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INVESTMENT MANAGEMENT

Return and Drawdown Similarities of Hedge Funds

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We investigate return persistence with a statistical test from 2 perspectives: based on 1) the weekly returns of the managers, and 2) mangers' drawdown behaviour. The dbSelect database provides daily index levels for live and defunct CTAs from January 2004 to December 2014. We calculate 52 weekly returns for each manager for each year. These weekly returns are the inputs for the analyses for perspective 1). For perspective 2), the returns are transformed: the 5 worst weekly returns are coded as "1", while the other 47 returns are coded as "0". This gives a vector with 52 entries for each year for each manager. If 2 managers exhibit similar drawdown behaviours, they should experience their worst drawdowns in the same weeks or have the "1" codes in the same weeks:

Week	Manager 1	Manager 2	Manager 3
1	0	1	0
2	0	0	1
3	0	0	0
4	1	1	0
5	0	0	1
6	0	0	1
7	1	0	0
8	1	1	0
9	0	0	0
10	0	0	1
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
48	0	0	1
49	0	0	0
50	1	1	0
51	0	0	0
52	1	1	0

Table 1: Example of the 0/1 coding for drawdown behaviour [perspective 2]

In Table 1, managers 1 and 2 share 4 of their 5 worst weekly drawdowns in weeks 4, 8, 50, and 52. Manager 3, on the contrary, does not share any of his 5 worst weekly drawdowns with neither manager 1 nor manager 2. For portfolio construction we would like to avoid investing simultaneously in managers 1 and 2, but would prefer to invest in, for example, managers 1 and 3. In order to quantify return or drawdown similarities, we calculate the Euclidean Distance for each pair of managers based on the 52 weekly data points for each year:

$$d_{x,y} = \sqrt{\sum_{t=1}^{T} (x_t - y_t)^2}$$

Where: T: number of weeks for each year [52],

x, y: coordinates of manager x and manager y [for 1): weekly returns; for 2): 0 or 1 for each week].

A Euclidean Distance of 0 means that 2 managers produce identical returns or drawdowns at the same weeks. For example, for perspective 2), i.e., 0/1 coding, the Euclidean Distance of 2 dissimilar managers would be: $\sqrt{5 \cdot [0-1]^2 + 5 \cdot [1-0]^2} = \sqrt{10} = 3.16$. We calculate the Euclidean Distances for each pair of managers for the 52 weeks of each year. For example, for N = 100 managers, this gives N · [N - 1] / 2 = 100 · 99 = 4,950 Euclidean Distances. A dissimilarity matrix is created that contains all Euclidean Distances for one year. If managers' return or drawdown behaviour for 2 consecutive years is identical, we can expect their dissimilarity matrices to be highly correlated. The null hypothesis of Mantel's (1967) test is that there is no relation between 2 matrices. If the return of drawdown behaviour of the managers in 2 consecutive years is similar and hence the 2 dissimilarity matrices are highly correlated [i.e., Mantel's r is high], we should be able to reject the null and expect p-values close to 0. Table 2 shows for each pair of consecutive years starting in 2003 that Mantel's r is significantly different from 0. The tests were conducted with the R package vegan. For example, the correlation between the 2 dissimilarity matrices of 2006 and 2007 is for perspective 1) 0.66 with a p-value of 0.0001 and for perspective 2) 0.25 with a p-value of 0.0010.

		0/1 coding		Returns	
start	end	Mantel r	p	Mantel r	p
2004	2005	0.22	0.0010	0.57	0.0001
2005	2006	0.16	0.0010	0.58	0.0001
2006	2007	0.25	0.0010	0.66	0.0001
2007	2008	0.14	0.0010	0.55	0.0001
2008	2009	0.12	0.0010	0.66	0.0001
2009	2010	0.23	0.0010	0.71	0.0001
2010	2011	0.26	0.0010	0.75	0.0001
2011	2012	0.28	0.0010	0.69	0.0001
2012	2013	0.15	0.0010	0.57	0.0001
2013	2014	0.26	0.0010	0.78	0.0001

Table 2: Mantel's r for 1) returns and 2) 0/1 coding

Mantel's r in Table 2 are higher for returns with an average of 0.66. The average Mantel's r for 0/1 coding is 0.21. All p-values are close to 0. We therefore conclude that there is persistence in the return and drawdown behaviour of hedge funds.

For the pairs of years including the extraordinary year 2008, when the S&P500 index lost -38%, Mantel's r are at their lowest levels [0/1 coding: 0.14 for 2007/08 vs. average of 0.21; returns: 0.55 vs. average of 0.66]. This can be interpreted as a structural break which led managers to change their strategies with an impact on their return and drawdown behaviour.

Why are Mantel's r lower for 0/1 coding than for returns? For the latter, all 52 weekly data points of one year are effectively included in the calculation of the Euclidean Distance. If there is a change in one data point, for example, manager i experiencing a large drawdown in week 23 and the manager j experiencing a draw up in the

same week, there is only a small impact on the Euclidean Distance, as only 1 / 52 data points change. For 0/1 coding only 5 weekly observations are 1, while the other 47 weekly observations are 0. This equals a change of 1 / 5 data points and hence as a higher impact on the Euclidean Distance and Mantel's r.

As an outlook for future work we will investigate whether portfolios formed on the basis of avoiding a concentration in managers with similar drawdown behaviour can help to build robust fund of hedge fund portfolios.

References

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