Manager skills of long/short equity hedge funds : the factor model dependency

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APPENDICES

Appendix 1

This table presents a list of academic papers which used Morningstar as commercial hedge fund database, considering five main financial economics journals: the Journal of Finance (JF) the Journal of Financial Economics (JFE) the Review of Financial Studies (RFS) the Journal of Financial & Quantitative Analysis (JFQA) and the Financial Analysts Journal (FAJ).

Authors	Title	Year	Journal
Agarwal V, Daniel ND & Naik NY	Do hedge funds manage their reported returns?	2011	RFS
Agarwal V, Daniel ND & Naik NY	Role of managerial incentives and discretion in hedge fund performance.	2009	JF
Agarwal V & Naik NY	Hedge funds for retail investors? An examination of hedged mutual funds.	2009	JFQA
Amin GS & Kat HM	Hedge fund performance 1990-2000: Do the « Money Machines » really add value?	2003	JFQA
Ang A, Gorovyy S & van Inwegen GB	Hedge fund leverage.	2011	JFE
Avramov D, Kosowski R, Naik NY & Teo M	Hedge funds, managerial skill, and macroeconomic variables.	2011	JFE
Bollen NPB & Pool VK	Suspicious patterns in hedge fund returns and the risk of fraud.	2012	RFS
Bollen NPB & Pool VK	Conditional return smoothing in the hedge fund industry.	2008	JFQA
Bollen NPB & Pool VK	Do hedge fund managers misreport returns? Evidence from the pooled distribution.	2009	JF
Bollen NPB & Whaley RE	Hedge fund risk dynamics: Implications for performance appraisal.	2009	JF
Brav A, Jiang W, Frank P & Randall ST	The returns to hedge fund activism.	2008	FAJ
Brown SJ, Goetzmann WN, Liang B & Schwarz C	Trust and delegation.	2012	JFE
Brown SJ, Goetzmann WN & Park J	Careers and survival: Competition and risk in the hedge fund and CTA industry.	2001	JF
Cassar G & Gerakos J	Hedge funds: Pricing controls and the smoothing of self-reported returns.	2011	RFS

Chen Y & Liang B	Do market timing hedge funds time the market?	2007	JFQA
Choi D, Getmansky M, Henderson B & Trookes H	Convertible bond arbitrageurs as suppliers of capital.	2010	RFS
Deuskar P, Pollet JM, Wang ZJ & Zheng L	The good or the bad? Which mutual fund managers join hedge funds?	2011	RFS
Dichev ID & Yu F	Higher risk, lower returns: What investors really earn.	2011	JFE
Dudley E & Nimalendran M	Margins and hedge fund contagion.	2011	JFQA
Eling M	Does the measure matter in the mutual fund industry?	2008	FAJ
Fung W & Hsieh DA	Empirical characteristics of dynamic trading strategies: The case of hedge funds.	1997	RFS
Fung W & Hsieh DA	Measurement biases in hedge fund performance data: An update.	2009	FAJ
Fung W & Hsieh DA	Hedge fund benchmarks: A risk-based approach.	2004	FAJ
Fung W, Hsieh DA, Naik NY & Ramadorai T	Hedge funds: Performance, risk, and capital formation.	2008	JF
Fung H-G, Xu XE & Yau J	Global hedge funds: Risk, return, and market timing.	2002	FAJ
Greenwood R & Schor M	Investor activism and takeovers.	2009	JFE
Griffin JM & Xu J	How smart are the smart guys? A unique view from hedge fund stock holdings.	2009	RFS
Kosowski R, Naik NY & Teo M	Do hedge funds deliver alpha? A Bayesian and bootstrap analysis.	2007	JFE
Massoud N, Nandy D, Saunders A & Song K	Do hedge funds trade on private information? Evidence from syndicated lending and short-selling.	2011	JFE
Ramadorai T	The secondary market for hedge funds and the closed hedge fund premium.	2012	JF

Retrieved from Joenväärä, Kosowski and Tolonen (2016)

Appendix 2

The table below summarizes and describes all the factors used in the four different multifactor models. The Fama and French factors (MKT, SMB, HML, RMW, CMA) and the momentum factor computed by Carhart (1997) are available on the website of K. French[1]. The Fung and Hsieh (2001) factors (PTFSBD, PTFSFX, PTFSCOM) are available on their website[2]. The equity market factor (SP) and the size spread factor (SIZE) are both available on Bloomberg. The bond market factor (BOND) and the credit spread factor (CRED) are, for their part, available on the website of the Federal Reserve Bank of St. Louis. Finally, the Agarwal and Naik (2004) optional factors (ATMP, OTMP, ATMC, ITMC) are computed from the S&P 500 index and the equity factor (RUS) is the Russel 3000 index monthly total return.

Risk Factors Denomination	
MKT	Market factor
SMB	Small Minus Big factor
HML	High Minus Low factor
MOM	Momentum factor
RMW	Robust Minus Weak factor
CMA	Conservative Minus Aggressive factor
RUS	Russell 3000 index monthly total return
PTFSBD	Monthly return of the PTFS Bond Lookback Straddle
PTFSFX	Monthly return of the PTFS Currency Lookback Straddle
PTFSCOM	Monthly return of the PTFS Commodity Lookback Straddle
SP	Standard & Poor's 500 index monthly total return
SIZE	Russell 2000 index monthly total return – Standard & Poor’s 500 monthly total index
BOND	Monthly change in the 10-year Treasury constant maturity yield (month end-to-month end)
CRED	The monthly change in the Moody's Baa yield less 10-year Treasury constant maturity yield (month end-to-month end)
ATMP	At-the-money European Put option on the Standard & Poor’s 500
OTMP	Out-of-the-money European Put option on the Standard & Poor’s 500
ATMC	At-the-money European Call option on the Standard & Poor’s 500
OTMC	Out-of-the-money European Call option on the Standard & Poor’s 500

[1] The data are retrieved from the Fama and French’s website http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[2] The data are retrieved from the Fama and French’s website https://faculty.fuqua.duke.edu/~dah7/HFRFData.htm

Appendix 3

In order to obtain their three factors, Fama and French made use of 6 value-weighted portfolios based on size and book-to-market. The description of these factors is available and monthly updated on their website[3].

SMB (Small Minus Big) is constructed by taking the difference between the mean return on the three small portfolios minus the mean return on the three big portfolios:

$$\text{SMB} = \frac{1}{3} * (\text{Small Value} + \text{Small Neutral} + \text{Small Growth})$$

$$-\frac{1}{3} * (\text{Big Value} + \text{Big Neutral} + \text{Big Growth})$$

HML (High Minus Low) is constructed by taking the difference between the mean return on the two value portfolios and the mean return on the two growth portfolios:

$$\text{HML} = \frac{1}{2} * (\text{Small Value} + \text{Big Value}) - \frac{1}{2} * (\text{Small Growth} + \text{Big Growth})$$

$\mathbf{R_M - R_f}$ is the excess return on the market, obtained by computing a value-weighted return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ. On top of that, these CRSP companies need to fulfil other criteria:

- A CRSP share of 10 or 11 at the beginning of month t;
- Good shares and price data at the beginning of month t;
- Good return data for t minus the one-month Treasury bill rate from Ibbotson Associates.

[3] The factors were retrieved from the Fama and French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_factors.html

Appendix 4

In order to obtain their five factors, Fama and French made use of 6 value-weighted portfolios based on size and book-to-market, 6 value-weighted portfolios based on size and profitability and 6 value-weighted portfolios based on size and investment. The description of these factors is available and monthly updated on their website[4].

SMB (Small Minus Big) is constructed by taking the difference between the mean return on the nine small stock portfolios and the mean return on the nine big stock portfolios:

$$\text{SMB} = \frac{1}{3} * (\text{SMB}_{\left(\frac{B}{M}\right)} + \text{SMB}_{(\text{OP})} + \text{SMB}_{(\text{INV})})$$

where

- $\text{SMB}_{\left(\frac{B}{M}\right)} = \frac{1}{3} * (\text{Small Value} + \text{Small Neutral} + \text{Small Growth})$

  $-\frac{1}{3} * (\text{Big Value} + \text{Big Neutral} + \text{Big Growth})$
- $\text{SMB}_{(\text{OP})} = \frac{1}{3} * (\text{Small Robust} + \text{Small Neutral} + \text{Small Weak})$

  $-\frac{1}{3} * (\text{Big Robust} + \text{Big Neutral} + \text{Big Weak})$
- $\text{SMB}_{(\text{INV})} = \frac{1}{3} * (\text{Small Conservative} + \text{Small Neutral} + \text{Small Aggressive})$

  $-\frac{1}{3} * (\text{Big Conservative} + \text{Big Neutral} + \text{Big Aggressive})$

HML (High Minus Low) is constructed by taking the difference between the mean return on the two value portfolios and the mean return on the two growth portfolios:

$$\text{HML} = \frac{1}{2} * (\text{Small Value} + \text{Big Value}) - \frac{1}{2} * (\text{Small Growth} + \text{Big Growth})$$

RMW (Robust Minus Weak) is constructed by taking the difference between the mean return on the two robust operating profitability portfolios and the mean return on the two weak operating profitability portfolios:

$$\text{RMW} = \frac{1}{2} * (\text{Small Robust} + \text{Big Robust}) - \frac{1}{2} * (\text{Small Weak} + \text{Big Weak})$$

[4] The factors were retrieved from the Fama and French's website:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_5_factors_2x3.html

CMA (Conservative Minus Aggressive) is constructed by taking the difference between the mean return on the two conservative investment portfolios and the mean return on the two aggressive investment portfolios:

$$\text{CMA} = \frac{1}{2} * (\text{Small Conservative} + \text{Big Conservative}) - \frac{1}{2} * (\text{Small Aggressive} + \text{Big Aggressive})$$

$\mathbf{R_M - R_f}$ is the excess return on the market, obtained by computing a value-weighted return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ. On top of that, these CRSP companies need to fulfil other criteria:

- A CRSP share of 10 or 11 at the beginning of month t;
- Good shares and price data at the beginning of month t;
- Good return data for t minus the one-month Treasury bill rate from Ibbotson Associates.

Appendix 5

Computation procedure

In order to synthetically recreate the optional factors constructed by Agarwal and Naik, the Black-Scholes model was used. The inputs of the model and the underlying assumptions are described below. Let

- S_t be the spot price of the underlying asset at time t. The period under study extends from January 1998 to December 2017 and options on the S&P500 index trading on the Chicago Mercantile Exchange are considered;
- K be the exercise price of the option;
- σ be the volatility of returns of the underlying asset. The VIX index was used since this volatility index depicts how volatile are the prices of options on the S&P 500;
- t be the time in years. As the options have a maturity of one month, the variable t will be set equal to 0.083 (1/12);
- r_f is the annualized risk-free interest rate, continuously compounded. The risk-free rate available on the website of Fama and French for each month was reused in this case and transformed to obtain the corresponding annualized rate.

Once all the inputs collected, the subsequent step was simply to apply the formula of the model until reaching the put/call price.

$$d_1 = \frac{1}{\sigma\sqrt{t}} * \left[\ln\left(\frac{S_t}{K}\right) + \left(r_f + \frac{\sigma^2}{2}\right) * t\right]$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$C(S, t) = N(d_1) * S_t - N(d_2) * Ke^{-rt}$$

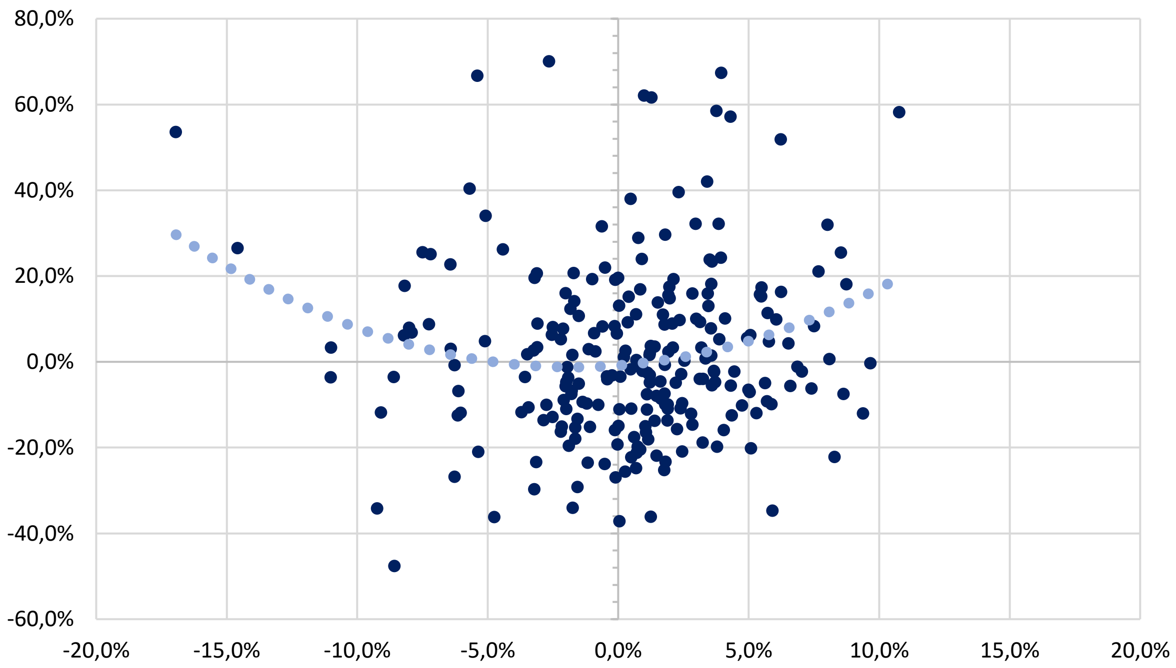
$$P(S, t) = N(-d_2) * Ke^{-rt} - N(-d_1) * S_t$$

With N(.) being the cumulative distribution function of the standard normal distribution, P the put price and C the call price. Once all the put prices are computed (for each month), the return on the option (not exercised) can be calculated. Then, it is interesting to compute the descriptive statistics (mean, standard deviation, median, etc.) of each series of returns to observe their characteristics and afterwards to plot it against the S&P 500 return to observe a potential relationship between the two series of return.

At-The-Money Put (ATMP)

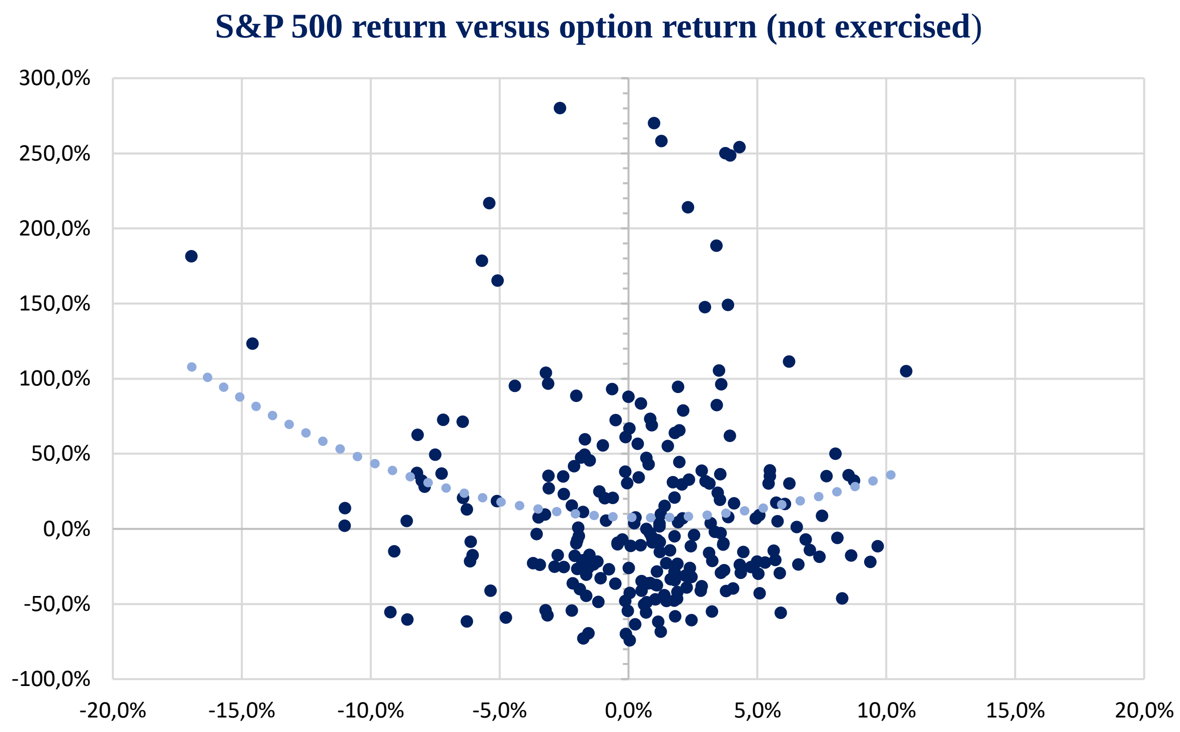
Descriptive Statistics	
Mean	2.1981
Standard Deviation	21.8193
Minimum	-47.6392
1st Percentile	-36.2085
Median	-1.1852
99th Percentile	64.8915
Maximum	143.3193

S&P 500 return versus option return (not exercised)



Out-of-The-Money Put (OTMP)

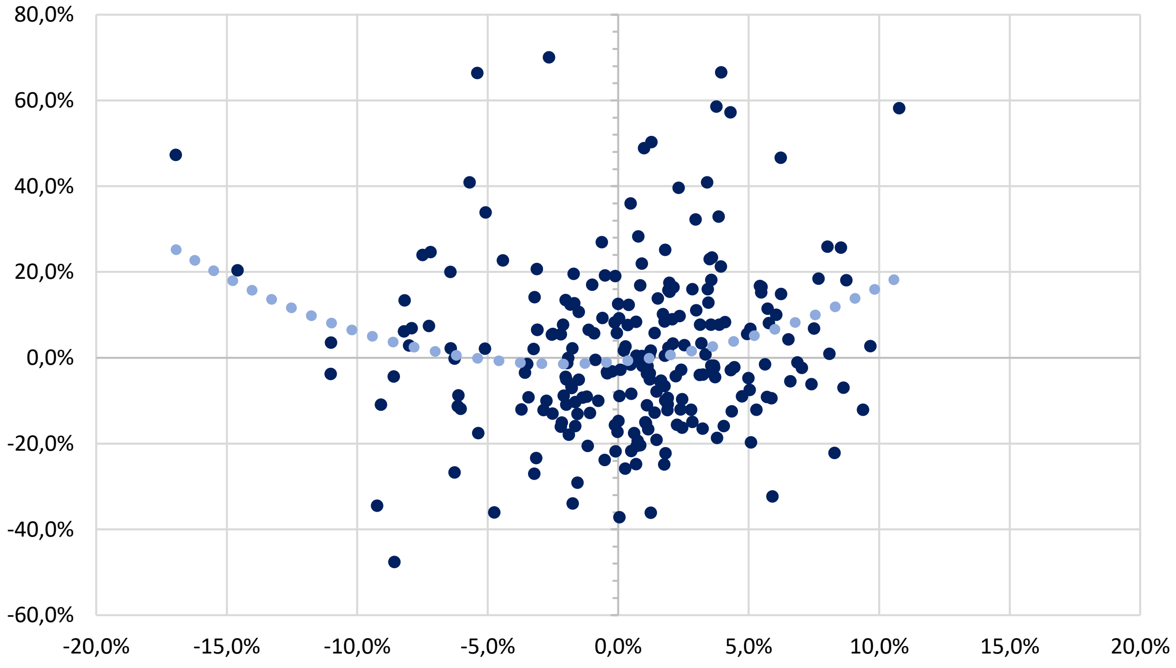
Descriptive Statistics	
Mean	18.8986
Standard Deviation	103.3573
Minimum	-74.4366
1st Percentile	-69.9892
Median	-4.3217
99th Percentile	355.2093
Maximum	1121.4824



At-the-Money Call (ATMC)

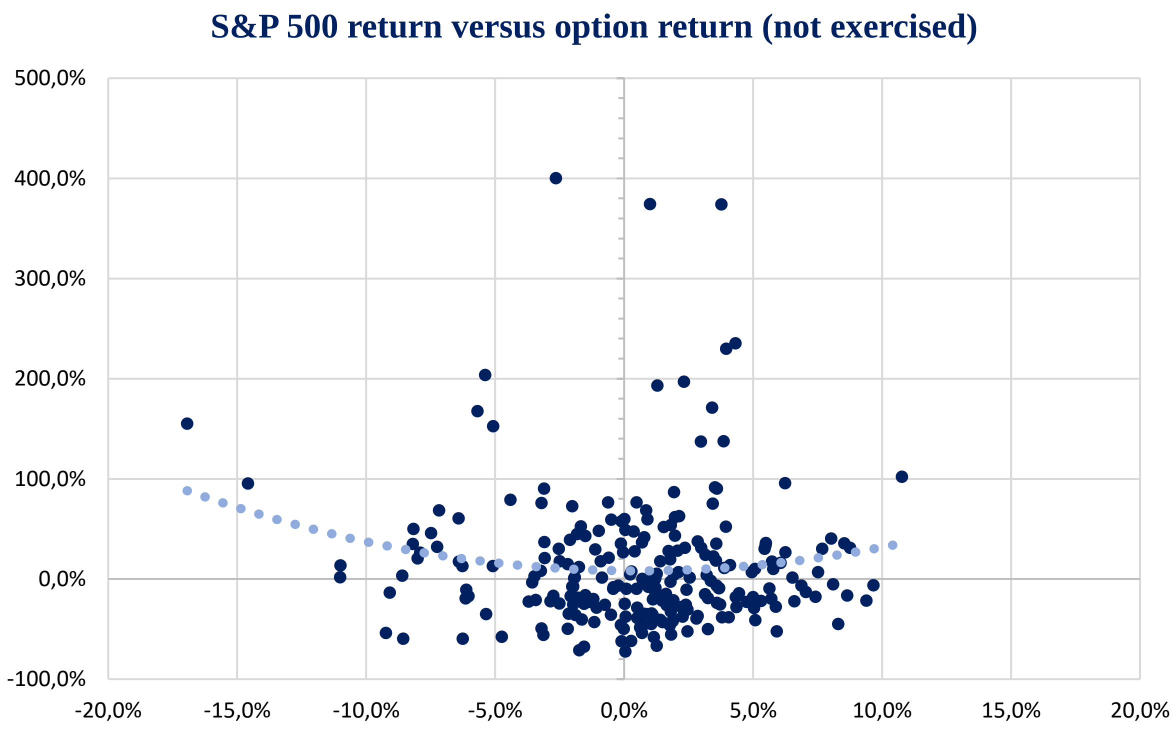
Descriptive Statistics	
Mean	1.9841
Standard Deviation	20.8712
Minimum	-47.6392
1st Percentile	-36.1662
Median	-1.1655
99th Percentile	63.3517
Maximum	143.3193

S&P 500 return versus option return (not exercised)



Out-of-The-Money Call (OTMC)

Descriptive Statistics	
Mean	15.4939
Standard Deviation	89.8134
Minimum	-72.8586
1st Percentile	-67.5631
Median	-2.8727
99th Percentile	321.1564
Maximum	997.5649



Appendix 6

Fama and French 3-factor model

Table 1: Summary statistics

Summary Statistics			
	MKT	SMB	HML
Mean	0.5725	0.2044	0.1390
Median	1.0900	0.1000	-0.1300
Variance	19.9643	11.4711	10.2947
Standard Deviation	4.4681	3.3869	3.2085
Minimum	-17.2300	-16.8800	-11.1000
Maximum	11.3500	21.7100	12.9000
Skewness	-0.7271	0.8254	0.1994
Kurtosis	1.2641	9.1493	2.4923

Table 2: Correlation matrix

Correlation Matrix				
	MKT	SMB	HML	PERF
MKT	**1.0000**	0.3170	0.1281	0.3952
SMB	0.3170	**1.0000**	-0.0500	0.1870
HML	0.1281	-0.0500	**1.0000**	-0.0021
PERF	0.3952	0.1870	-0.0021	**1.0000**

Table 3: Multicollinearity statistics (VIF)

Multicollinearity Statistics			
	MKT	SMB	HML
Tolerance	0.879	0.891	0.975
VIF	1.138	1.122	1.026
Global Multicollinearity Index			1.095

Table 4: Collinearity diagnostics (Condition Index)

Collinearity Diagnostics (Intercept adjusted)					
Number	**Eigenvalue**	**Condition Index**	**Proportion of Variation**		
			MKT	SMB	HML
1	1.3267	1.0000	0.3434	0.3023	0.0232
2	1.0344	1.1324	0.0098	0.1123	0.8083
3	0.6388	1.4410	0.6466	0.5853	0.1684
Multicollinearity Index of Besley, Kuh and Welsh (1980)					1.0953

Table 5: Model parameters

Model Parameters (PERF)						
Source	Value	Standard Error	T	Pr > |t|	Lower Bound (95%)	Upper Bound (95%)
Intercept	0.236	0.053	4.427	< **0.0001****	0.217	0.254
MKT	0.492	0.113	4.353	< **0.0001****	0.488	0.497
SMB	0.134	0.021	6.381	< **0.0001****	0.127	0.141
HML	-0.094	0.023	-4.086	< **0.0001****	-0.101	-0.088

Note:
*Significant at the 5 percent level in a one-tailed test.
**Significant at the 1 percent level in a one-tailed test.

Appendix 7

Fama and French 5-factor model

Table 1: Summary statistics

Summary Statistics					
	MKT	SMB	HML	RMW	CMA
Mean	0.5725	0.2434	0.1390	0.3112	0.2376
Median	1.0900	0.0700	-0.1300	0.3000	-0.0400
Variance	19.9643	10.1333	10.2947	9.3322	4.8524
Standard Deviation	4.4681	3.1833	3.2085	3.0549	2.2028
Minimum	-17.2300	-14.8500	-11.1000	-18.7200	-6.8700
Maximum	11.3500	18.2700	12.9000	13.5100	9.5800
Skewness	-0.7271	0.4677	0.1994	-0.3709	0.7034
Kurtosis	1.2641	5.4525	2.4923	8.6511	2.4916

Table 2: Correlation matrix

Correlation Matrix						
	MKT	SMB	HML	RMW	CMA	PERF
MKT	**1.0000**	0.3401	0.1283	-0.5042	-0.1440	0.3951
SMB	0.3401	**1.0000**	0.1334	-0.4201	0.0711	0.1892
HML	0.1283	0.1334	**1.0000**	0.1480	0.5440	-0.0020
RMW	-0.5042	-0.4201	0.1480	**1.0000**	0.1632	-0.2385
CMA	-0.1440	0.0711	0.5440	0.1632	**1.0000**	-0.1071
PERF	0.3951	0.1892	-0.0020	-0.2385	-0.1071	**1.0000**

Table 3: Multicollinearity statistics (VIF)

Multicollinearity Statistics					
	MKT	SMB	HML	RMW	CMA
Tolerance	0.651	0.769	0.619	0.618	0.652
VIF	1.536	1.301	1.617	1.618	1.533
Global Multicollinearity Index					1.521

Table 4: Collinearity diagnostics (Condition Index)

Collinearity Diagnostics (Intercept adjusted)							
Number	**Eigenvalue**	**Condition Index**	**Proportion of Variation**				
			MKT	SMB	HML	RMW	CMA
1	1.8750	1.0000	0.1126	0.0972	0.0024	0.1258	0.0171
2	1.5934	1.0847	0.0075	0.0409	0.1863	0.0003	0.1702
3	0.6877	1.6511	0.3816	0.4677	0.1075	0.0101	0.0450
4	0.5162	1.9057	0.0108	0.3726	0.0675	0.4853	0.3529
5	0.3275	2.3924	0.4872	0.0214	**0.6361**	0.3784	0.4146
Multicollinearity Index of Besley, Kuh and Welsh (1980)							1.2860

Table 5: Model parameters

Model Parameters						
Source	Value	Standard Error	T	Pr > |t|	Lower Bound (95%)	Upper Bound (95%)
Intercept	0.271	0.110	2.445	0.0147*	0.252	0.290
MKT	0.470	0.118	3.983	**< 0.0001****	0.465	0.475
SMB	0.141	0.031	4.548	**< 0.0001****	0.134	0.149
HML	-0.068	0.032	-2.125	0.0336*	-0.076	-0.060
RMW	-0.037	0.051	-0.7257	0.4680	-0.047	-0.027
CMA	-0.125	0.038	-3.2894	**< 0.0001****	-0.138	-0.112

Note:
*Significant at the 5 percent level in a one-tailed test.
**Significant at the 1 percent level in a one-tailed test.

Appendix 8

Fung and Hsieh 7-factor model

Table 1: Summary statistics

Summary Statistics							
	SP	SIZE	CRED	BOND	PTFSBD	PTFSFX	PTFSCOM
Mean	0.3569	0.1359	0.3030	-0.1553	-2.2905	-0.9731	-0.6264
Median	0.8270	0.5546	-0.4484	-0.5146	-4.9600	-4.4300	-4.2800
Variance	18.5782	20.0609	43.2974	44.0017	226.6070	342.6320	208.7569
Standard Deviation	4.3102	4.4789	6.5801	6.6334	15.0535	18.5103	14.4484
Minimum	-17.0222	-17.2901	-20.7547	-31.4448	-26.6300	-31.8100	-24.6500
Maximum	10.7719	11.6975	40.0552	21.5909	68.8600	69.2200	64.7500
Skewness	-0.6716	-0.5742	1.4075	-0.0478	1.3859	1.2336	1.1620
Kurtosis	1.3295	1.2586	6.4528	2.7961	2.7060	1.9018	1.8531

Table 2 : Correlation matrix

Correlation Matrix								
	SP	SIZE	CRED	BOND	PTFSBD	PTFSFX	PTFSCOM	PERF
SP	**1.0000**	-0.2934	-0.3794	0.1834	-0.3285	-0.2881	-0.2128	0.3793
SIZE	-0.2934	**1.0000**	-0.3922	0.2144	0.0130	0.0768	0.0704	0.0084
CRED	-0.3794	-0.3922	**1.0000**	-0.4507	0.2695	-0.3515	0.2056	-0.2327
BOND	0.1834	0.2144	-0.4507	**1.0000**	-0.2475	-0.1416	-0.1754	0.1086
PTFSBD	-0.3285	0.0130	0.2695	-0.2475	**1.0000**	0.4136	0.2269	-0.1542
PTFSFX	-0.2881	0.0768	0.3515	-0.1416	0.4136	**1.0000**	0.3997	-0.0929
PTFSCOM	-0.2128	0.0704	0.2056	-0.1754	0.2269	0.3997	**1.0000**	-0.0965
PERF	0.3793	0.0084	-0.2327	0.1086	-0.1542	-0.0929	-0.0965	**1.0000**

Table 3 : Multicollinearity statistics (VIF)

Multicollinearity Statistics							
	SP	SIZE	CRED	BOND	PTFSBD	PTFSFX	PTFSCOM
Tolerance	0.594	0.591	0.466	0.761	0.753	0.660	0.815
VIF	1.684	1.693	2.147	1.308	1.329	1.516	1.226
	Global Multicollinearity Index						1.5575

Table 4: Collinearity diagnostics (Condition Index)

Collinearity Diagnostics (Intercept adjusted)									
Number	Eigenvalue	Condition Index		Proportion of Variation					
			MKT	SIZE	CRED	BOND	PTFSBD	PTFSFX	PTFSCOM
1	2.4649	1.0000	0.0499	0.0014	0.0067	0.0041	0.0486	0.0557	0.0447
2	1.2114	1.4264	0.0335	0.4284	0.1003	0.1852	0.0001	0.0098	0.0153
3	1.0420	1.5380	0.0445	0.0427	0.5328	0 .3485	0.0593	0.0116	0.0991
4	0.9395	1.6197	0.1153	0.0607	0.0070	0.6418	0.1460	0.1266	0.0928
5	0.7247	1.8441	0.0174	0.0403	0.2890	0.0013	0.3077	0.0062	0.4351
6	0.6228	1.9893	0.1852	0.0414	0.0523	0.0164	0.0021	0.0362	0.0033
7	0.4578	2.3203	0.4819	0.3191	0.0030	0.1895	0.3013	0.1859	0.0009
	Multicollinearity Index of Besley, Kuh and Welsh (1980)								1.2035

Table 5: Model parameters

Model Parameters (PERF)						
Source	Value	Standard Error	T	Pr > |t|	Lower Bound (95%)	Upper Bound (95%)
Intercept	0.2368	0.0196	12.0816	< **0.0001****	0.4180	0.4555
SP	0.5189	0.1851	2.8201	0.0048**	0.5134	0.5244
SIZE	0.1379	0.0291	4.7388	< **0.0001****	0.1323	0.1435
CRED	-2.0464	0.7874	-2.5689	0.0102*	-2.3502	-1.7425
BOND	-1.2201	0.5212	-4.4142	< **0.0001****	-1.5023	-1.0091
PTFSBD	-0.0123	0.0034	-3.6176	< **0.0001****	-0.0137	-0.0109
PTFSFX	0.0153	0.0061	2.5081	0.0121*	0.0142	0.0165
PTFSCOM	-0.0097	0.0071	-1.3661	0.1719	-0.0111	-0.0084

Note:
*Significant at the 5 percent level in a one-tailed test.
**Significant at the 1 percent level in a one-tailed test.

Appendix 9

Agarwal and Naik 8-factor model

Table 1: Summary statistics

Summary Statistics								
	RUS	ATMP	OTMP	ATMC	OTMC	SMB	HML	MOM
Mean	0.8495	2.1981	18.8986	1.9841	15.4939	0.2238	0.1523	0.3590
Median	1.3900	-1.1852	-4.3217	-1.1655	-2.8727	0.1200	-0.1100	0.5200
Variance	20.0256	476.0829	10682.7339	435.6089	8066.4497	11.5144	10.3600	29.2959
Standard Dev	4.4750	21.8193	103.3573	20.8712	89.8134	3.3933	3.2187	5.4126
Minimum	-17.2300	-47.6392	-74.4366	-47.6392	-72.8586	-16.8800	-11.1000	-34.3900
Maximum	11.3500	143.3193	1121.4824	143.3193	997.5649	21.7100	12.9000	18.3600
Skewness	-0.7203	1.6941	6.2626	1.8171	6.3389	0.8145	0.1878	-1.4154
Kurtosis	4.2525	7.3891	57.8418	8.8805	61.5059	9.1388	2.4659	9.1438

Table 2: Correlation matrix

Correlation Matrix									
	MKT	ATMP	OTMP	ATMC	OTMC	SMB	HML	MOM	PERF
MKT	**1.0000**	-0.5801	-0.3847	-0.5749	-0.3986	0.1001	0.1739	-0.1541	0.3922
ATMP	-0.5801	**1.0000**	0.8774	0.4613	0.5167	-0.0440	-0.0580	0.0568	-0.2111
OTMP	-0.3847	0.8774	**1.0000**	0.4815	0.6123	-0.0692	-0.0534	0.0948	-0.1394
ATMC	-0.5749	0.4613	0.4815	**1.0000**	0.8923	-0.0384	-0.0523	-0.0537	-0.2093
OTMC	-0.3986	0.5167	0.6123	0.8923	**1.0000**	-0.0663	-0.0521	0.0928	-0.1467
SMB	0.1001	-0.0440	-0.0692	-0.0384	-0.0663	**1.0000**	-0.0419	-0.0143	0.0455
HML	0.1739	-0.0580	-0.0534	-0.0523	-0.0521	-0.0419	**1.0000**	-0.2950	0.0582
MOM	-0.1541	-0.0568	0.0948	0.0537	0.0928	-0.0143	-0.2950	**1.0000**	-0.0437
PERF	0.3922	-0.2111	-0.1394	-0.2093	-0.1467	0.0455	0.0582	-0.0437	**1.0000**

Table 3: Multicollinearity statistics (VIF)

Multicollinearity Statistics								
	MKT	ATMP	OTMP	ATMC	OTMC	SMB	HML	MOM
Tolerance	0.553	0.003	0.005	0.003	0.004	0.970	0.886	0.883
VIF	1.807	**297.259**	**197.039**	**318.797**	**222.613**	1.031	1.129	1.132
Global Multicollinearity Index								130.1008

Table 4: Collinearity diagnostics (Condition Index)

Collinearity Diagnostics (Intercept adjusted)										
Number	**Eigenvalue**	**Condition Index**	**Proportion of Variation**							
			MKT	ATMP	OTMP	ATMC	OTMC	SMB	HML	MOM
1	4.2560	1.0000	0.0114	0.0001	0.0002	0.0001	0.0001	0.0015	0.0010	0.0025
2	2.9779	1.1955	0.0000	0.0000	0.0000	0.0000	0.0000	0.0100	0.0022	0.0168
3	1.2375	1.8544	0.0053	0.0000	0.0000	0.0000	0.0000	0.1333	0.3254	0.1647
4	1.0532	2.0101	0.0903	0.0000	0.0001	0.0000	0.0001	0.0838	0.0651	0.0020
5	0.7912	2.3192	0.0179	0.0000	0.0000	0.0000	0.0000	0.6742	0.1231	0.0073
6	0.6346	2.5896	0.0004	0.0000	0.0000	0.0000	0.0000	0.0282	0.3649	0.7687
7	0.6122	2.6365	0.4735	0.0000	0.0005	0.0000	0.0003	0.0017	0.0479	0.0075
8	0.0010	65.1102	0.0001	**0.9138**	**0.8311**	**0.9394**	**0.8249**	0.0000	0.0024	0.0059
Multicollinearity Index of Besley, Kuh and Welsh (1980)										125.5882

Table 5: Model parameters

Model Parameters (PERF)						
Source	Value	Standard Error	T	Pr > |t|	Lower Bound (95%)	Upper Bound (95%)
Intercept	0.1120	0.0361	3.1024	0.0019**	0.330	0.368
MKT	0.540	0.1823	2.9622	0.0031**	0.534	0.545
ATMP	-0.076	0.007	-10.977	< **0.0001****	-0.090	-0.062
OTMP	0.021	0.001	18.193	< **0.0001****	0.019	0.023
ATMC	0.103	0.007	13.818	< **0.0001****	0.089	0.118
OTMC	-0.028	0.001	-19.725	< **0.0001****	-0.031	-0.025
SMB	0.2584	0.0821	3.1473	0.0016**	-0.002	0.012
HML	-0.016	0.092	-0.1739	0.8619	-0.023	-0.010
MOM	0.214	0.032	6.5625	< **0.0001****	0.018	0.025

Note:
*Significant at the 5 percent level in a one-tailed test.
**Significant at the 1 percent level in a one-tailed test.

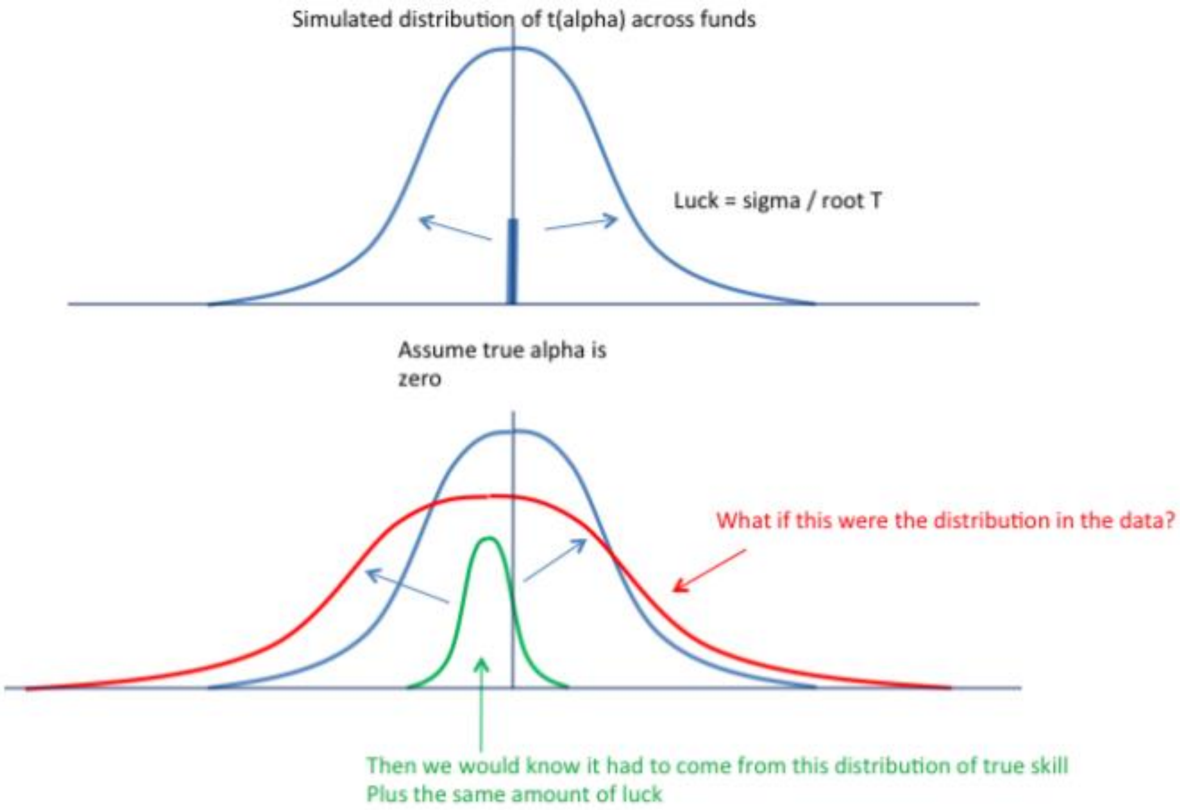
Appendix 10

By plotting the simulated distribution – where all true alphas are in fact zero – and the true distribution. the underlying distribution of true alpha can be deduced. Even though it will not show precisely who are the best ones, it will highlight the actual proportion of good and bad funds. The idea behind the bootstrap procedure is simply simulating how many alpha t-statistics will be seen if there is no true alpha and then, observing what the world distribution of alpha t-statistics looks like.

$$R_{i,t} = \alpha_i + \sum_{k=0}^{K} \beta_{i,k} * F_{k,t} + \varepsilon_{i,t}$$

$$\sigma(\alpha_i) = \sigma(\varepsilon_{i,t})/\sqrt{T}$$

$$t_i = \alpha_i / \sigma(\alpha_i)$$

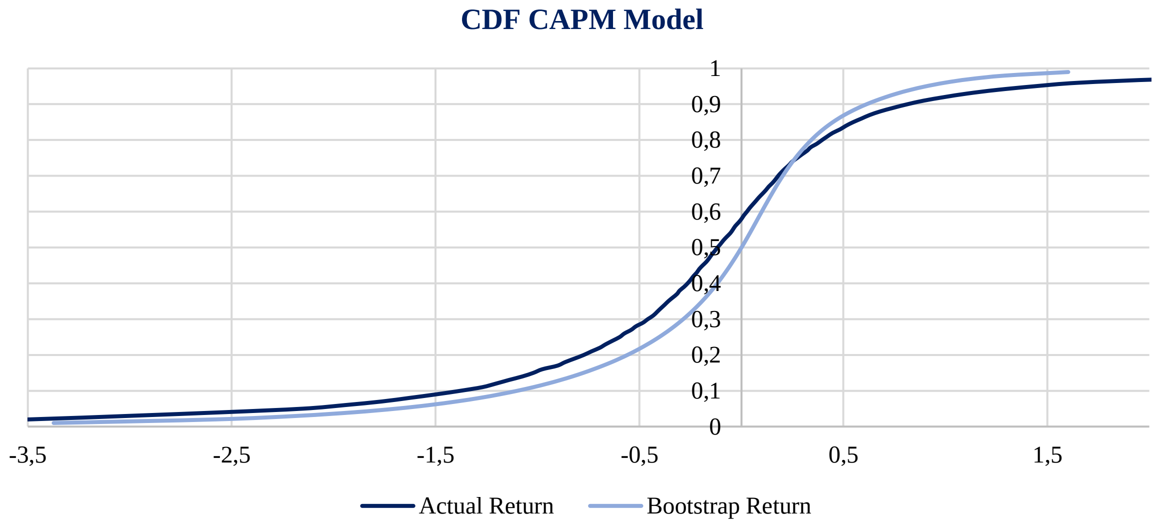


Graphs and formulas retrieved from John Cochrane's courses[5]

[5] Retrieved from the John Cochrane's website: https://faculty.chicagobooth.edu/john.cochrane/teaching/coursera_documents/Notes_for_Performance_Evaluation_Lectures.pdf

Appendix 11

The table shows values of t(α) at prespecified percentiles of the distribution of the CAPM t(α) estimates for actual hedge fund returns. The column « Simulated » shows the mean value of t(α) estimates at the different ranks from the simulation runs. The table also pictures in the column « % < Actual » the fraction of the 1000 bootstrap simulations providing lower values of t(α) at the selected percentiles than those observed for actual hedge fund returns.



CAPM Model			
	Simulated	Actual	% < Actual
1	-3.3733	-4.1246	0.51
2	-2.5786	-3.4944	0.57
3	-2.1726	-2.9988	0.84
4	-1.8987	-2.5439	0.97
5	-1.6931	-2.1507	0.41
10	-1.0989	-1.3775	2.12
20	-0.5593	-0.7732	2.5
30	-0.2854	-0.4592	6.23
40	-0.1181	-0.2642	11.28
50	< 0.0001	-0.1176	18.98
60	0.0991	0.0265	32.41
70	0.2023	0.1799	45.87
80	0.3421	0.3948	59.84
90	0.6132	0.8133	75.15
95	0.9034	1.4330	92.38
96	0.9960	1.6518	94.51
97	1.1161	2.0802	97.55
98	1.2916	2.7445	98.86
99	1.6025	3.6459	99.61

Appendix 12

The table below displays the summary statistics of the four variables representing public information, including lagged value of the three-month T-bill rate, the term premium which is the spread between 10-year and three-month Treasury bonds, the quality premium which is the spread between Moody's BAA- and AAA-rated corporate bonds and the dividend yield on the Standard and Poor's 500 index[6]. The instruments' data are available on the website of the Federal Reserve Bank of St. Louis[7].

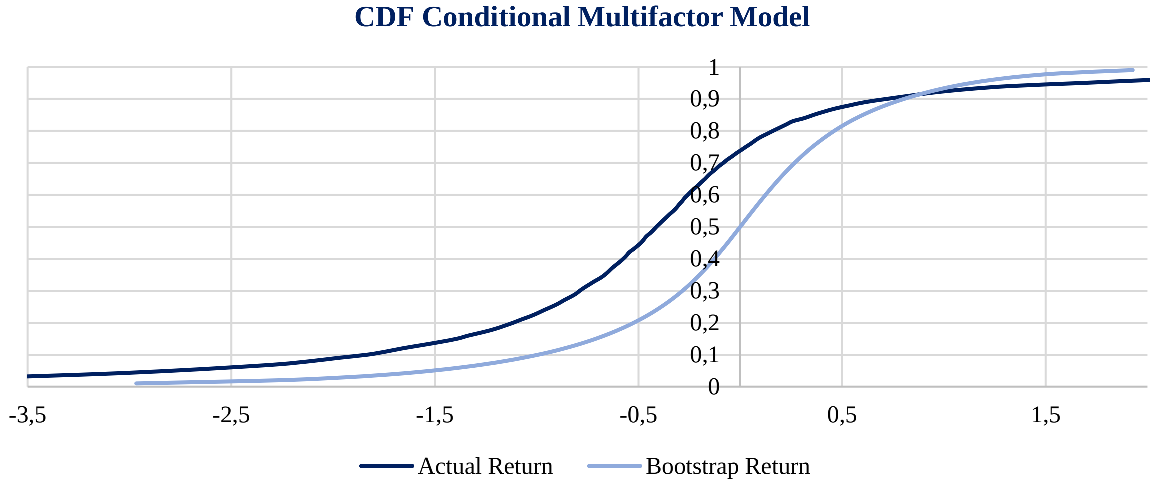
Summary Statistics				
	Mean	Standard Deviation	Min	Max
T-bill rate	1.9385	2.0357	0.0100	6.1700
Term Spread	1.8375	1.1138	-0.5300	3.7000
Quality Spread	1.0525	0.7398	0.4212	1.6817
Dividend Yield	1.8357	0.4055	1.1100	3.6000

[6] The dividend yield on the Standard and Poor's 500 index was retrieved from the website « Multpl »: http://www.multpl.com/s-p-500-dividend-yield/table?f=m

[7] The instrument's data were retrieved from the Federal Bank of St. Louis' website: https://fred.stlouisfed.org/

Appendix 13

The table shows values of t(α) estimates at prespecified percentiles of the distribution of the conditional model t(α) estimates for actual hedge fund returns. The column « Simulated » shows the mean value of t(α) estimates at the different ranks from the simulation runs. The table also pictures in the column « % < Actual » the fraction of the 1000 bootstrap simulations providing lower values of t(α) at the selected percentiles than those observed for actual hedge fund returns.



Conditional Model			
	Simulated	Actual	% < Actual
1	-2.9660	-4.7637	0.67
2	-2.2653	-4.1932	0.08
3	-1.9165	-3.6047	0.14
4	-1.6844	-3.1288	1.17
5	-1.5113	-2.7839	0.37
10	-0.9916	-1.8305	1.89
20	-0.5222	-1.1146	2.1
30	-0.2832	-0.7878	3.17
40	-0.1266	-0.5742	6.28
50	< 0.0001	-0.4116	8.47
60	0.1245	-0.2573	11.68
70	0.2675	-0.0826	23.62
80	0.4620	0.1609	36.16
90	0.8052	0.7212	44.61
95	1.1379	1.6898	89.17
96	1.2426	2.0436	92.67
97	1.3780	2.5043	97.11
98	1.5748	3.0042	99.08
99	1.9274	3.6844	99.87