Compensation Option, Managerial Incentives, and Risk Taking in Hedge Funds

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Motivation

- The unique compensation structure of hedge funds is the major income-generator for their managers.
- High water mark and incentive fee.
- Performance incentive fee is similar to a long position in a call option on fund's NAV.
- How do these managers respond, in terms of risk taking, when the option has different "moneyness".

Contributions

- This is one of the few papers to empirically approximate optionality of hedge funds managers' compensation structure (see Brown Goetzmann and Park (2001))
- We test theoretical models proposed, including Carpenter (2000), Gotezmann, Ingersoll, and Ross (2003), Hodder and Jackwerth (2007).
- We find that managers do increase their fund volatility when the compensation option is "out-of-the-money".
- We identify several fund characteristics that may influence managers' risk-taking behavior, for example, size, age, and management fees.

Data Description

- Combined hedge funds data from 3 major databases: CISDM, HFR, and TASS.
- Survivorship bias taken care of by including both live and defunct funds.
- Altogether there are 6282 individual funds with return history from January 1994 to August 2005.
- The entire sample period is divided into 3-year sample periods to conduct the study. For example, 1st sample period goes from Jan 1994 to Dec 1996, 2nd sample period goes from Jan 1995 to Dec 1997, and so on.

Proxy for Compensation Option

- Maximum NAV of the fund in the previous 3-year sample is assumed to be the High-Water Mark.
- For each year a fund's NAV is compared to the HWM to determine the "moneyness of the option"
- If the NAV is less than HWM * Threshold, then the incentive fee is "out-of-the-money".
- The threshold is used to address the issue that capital inflows coming at different times are subject to different high-water mark.
- The "moneyness" of the compensation option as well as the length of time that the fund stays under HWM are combined to approximate for management's compensation option and length of time that the manager has not received performance incentive.

Shift of Risk-Taking: Regression

$$\text{Stdev Ratio } 2_i = \alpha_i + \beta_1 \times \text{Moneyness}_i + \beta_2 \times \text{Time-under}_i + \beta_3 \times \text{Avg Relative Return}_i + \beta_4 \times \text{Stdev Ratio } 1_i + \varepsilon_i$$

- This cross-sectional regression is run to determine if moneyness affects each year's second half relative volatility.
- Moneyness is -1,0, or +1 depending on if the option is out-of, at- or in-the-money.
- Hypothesis is that $\beta_1 < 0$ *and* $\beta_2 > 0$

Summary Statistics

Year	"In-the-Money" (%)	"Out-of-the-Money" (%)	Mean Time-Under(month)	Median Time-Under(month)	Min NAV (%)
1997	4.15	8.76	2	0	47
1998	43.78	7.68	2	0	32
1999	39.20	16.65	13	12	13
2000	47.51	10.86	4	0	12
2001	47.78	15.21	5	3	8
2002	40.96	17.50	7	3	1
2003	34.32	25.45	17	14	5
2004	68.92	7.10	5	0	48

Regression Results (Threshold = 0.9)

Panel A. Summary Stats of Explanatory Factors

	Mean	Minimum	Maximum	Stdev
Time-under (month)	7.74	0.00	42.00	10.40
Avg. Return (%)	1.07	-12.79	31.58	2.15
Stdev Ratio 1	1.08	0.00	14.63	1.08
Stdev Ratio 2	0.86	0.00	8.24	0.81
Moneyness	0.25	-1.00	1.00	0.73

Panel B. Parameter Estimates

	Estimate	Std Error	t-value	p-value
Intercept	0.23	0.01	20.65	<0.0001
Moneyness	-0.06	0.01	-6.39	<0.0001
Time-under	0.01	0.00	11.81	<0.0001
Avg. Return	1.77	0.29	6.01	<0.0001
Stdev ratio 1	0.50	0.01	86.49	<0.0001

Adj. $R^2 = 0.51$

Shift of Risk-taking: Contingency Table Test

	Funds with January to June Return Less Than Median		Funds with January to June Return Greater Than Median			
Year	Variance Ratio Low	Variance Ratio High	Variance Ratio Low	Variance Ratio High	Log Odds Ratio	Chi-square Test p-value
1994	61	106	106	62	1.09	<0.0001
1995	115	129	29	117	-1.28	0.2400
1996	124	192	192	125	0.87	<0.0001
1997	157	248	248	158	0.91	<0.0001
1998	238	273	272	240	0.26	0.0362
1999	228	417	418	231	1.20	<0.0001
2000	373	426	426	374	0.26	0.0086
2001	444	497	497	444	0.23	0.0145
2002	501	626	627	502	0.45	<0.0001
2003	584	718	719	586	0.41	<0.0001
2004	697	764	764	698	0.18	0.0139

Size Effect in Shift of Risk-taking

	Estimate	Std Error	t-value	p-value	Adj. R^2
Panel A. Funds with AUM in the 1st Quintile					
Intercept	0.26	0.04	6.61	0.00	0.50
Moneyness	-0.01	0.04	-0.24	0.82	
Time-under	0.01	0.00	5.92	0.00	
Std ratio 1	0.53	0.02	33.01	0.00	
Panel B. Funds with AUM in the 2nd Quintile					
Intercept	0.32	0.04	8.65	0.00	0.44
Moneyness	-0.03	0.03	-0.90	0.42	
Time-under	0.01	0.00	5.03	0.01	
Std ratio 1	0.47	0.02	29.04	0.00	
Panel C. Funds with AUM in the 3rd Quintile					
Intercept	0.29	0.03	10.02	0.00	0.50
Moneyness	-0.08	0.02	-3.34	0.03	
Time-under	0.01	0.00	5.46	0.01	
Std ratio 1	0.49	0.02	32.08	0.00	
Panel D. Funds with AUM in the 4th Quintile					
Intercept	0.17	0.03	5.35	0.01	0.51
Moneyness	-0.02	0.03	-0.67	0.54	
Time-under	0.01	0.00	6.16	0.00	
Std ratio 1	0.57	0.02	33.22	0.00	
Panel E. Funds with AUM in the 5th Quintile					
Intercept	0.15	0.03	5.55	0.01	0.50
Moneyness	-0.02	0.02	-0.95	0.40	
Time-under	0.01	0.00	6.28	0.00	
Std ratio 1	0.59	0.02	31.85	0.00	

Age Effect in Shift of Risk-taking

	Estimate	Std Error	t-value	p-value	Adj. R^2
Panel A. Funds Age = 0-2 Years					
Intercept	0.26	0.04	6.16	0.00	0.44
Moneyness	-0.03	0.04	-0.89	0.42	
Time-under	0.00	0.00	1.96	0.12	
Std ratio 1	0.38	0.02	16.93	0.00	
Panel B. Funds Age = 1-3 Years					
Intercept	0.26	0.03	8.32	0.00	0.52
Moneyness	-0.06	0.03	-2.30	0.08	
Time-under	0.01	0.00	2.96	0.04	
Std ratio 1	0.47	0.02	29.07	0.00	
Panel C. Funds Age = 2-4 Years					
Intercept	0.28	0.02	12.11	0.00	0.48
Moneyness	-0.09	0.02	-4.51	0.01	
Time-under	0.01	0.00	5.76	0.00	
Std ratio 1	0.48	0.01	43.82	0.00	
Panel D. Funds Age = 3-5 Years					
Intercept	0.26	0.02	12.14	0.00	0.48
Moneyness	-0.09	0.02	-4.84	0.01	
Time-under	0.01	0.00	6.65	0.00	
Std ratio 1	0.51	0.01	48.24	0.00	
Panel E. Funds Age = 4-6 Years					
Intercept	0.18	0.02	7.80	0.00	0.52
Moneyness	-0.04	0.02	-1.76	0.15	
Time-under	0.01	0.00	8.49	0.00	
Std ratio 1	0.55	0.01	45.18	0.00	

Mgt Fee Effect in Shift of Risk-taking

	Estimate	Std Error	t-value	p-value	Adj. R^2
Panel A. Management Fees 0-1%					
Intercept	0.26	0.04	6.16	0.00	0.44
Moneyness	-0.03	0.04	-0.89	0.42	
Time-under	0.00	0.00	1.96	0.12	
Std ratio 1	0.38	0.02	16.93	0.00	
Panel B. Management Fees 1-3%					
Intercept	0.26	0.03	8.32	0.00	0.52
Moneyness	-0.06	0.03	-2.30	0.08	
Time-under	0.01	0.00	2.96	0.04	
Std ratio 1	0.47	0.02	29.07	0.00	
Panel C. Management Fees 3-5%					
Intercept	0.28	0.02	12.11	0.00	0.48
Moneyness	-0.09	0.02	-4.51	0.01	
Time-under	0.01	0.00	5.76	0.00	
Std ratio 1	0.48	0.01	43.82	0.00	

Impact of Change in Threshold

	Estimate	Std Error	t-value	p-value	R^2
Panel A. Threshold = 0.20					
Intercept	0.24	0.01	20.13	<0.0001	0.48
Moneyness	-0.02	0.01	-1.67	0.10	
Time-under	0.01	0.00	13.43	<0.0001	
Avg. Return	0.16	0.34	0.48	0.63	
Std ratio 1	0.50	0.01	73.00	<0.0001	
Panel B. Threshold = 0.95					
Intercept	0.25	0.01	17.04	<0.0001	0.48
Moneyness	-0.03	0.02	-1.64	0.08	
Time-under	0.01	0.00	13.43	<0.0001	
Avg. Return	0.16	0.34	0.48	0.63	
Std ratio 1	0.49	0.01	74.80	<0.0001	

Robustness Test: Within-Style Analysis

	Estimate	Std Error	t-value	p-value	R-square
Panel A. Equity Hedge Funds					
Intercept	0.33	0.03	11.00	0.00	0.42
Moneyness	-0.10	0.02	-4.09	0.01	
Time-under	0.01	0.00	6.58	0.00	
Std ratio 1	0.49	0.01	33.45	0.00	
Panel B. Emerging Market Funds					
Intercept	0.25	0.01	17.04	<0.0001	0.48
Moneyness	-0.03	0.02	-1.64	0.08	
Time-under	0.01	0.00	13.43	<0.0001	
Std ratio 1	0.49	0.01	74.80	<0.0001	
Panel C. All Funds with Style Description					
Intercept	0.24	0.01	17.43	0.00	0.51
Moneyness	-0.04	0.01	-3.58	0.02	
Time-under	0.01	0.00	13.32	0.00	
Std ratio 1	0.53	0.01	78.37	0.00	

Illiquidity and Risk Shifting

- The methodology proposed by Getmansky, Lo, and Markarov (2004) is used to identify liquid vs illiquid funds.
- Similar to GLM, the following strategies displayed low level of liquidity:
  - Convertible arbitrage
  - Distressed securities
  - Event driven

Results for Illiquid Funds

	Funds with January to July Return Less Than Median		Funds with January to July Return Greater Than Median			
Year	Variance Ratio Low	Variance Ratio High	Variance Ratio Low	Variance Ratio High	Log Odds Ratio	Chi-square Test p-value
1994	10	16	16	12	0.7577	0.1698
1995	20	29	29	22	0.6478	0.1086
1996	26	33	33	27	0.4391	0.2330
1997	32	42	42	34	0.4832	0.1410
1998	46	42	42	47	-0.2034	0.4990
1999	39	70	70	40	1.1445	<.0001
2000	54	71	70	56	0.4968	0.0503
2001	85	65	65	86	-0.5482	0.0181#
2002	87	96	96	88	0.1855	0.3748
2003	110	110	110	112	-0.0180	0.9246
2004	102	129	131	106	0.4466	0.0162

Conclusion

- Hedge fund managers tend to increase their volatility when facing an “out-of-the-money” compensation option.
- The fund size, age, as well as management fees seem to play a role in the shift of risk behavior.
- Equity hedge and emerging market are the two styles that exhibit the kind of risk-shifting behavior.
- Illiquid funds tend not to display the risk-shifting behavior