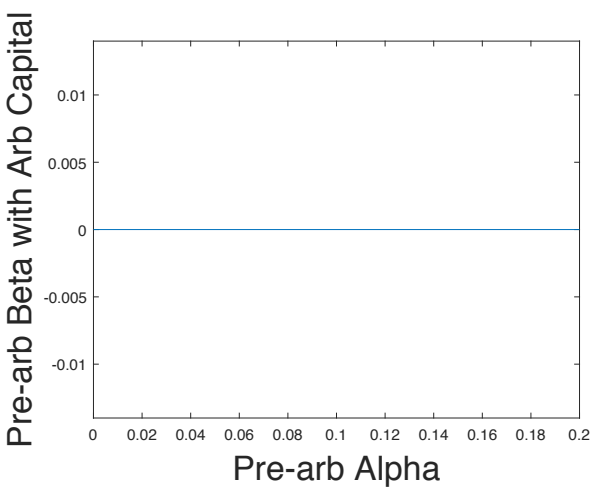
$$r^e_{i,t+1} = \tilde{\epsilon}_{i,t}$$

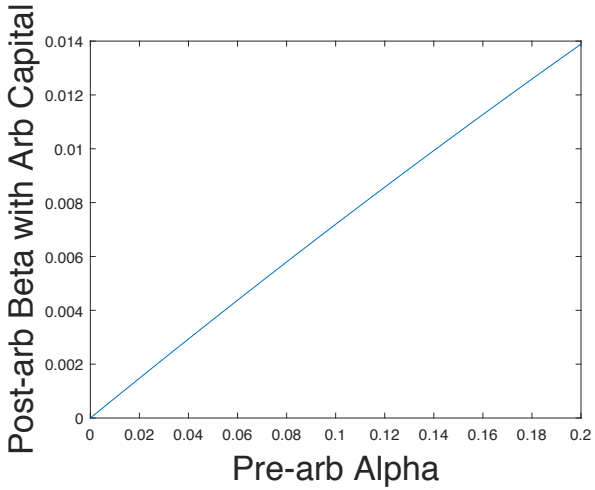
  i.e., $\alpha_i = 0 \ \ \forall \ \ i$.
- However, when $k_2 \in [0, 1)$ with non-zero conditional probability:

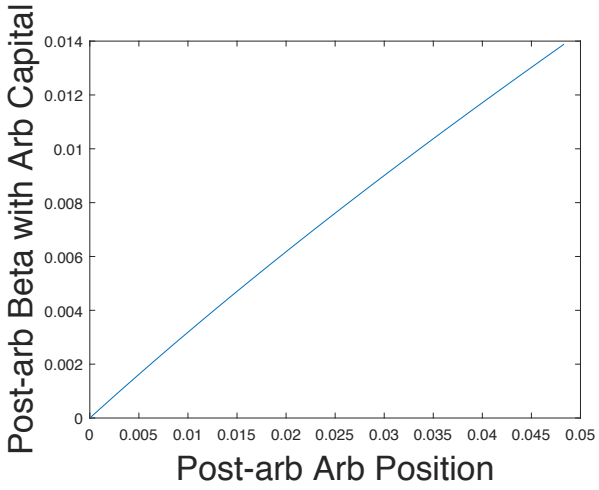
$$\mathbb{E}_1[r^e_{i,2}] = \alpha_{i,2} + \lambda_k \beta_{i,k}$$

Key Result

From Figure 2:†







- In the "Pre-arb" economy ($\mu = 0$) there is risk-free arbitrage.
- In the "Post-arb" economy, because of the possibility that capital will constrained in $t = 2$,
  - It is optimal for the arbs to size their positions so that risk lines up with α.
  - In the resulting equilibrium, alphas "line up" with risk (capital-beta)

† for $\phi = 0.2$, $\mu = \phi/2$, $k_2 \sim U[-10, 10]$, $k_1 \geq 1$, $c = 0.5$, $\delta_{i,t}/v \sim \mathcal{N}(0, 0.1)$

Capital "Crash" Returns

When k_1 is sufficiently large, realized $k_2 << k_1$, and $\forall i \in [0, i_2^*]$

- From $t = 1$ to 2, arbs lose money on all positions, and highest alpha positions lose the most:

$$\begin{aligned} r^e_{i,2} &< 0 \\ \frac{\partial r^e_{i,2}}{\partial(\phi i)} &< 0 \end{aligned}$$

- From $t = 2$ to 3, the positions recover; highest alpha positions bounce back the most:

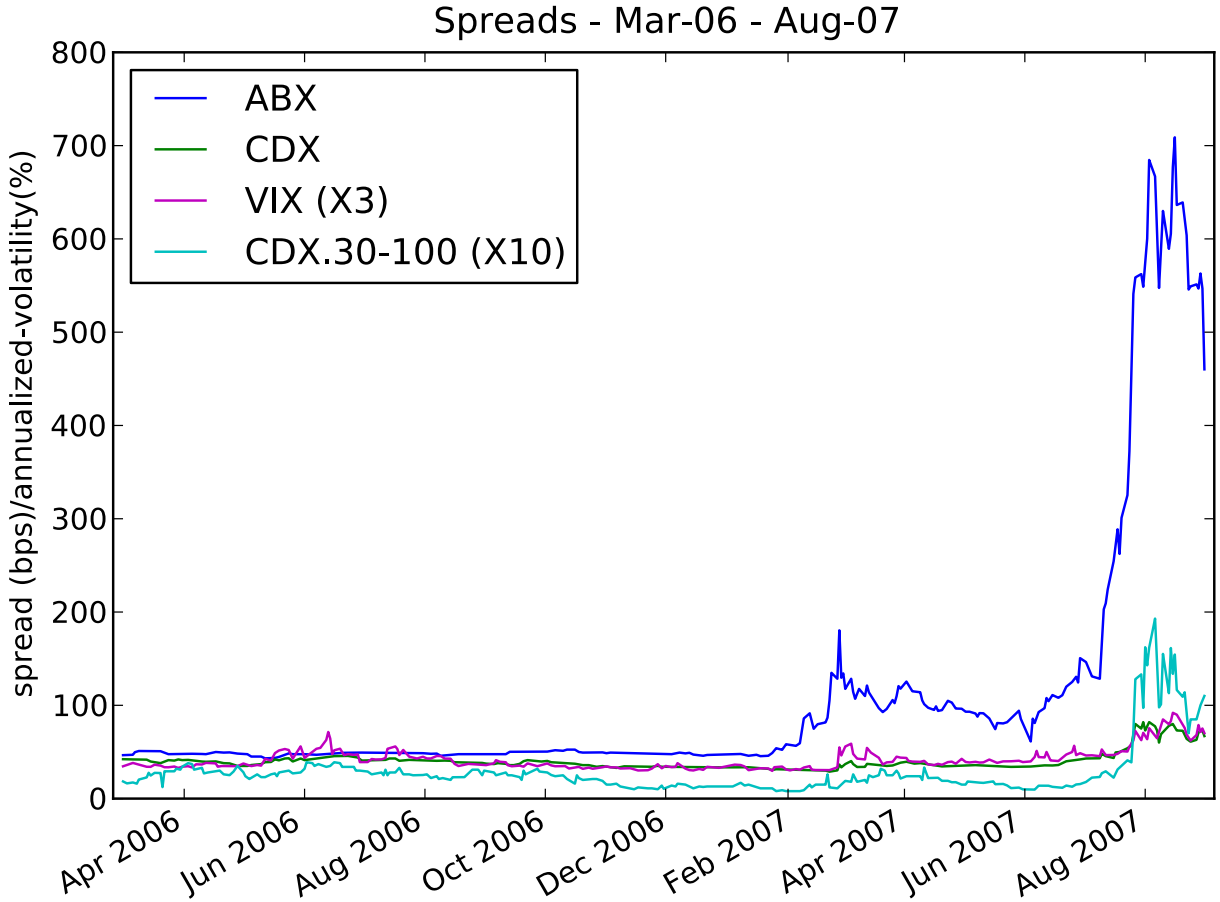
$$\begin{aligned} \mathbb{E}_2[r^e_{i,3}] &> 0 \\ \frac{\partial \mathbb{E}_2[r^e_{i,3}]}{\partial(\phi i)} &> 0 \end{aligned}$$

The "Quant Liquidity Crunch"

- This is really important; with close links to the ICR literature:
  - Adrian, Etula, and Muir (2014), Haddad and Muir (2018), He and Krishnamurthy (2013), He, Kelly, and Manela (2017), and others.
- It is also really timely, as quant firms have possibly gone through something like a "capital crash" over the past year.
- I've heard several industry practitioners describe this 2017 as "another August 2007."
- Thummim nicely relates his model to August 2007
- I'll give just a slightly different perspective.
  - Most of what I will discuss is in covered in Daniel (2009).

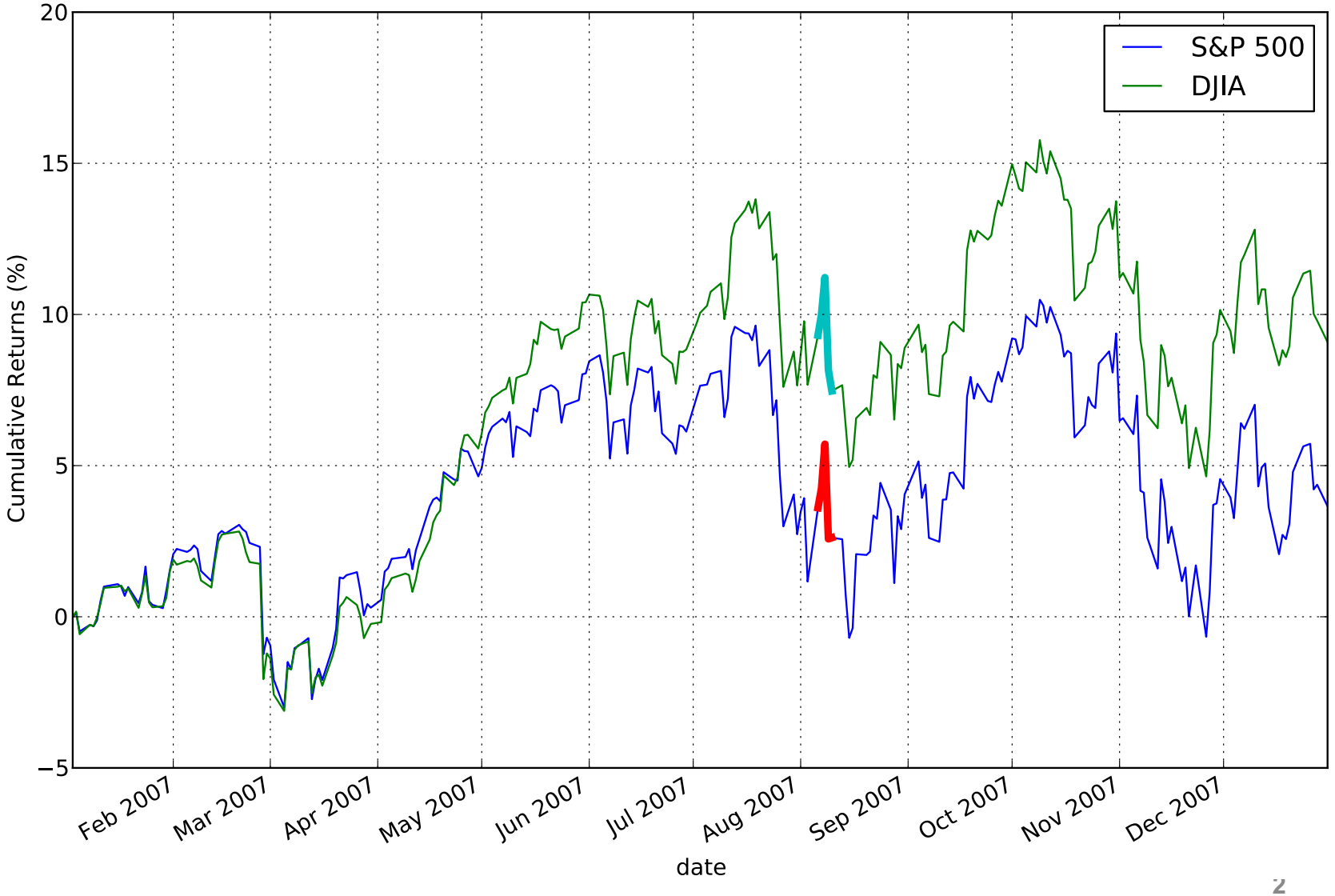
The Subprime and Credit Crises

- ABX rose starting in late 2006, and more dramatically in July ‘07.
- CDX jumped dramatically in July (22-> 82 bps) leading to losses in fixed income and multi-strategy hedge funds.



S&P and DJIA Cumulative Returns

-- *January-December 2007*



Quant firm E[R] model

Regions/Countries:

- **US**
- **UK**
- **Europe ex-UK**
- **Japan**
- **Australia/New Zealand**
- **Canada**
- **Hong Kong**
- **Singapore**

Valuation

How is the company priced relative to fundamental accounting measures?

Metrics:
Book-to-price ratio
Sales-to-price ratio
Reserves-to-price ratio

Profitability

What are the company's profit margins? How efficient are its operations?

Metrics:
Earnings-to-sales ratio
Sales-to-total-assets ratio
EBIT-to-enterprise value
Forecast earnings-to-price

Analyst Sentiment

Are analysts upgrading or downgrading their view of this company?

Metrics:
Earnings forecast revisions
Recommendation changes

Earnings Quality

Were earnings derived from sustainable sources?

Metrics:
Accruals-to-total-assets
Change in net operating assets
Writeoffs-to-bad debt expense

Momentum

How has the market responded to the company's changing fortunes?

Metrics:
Short-term reversals
Medium-term continuations
Long-term reversals
Earnings response

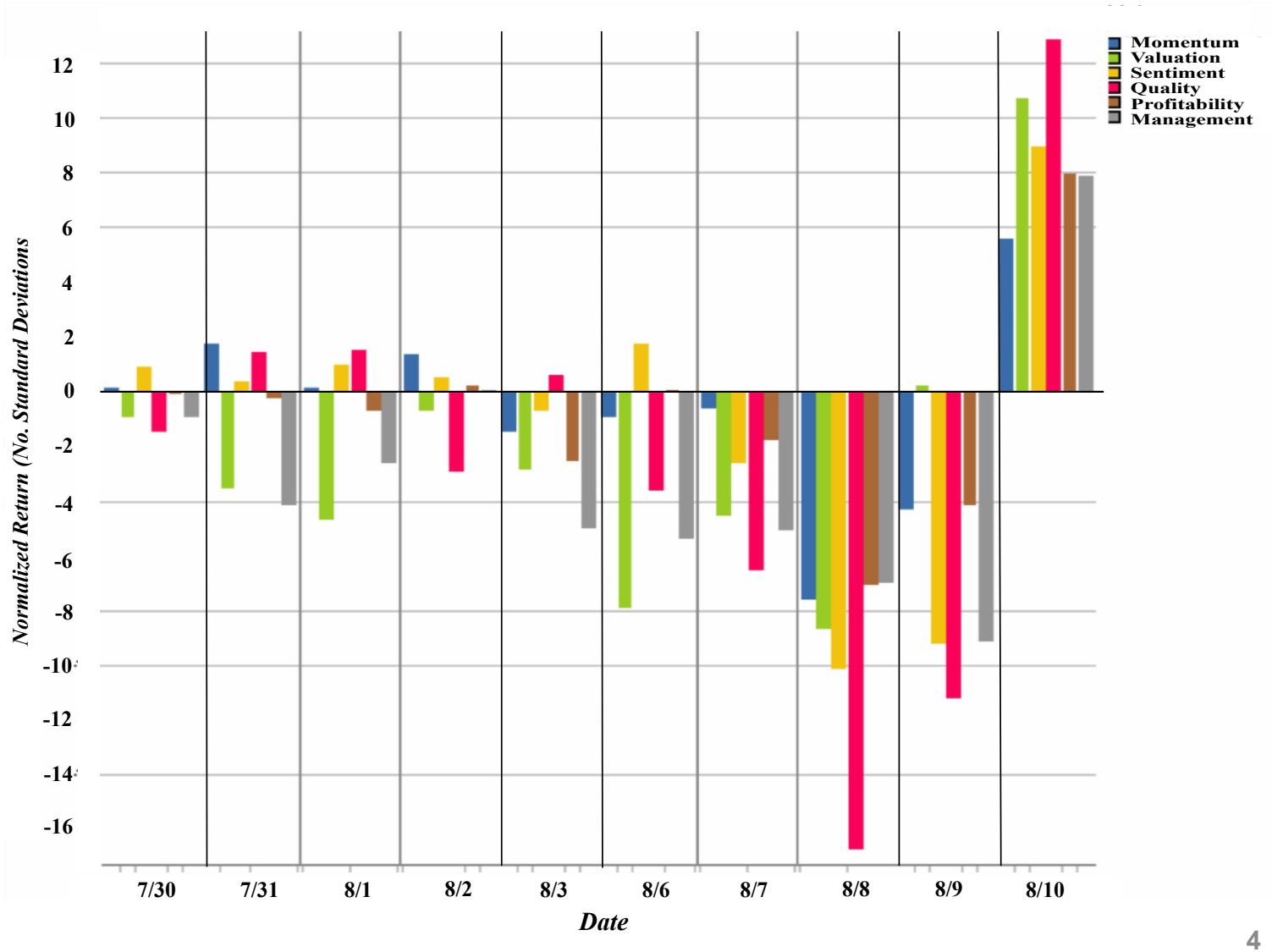
Management Impact

What is company management strategy and behavior?

Metrics:
Net external financing
Change in shares outstanding
Management forecast bias

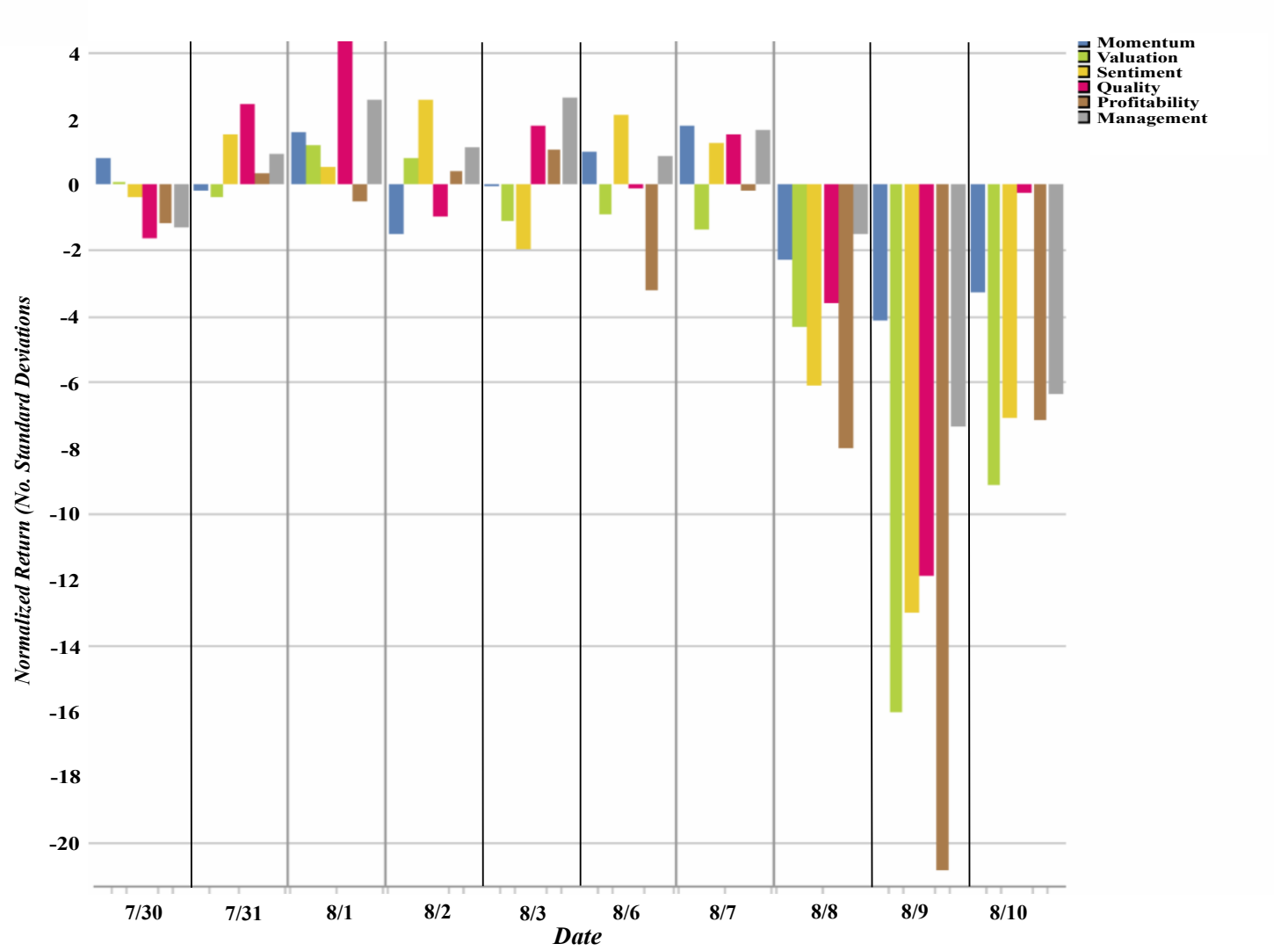
US Theme Returns

-- *July 30 - August 10*



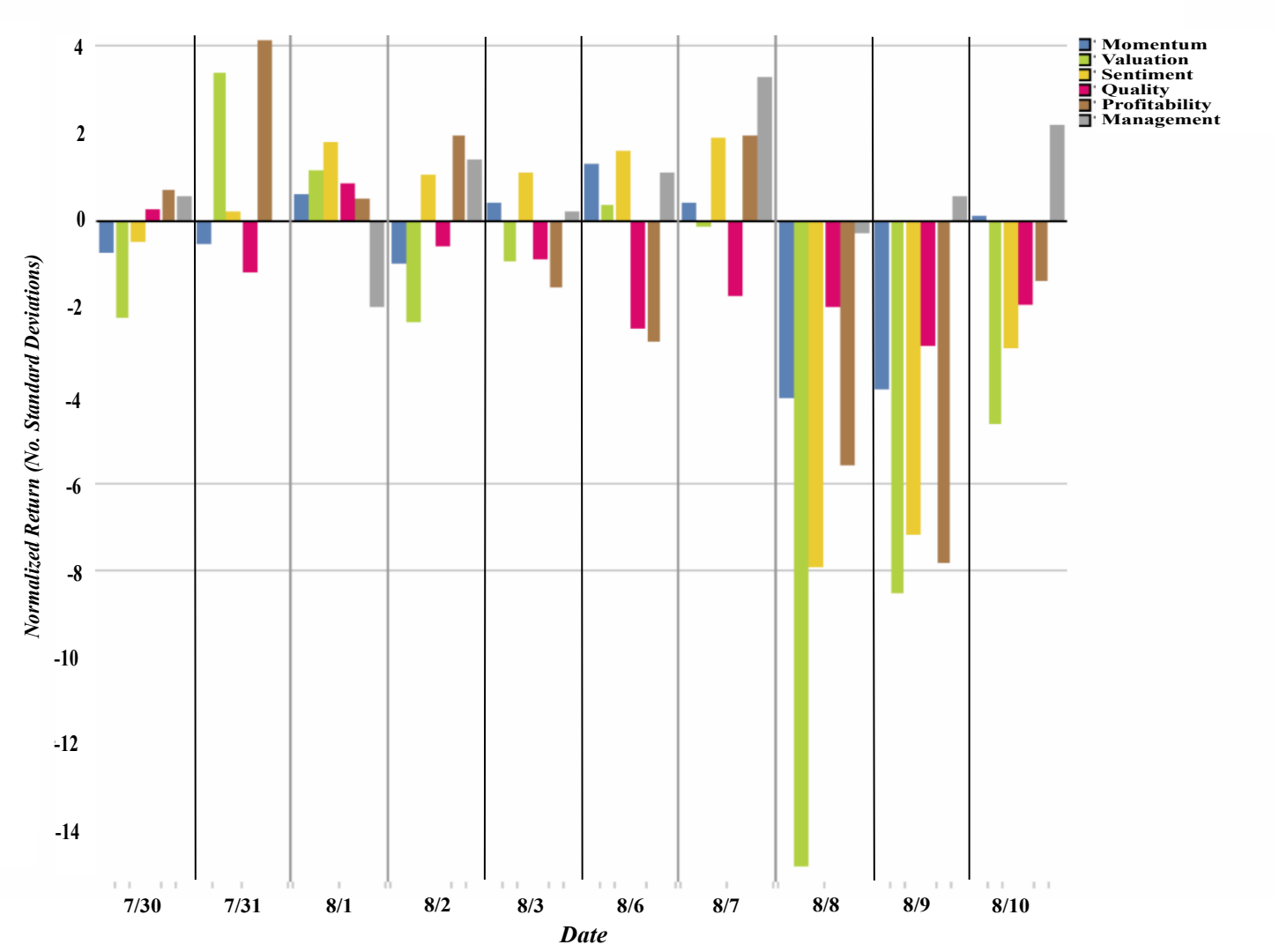
JP Theme Returns

-- *July 30 - August 10*



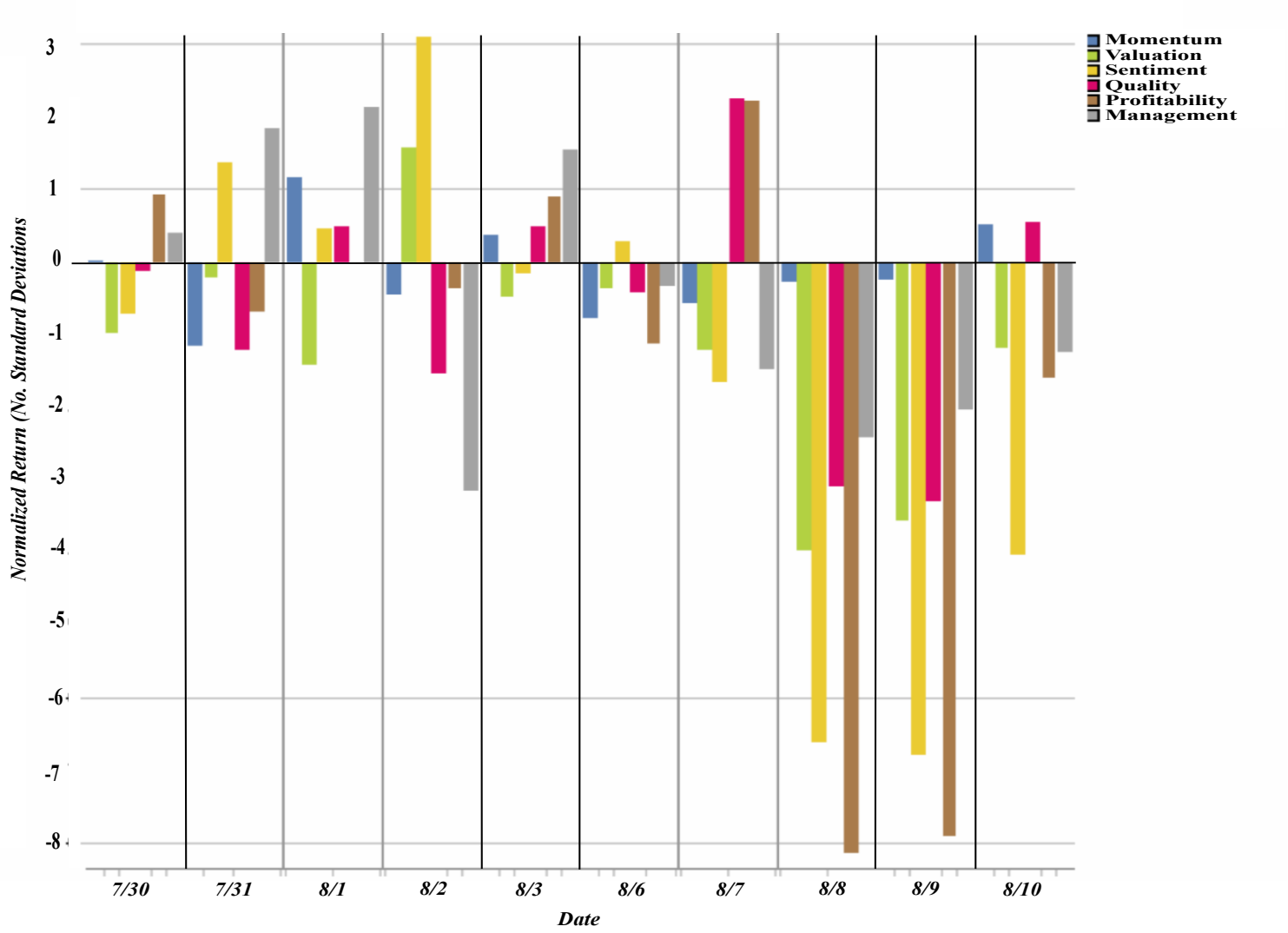
EU Theme Returns

-- *July 30 - August 10*



UK Theme Returns

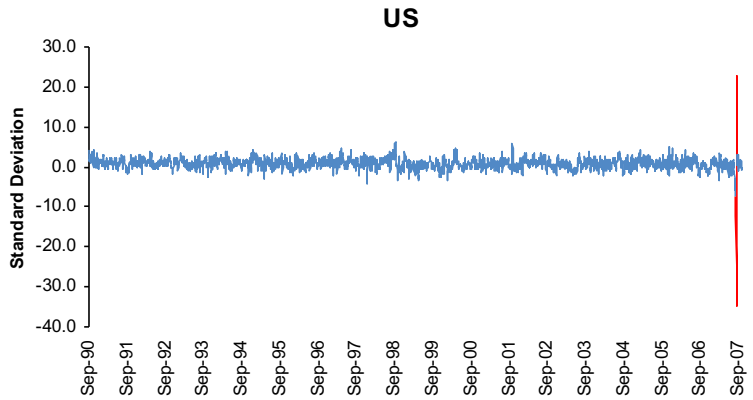
-- *July 30 - August 10*

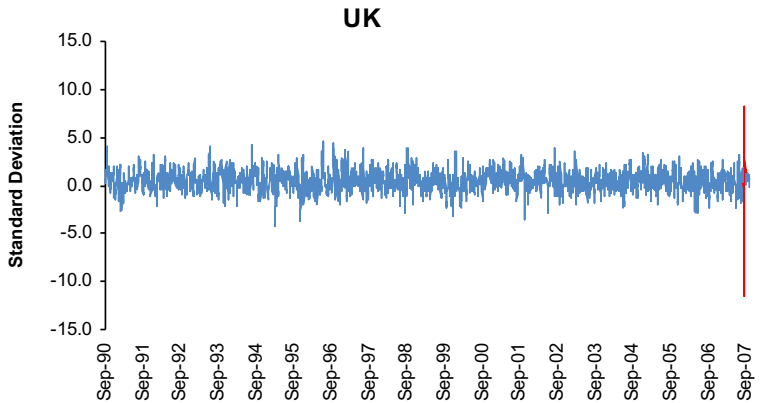


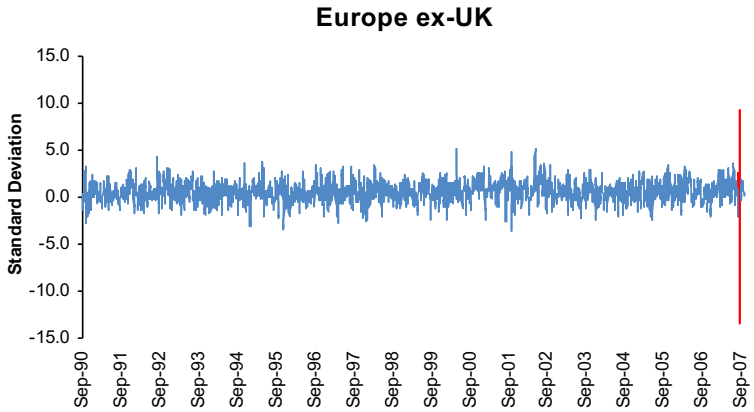
How unusual was the event?

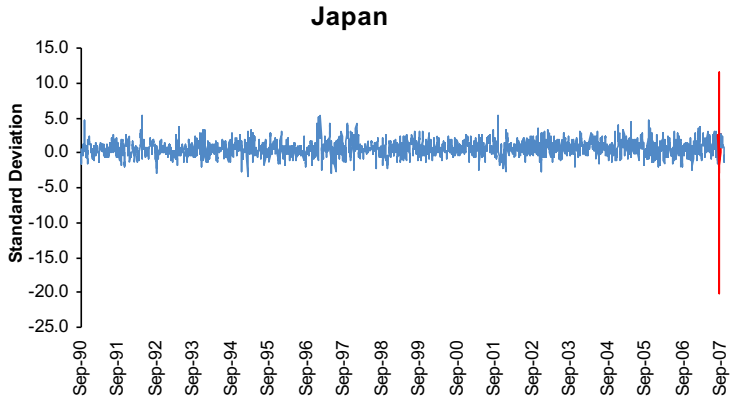
Cumulative 5-day standardized returns

Our models in all major regions experienced extraordinary drawdowns at virtually the same time

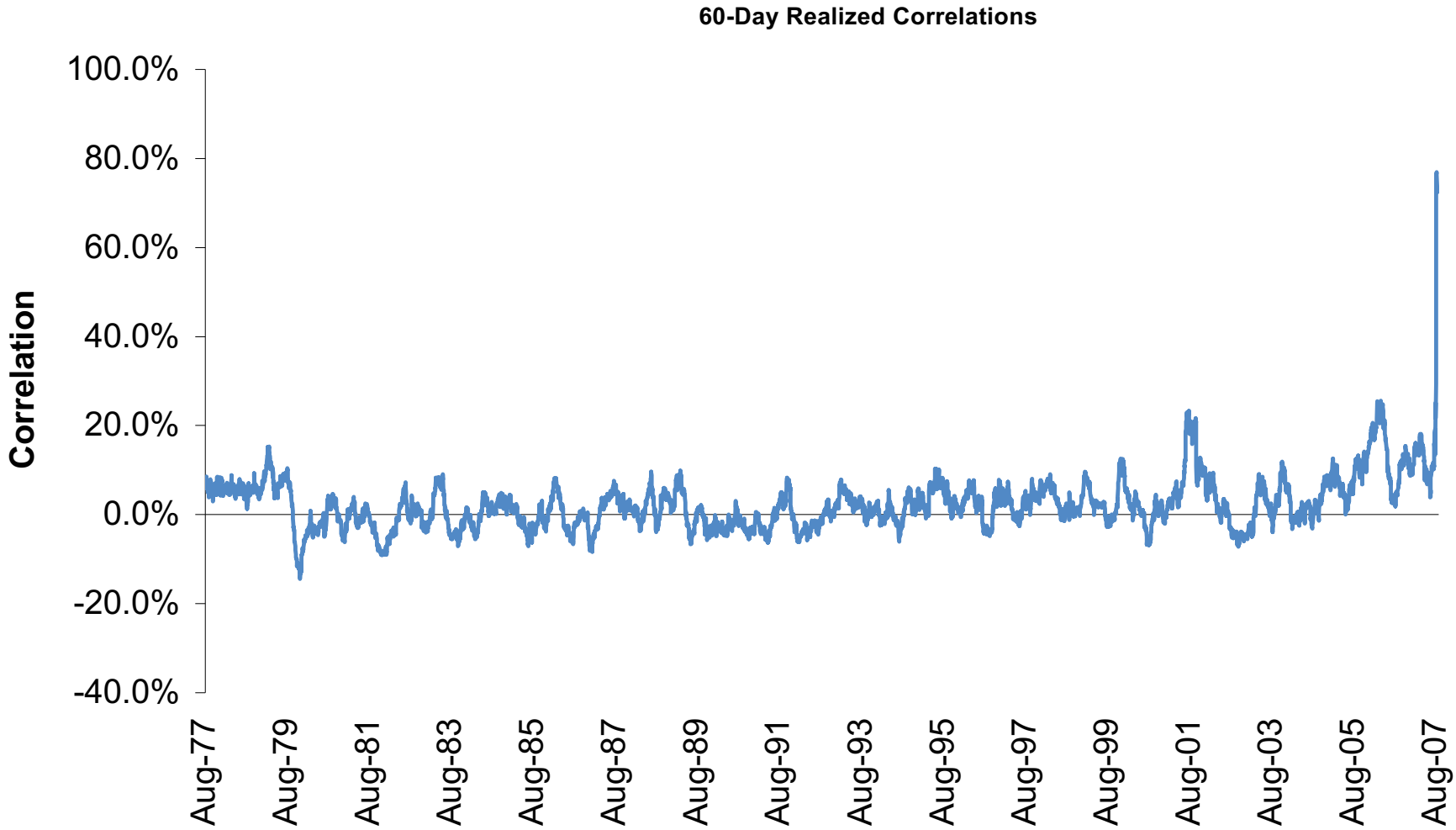




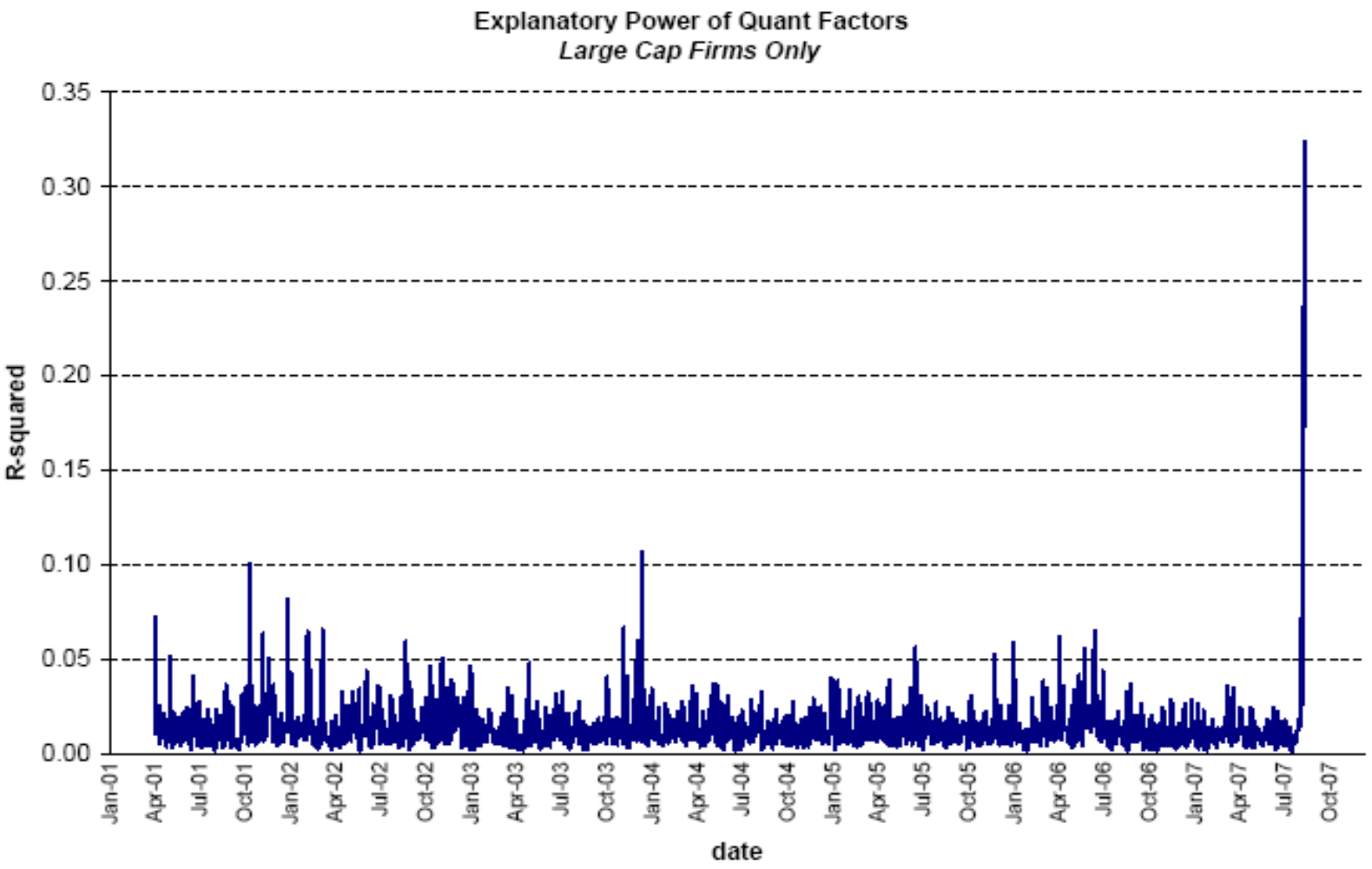




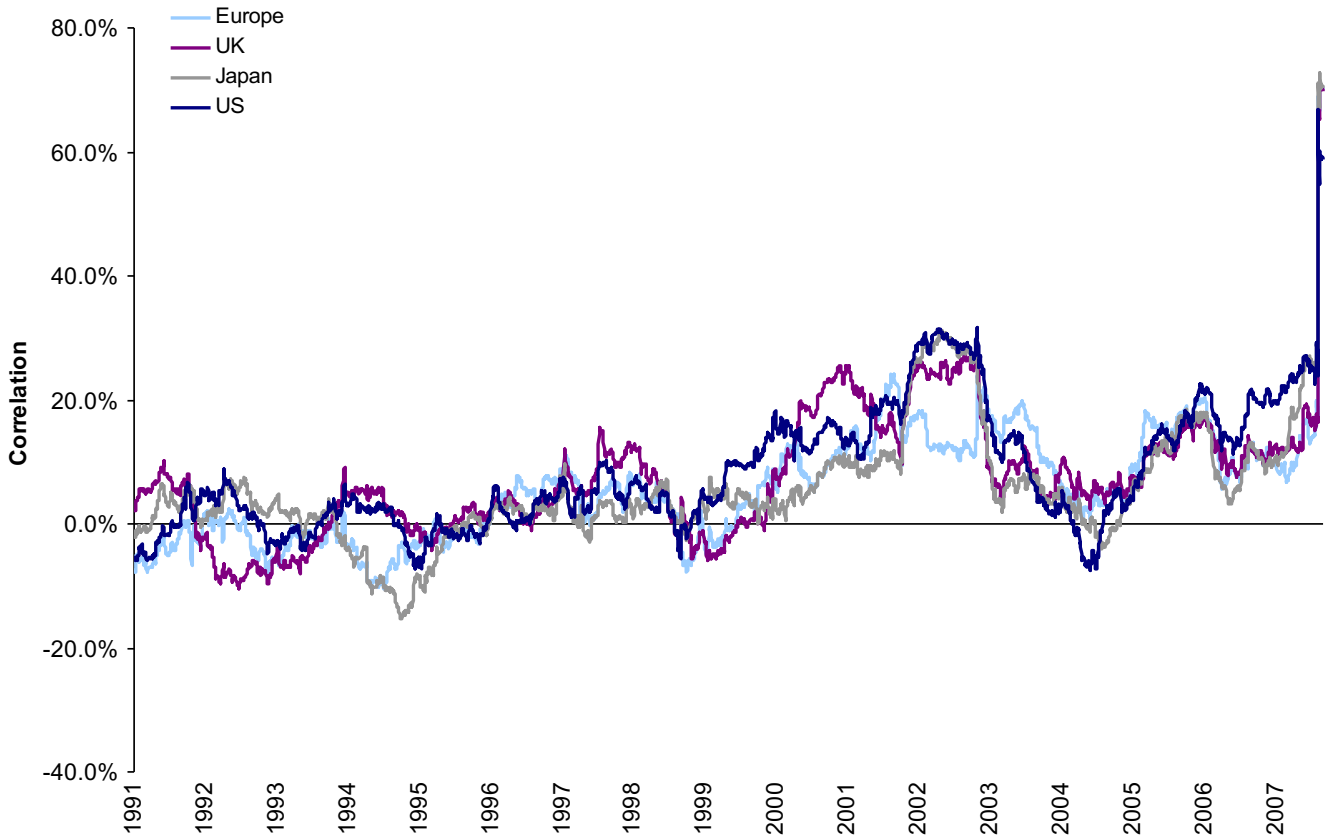
Average Pairwise Theme Return Correlations



Cross-Sectional Regression R^2s

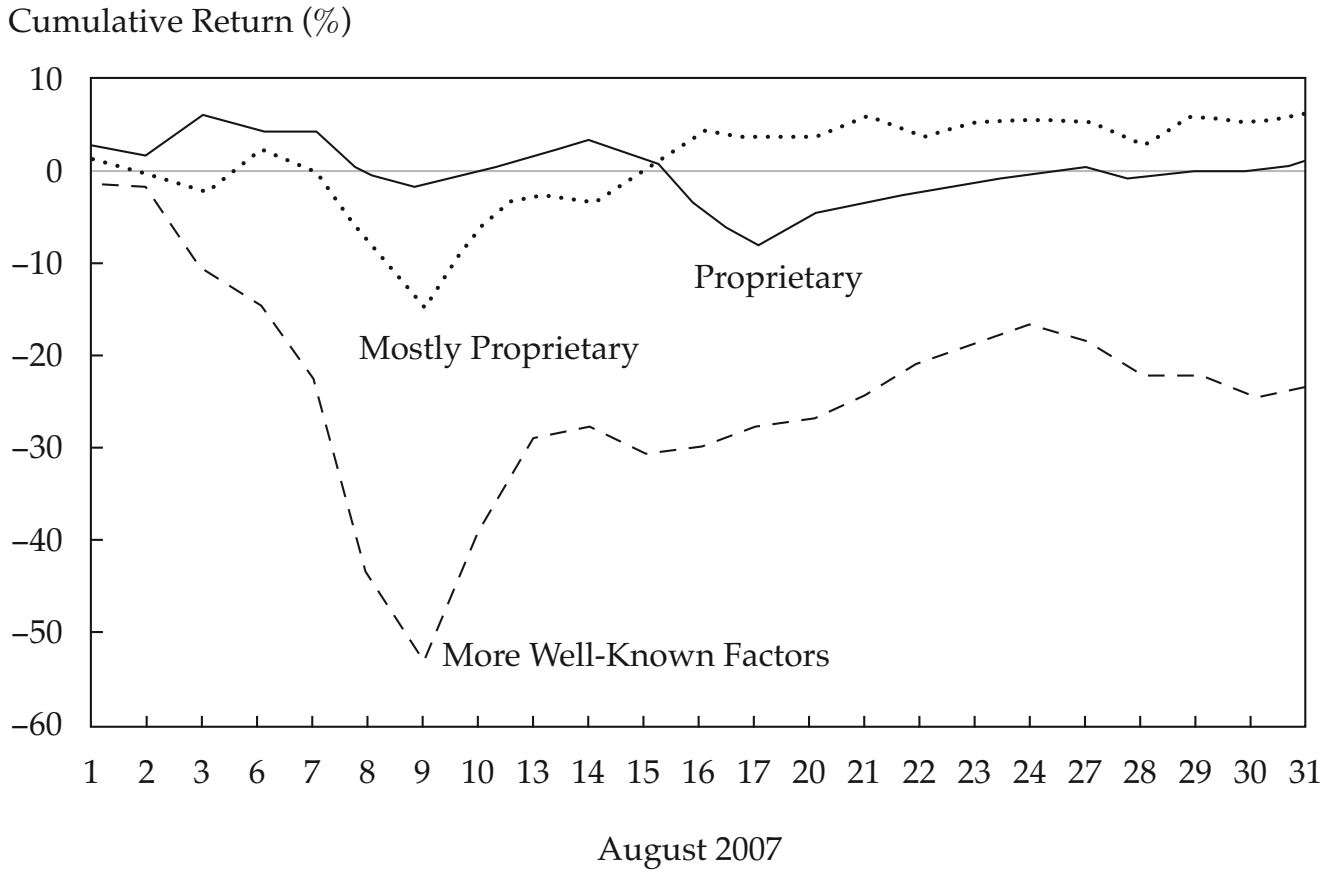


Regional performance correlations



252 day realized model portfolio average pairwise return correlations using 3-day overlapping daily returns

Proprietary Factors



Notes: Signal returns are scaled to target 1 percent daily volatility, which is equivalent to 16 percent annualized volatility. The data are scaled to normalize different return series.

References I

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