Conditional Performance of Hedge Funds

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September 12, 2003

A. Introduction

- We measure the conditional performance of hedge funds using the stochastic discount factor (SDF) approach.
- This approach is most suitable for performance evaluation of actively managed portfolios because it imposes fewer restrictions on the behavior of underlying return.
- Dynamic trading strategies have time varying exposure to economic factors. SDF approach is capable of handling time variation in properties of returns.

B. Introduction

- Performance of hedge funds are measured using single-factor and multi-factor models.
- Performance of hedge funds are measured assuming fixed as well as time varying exposures to economic factors.

C. Summary of Results

- Hedge indices have had positive alpha over the last 10 years. No surprise here.
- The estimated alphas are about the same regardless of the model used.
  - Single-factor;
  - Multi-factor;
  - Fixed exposure;
  - Time-varying exposure.
- How could this be the case?

D. Summary of Results

- Some possible answers:
  - We have a useless model;
  - Alphas are driven entirely by managers' skills and these cannot be explained by any systematic economic model (at least the one used in the paper).
- What is the significance?
  - Does not matter what model we use to measure performance.
  - We need better models to measure performance.

E. Models of Performance Measurement

- "Absolute" return approach : $\alpha_i = R_i - R_f$
- Single-factor, fixed exposure approach (e.g., CAPM):

$$[R_i - R_f] = \alpha_i + \beta_i [R_k - R_f] .$$

- Single-factor, linear time varying exposure approach (e.g., Merton):

  $\beta_i = a_i + b_i R_k$:

$$[R_i - R_f] = \alpha_i + a_i [R_k - R_f] + b_i R_k [R_k - R_f] .$$

- Multi-factor, linear time varying exposure approach: extension of Merton's approach.

F. Stochastic Discount Factor

- Assumes that there are no arbitrage opportunities in financial markets.
- There will always exist a positive random variable, m such that

$$E\left[\left(R_i - R_f\right) m\right] = 0.$$

- What is m after all?
  - A discount factor that simultaneously adjusts random returns for time value of money and risk.
- So what is the significance of this?

G. SDF Continued

- If we can estimate this random variable, then if

$$E\left[\left(R_i - R_f\right) m\right] > 0,$$

  manager i has a positive alpha.
- Does not make any strong assumption about the return process of the hedge fund.
- Can measure performance using multiple benchmarks.
- Benchmarks could be buy and hold portfolios or dynamic combinations of passive indices.

H. How Can m Be Estimated?

- Linear/nonlinear function of passive or active portfolios:
  - $m = \sum_j w_j R_j$.
  - R_j could be passive indices, mutual fund returns, return to systematic trading strategies (e.g., covered call or momentum).
- Linear/nonlinear function of economic factors:
  - $m = \sum_k a_k f_k$.
  - f_k could be financial (credit spread, volatility, term spread) or economic variables (inflation, GDP, money supply).
- The parameters are then estimated.

I. Estimation of m

- We know that passive indices have no alpha. For example,

$$E\left[\left(R_{S\&P} - R_f\right) m\right] = 0$$

must hold. In this case S&P is a primitive asset. Any portfolio, trading strategy and asset that we know does not have an alpha can be used as a primitive asset.

- Example:

$$m = a + b\left(f_t\right) R_{S\&P}.$$

In this case m is a time varying function of S&P500 return.

J. Empirical Methodology

- Use univariate and multivariate regression.
- Use Generalized Method of Moments:
  - Nests multivariate regression;
  - Imposes few restrictions on the data;
  - Very suitable when volatility is changing and returns may be autocorrelated;

K. Summary Statistics

Returns on Hedge Funds	Mean	Standard Deviation	Skewness	Kurtosis	Auto 1	Auto 2	Auto 3	Annualized Sharpe Ratio
Covertible Arbitrage	0.94%	0.99%	-1.386	3.353	0.542	0.238	-0.028	1.91
Equity Hedge	1.59%	2.71%	0.095	1.230	0.122	0.043	-0.013	1.52
Event Driven	1.26%	1.93%	-1.475	5.800	0.253	0.003	-0.007	1.54
Distressed Securites	1.20%	1.85%	-0.701	5.736	0.502	0.128	0.002	1.49
Merger Arbitrage	0.97%	1.30%	-3.078	13.493	0.143	-0.022	0.053	1.53
Equity Market Neutral	0.89%	0.95%	-0.069	0.311	-0.015	0.030	0.090	1.78
Emerging Markets	1.23%	4.65%	-0.760	3.343	0.313	0.079	0.021	0.62
Equity NonHedge	1.44%	4.30%	-0.555	0.584	0.167	-0.055	-0.119	0.83
Fixed Income	0.90%	1.06%	-0.334	4.454	0.401	0.237	0.014	1.63
Fixed Income Arbitrage	0.70%	1.38%	-1.621	8.224	0.398	0.131	0.130	0.74
Hight Yield	0.76%	2.01%	-0.707	5.463	0.410	0.202	-0.008	0.62
Composite	1.26%	2.11%	-0.726	2.894	0.232	0.047	-0.062	1.41
Fund of Funds	0.89%	1.76%	-0.349	3.679	0.305	0.111	-0.005	0.96
Macro	1.40%	2.59%	0.234	0.211	0.173	0.010	-0.016	1.33
Market Timing	1.16%	2.01%	0.059	-0.559	-0.042	0.090	-0.060	1.31
Relative Value	1.08%	1.12%	-1.124	10.496	0.227	0.170	0.018	2.11
Short	0.37%	6.70%	0.120	1.062	0.083	-0.070	-0.025	-0.01
Statistical Arbitrag	0.86%	1.13%	-0.021	0.320	0.201	0.058	0.054	1.41
Returns on Primitive Assets								
Large	1.09%	4.07%	-0.440	0.527	0.004	-0.075	-0.057	0.59
Small	1.19%	5.97%	-0.470	1.029	0.167	-0.132	-0.198	0.46
Growth	1.14%	4.80%	-0.476	0.628	0.000	-0.003	-0.040	0.53
Value	1.07%	4.25%	-0.149	0.889	0.104	-0.154	-0.062	0.54
Long-Term Gov Bonds	0.76%	2.29%	-0.119	0.332	0.156	-0.035	-0.008	0.54
Long-Term Corp Bonds	0.76%	1.82%	0.058	0.257	0.095	0.048	-0.024	0.68
High Yield	0.73%	2.24%	-0.205	5.029	0.300	0.038	-0.035	0.51
Momentum	0.39%	3.90%	-0.332	3.693	0.030	-0.070	0.076	0.35
T-Bill	0.40%	0.11%	0.275	0.131	0.904	0.878	0.855	0.00
Factors								
Credit Spread	0.78%	0.18%	1.280	1.909	0.889	0.804	0.707	
Term Spread	1.85%	1.30%	0.372	-0.787	0.975	0.944	0.912	
Dividend Yield	2.26%	0.83%	0.102	-1.263	0.995	0.988	0.982	
Volatility Index	20.41%	6.80%	0.845	1.262	0.833	0.690	0.632	
T-Bill	4.92%	1.33%	0.131	0.238	0.984	0.955	0.915	

L. Lagged Correlations Between Factors and Hedge Funds

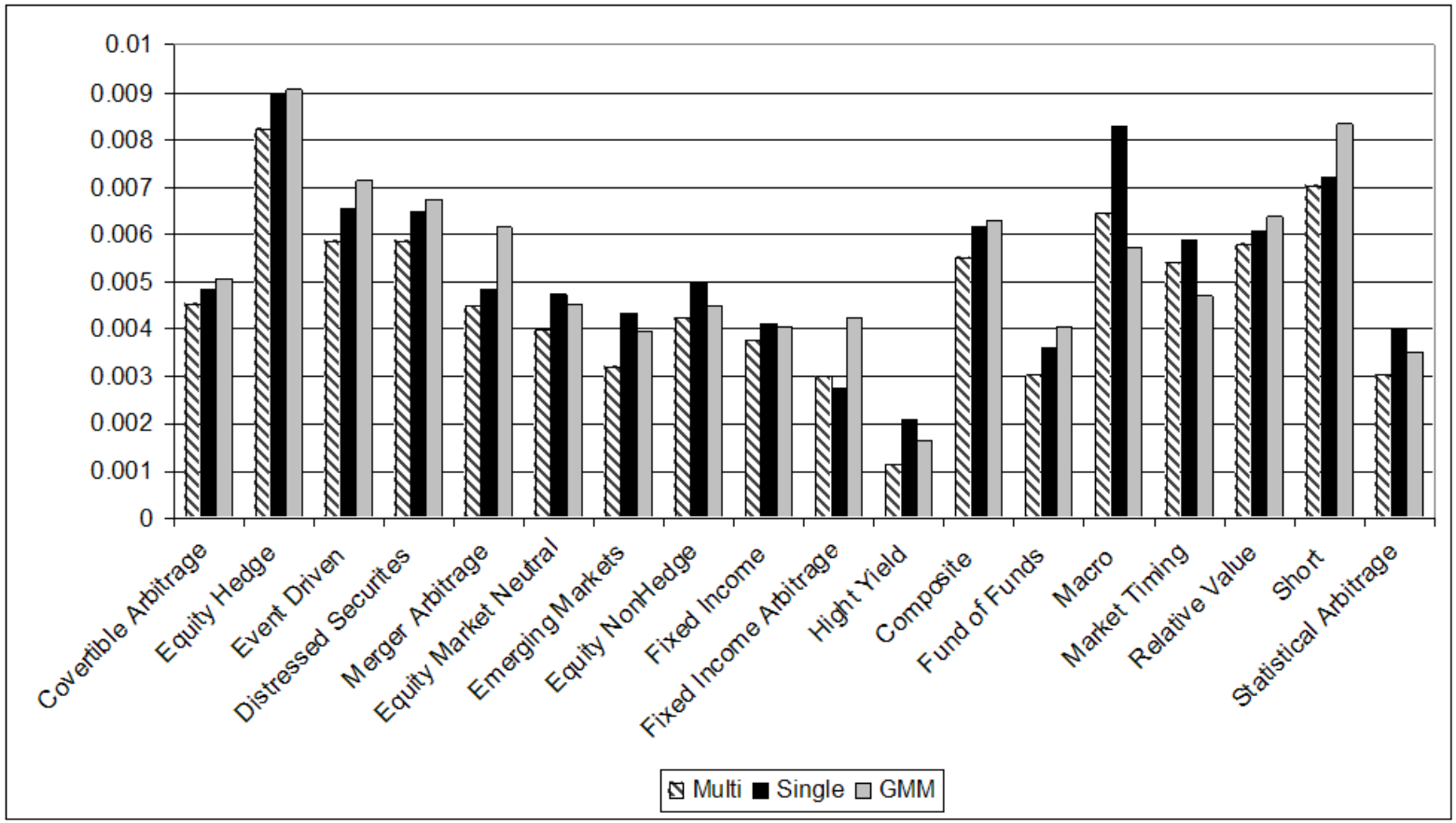
	T-Bill	Credit Spread	Term Spread	Dividend Yield	Volatility Index
Covertible Arbitrage	-0.013	-0.032	-0.046	-0.103	-0.163
Equity Hedge	0.034	0.126	0.012	0.084	-0.010
Event Driven	-0.094	0.101	0.109	0.081	-0.146
Distressed Securites	-0.130	**0.180**	**0.226**	**0.204**	**-0.272**
Merger Arbitrage	0.034	0.015	-0.052	0.021	-0.082
Equity Market Neutral	**0.180**	0.085	-0.100	0.081	-0.065
Emerging Markets	**-0.182**	0.162	**0.256**	0.132	-0.133
Equity NonHedge	-0.084	0.142	0.117	0.105	-0.020
Fixed Income	-0.059	**0.310**	**0.244**	**0.298**	**-0.294**
Fixed Income Arbitrage	-0.062	**0.202**	**0.258**	**0.274**	**-0.368**
Hight Yield	-0.147	**0.188**	**0.233**	**0.200**	**-0.313**
Composite	-0.083	0.141	0.145	0.125	-0.109
Fund of Funds	0.008	0.084	0.091	0.105	-0.137
Macro	-0.062	0.126	**0.214**	**0.220**	**-0.189**
Market Timing	-0.026	0.099	0.020	0.001	0.094
Relative Value	-0.068	0.138	0.123	0.150	-0.140
Short	0.089	-0.111	-0.072	-0.047	-0.061
Statistical Arbitrage	0.104	0.084	0.064	**0.206**	-0.071

In bold, significant values at the level of significance alpha=0.050 (two-tailed test)

M. Single-Factor Results Using Two Different Benchmarks

	Covertible Arbitrage	Equity Hedge	Event Driven	Distressed Securites	Merger Arbitrage	Equity Market Neutral	Emerging Markets	Equity NonHedge	Fixed Income	Fixed Income Arbitrage	Hight Yield	Composite	Fund of Funds	Macro	Market Timing	Relative Value	Short
Small Cap As Benchmark																	
Alpha	0.48%	0.90%	0.65%	0.65%	0.48%	0.47%	0.43%	0.50%	0.41%	0.27%	0.21%	0.61%	0.36%	0.83%	0.59%	0.61%	0.72%
T-Stat	6.439	6.730	6.573	5.134	5.110	6.034	1.434	4.114	5.836	2.340	1.458	6.931	2.896	4.325	4.577	7.344	2.370
P-Value	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.37%	0.01%	0.00%	2.07%	14.71%	0.00%	0.44%	0.00%	0.00%	0.00%	1.91%
Beta	0.074	0.367	0.258	0.188	0.111	0.018	0.500	0.680	0.114	0.031	0.189	0.309	0.163	0.211	0.220	0.096	-0.943
T-Stat	5.913	16.546	15.603	8.966	7.019	1.388	9.935	33.664	9.698	1.579	8.005	20.974	7.946	6.608	10.297	7.021	-18.704
P-Value	0.00%	0.00%	0.00%	0.00%	0.00%	16.73%	0.00%	0.00%	0.00%	11.65%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
RSQ	0.198	0.198	0.632	0.361	0.258	0.013	0.410	0.889	0.398	0.017	0.311	0.756	0.308	0.235	0.427	0.258	0.711
High Yield Bond As Benchmark																	
Alpha	0.47%	1.02%	0.67%	0.61%	0.48%	0.48%	0.49%	0.66%	0.39%	0.25%	0.09%	0.67%	0.41%	0.82%	0.66%	0.60%	0.39%
T-Stat	6.522	4.940	5.494	5.228	4.987	6.105	1.438	2.262	6.114	2.191	1.192	4.664	2.877	4.211	4.139	7.180	0.765
P-Value	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.26%	2.52%	0.00%	3.01%	23.51%	0.00%	0.46%	0.00%	0.01%	0.00%	44.55%
Beta	0.233	0.531	0.581	0.558	0.286	0.015	1.022	1.140	0.343	0.138	0.799	0.562	0.245	0.526	0.305	0.246	-1.273
T-Stat	7.382	5.852	10.836	10.767	6.753	0.426	6.741	8.811	12.200	2.731	22.752	8.799	3.929	6.085	4.310	6.656	-5.647
P-Value	0.00%	0.00%	0.00%	0.00%	0.00%	67.06%	0.00%	0.00%	0.00%	0.71%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
RSQ	0.277	0.194	0.453	0.449	0.243	0.001	0.242	0.353	0.512	0.050	0.785	0.353	0.098	0.207	0.116	0.277	0.183

N. Comparison of Results for Hedge Fund Indices



O. Summary Statistics for Hedge Fund Managers

	Mean	Standard Deviation	Skewness	Kurtosis	Auto 1	Auto 2	Auto 3	Annualized Sharpe Ratio	# of Funds	Average Assets Under Management
S. Conv Arb	0.95%	0.72%	-0.489	1.970	0.277	0.081	0.064	2.57	21	$ 116,645,194
L. Conv Arb	1.19%	1.16%	-1.621	4.695	0.547	0.284	0.112	2.33	21	$ 506,235,995
S. Eq Hedge	1.76%	2.69%	-0.244	1.152	0.163	-0.064	-0.132	1.73	30	$ 137,890,283
L. Eq Hedge	1.96%	8.00%	1.268	4.424	0.211	0.273	0.051	0.67	30	$ 997,364,864
S. Event Drv	1.16%	2.02%	-1.854	8.666	0.286	0.044	-0.031	1.28	30	$ 102,111,692
L. Event Drv	1.25%	1.50%	-3.986	26.237	0.222	0.060	-0.022	1.93	30	$ 491,007,415
S. Distressed	1.04%	1.58%	-1.350	7.456	0.381	0.177	0.004	1.37	15	$ 92,958,815
L. Distressed	1.12%	1.73%	-2.581	13.164	0.307	0.075	-0.052	1.43	15	$ 983,144,555
S. Merg Arb	1.04%	1.20%	-2.459	10.303	0.035	-0.006	0.128	1.82	15	$ 117,588,672
L. Merg Arb	0.96%	0.82%	-2.493	13.657	0.297	0.116	0.052	2.32	15	$ 248,493,834
S. Eq MN	1.10%	1.26%	-0.478	1.786	0.081	-0.111	0.018	1.89	22	$ 156,115,600
L. Eq MN	0.87%	1.78%	-0.541	1.036	0.003	-0.001	0.108	0.89	22	$ 428,455,392

P. Single-Factor Models for Managers

	S. Conv Arb	L. Conv Arb	S. Eq Hedge	L. Eq Hedge	S. Event Drv	L. Event Drv	S. Distressed	L. Distressed	S. Merg Arb	L. Merg Arb	S. Eq MN	L. Eq MN
Small Cap As Benchmark												
Alpha	0.49%	0.71%	1.02%	1.10%	0.52%	0.69%	0.50%	0.59%	0.53%	0.48%	0.62%	0.33%
T-Stat	7.085	6.165	7.108	1.350	4.052	5.795	3.427	3.556	5.041	6.550	4.866	1.945
P-Value	0.000	0.000	0.000	0.181	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.055
Beta	0.054	0.076	0.353	0.480	0.249	0.158	0.133	0.135	0.109	0.070	0.079	0.131
T-Stat	5.289	4.440	16.556	3.960	13.139	8.890	6.056	5.485	7.002	6.371	4.202	5.094
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RSQ	0.254	0.194	0.770	0.161	0.678	0.491	0.309	0.268	0.374	0.331	0.177	0.240
F-Value	27.975	19.715	274.100	15.684	172.642	79.035	36.681	30.089	49.026	40.595	17.658	25.949
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
High Yield Bond As Benchmark												
Alpha	0.51%	0.75%	1.26%	1.41%	0.67%	0.78%	0.57%	0.63%	0.58%	0.52%	0.66%	0.41%
T-Stat	7.150	6.166	3.907	1.291	2.902	5.370	3.343	4.249	4.864	6.306	4.779	1.883
P-Value	0.000	0.000	0.000	0.200	0.005	0.000	0.001	0.000	0.000	0.000	0.000	0.063
Beta	0.188	0.254	0.659	1.072	0.629	0.491	0.422	0.621	0.346	0.218	0.238	0.387
T-Stat	5.320	4.269	4.894	2.436	6.832	7.362	5.407	8.697	6.177	5.468	3.558	4.199
P-Value	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
RSQ	0.257	0.182	0.226	0.067	0.363	0.398	0.263	0.480	0.318	0.267	0.134	0.177
F-Value	28.308	18.221	23.949	5.932	46.670	54.195	29.237	75.638	38.158	29.894	12.657	17.633
P-Value	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000

Q. Comparison of Results for Hedge Fund Managers