

# Modelling the performance of hedge fund managers

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Joint work with Darren Upton and Mike Robinson

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The views expressed herein are those of the authors and do not necessarily represent the opinion of Man Investments

Overall aim: quantify the risk and return aspects of hedge fund portfolios

Approach: develop a model suitable for simulation and calibrate it by fitting to historical manager data

- The characteristics of manager data
- Model building – selecting parsimonious, flexible and tractable components
- Model fitting (parameter estimation) and appraisal of fit
- Some results and implications
- Where next?

# Background

What are hedge funds?

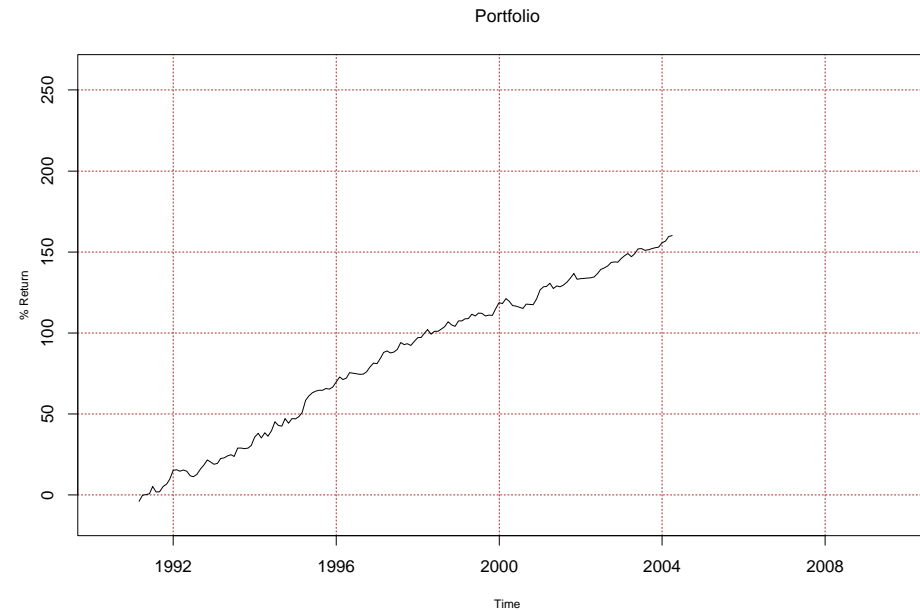
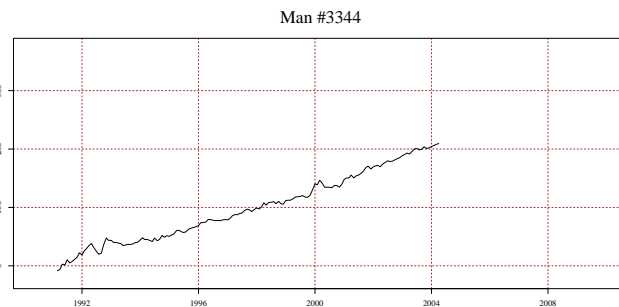
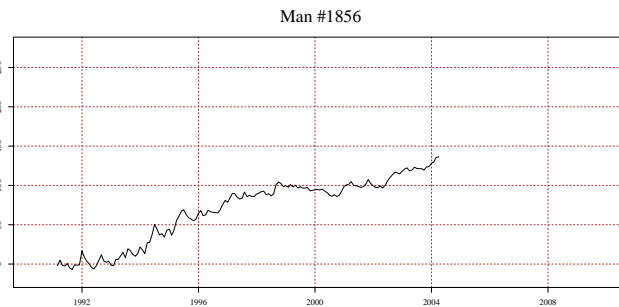
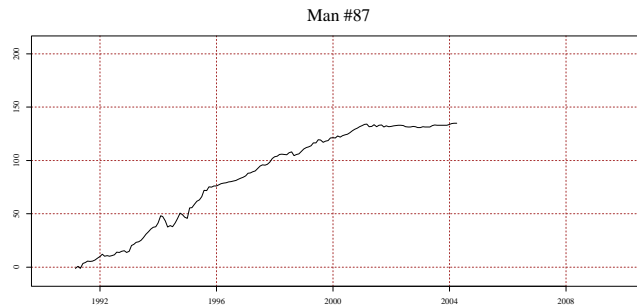
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- Investment vehicles that target *absolute returns*
- Hedge fund managers employ a diverse range of investment styles e.g.
  - Trend Following / Momentum Trading
  - Global Macro
  - Statistical Arbitrage
  - Multi-Strategy Arbitrage
  - etc
- Managers borrow additional money to ‘leverage’ their investments

# Background

## Problem?

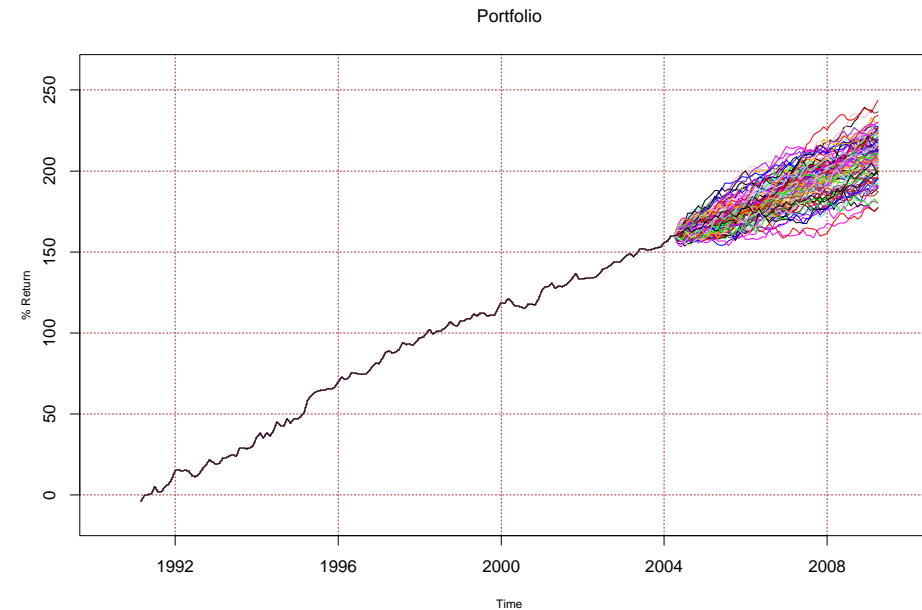
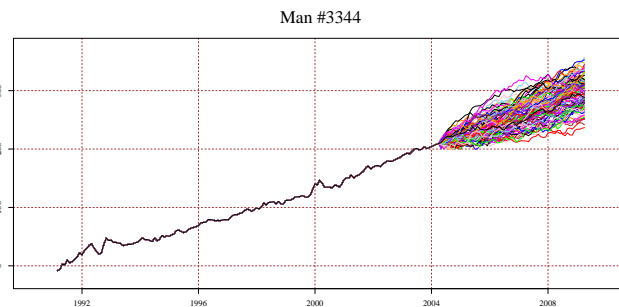
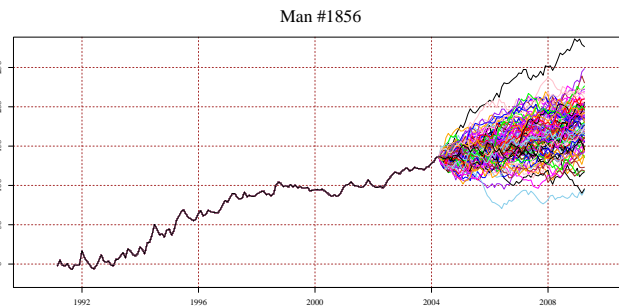
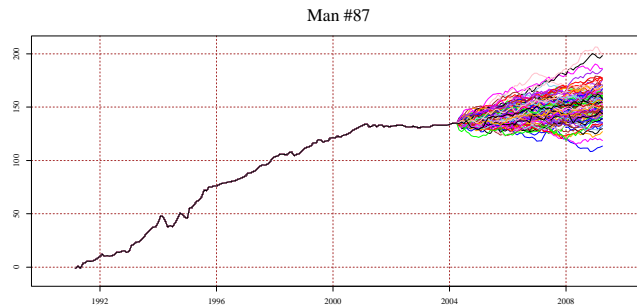
- Construct a model to simulate the future performance of a portfolio of managers, accounting for
  - Distributional shape
  - Time varying properties
  - Dependence between managers in the portfolio



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Problem?

- Construct a model to simulate the future performance of a portfolio of managers, accounting for
  - Distributional shape
  - Time varying properties
  - Dependence between managers in the portfolio



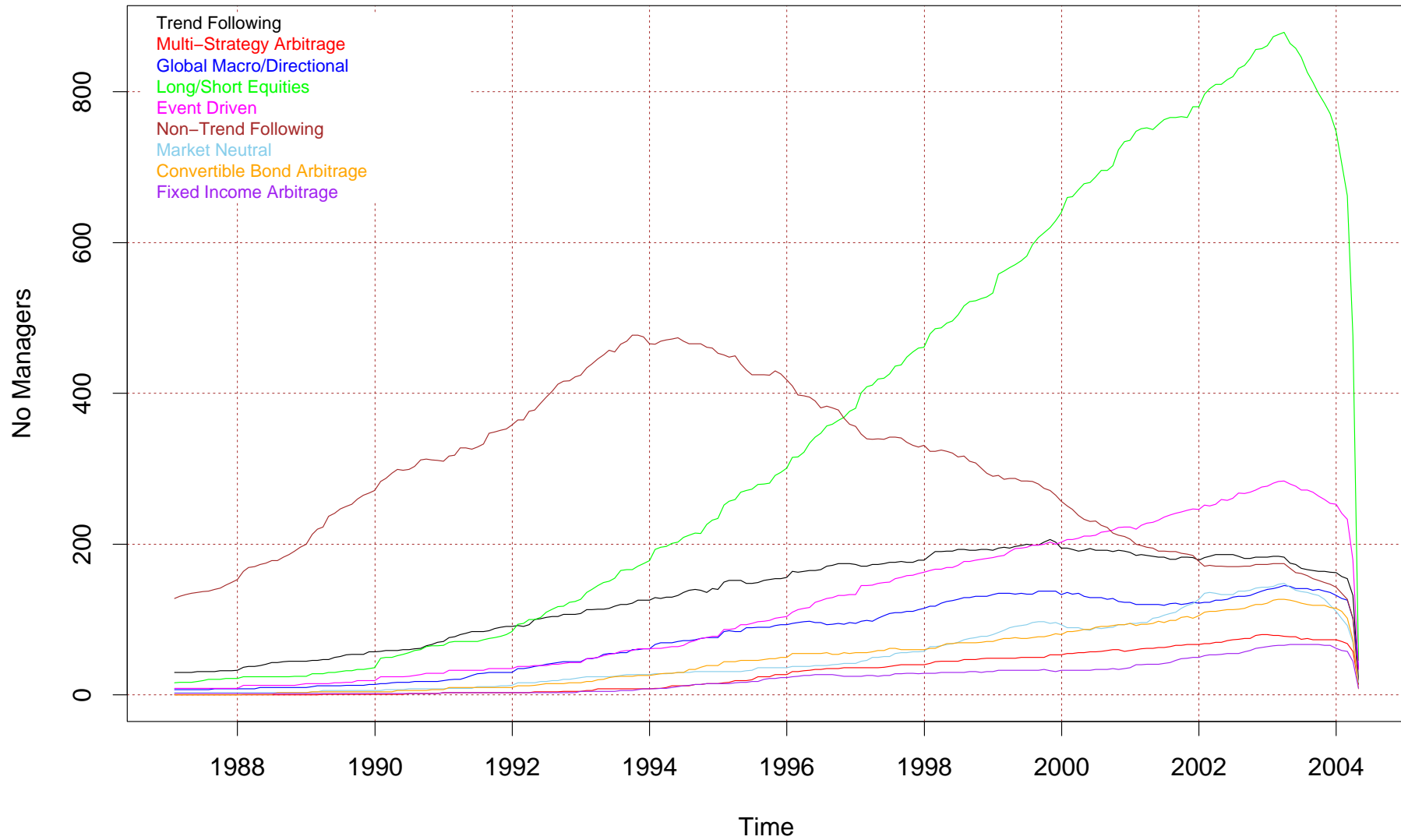
- 4000+ manager track-records (individual time series)
- Potentially 208 monthly observations per manager (Jan 1987 - April 2004)
- Managers are classified into one of 9 'broad styles'
- Possible biases include
  - Survivorship bias
  - Selection bias
  - Drop-in and drop-out biases
  - Classification bias
- Some data cleaning was required

# Data

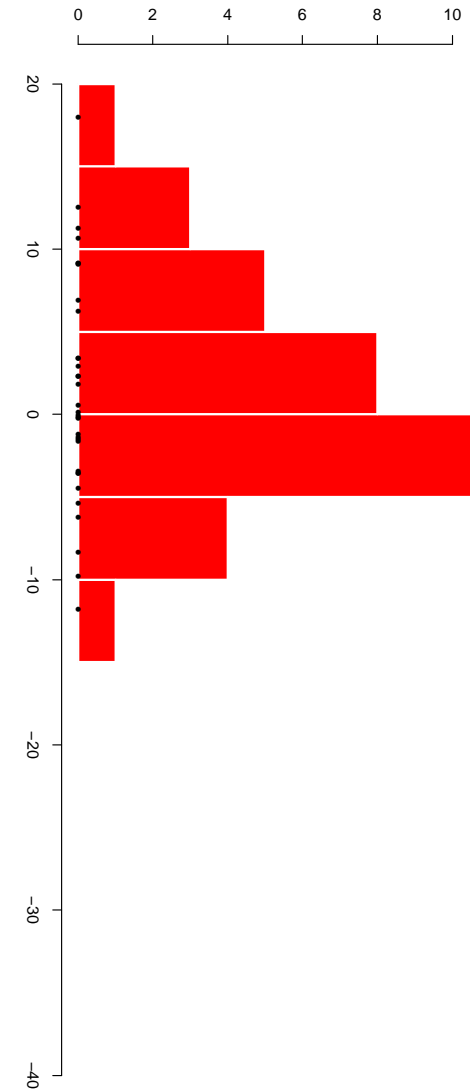
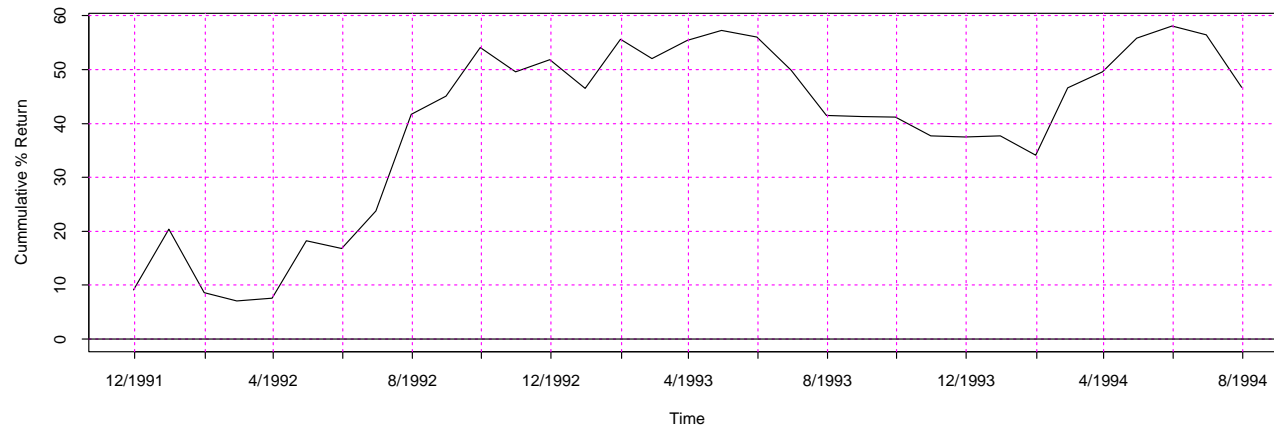
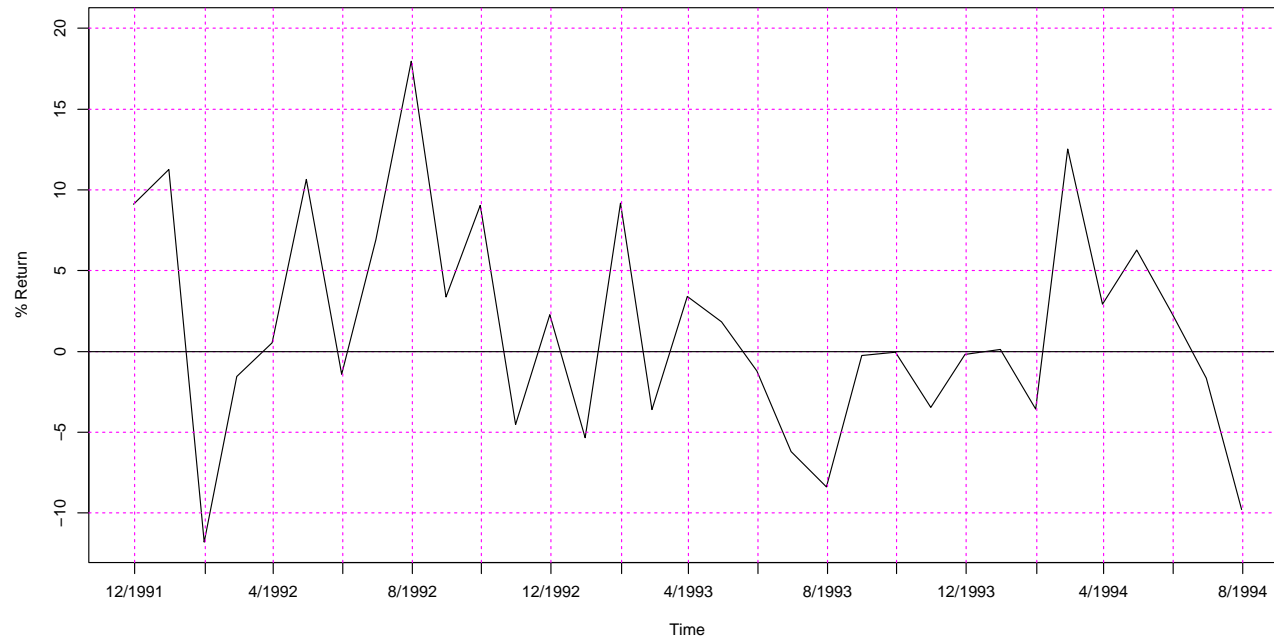
A snapshot



Manager Style	1 NTF	2 NTF	3 NTF	4 NTF	5 NTF	6 NTF	7 TF	8 NTF	9 NTF	10 TF	11 NTF	12 NTF	13 FIA	14 FIA	15 FIA
199105	.	.	.	.	.	.	.	-1.05	.	.	.	.	-2.67	-2.02	.
199106	.	.	.	.	.	.	1.93	4.94	.	.	.	.	-1.91	1.03	.
199107	.	.	.	.	.	.	-0.45	-2.9	.	.	.	.	-10.1	0.66	.
199108	.	.	.	.	.	.	-1.74	1.46	.	.	.	.	-0.66	2.55	.
199109	.	.	.	.	.	.	4.88	5.11	.	.	.	.	-3.61	2.92	.
199110	.	.	.	.	.	.	1.89	2.61	.	.	.	.	-1.32	0.05	.
199111	.	.	.	.	.	.	1.67	-3.04	.	.	.	.	-6.32	-0.36	.
199112	.	.	.	.	.	.	1.99	5.9	.	.	.	.	19.21	6.7	.
199201	.	.	.	.	.	.	-3.92	-7.18	.	.	.	.	-15.0	-1.89	.
199202	.	1.28	.	.	.	.	-1.26	-4.81	.	.	.	.	-2.88	-0.15	.
199203	.	-0.01	.	.	.	.	1.19	1.21	.	.	.	.	-2.19	-0.03	.
199204	0.16	-1.58	.	.	.	.	0.21	-2.56	.	.	.	.	3.17	-0.76	.
199205	1.47	-0.59	.	.	.	.	-0.2	-0.05	.	.	.	.	0.37	2.45	.
199206	-1.39	-3.61	.	.	.	.	3.72	0.36	.	.	.	.	-1.61	2.62	.
199207	3.71	-1.47	.	.	.	.	0.87	2.01	.	.	.	.	8.52	5.46	.
199208	3.98	-0.27	.	.	.	.	1.64	-1.39	.	.	-6.23	7.93	3.52	1.74	.
199209	3.84	1.94	.	.	.	.	.	-4.74	.	.	1.11	1.37	-0.55	0.1	.
199210	1.07	4.8	.	.	.	.	.	-3.54	.	.	-20.1	-5.38	-6.77	-0.38	.
199211	-3.18	-0.27	.	.	.	.	.	-0.98	.	.	6.16	-1.31	2.24	1.03	.
199212	0.69	-2.19	.	.	.	.	.	0.63	.	.	7.13	-3.59	-0.2	1.51	.
199301	-3.32	-2.48	.	.	.	.	.	.	.	.	0.33	4.12	-0.15	1.28	.
199302	-1.72	21.19	.	.	.	.	.	.	.	.	1.95	12.02	3.55	3.7	.
199303	-7.03	8.76	.	.	.	.	.	.	.	.	5.59	-0.65	0.35	1.23	.
199304	-2.62	0.2	.	1.8	.	.	.	.	.	.	1.65	4.69	-0.6	0.43	.
199305	.	-1.55	.	2.26	.	.	.	.	.	.	4.53	6.85	2.17	0.36	.

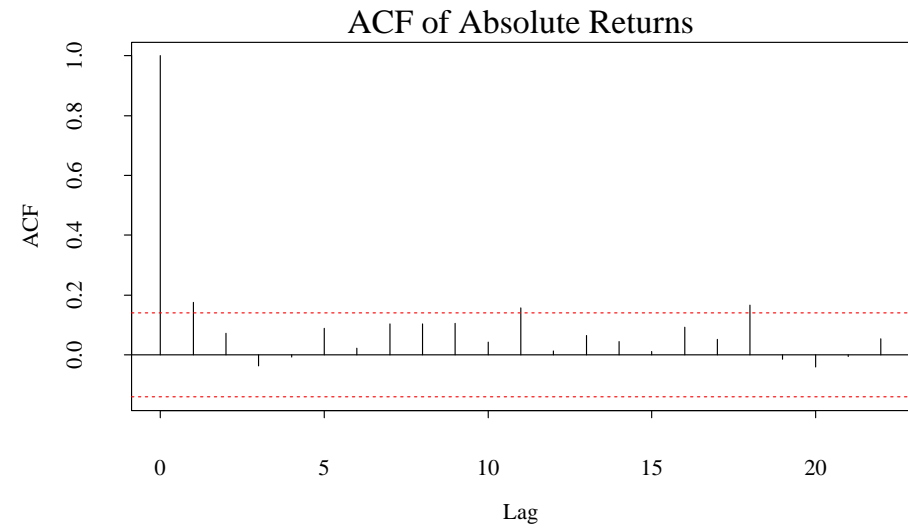
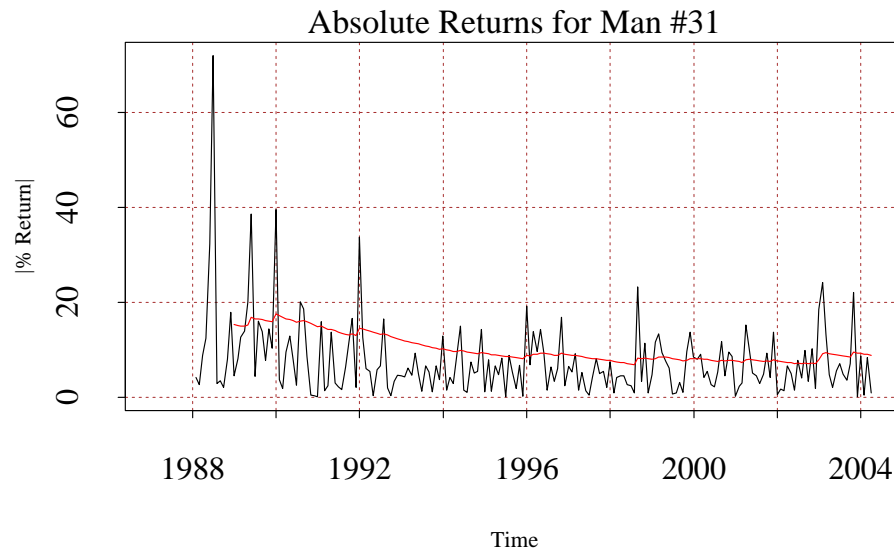
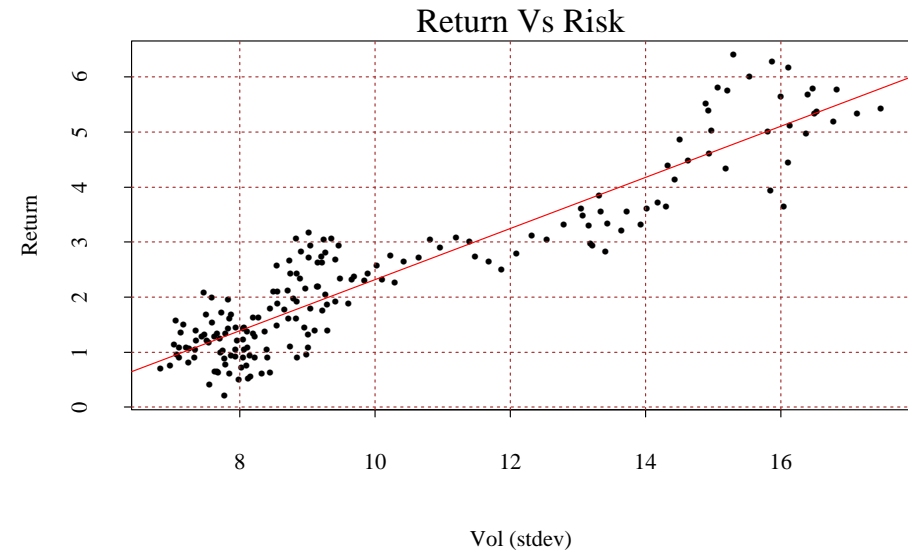
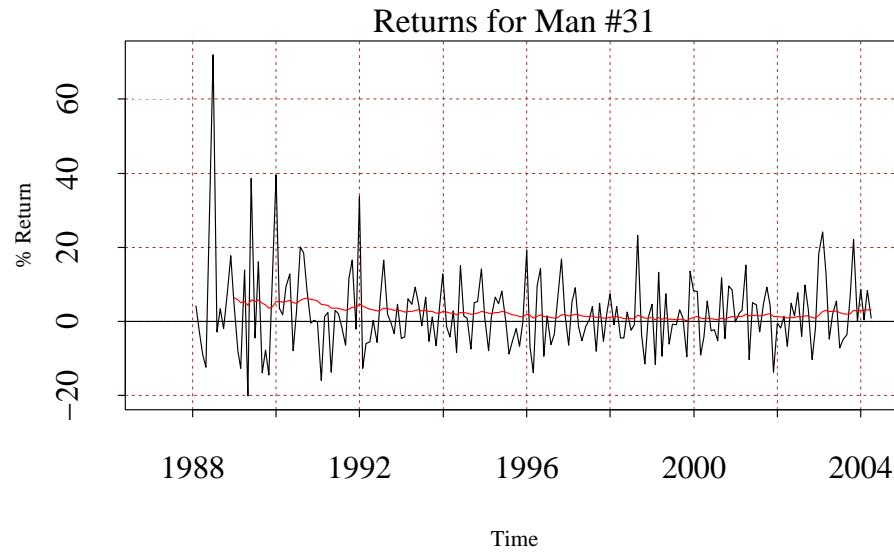


### An Example Manager



# Characteristics

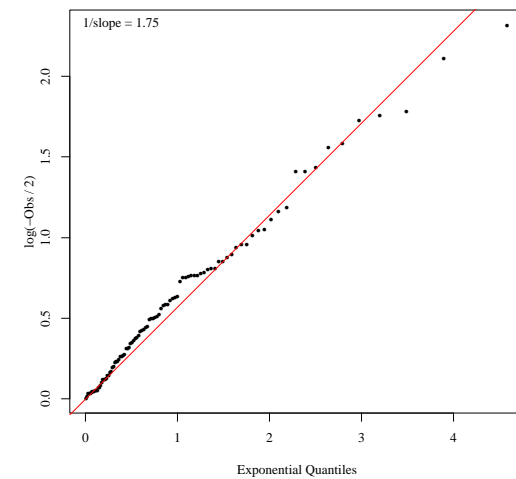
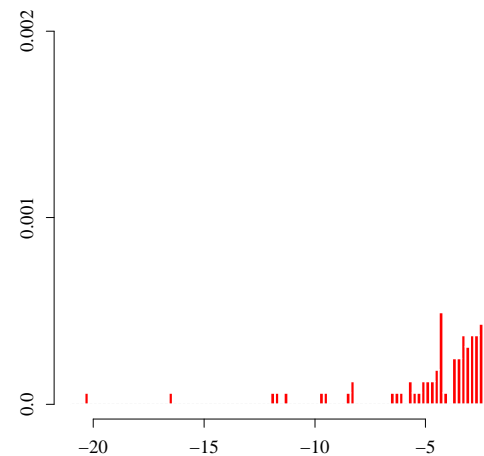
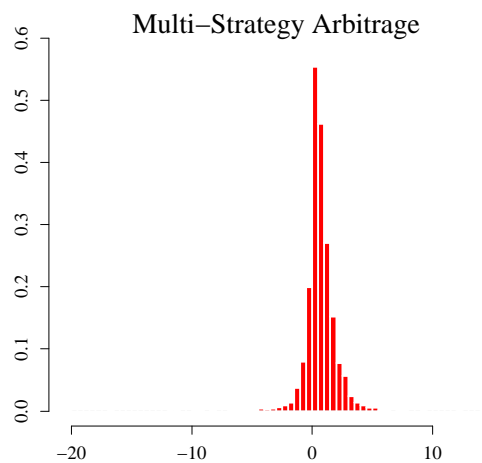
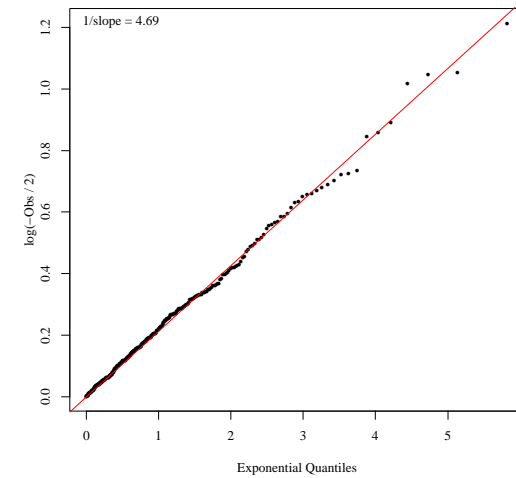
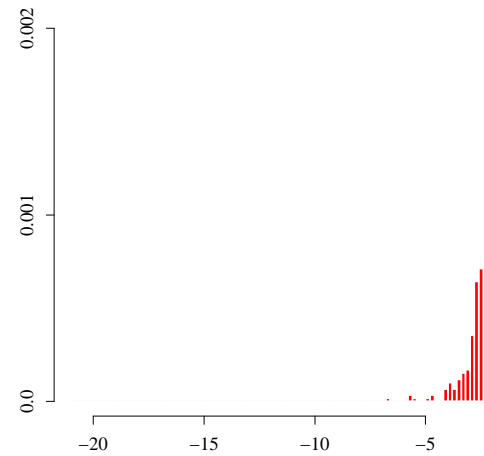
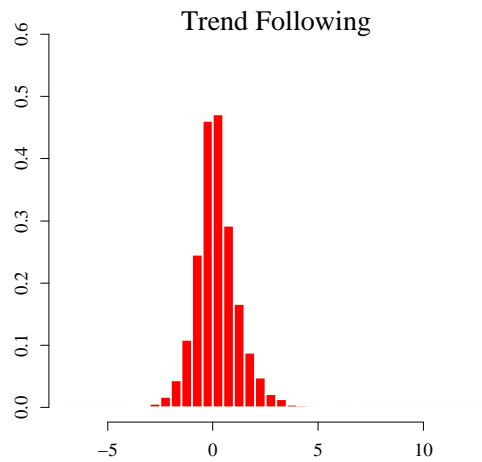
Dynamic related mean and stdev, serial dependence



# Characteristics

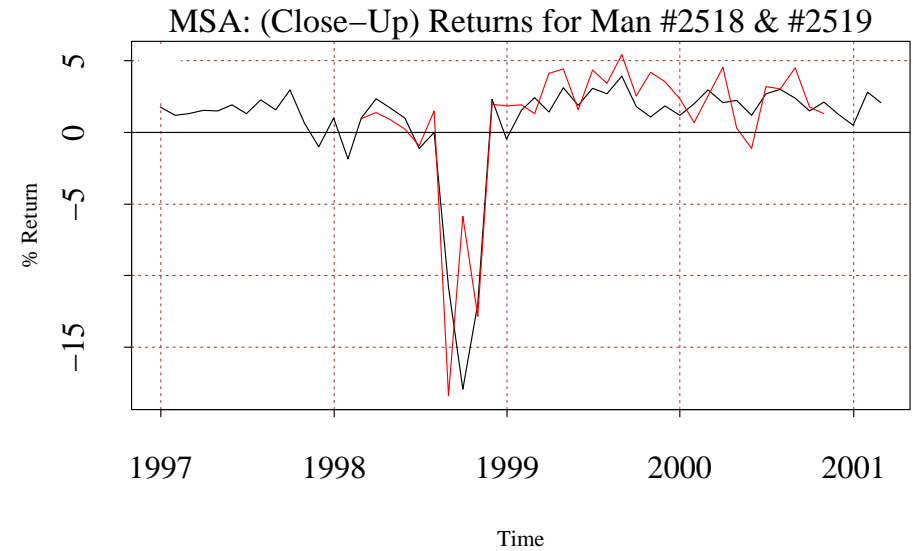
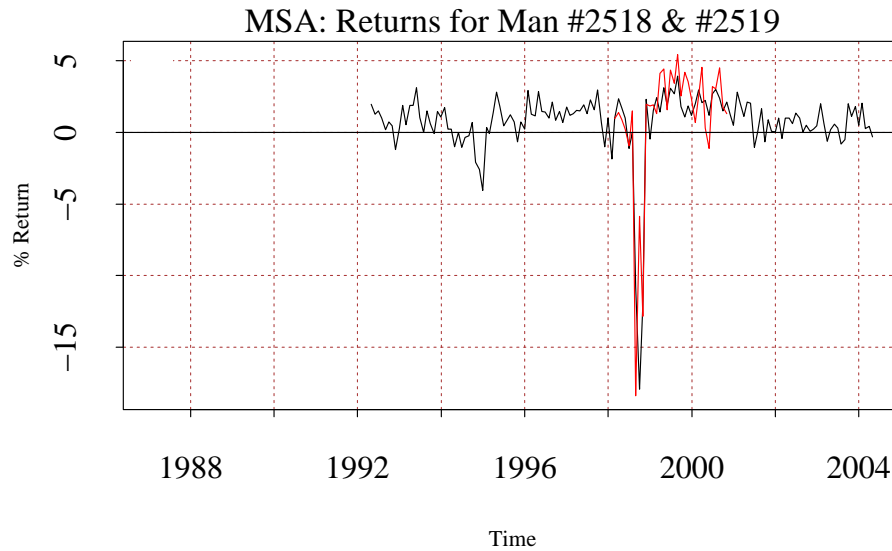
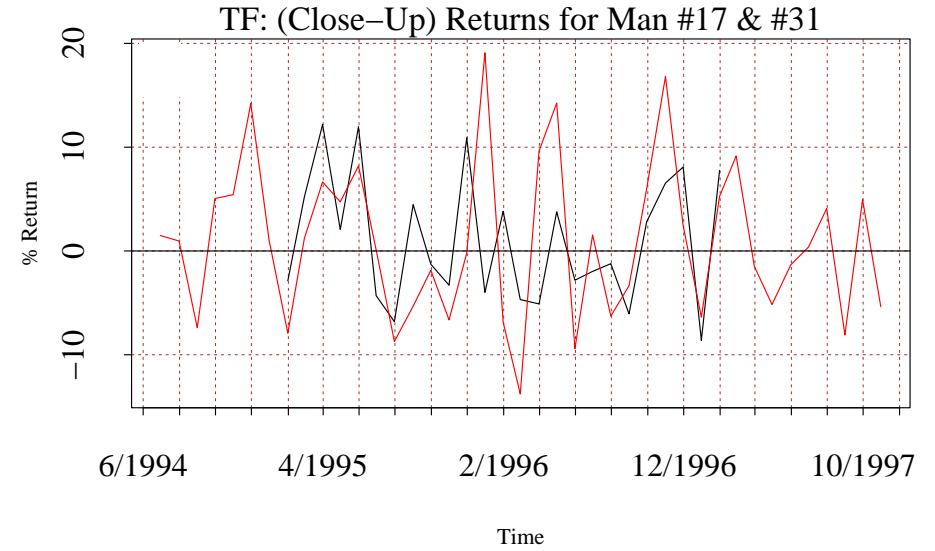
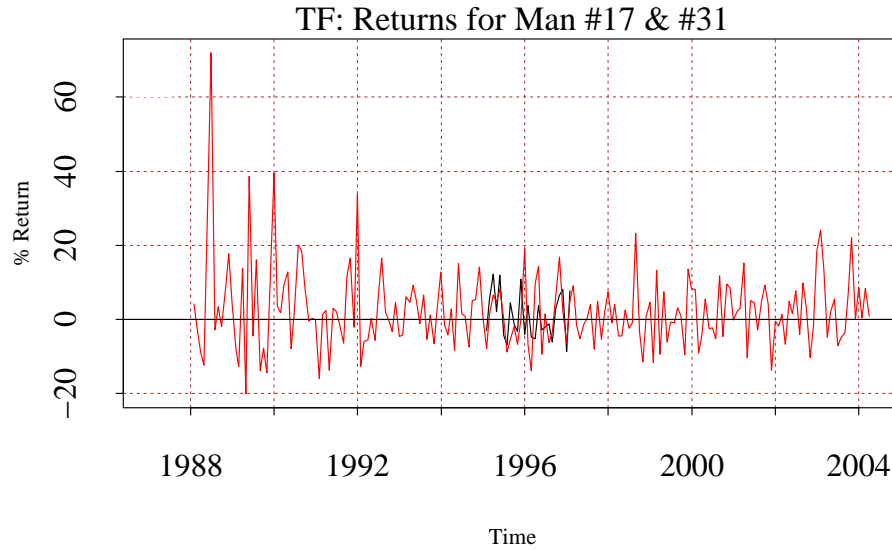
Asymmetric distributions, non-Gaussian tails

Standardising returns by a rolling estimate of location and scale and pooling across managers within each style illustrates the distributional shape of returns



# Characteristics

Between manager dependence



# Model

## Univariate structure

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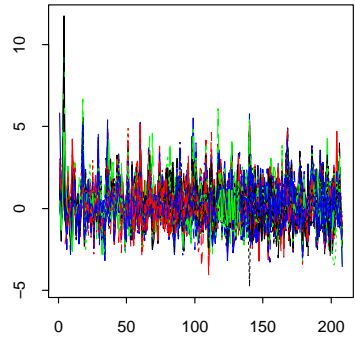
We model a 'typical manager' in each style

We assume that managers in a given style, after adjusting for their overall risk (leverage), follow the same parametric model

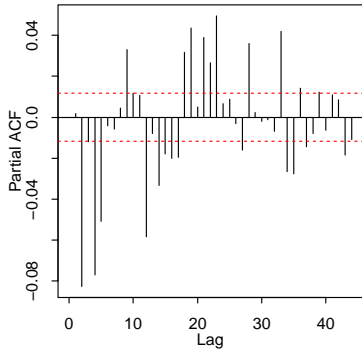
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- Maximum likelihood, maximising over the 108 parameters
  - 7 parameters for each style for the time-series component ( $9 \times 7 = 63$ )
  - $N(N + 1)/2$  for the copula ( $9 \times 10/2 = 45$ ).
- A single likelihood evaluation takes approximately 2 seconds.
- The maximisation takes of the order of 12 hours.
- Tested by simulating a comparable dataset, and fitting parameters by likelihood
  - the estimates were not significantly different from their true values (p-value approximately 0.6).

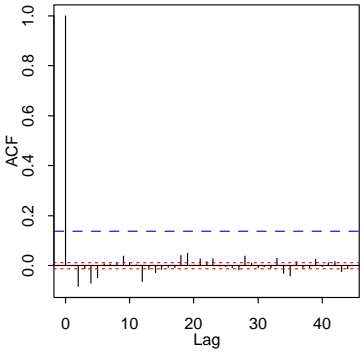
Trend Following



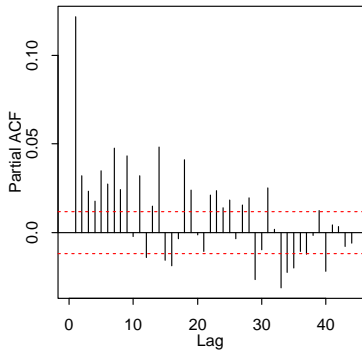
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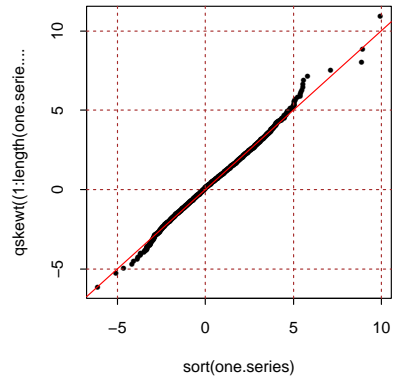
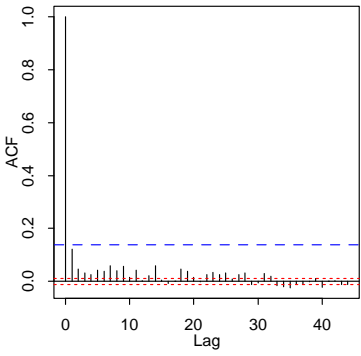
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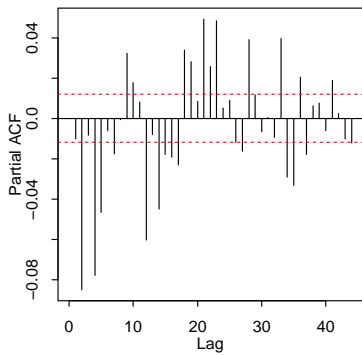
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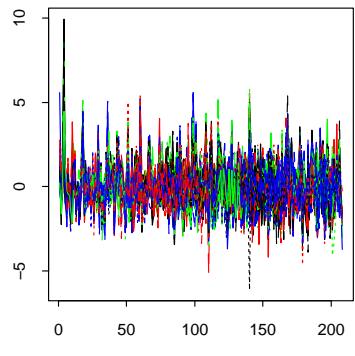
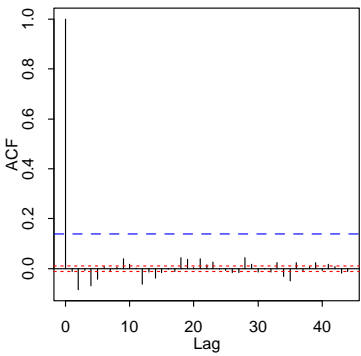
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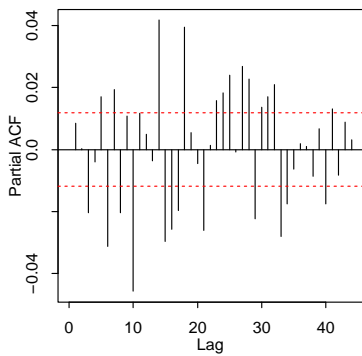
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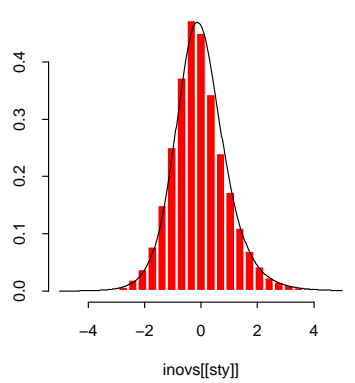
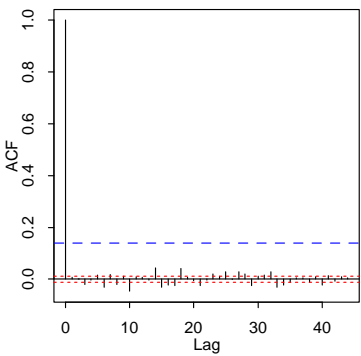
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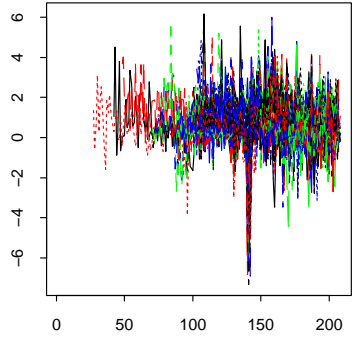
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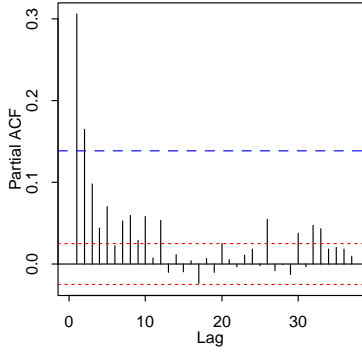
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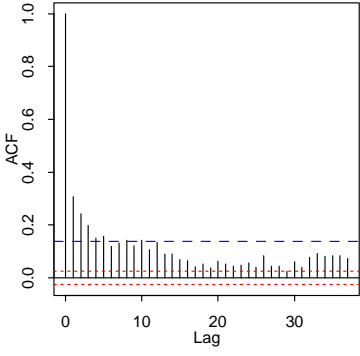
Multi-Strategy Arbitrage



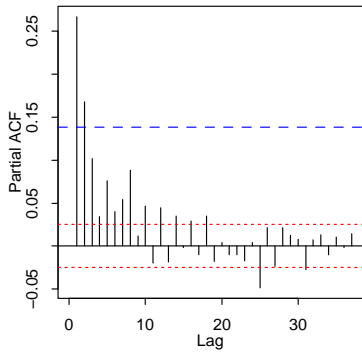
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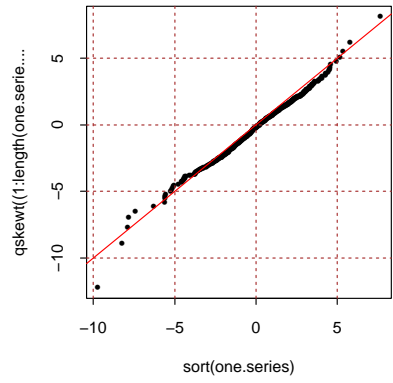
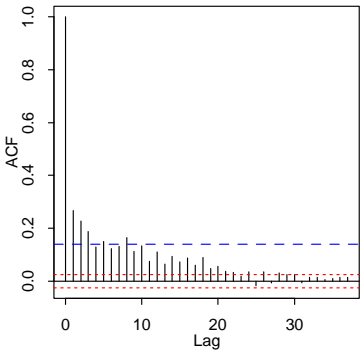
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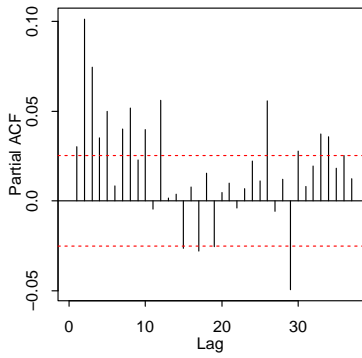
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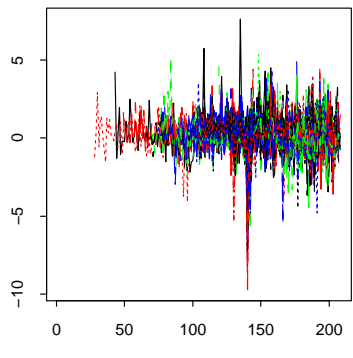
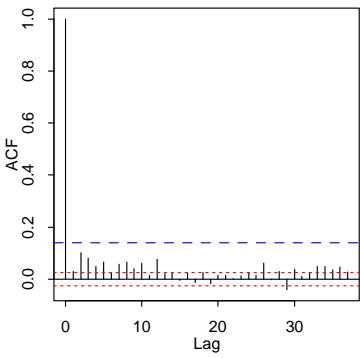
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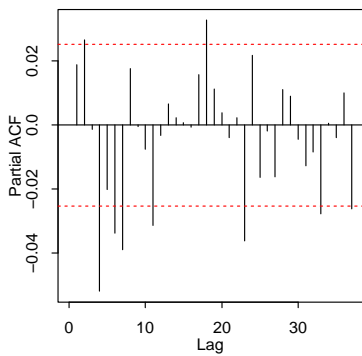
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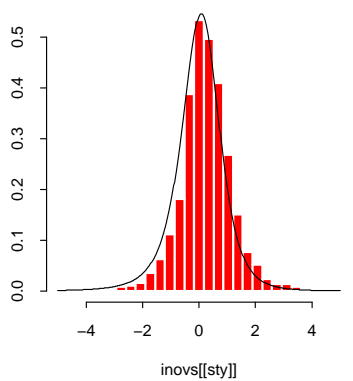
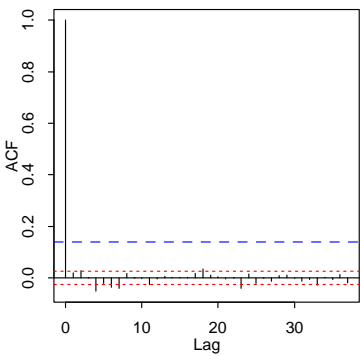
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# Conclusion

## Future work

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- Extreme value/GPD tail, or alternative distribution e.g. generalised hyperbolic
- Stronger dependence in stressed events
- Random effects for individual manager risk (leverage)
- Testing for differences between style classifications