

Upside Potential of Hedge Funds as a Predictor of Future Performance

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Introduction

- Despite increasing interest to develop complex alternative measures to identify best performers, there is still naïve tendency of hedge fund investors to chase past high returns.
- As evidenced in Brown, Goetzmann, Liang, and Schwarz (2008, 2012), fund flows are highly correlated to past returns in the hedge fund universe.
- The concentration of the financial press on funds with extreme past high returns is an evidence of the significant behavioral bias on the part of both the financial press and the investors who take this writing seriously.

Introduction

- With this study, we investigate whether there might be a rational basis for this return chasing behavior.
- We examine maximum monthly returns of hedge funds over a fixed time interval (*MAX*) and find that *MAX* is positively associated with high future hedge fund returns.
- We attribute this finding to the fact that standard performance metrics do not account for positive skewness as a relevant performance characteristic.
- Once accounted for, we find that this behavioral bias is indeed important as it contributes to standard performance measures in predicting future returns.

Introduction

- Hedge funds' frequent utilization of dynamic trading strategies with nonlinear payoffs is clearly reflected in their non-normal return distributions.
- Historical distribution of monthly hedge fund returns is skewed, peaked around the mode, and has fat tails.
- *MAX*, not only captures option-like features of hedge fund payoffs, but also predicts the cross-sectional differences in future hedge fund returns.
- Performance of hedge funds have been tested by other criteria such as alpha, Sharpe Ratio, and Appraisal Ratio. We check whether *MAX* complements these standard performance measures.

Why *MAX* is important?

- A hedge fund manager can implement a short volatility strategy by buying the benchmark and writing deep out-of-the-money call and put options. This strategy will lead to a Sharpe Ratio and alpha greater than the benchmark, but a *MAX* lower than that of the benchmark.
- A hedge fund manager can also implement a portfolio insurance strategy by buying deep out-of-the-money call and put options. This strategy will lead to a high *MAX* in extraordinary times, but a lower alpha and Sharpe ratio than that of the benchmark in normal times.
- It is critical to select fund managers who can generate positive and significant alpha & high *MAX* at the same time.

Literature Review

- Literature on option-like features of hedge fund returns:
 - Jagannathan and Korajczyk (1986) → suggest factoring in the value of implied options in measuring performance.
 - Agarwal and Naik (2004) → suggest augmenting risk factors with out-of-the-money call and put factors in estimating alpha.
 - It's a challenge to estimate option-based risk factors for hedge funds when the only information available to investors is a small number of monthly hedge fund returns.

Data

- Lipper TASS hedge fund database as of December 2014 included information on 11,099 US-based defunct and live hedge funds with close to \$400 billion under management.
- ❖ 8,684 defunct and 2,415 live funds
- ❖ net monthly returns and AUM for each individual hedge fund
- ❖ fund characteristics, including management and incentive fees, redemption period, minimum investment amount, and lockup period specifications
- ❖ After taking care of potential data bias issues in the database, the sample reduces to 8,010 hedge funds.

Data: Summary Statistics

Cross-sectional Statistics of Hedge Fund Characteristics

	N	Mean	Median	Std. Dev.	Minimum	Maximum
Average Monthly Return over the life of the Fund (%)	11,099	0.50	0.49	1.24	-25.14	25.47
Average Monthly AUM over the life of the Fund (million \$)	11,099	85.7	40.0	233.8	0.5	7,835.1
Age of the Fund (# of months in existence)	11,099	73.4	60.0	54.0	1.0	252.0
Management Fee (%)	10,971	1.46	1.50	0.65	0.00	10.00
Incentive Fee (%)	10,847	15.40	20.00	7.79	0.00	50.00
Redemption Period (# of days)	11,099	37.1	30.0	32.9	0.0	365.0
Minimum Investment Amount (million \$)	11,014	1.30	0.25	15.32	0.00	1,000.00

Time-series Distribution of Individual Hedge Fund Returns

	Variance	Skewness		Excess Kurtosis		Normality Jarque-Bera Statistic
		Positive	Negative	Positive	Negative	
Total # of funds	8,010	2,888	5,122	7,118	892	8,010
% of funds significant at 10%	100.0%	50.3%	63.8%	74.8%	1.0%	70.3%
% of funds significant at 5%	100.0%	44.2%	57.9%	70.4%	0.1%	66.0%
% of funds significant at 1%	100.0%	33.4%	47.1%	62.8%	0.1%	60.0%

➤ Evidence of hedge fund returns are skewed and have fat tails.

Empirical Results

❖ Univariate Portfolio Results for Alternative MAX Measures:

	Average Size of <i>MAX6</i>	Average Size of <i>MAX9</i>	Average Size of <i>MAX12</i>	Average Size of <i>MAX18</i>	Average Size of <i>MAX24</i>
Q1	1.07	1.45	1.67	1.98	2.20
Q2	2.20	2.69	3.04	3.57	3.96
Q3	3.46	4.17	4.69	5.46	6.04
Q4	5.58	6.61	7.39	8.54	9.41
Q5	12.67	14.51	15.88	17.94	19.52
	Next-month returns of <i>MAX6</i> Quintiles	Next-month returns of <i>MAX9</i> Quintiles	Next-month returns of <i>MAX12</i> Quintiles	Next-month returns of <i>MAX18</i> Quintiles	Next-month returns of <i>MAX24</i> Quintiles
Q1	0.10	0.08	0.09	0.11	0.14
Q2	0.30	0.33	0.33	0.33	0.30
Q3	0.43	0.44	0.45	0.43	0.38
Q4	0.59	0.60	0.58	0.55	0.51
Q5	0.91	0.83	0.79	0.67	0.64
Q5 – Q1	0.81	0.75	0.70	0.56	0.51
Return Diff.	(3.85)	(3.79)	(3.48)	(3.01)	(2.71)
Q5 – Q1	0.55	0.50	0.47	0.39	0.36
9-factor Alpha Diff.	(2.87)	(2.70)	(2.44)	(2.10)	(2.04)

Empirical Results

- ❖ *Do High MAX Funds Continue to be High MAX Funds in the Future? Persistence of MAX:*

	Low MAX	Q2	Q3	Q4	High MAX	Total
Low MAX	59.5%	24.9%	10.0%	3.8%	1.8%	100.0%
Q2	25.8%	35.7%	23.7%	10.8%	4.0%	100.0%
Q3	10.0%	24.5%	32.5%	23.1%	10.0%	100.0%
Q4	4.4%	10.7%	23.5%	35.6%	25.8%	100.0%
High MAX	1.6%	4.1%	10.0%	26.1%	58.2%	100.0%

Empirical Results

❖ Persistence in MAX via Fama-MacBeth Regressions:

Intercept	MAX	MIN	Alpha	AVRG	STDEV	LagRet	Size	Age	Flow	IncentFee	MgtFee	MinInv	Redemption	DLockup	DLever	R ²
2.381 (14.35)	0.530 (30.35)															28.47% (27.63)
2.666 (14.09)		0.394 (19.53)														22.36% (18.11)
5.266 (18.28)			0.490 (3.46)													5.43% (6.92)
5.105 (17.30)				0.482 (4.16)												5.58% (6.70)
5.786 (21.32)					1.150 (18.86)											6.66% (11.11)
5.386 (19.94)						0.076 (3.29)										4.60% (10.74)
5.847 (21.75)							-0.425 (-3.62)									0.25% (9.69)
6.431 (9.36)								-0.048 (-1.11)								0.16% (5.55)
5.786 (21.33)									0.001 (0.34)							0.11% (5.02)
3.829 (15.24)										0.130 (22.53)						3.16% (16.46)
4.953 (15.88)											0.573 (10.55)					0.80% (7.29)
5.849 (21.18)												-0.065 (-9.39)				0.19% (15.02)
6.466 (23.70)													-0.020 (-11.35)			1.22% (8.69)
5.686 (21.18)														0.408 (4.14)		0.22% (5.63)
5.152 (20.32)															1.092 (15.98)	0.91% (9.76)
0.660 (1.03)	0.428 (18.59)	0.071 (3.15)	0.411 (6.68)	-0.032 (-0.37)	1.053 (10.40)	0.026 (2.20)	-0.069 (-1.42)	0.017 (1.11)	0.006 (2.86)	0.035 (6.24)	0.027 (0.65)	-0.009 (-2.88)	0.002 (1.17)	0.265 (3.82)	0.177 (5.12)	40.63% (34.74)

Empirical Results

❖ Average Characteristics of MAX-sorted Quintile Portfolios:

	<i>MAX</i>	<i>MIN</i>	<i>AVRG</i>	<i>STDEV</i>	<i>LagRet</i>	<i>Size</i>	<i>Age</i>	<i>Flow</i>	<i>IncentFee</i>	<i>MgtFee</i>	<i>MinInvest</i>	<i>Redemption</i>	<i>DLockup</i>	<i>DLever</i>
Q1	1.67	2.08	0.22	1.12	-0.05	0.14	58.8	-0.21	12.9	1.34	1.69	42.4	0.20	0.49
Q2	3.04	3.01	0.41	1.79	0.17	0.15	59.5	-0.14	13.0	1.41	1.21	40.8	0.22	0.51
Q3	4.69	4.30	0.56	2.64	0.29	0.15	58.8	-0.09	14.8	1.46	1.08	37.0	0.23	0.56
Q4	7.39	6.14	0.82	3.97	0.52	0.13	58.9	0.09	16.8	1.49	0.83	33.2	0.25	0.62
Q5	15.88	10.35	1.61	7.57	1.32	0.10	59.9	0.11	17.9	1.58	0.64	29.9	0.24	0.66

Empirical Results

- ❖ *MAX and Traditional Measures of Performance:*
- *Correlations between Alpha, Appraisal Ratio, Sharpe Ratio, & MAX*

Panel A. Sample Correlations

	Alpha	Appraisal Ratio	Sharpe Ratio	<i>MAX</i>
Alpha	1.000	0.532	0.221	0.223
Appraisal Ratio		1.000	0.695	-0.071
Sharpe Ratio			1.000	-0.056
<i>MAX</i>				1.000

Panel B. Rank-Order Correlations

	Alpha	Appraisal Ratio	Sharpe Ratio	<i>MAX</i>
Alpha	1.000	0.862	0.411	0.165
Appraisal Ratio		1.000	0.543	-0.073
Sharpe Ratio			1.000	-0.012
<i>MAX</i>				1.000

Bivariate Portfolios of *MAX*

❖ *Dependent Bivariate Portfolio Sorts of MAX:*

First stage: Sort hedge funds into 5 quintiles based on alternative performance measures and fund characteristics (*AVRG, STDEV, Sharpe Ratio, Appraisal Ratio, Alpha, Fund Flows, and Incentive Fees*) separately. Within each *performance and characteristics-sorted* quintiles, sort hedge funds further into 5 sub-quintiles based on their *MAX*.

Second stage: Analyze each quintile's next month return performance and see if the returns of *high MAX* quintiles are statistically different than the returns of *low MAX* quintiles.

Empirical Results

❖ *Dependent Bivariate Portfolio Sort Results for MAX:*

	<i>MAX</i> portfolios controlling for AVRG	<i>MAX</i> portfolios controlling for STDEV	<i>MAX</i> portfolios controlling for SR	<i>MAX</i> portfolios controlling for 9-factor Alpha	<i>MAX</i> portfolios controlling for 9-factor AR	<i>MAX</i> portfolios controlling for Incentive Fee	<i>MAX</i> portfolios controlling for Fund Flows
Q1	2.39	3.42	1.84	2.05	1.78	1.76	1.75
Q2	3.74	4.96	3.24	3.48	3.13	3.26	3.15
Q3	5.16	6.04	4.85	5.00	4.71	4.90	4.78
Q4	7.30	7.38	7.42	7.34	7.32	7.38	7.38
Q5	14.06	10.86	15.30	14.57	15.47	15.36	15.60
	Next-month returns of <i>MAX</i> Quintiles	Next-month returns of <i>MAX</i> Quintiles	Next-month returns of <i>MAX</i> Quintiles	Next-month returns of <i>MAX</i> Quintiles	Next-month returns of <i>MAX</i> Quintiles	Next-month returns of <i>MAX</i> Quintiles	Next-month returns of <i>MAX</i> Quintiles
Q1	0.21	0.06	0.12	0.10	0.04	0.10	0.09
Q2	0.37	0.34	0.32	0.30	0.29	0.34	0.35
Q3	0.47	0.49	0.45	0.42	0.39	0.47	0.45
Q4	0.53	0.61	0.56	0.48	0.53	0.55	0.58
Q5	0.65	0.75	0.79	0.67	0.73	0.78	0.77
Q5 – Q1 Return Diff.	0.44 (3.02)	0.69 (5.71)	0.67 (3.39)	0.57 (3.18)	0.69 (3.46)	0.68 (3.37)	0.68 (3.55)
Q5 – Q1 9-factor Alpha Diff.	0.29 (2.09)	0.68 (5.00)	0.41 (2.40)	0.39 (2.30)	0.50 (2.60)	0.46 (2.44)	0.45 (2.47)

Robustness Check

- ❖ *Detailed Analysis of the Interaction between MAX & STDEV:*
- *An Alternative Measure to MAX: MAX / STDEV*

	Average Size of <i>MAX12/STDEV12</i> Quintiles	Average Size of <i>MAX24/STDEV24</i> Quintiles	Average Size of <i>MAX36/STDEV36</i> Quintiles
Q1	1.19	1.48	1.65
Q2	1.67	1.96	2.15
Q3	1.99	2.28	2.47
Q4	2.35	2.65	2.87
Q5	3.28	3.52	3.76
	Next-month returns of <i>MAX12/STDEV12</i> Quintiles	Next-month returns of <i>MAX24/STDEV24</i> Quintiles	Next-month returns of <i>MAX36/STDEV36</i> Quintiles
Q1	0.05	0.20	0.23
Q2	0.40	0.39	0.43
Q3	0.55	0.50	0.46
Q4	0.61	0.53	0.50
Q5	0.64	0.51	0.47
Q5 – Q1 Return Diff.	0.59 (4.42)	0.31 (2.61)	0.24 (2.38)
Q5 – Q1 9-factor Alpha Diff.	0.68 (5.17)	0.44 (3.99)	0.34 (3.31)

Empirical Results

- ❖ *MAX versus Alpha:*
- *Independent Bivariate Portfolio Sorts of MAX and the Alpha*

		MAX quintiles							
		Q1	Q2	Q3	Q4	Q5	Average	Q5-Q1 Ret Diff.	Q5-Q1 Alpha Diff.
Alpha quintiles	Q1	-0.48	-0.03	0.19	0.23	0.52	0.09	1.00 (4.40)	0.80 (3.23)
	Q2	-0.07	0.21	0.32	0.48	0.51	0.29	0.57 (2.76)	0.48 (2.33)
	Q3	0.10	0.33	0.42	0.51	0.70	0.41	0.60 (2.80)	0.50 (2.18)
	Q4	0.17	0.42	0.46	0.60	0.80	0.49	0.63 (3.12)	0.44 (2.08)
	Q5	0.29	0.52	0.64	0.75	0.94	0.63	0.66 (2.70)	0.50 (2.01)
Average		0.01	0.29	0.41	0.51	0.69		0.69 (3.69)	0.54 (2.79)
Q5-Q1 Ret Diff.		0.77 (6.42)	0.55 (6.51)	0.45 (5.99)	0.52 (3.64)	0.42 (2.51)	0.54 (6.35)		
Q5-Q1 Alpha Diff.		0.79 (5.64)	0.63 (8.18)	0.50 (5.02)	0.70 (4.04)	0.50 (2.84)	0.62 (8.47)		

Empirical Results

❖ *MAX versus Alpha:*

➤ A Closer Look at the Corner Portfolios of Independent Sorts

	<u>Average Raw Returns</u>			<u>Risk-Adjusted Returns</u>	
	<i>Low MAX</i>	<i>High MAX</i>		<i>Low MAX</i>	<i>High MAX</i>
<i>Low Alpha</i>	-0.48 (-4.18)	0.52 (1.77)	<i>Low Alpha</i>	-0.59 (-6.13)	0.20 (0.78)
<i>High Alpha</i>	0.29 (2.74)	0.94 (3.58)	<i>High Alpha</i>	0.20 (1.63)	0.70 (3.25)

Empirical Results

❖ *MAX versus MIN:*

➤ *Independent Bivariate Portfolio Sorts of MAX and MIN*

		MAX quintiles							
		Q1	Q2	Q3	Q4	Q5	Average	Q5-Q1 Ret Diff.	Q5-Q1 Alpha Diff.
MIN quintiles	Q1	0.19	0.42	0.54	0.70	0.91	0.55	0.72 (3.81)	0.80 (3.98)
	Q2	0.11	0.36	0.43	0.57	0.58	0.41	0.47 (3.18)	0.61 (4.03)
	Q3	-0.03	0.26	0.49	0.50	0.62	0.37	0.65 (3.36)	0.58 (2.67)
	Q4	-0.09	0.21	0.41	0.61	0.68	0.36	0.77 (4.04)	0.59 (2.82)
	Q5	-0.86	-0.06	0.30	0.43	0.74	0.11	1.61 (5.75)	1.28 (4.74)
Average		-0.14	0.24	0.43	0.56	0.71		0.85 (6.12)	0.77 (5.16)
Q5-Q1 Ret Diff.		-1.05 (-3.25)	-0.48 (-2.05)	-0.24 (-1.50)	-0.27 (-1.18)	-0.16 (-0.50)	-0.44 (-1.56)		
Q5-Q1 Alpha Diff.		-0.75 (-2.32)	-0.33 (-1.85)	-0.18 (-1.27)	-0.31 (-0.84)	-0.14 (-0.48)	-0.23 (-1.43)		

Empirical Results

❖ Fama-MacBeth Cross-sectional Regressions for MAX:

	(1)	(2)	(3)	(4)
Intercept	0.208 (2.25)	0.053 (0.22)	-0.077 (-0.46)	-0.025 (-0.13)
<i>MAX</i>	0.042 (3.52)	0.037 (2.78)	0.036 (3.12)	0.036 (2.96)
<i>MIN</i>		-0.010 (-1.20)	-0.007 (-1.00)	-0.007 (-0.99)
Sharpe Ratio (SR)		0.123 (2.58)		
SR × <i>MAX</i>		0.050 (2.19)		
Alpha			0.134 (3.16)	
Alpha × <i>MAX</i>			0.009 (2.10)	
Appraisal Ratio (AR)				0.137 (4.79)
AR × <i>MAX</i>				0.026 (2.14)
Other Controls	No	Yes	Yes	Yes

Empirical Results

- ❖ *Long-term Predictive Power of MAX:*
- Univariate Portfolios of *MAX* using Quarterly Returns

	1-quarter ahead Average Return	2-quarter ahead Average Return	3-quarter ahead Average Return	4-quarter ahead Average Return	5-quarter ahead Average Return	6-quarter ahead Average Return
Q1	0.42	0.52	0.57	0.56	0.56	0.57
Q2	1.04	1.12	1.02	1.02	0.93	0.85
Q3	1.42	1.46	1.35	1.19	1.18	1.09
Q4	1.77	1.62	1.54	1.44	1.35	1.28
Q5	2.48	2.02	1.88	1.75	1.64	1.70
Q5 – Q1 Return Diff.	2.05 (3.39)	1.51 (2.87)	1.32 (2.82)	1.20 (2.58)	1.09 (2.50)	1.13 (2.80)
Q5 – Q1 9-factor Alpha Diff.	1.81 (2.49)	1.25 (2.15)	1.15 (2.15)	1.10 (2.13)	1.01 (2.08)	0.92 (1.98)

Empirical Results

- ❖ *Long-term Predictive Power of MAX:*
- Fama-MacBeth Cross-sectional Regressions

	3-Month-ahead Predictability of <i>MAX</i>		12-Month-ahead Predictability of <i>MAX</i>	
	(1)	(2)	(1)	(2)
Intercept	0.209 (2.01)	0.187 (0.60)	0.262 (2.50)	-0.617 (-0.86)
<i>MAX</i>	0.034 (2.93)	0.033 (2.45)	0.026 (2.85)	0.033 (2.57)
<i>MIN</i>		-0.005 (-0.62)		-0.012 (-1.23)
Sharpe Ratio (SR)		0.137 (2.77)		0.092 (2.12)
SR × <i>MAX</i>		0.067 (2.10)		0.067 (2.49)
Other Controls	No	Yes	No	Yes

Empirical Results

- ❖ *MAX and Hedge Fund Survival:*
- *Fama-MacBeth Cross-sectional Logit Regressions of Hedge Fund Survival on MAX and Controls*

	<u>Panel A</u>		<u>Panel B</u>		<u>Panel C</u>	
	<i>1-month-ahead Fund Survival Regressed on MAX & Control Variables</i>		<i>3-month-ahead Fund Survival Regressed on MAX & Control Variables</i>		<i>12-month-ahead Fund Survival Regressed on MAX & Control Variables</i>	
	(1)	(2)	(1)	(2)	(1)	(2)
Intercept	4.137 (39.76)	3.703 (24.39)	3.252 (31.75)	2.758 (23.66)	1.819 (18.34)	1.360 (15.04)
<i>MAX</i>	0.034 (5.94)	0.051 (6.42)	0.013 (2.83)	0.018 (2.65)	0.012 (2.94)	0.017 (2.35)
<i>MIN</i>		0.001 (0.20)		-0.015 (-2.92)		-0.021 (-4.80)
Sharpe Ratio (SR)		0.595 (7.21)		0.626 (7.15)		0.589 (7.05)
SR × <i>MAX</i>		0.094 (2.10)		0.045 (2.42)		0.100 (7.23)
Other Controls	No	Yes	No	Yes	No	Yes

Empirical Results

❖ Do Investors Prefer high MAX Funds?

Panel A: Cross-sectional regressions of Incentive Fee on MAX with and without control variables:

Intercept	MAX	MIN	SR	STDEV	LagRet	Size	Age	Flow	MgtFee	MinInv	Redemption	DLockup	DLever
13.378 (142.48)	0.283 (20.54)												
10.492 (19.17)	0.199 (13.17)	0.097 (4.67)	0.946 (4.18)	0.213 (3.32)	-0.011 (-1.12)	0.051 (0.87)	-0.028 (-2.61)	0.005 (1.38)	0.892 (6.75)	0.048 (7.61)	-0.001 (-0.45)	3.273 (31.88)	3.591 (74.40)

Panel B: Cross-sectional regressions of Management Fee on MAX with and without control variables:

Intercept	MAX	MIN	SR	STDEV	LagRet	Size	Age	Flow	IncentFee	MinInv	Redemption	DLockup	DLever
1.383 (214.92)	0.012 (10.12)												
1.321 (31.48)	0.008 (6.48)	-0.002 (-1.94)	-0.057 (-3.54)	0.019 (3.21)	-0.002 (-1.48)	-0.007 (-0.48)	0.002 (1.77)	-0.001 (-2.20)	0.007 (8.61)	-0.007 (-16.29)	-0.003 (-8.37)	-0.168 (-20.53)	0.108 (13.61)

Panel C: Cross-sectional regressions of one-month-ahead Hedge Fund Flows on MAX with and without control variables:

Intercept	MAX	MIN	SR	STDEV	LagRet	Size	Age	MgtFee	IncentFee	MinInv	Redemption	DLockup	DLever
-0.410 (-3.75)	0.020 (2.96)												
0.466 (0.43)	0.019 (2.38)	0.010 (1.62)	1.137 (9.20)	-0.194 (-5.11)	0.017 (2.38)	0.026 (0.41)	-0.040 (-1.38)	-0.049 (-1.38)	0.004 (1.11)	0.002 (0.77)	0.002 (2.43)	0.135 (2.84)	0.123 (2.62)

MAX and Hedge Fund Investment Styles

- We also check whether our main findings would change (and how) if our analysis is applied to homogeneous groups of hedge funds (hedge fund investment styles).
- Some hedge funds willingly take direct market exposure (**directional strategies**, such as Managed Futures, Global Macro, and Emerging Markets funds).
- Some try to minimize the market risk altogether (**non-directional strategies**, such as Equity Market Neutral, Fixed Income Arbitrage, and Convertible Arbitrage funds).
- And some try to diversify the market risk by taking both long and short, diversified positions (**semi-directional strategies**, such as Long/Short Equity Hedge, Event Driven, and Multi-strategy funds).

Empirical Results

❖ *MAX by 3 Broad Hedge Fund Categories:*

	Non-directional Hedge Funds	Semi-directional Hedge Funds	Directional Hedge Funds	All Hedge Funds
Number of Funds	718	5,383	1,544	7,645
% of Funds in total sample	9.4%	70.4%	20.2%	100.0%
Average <i>MAX</i>	4.05	5.98	9.61	6.56
Avg. Std. Dev. of <i>MAX</i>	1.76	2.43	3.75	2.63
Avg. Max–Min spread of <i>MAX</i>	5.61	7.95	12.25	8.60
% of Funds using Futures	13.9%	14.0%	41.0%	19.9%
% of Funds using other Derivatives	17.5%	18.5%	24.1%	19.6%

Empirical Results

❖ *Univariate Portfolios of MAX for Hedge Fund Styles:*

Hedge Fund Styles	Next Month Return Difference	9-Factor Alpha Difference
Convertible Arbitrage	0.42 (1.63)	0.25 (1.16)
Equity Market Neutral	0.59 (3.09)	0.38 (2.20)
Fixed Income Arbitrage	0.64 (2.46)	0.41 (2.11)
Long-short Equity Hedge	0.60 (2.46)	0.45 (2.16)
Multi Strategy	0.63 (4.39)	0.46 (3.60)
Event Driven	0.75 (3.53)	0.48 (3.00)
Global Macro	0.74 (3.61)	0.64 (2.93)
Managed Futures	0.82 (4.42)	0.71 (3.77)
Emerging Markets	0.98 (2.41)	0.58 (2.26)

Empirical Results

❖ *MAX and Leverage / Derivatives Usage:*

Panel A. Funds with Low Leverage and Derivatives Usage

Quintiles	Next Month Average Returns	Next Month 9-Factor Alphas
Q1	0.14 (1.06)	-0.01 (-0.10)
Q2	0.17 (1.16)	0.00 (0.01)
Q3	0.34 (2.05)	0.22 (1.35)
Q4	0.34 (1.89)	0.16 (1.00)
Q5	0.41 (1.69)	0.25 (1.06)
Q5 – Q1	0.27	0.26
<i>t</i> -statistic	(1.43)	(1.14)

Empirical Results

❖ *MAX and Leverage / Derivatives Usage:*

Panel B. Funds with High Leverage and Derivatives Usage

Quintiles	Next Month Average Returns	Next Month 9-Factor Alphas
Q1	-0.04 (-0.42)	-0.05 (-0.65)
Q2	0.37 (3.76)	0.37 (3.64)
Q3	0.43 (4.37)	0.37 (4.08)
Q4	0.54 (3.93)	0.39 (3.15)
Q5	0.81 (4.33)	0.68 (3.58)
Q5 – Q1	0.85	0.74
<i>t</i> -statistic	(4.76)	(3.68)

Market-timing Ability of Hedge Funds

- Market-timing ability of hedge funds is tested with pooled panel regressions of Henriksson-Merton (1981) model:

$$R_{i,t} = \alpha + \beta_1 \cdot MKT_t + \beta_2 \cdot MKT_t^{high} + \varepsilon_{i,t},$$

$$MKT_t^{high} = \begin{cases} MKT_t & \text{if } MKT_t \text{ is higher than its time - series median} \\ 0 & \text{otherwise} \end{cases}.$$

	Non-Directional Hedge Funds	Semi-Directional Hedge Funds	Directional Hedge Funds
β_2 from using MKT in the market-timing estimation	-0.050 (-0.80)	0.169 (2.07)	0.277 (2.62)

Empirical Results

❖ *MAX and Market-timing Ability at the Fund Level:*

Panel A. Funds with Low Market-timing Ability

Quintiles	Next Month Average Returns	Next Month 9-Factor Alphas
Q1	0.02 (0.20)	-0.12 (-1.01)
Q2	0.15 (1.12)	0.01 (0.09)
Q3	0.34 (2.37)	0.24 (1.74)
Q4	0.33 (1.85)	0.17 (0.92)
Q5	0.32 (1.32)	0.09 (0.36)
Q5 – Q1	0.30	0.21
<i>t</i> -statistic	(1.56)	(0.86)

Empirical Results

❖ *MAX and Market-timing Ability at the Fund Level:*

Panel B. Funds with High Market-timing Ability

Quintiles	Next Month Average Returns	Next Month 9-Factor Alphas
Q1	0.06 (0.37)	0.17 (0.76)
Q2	0.53 (2.45)	0.62 (2.04)
Q3	0.65 (2.65)	0.85 (2.58)
Q4	0.77 (2.87)	0.86 (2.40)
Q5	0.97 (2.48)	1.08 (2.06)
Q5 – Q1	0.91	0.91
<i>t</i> -statistic	(2.55)	(2.11)

Conclusion

- Both Fama-MacBeth cross-sectional regressions and portfolio tests provide strong corroborating evidence for an economically and statistically significant positive relation between *MAX* and future hedge fund returns.
- *MAX* has low correlation with traditional measures of performance, yet has strong predictive power over future hedge fund returns.
- More importantly, its predictive power is not subsumed by other performance measures.

Conclusion

- The predictive power of *MAX* increases as we move from the least directional strategies to the most directional strategies. We obtain the highest predictive power of *MAX* for the directional strategies, for those funds with the most leverage and derivatives usage.
- Directional strategy fund managers possess significant market-timing ability. Both the magnitude and the variation of *MAX* is much bigger for the directional strategies.
- All results suggest that *MAX*'s predictive power is related to funds' market-timing ability and their usage of derivatives and leverage.

THANK YOU...