

## PERFORMANCE PERSISTENCE IN HEDGE FUNDS

### Identifying Future Outperformers Using a Measure of Manager Skill (*MMS*)

#### Introduction

Over the past two decades, the hedge fund industry has experienced exponential growth, with more than 8,000 funds and AUM exceeding \$2trn as of the end of 2011. The number of hedge funds available to investors as well as the large potential dispersion in their performances makes identifying future top performers challenging. One commonly used approach is to rely on funds' past track records and compute various performance statistics such as average returns and Sharpe ratios. Funds will then be evaluated based on these statistics, implicitly assuming that they are predictive of the funds' future performances. This, in turn, relies on the concept of performance persistence – the idea that when a manager's successful track record reflects skill (as opposed to sheer luck), his future performance is also likely to be superior to peers.

There has been extensive research looking into the existence of performance persistence among hedge funds employing different return measures and various statistical techniques. Most studies did not find evidence supporting performance persistence or documented persistence patterns that were highly sensitive to the choice of the database and sample period.<sup>1</sup> In addition, the methodologies used in these studies were often complex, required multiple assumptions and were not easily adaptable for use by investors.

The inability to detect performance persistence among hedge funds reflects the difficulty in identifying investment skill. Distilling skill from random success requires a methodology that can properly account for risk (both systematic and idiosyncratic) as well as a sufficiently long track record. The unique characteristics of hedge funds present serious challenges on both fronts. While their investment mandates typically allow the use of leverage, short selling, derivatives, and highly illiquid securities, with little and often no limits on geographical and issuer specific concentrations, hedge funds do not follow any designated benchmarks, and are not required to provide detailed information on their holdings or the type of strategies they employ. Furthermore, many hedge funds have relatively short histories that limit the accuracy of any statistical inference.

Arik Ben Dor  
+1 212 526 7713  
[arik.bendor@barcap.com](mailto:arik.bendor@barcap.com)

Jason Xu  
+1 212 526 6782  
[Jason.Xu@barcap.com](mailto:Jason.Xu@barcap.com)

[www.barcap.com](http://www.barcap.com)

<sup>1</sup> Brown, Goetzmann, and Ibbotson (1999) for example, analyzed the performance of offshore funds by regressing annual performance against past returns and documented little persistence across managers. Bares, Gibson, and Cyger (2003) used a nonparametric approach, and found no evidence of persistence over a one-year horizon. More recently, Kosowski, Naik, and Teo (2007) detected evidence of performance persistence over a one-year horizon using Fund and Hsieh (2004) seven-factor model after applying a bootstrap procedure, as well as a Bayesian technique. However, Joenvaara, Kosowski, and Tolonen (2012) showed those persistence results were sensitive to the choice of the database and sample period.

We present a proprietary measure for evaluating the performance of hedge funds, which we term *MMS* (Measure of Manager Skill). It controls for risk and is invariant to leverage. Furthermore, the measure is model-free and requires only limited data. *MMS* decomposes a fund's returns into "alpha" and "beta", and assigns higher scores to funds that were found to generate high "alpha". After discussing the pitfalls of traditional performance measures and confirming that they are not able to detect performance persistence, we analyzed the performance of various hedge fund portfolios formed using *MMS* scores.

We find very strong evidence of persistence. Specifically, funds that received the top 25% of *MMS* scores (termed "winners") had a 40% chance of maintaining their ranking in the subsequent year, whereas "losers" (those with the bottom 25% of *MMS* scores) had a similar probability (38%) of remaining "losers." These results were observed not only in the aggregate, but across all hedge fund styles and in each year since 1997. In particular, an equally weighted portfolio of "winners" delivered a Sharpe ratio of 1.37 between 1997 and 2011 compared with a Sharpe ratio of 0.32 for "losers" over the same period. Additional tests confirmed that the superior performance of "winners" is not driven by a difference in characteristics (compared with "losers" funds) or larger exposure to market risk and increased with the ranking frequency.

## Performance Persistence: Discussion and Illustration

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When selecting a hedge fund for investment, is the fund manager's prior track record useful? If past performance is indicative of future results, this information is valuable. If not, investors may be better off basing their selection on other considerations such as the manager's reputation, investment style, and fee structure.

Before introducing *MMS*, our measure of manager skill, we illustrate the challenges in detecting persistence using two common performance statistics: mean return and Sharpe ratio. We construct portfolios of hedge funds based on ranking generated by these statistics and analyze their subsequent performance. Our primary data source is the Hedge Fund Research (HFR) database, which classifies funds into five broad strategy groups (Equity Hedge, Event-Driven, Macro, Relative Value and Fund of Funds) and more than two dozen sub-strategies. Our sample spans 16 years from January 1996 to December 2011, and consists of 2703 active funds and 5370 defunct funds, with monthly net returns reported in US dollars. Fund of funds were excluded to avoid double counting.

### Identifying Performance Persistence

Portfolios were formed by ranking all funds annually based on their average return or Sharpe ratio calculated over the previous 12-month period. Funds were then assigned to four quartile portfolios Q1-Q4, based on their rankings.<sup>2</sup> Funds that received the highest ranking ("winners") were assigned to portfolio Q4, while those with the lowest scores ("losers") were included in Q1. Post-formation portfolio returns were computed monthly based on equally weighting all constituents, which remained unchanged until the next ranking date, unless they were removed because they no longer reported their performances.<sup>3</sup>

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<sup>2</sup> Specifically, the ranking is done as of December 31 of each year. Funds with fewer than 12 monthly consecutive returns were not ranked.

<sup>3</sup> For example, the portfolios' returns for 2009 reflected their composition based on funds' ranking using 2008 performance data. The majority of funds that stopped reporting become defunct. See Ambastha and Ben Dor (2010) for more details.

If higher values for a certain performance statistic (such as the average return or Sharpe ratio) are indeed associated with better skill, then, funds with higher past average returns or Sharpe ratios would be expected to outperform funds with lower values in the future on average. Specifically, in the context of our exercise, the portfolios' post-formation performance should exhibit a clear monotone ordering with the Q4 and Q1 portfolios achieving the best and worst performance, respectively.

Figure 1 reports various performance statistics for the four portfolios based on their post-formation returns using either average return (Panel A) or Sharpe ratio (Panel B) as the ranking statistic. Overall, the results do not indicate that selecting funds based on either past average return or Sharpe ratio would result in superior future performance. Panel A reveals that although Q4, the "winner" portfolio, boasts the highest average return among all portfolios, it also has the worst risk properties, with almost twice the monthly volatility and drawdown as the Q3 portfolio (3.50% and -28.48% compared with 1.94% and -16.80%, respectively). Consequently, the "winner" portfolio actually realized the second lowest Sharpe ratio, consistent with the notion that higher past absolute returns were associated with taking more risk and not better "skill."

The results in Panel B suggest a positive, albeit weak, relation between rankings and subsequent performance. However, the difference in Sharpe ratios among the portfolios is both statistically and economically insignificant (0.80, 0.66, and 0.66 for Q4, Q3, and Q2, respectively). In addition, the tail risk properties of the quartile portfolios are very similar. In fact, the drawdown and worst month return of the Q2 portfolio were actually better than those of Q4.

**Figure 1: Post-Formation Performance of Quartile Portfolios 1997 - 2011**

|   | Q1 - Loser | Q2     | Q3     | Q4- Winner |
|---|------------|--------|--------|------------|
| <b>Panel A: Ranking by Avg. Return</b>  |            |        |        |            |
| Mean Return (%/mo)                      | 0.68       | 0.59   | 0.73   | 0.83       |
| Volatility (%/mo)                       | 2.86       | 1.68   | 1.94   | 3.50       |
| 5th Percentile                          | -3.49      | -1.79  | -2.22  | -5.14      |
| Worst Month                             | -8.09      | -6.89  | -6.01  | -13.38     |
| Maximum Drawdown                        | -28.72     | -18.52 | -16.80 | -28.48     |
| Sharpe Ratio (Ann.)                     | 0.50       | 0.66   | 0.83   | 0.56       |
| <b>Panel B: Ranking by Sharpe Ratio</b> |            |        |        |            |
| Mean Return (%/mo)                      | 0.59       | 0.75   | 0.75   | 0.75       |
| Volatility (%/mo)                       | 2.54       | 2.53   | 2.56   | 2.06       |
| 5th Percentile                          | -2.98      | -2.76  | -3.32  | -2.54      |
| Worst Month                             | -8.34      | -7.22  | -8.88  | -7.78      |
| Maximum Drawdown                        | -27.50     | -19.64 | -23.34 | -21.86     |
| Sharpe Ratio (Ann.)                     | 0.43       | 0.66   | 0.66   | 0.80       |

Note: Funds were ranked annually in December based on mean returns or Sharpe ratios over the previous 12 months and then assigned into quartile portfolios Q1-Q4. Funds in the "winner" and "loser" portfolios were ranked in the top and bottom 25% of all funds respectively. Performance statistics are based on post-formation returns. Sharpe ratio was computed based on the 1-month Libor rate. Source: Hedge Fund Research, Barclays Research

Why did using a Sharpe ratio fail to generate performance persistence? Indeed, unlike *absolute* return, the Sharpe ratio is a measure of risk-adjusted performance. However, it does not distinguish between the drivers of performance (ie, "alpha" versus "betas"). Thus, a fund with a large exposure (beta) to a certain systematic factor but no alpha can be termed a "winner" if the factor realizations were sufficiently high during the ranking period. As long as the factor realizations enjoy positive momentum, the fund will continue to

generate strong returns post-ranking. However, if this is not the case, the fund will not outperform or may even underperform if the factor realizations exhibit mean reversion.<sup>4</sup>

One episode that illustrates this issue occurred in 2007-09 when the financial markets experienced a sharp downturn starting in late 2007 and then a strong reversal from March 2009 onward. Figure 2 plots the post-formation performance of the “winner” and “loser” portfolios in these years based on ranking by average return or Sharpe ratio. Hence, funds comprising the “loser” portfolio in 2009 were the ones that experienced the worst performance (as measured by the appropriate performance statistic) in 2008, likely as a result of having more leverage and systematic market exposure. It is not surprising then that these funds outperformed the “winner” significantly in 2009 as their characteristics benefited them once the market rebounded strongly. The “winner” portfolio based on ranking by average return and Sharpe ratio underperformed the “loser” portfolio by a striking 51% and 35%, respectively. Thus, not only did we not observe persistence in fund performance, but quite the opposite with the ordering of funds’ performances completely reversed.

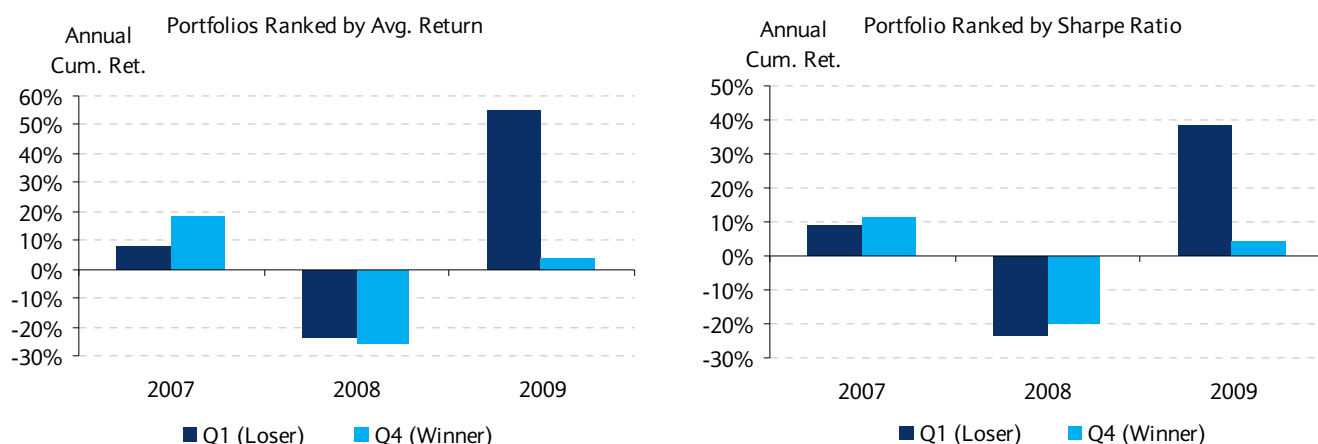
The results in Figure 1 and 2 highlight some of the challenges that need to be addressed by any performance statistic used to identify performance persistence. Two aspects of hedge fund performance that deserve special attention are risk adjustment and separation of “alpha” and “beta.”

#### *Risk-adjusted Performance*

In order to measure performance properly, one has to account for *all* risks a fund was taking. Otherwise, many of the funds with higher performance ex-post would also be those that took large risks ex-ante. For example, consider the case of Funds A and B, which implement the same exact strategy, except that Fund A is twice leveraged. By construction then, the average return of Fund A would be twice that of Fund B. Not adjusting for leverage would lead us to mistakenly conclude that Fund A is better or worse than Fund B.

While conceptually simple, measuring the risk taken by hedge funds is particularly challenging. Unlike mutual funds, hedge funds operate with a much greater flexibility, and use leverage and

**Figure 2: Annual Performance of Q4 and Q1 Portfolios in 2007-09**



Note: Funds were assigned into quartile portfolios Q1-Q4 each December based on their mean returns or Sharpe ratios computed over the previous 12 months. Funds in the “winner” and “loser” portfolios were ranked in the top and bottom 25% of funds, respectively. Annual performance is based on post-formation returns.  
Source: Hedge Fund Research, Barclays Research

<sup>4</sup> The fund may continue to outperform even the factor realizations revert as long as it re-adjusts its market exposures appropriately in a timely fashion, also known as ‘market timing’. For a discussion on the difference between ‘market timing’ and ‘alpha’ see Ben Dor, Dynkin, and Gould (2006).

derivatives extensively. Because of the flexibility they enjoy, hedge funds exhibit significant variations in risk profile cross-sectionally and over time, even for the same fund.

### *Separation of “Alpha” and “Beta”*

The second challenge in finding persistence is the lack of an accepted, well-defined benchmark for hedge funds. Such a benchmark would enable decomposing returns into “alpha” and “beta”, where “alpha” represents manager’s skill, and “beta” refers to exposure to any systematic factor, whether “traditional” (ie, market indices or asset classes) or “exotic” (e.g., volatility), either directly or indirectly.<sup>5</sup> Funds with strong past performance due to “high alpha” are more likely to be future top performers irrespective of market conditions, unlike cases in which performance was driven by “beta” (Figure 2).

Because of the variety and complexity of trading strategies employed by hedge funds, benchmarking their returns is extremely difficult. While some factor-based models have been proposed (for example Fung and Hsieh (2004) seven-factor model), such model-based benchmarks are quite data-intensive, and cannot be precisely estimated given the relatively short history of most funds. Furthermore, even with sufficient data, the dynamics of the hedge fund industry may require constantly updating the set of factors utilized, contradicting the “backward-looking” nature of these models.

## **Measure of Manager Skill (MMS)**

To address the challenges discussed in the previous section, we propose a new (and proprietary) measure for evaluating the performance of individual funds termed *MMS* (Measure of Manager Skill). It is a measure of a fund’s risk-adjusted performance, and is invariant to leverage. More importantly, *MMS* decomposes a fund’s returns into “alpha” and “beta” and assigns higher scores to funds with high “alpha.” In addition, unlike other measures of manager skill, *MMS* is model-free and can be estimated precisely even with a relatively short return history. Because of this advantage, it can quickly incorporate new information about funds.

If *MMS* is an effective measure of a manager’s skill, funds with high scores should deliver better risk-adjusted performance consistently and there should be a positive relation between past rankings and future performance. We first present evidence of performance persistence based on employing *MMS*, and then analyze the performance of hedge funds that received high *MMS* scores.

## **Performance Persistence**

Figure 3 presents the average annual transition probabilities based on *MMS* ranking between any two consecutive years over the sample period. The rows and columns represent funds’ rankings in year  $t$  and  $t+1$ , respectively, and the diagonal cells therefore represent the percentage of funds with unchanged ranking. Thus, performance persistence requires that the value in the bottom diagonal (ie, for Q4) should be significantly higher than 25%, representing a random draw.

<sup>5</sup> As an example for indirect exposure to systematic risk, consider ‘Merger Arbitrage’. It exhibits a payoff profile similar to an out-of-the-money put on the S&P 500 index, although the strategy does not employ any such options. The reason for the option-like profile is that the strategy payoff depends on whether the merger is completed or not. In up or flat markets, an unsuccessful acquisition is an idiosyncratic event (i.e., unrelated to the broad market), whereas in down markets, the probability that a deal will fail increases the larger the decline. This is because the target would like to maintain the original deal price, whereas the acquirer would like to adjust the price downward to reflect the new state of the market. For more details see Mitchell and Pulvino (2001).

For example, if the population of funds in year  $t$  and  $t+1$  was 800, the top quartile portfolio (“winner”) in year  $t$  would include 200 funds. Lack of persistence implies that these funds would be equally likely to end up in any of the quartile portfolios in year  $t+1$ . Thus, of the 200 funds, only 50 on average would maintain their “winner” status (based on their rankings in year  $t+1$ ), and the rest would be included in one of the three remaining portfolios. Since the same argument would also apply to the Q1- Q3 portfolios in year  $t$ , the “winner” portfolio in year  $t+1$  would comprise an equal number of funds (50) from the Q1-Q4 portfolios in year  $t$ .

The results in Figure 3 indicate, however, that 80 of the funds (the equivalent of 40% in our example) ranked in the top quartile (“winner”) in year  $t$  maintained their top ranking in the subsequent year and only 30 (ie, 15%) were reclassified as “losers.” While funds in the Q3 portfolio (and to a slightly lesser extent Q2) are distributed almost uniformly in year  $t+1$ , the worst performing ones (“losers”) exhibited strong persistence as well, with a 38% probability of staying in the bottom quartile in the following year. Consequently, the probability a “winner” fund would be ranked above the median fund in year  $t+1$  was 65%, almost double that of “losers” (34%), or 130 funds compared with just 68 out of the 200 funds in each of the portfolios in our example.

The results in Figure 3 hold not just for the aggregate but also for different hedge fund styles and individual years. Figure 4 shows the percentage of funds with above-median ranking separately for funds that were ranked as “winner” or “loser” in the prior year. Panel A shows that the percentage of “winner” funds that outperformed the median was higher than 60% in all years with the exception of 2009 (58%). In contrast, the percentage of “loser” funds that outperformed the median was consistently lower than 40%. Similarly, “winner” funds outperformed the median with more than 60% likelihood across all styles, with relative value fixed income funds exhibiting the strongest persistence (76%). “Loser” funds again exhibit the mirror image with only 35% outperforming the median on average.

**Figure 3: Transition Frequencies among Quartile Portfolios Based on MMS Rankings**

|                     |               | Ranking at Year $t+1$ |     |     |               |
|---------------------|---------------|-----------------------|-----|-----|---------------|
|                     |               | Q1 (“loser”)          | Q2  | Q3  | Q4 (“winner”) |
| Ranking at Year $t$ | Q1 (“loser”)  | 38%                   | 28% | 21% | 13%           |
|                     | Q2            | 29%                   | 28% | 25% | 18%           |
|                     | Q3            | 24%                   | 26% | 27% | 23%           |
|                     | Q4 (“winner”) | 15%                   | 19% | 26% | 40%           |

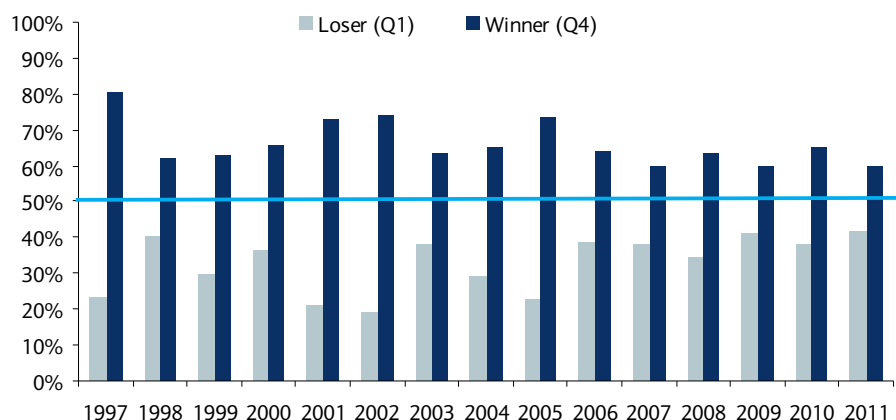
Note: Funds were assigned into quartile portfolios Q1-Q4 every December between 1997 and 2011, based on their MMS scores computed over the previous 12 months. Funds termed “Winner” and “Loser” were ranked in the top and bottom 25% of funds, respectively. The table reports the average transition frequencies among quartile portfolios between any two consecutive years using only funds with complete 12-month histories. Source: Hedge Fund Research, Barclays Research

Another important aspect of the ability to identify performance persistence is attrition rates. Hedge funds as a group experience a rate of attrition considerably higher than other types of asset managers. For example, Ambastha and Ben Dor (2010) found that in 2008, more than one quarter of funds in the HFR database stopped reporting and most of them were liquidated.

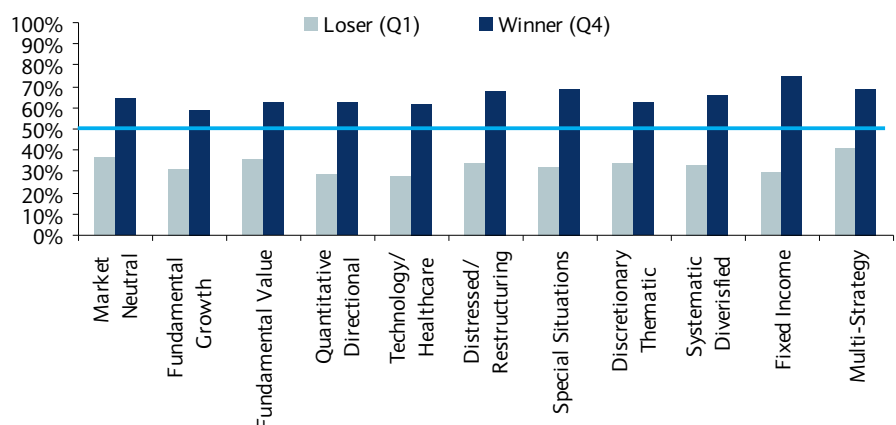
Figure 5 plots the post-ranking attrition rates for “winner” and “loser” funds. Consistent with the evidence in Figure 3, “loser” funds were much more likely to stop reporting during the year post-ranking. Their attrition rate was 20% on average, more than twice that of “winner” funds. In addition, the attrition rate of “loser” funds varied considerably with the overall market environment. In 2008, at the peak of the financial crisis, the attrition rate for “loser” funds reached a record of 35% while for “winner” funds it was only 13%, slightly above its long-term average.

**Figure 4: Percentage of “Winner” and “Loser” Funds with above Median Ranking in Following Year**

**Panel A: By Year (aggregated across styles)**

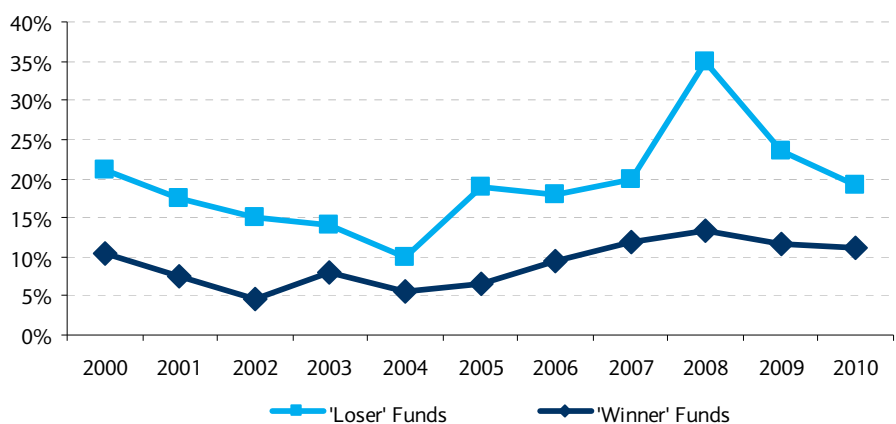


**Panel B: By Style (aggregated over time)**



Note: Funds were assigned into quartile portfolios Q1-Q4 every December based on their *MMS* scores computed over the previous 12 months. Funds termed “winner” and “loser” were ranked in the top and bottom 25% of funds, respectively. Probabilities were computed only for funds with rankings in year  $t$  and  $t+1$ . Style categories were based on HFR classifications. Source: Hedge Fund Research, Barclays Research

**Figure 5: Yearly Attrition Rates for “Winner” and “Loser” Funds**



Note: Funds were assigned into quartile portfolios every December based on their *MMS* scores computed over the previous 12 months. Funds termed “winner” and “loser” were ranked in the top and bottom 25% of funds, respectively. Attrition rates were computed as the number of “winner” and “loser” funds that stopped reporting in a certain year divided by their population as the beginning of the year. Since funds are delisted from the HFR dataset only three months after they stopped reporting, the data for 2011 is not final yet and is therefore excluded. Source: Hedge Fund Research, Barclays Research

## Portfolio Performance

The last section introduced MMS as a ranking statistic and showed that funds with MMS rankings in the top and bottom quartiles of the population are likely to maintain their respective ranking beyond what is implied by random chance. In this section we provide direct evidence on the relation between MMS scores and future *absolute* and *risk-adjusted* returns. To examine this relation, Figure 6 presents various performance statistics for the quartile portfolios Q1-Q4 constructed based on MMS rankings over the entire sample and for two separate sub-periods.<sup>6</sup>

Despite significant variation in absolute return over time, the ordering of performance based on past rankings is preserved and the difference between the Q4 and Q1 portfolios in the two sub-periods is relatively similar (42bp/month and 31bp/month). Furthermore, there is a clear negative relation between rankings and risk, irrespective of how it is measured. In particular, the “winner” portfolio experienced return volatility and drawdown of 1.56% and -12.81%, respectively, that were almost half that of the portfolio with the second highest ranked funds: Q3 (2.24% and -21.62%, respectively). As a result, the Sharpe ratio increases consistently across portfolios by a factor of more than four from a low of 0.32 (“Loser”) to 1.37 (“Winner”). These results hold equally well in both sub-periods.

**Figure 6: Performance Statistics for Portfolios Formed based on MMS Rankings**

|                                    | Q1 - Loser | Q2     | Q3     | Q4 - Winner |
|------------------------------------|------------|--------|--------|-------------|
| Panel A: Full Sample (1997 - 2011) |            |        |        |             |
| Mean Return (%/mo)                 | 0.53       | 0.67   | 0.74   | 0.89        |
| Volatility (%/mo)                  | 2.84       | 2.56   | 2.24   | 1.56        |
| 5th Percentile                     | -3.99      | -3.32  | -2.49  | -1.59       |
| Worst Month                        | -9.33      | -8.72  | -8.92  | -4.98       |
| Maximum Drawdown                   | -31.32     | -26.31 | -21.62 | -12.81      |
| Sharpe Ratio (Ann.)                | 0.32       | 0.54   | 0.72   | 1.37        |
| Panel B: Sub Sample (1997 - 2003)  |            |        |        |             |
| Mean Return (%/mo)                 | 0.78       | 0.91   | 1.00   | 1.20        |
| Volatility (%/mo)                  | 3.05       | 2.63   | 2.36   | 1.61        |
| 5th Percentile                     | -3.40      | -2.57  | -2.11  | -1.02       |
| Worst Month                        | -7.38      | -8.60  | -8.92  | -3.80       |
| Maximum Drawdown                   | -16.07     | -12.61 | -12.46 | -3.95       |
| Sharpe Ratio (Ann.)                | 0.48       | 0.72   | 0.95   | 1.81        |
| Panel C: Sub Sample (2004 - 2011)  |            |        |        |             |
| Mean Return (%/mo)                 | 0.31       | 0.47   | 0.50   | 0.62        |
| Volatility (%/mo)                  | 2.65       | 2.50   | 2.11   | 1.47        |
| 5th Percentile                     | -4.13      | -3.57  | -3.07  | -1.99       |
| Worst Month                        | -9.33      | -8.72  | -7.50  | -4.98       |
| Maximum Drawdown                   | -31.32     | -26.31 | -21.62 | -12.81      |
| Sharpe Ratio (Ann.)                | 0.16       | 0.38   | 0.50   | 0.98        |

Note: Funds were assigned into quartile portfolios Q1-Q4 every December based on their MMS scores computed over the previous 12 months. Funds termed “winner” and “loser” were ranked in the top and bottom 25% of funds, respectively. Performance statistics are based on post-formation returns. Sharpe ratio was computed based on the 1-month Libor rate. Source: Hedge Fund Research, Barclays Research

Figure 7 plots the rolling three-year Sharpe ratios of the “winner” portfolio alongside that of the “loser” portfolio. The plot indicates that the risk-adjusted performance of the “winner” portfolio was superior to that of the “loser” portfolio in any three-year period since 1997. In particular, the Sharpe ratio of the “winner” portfolio was always higher by at least 0.4, and was positive in all but a six-month period during the peak of the financial crisis.

<sup>6</sup> Recall that the constituent funds in each portfolio are determined annually.



Figure 7: Rolling 36-month Sharpe Ratios of “Winner” and “Loser” Portfolios



Note: Funds were assigned into quartile portfolios Q1-Q4 every December based on their *MMS* scores computed over the previous 12 months. Funds termed “winner” and “loser” were ranked in the top and bottom 25% of funds, respectively. Sharpe ratios were computed over rolling 36-months periods based on the portfolios post-formation returns and using the 1-month Libor rate. Source: Hedge Fund Research, Barclays Research

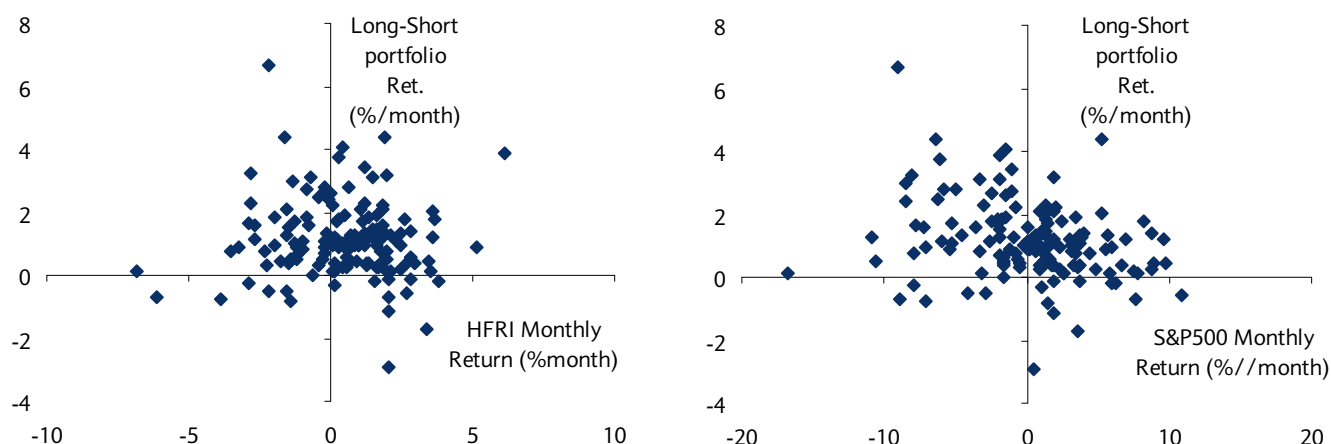
Notice, however, that the magnitude of the difference in risk-adjusted performance between the “winner” and “loser” portfolios (represented by the vertical distance between the two lines in Figure 7) is not constant. In particular, it declined substantially between 2006 and early 2008, as “loser” funds outperformed “winners” in absolute terms during the bull market. This highlights the fact that although persistence should result in higher-ranked funds outperforming lower-ranked ones on average, it is not necessarily the case in the short run. This is because funds with low rankings (ie, no alpha) but large market exposures may still generate higher returns than better-ranked funds if the market rallies. However, such an outcome may only hold for a limited period. Eventually, as market conditions change, the benefit of superior skill will materialize, and highly ranked funds (ie, with large alpha) will outperform lower ranked funds.

To measure more accurately the magnitude of the difference in “alpha” between the “winner” and “loser” portfolios, we analyze the performance of a theoretical portfolio representing “long” and “short” positions in the “winner” and “loser” portfolios, respectively. To ensure the systematic risk of the long-short portfolio is eliminated, the position in the “winner” portfolio is scaled such that its risk *ex-ante* is equalized to that of the “loser” portfolio.<sup>7</sup> Consequently, the performance of the long-short portfolio is a direct measure of relative “alpha,” the skill difference between “winner” and “loser” funds.

Figure 8 displays monthly returns of the long-short portfolio against those of the HFRI composite and S&P500 Indices since January 2000. Both charts illustrate that the performance differential between the “winner” and “loser” portfolios does not depend on the overall hedge funds market (the correlation is -0.04) or the state of the overall market as represented by the S&P500 (the “beta” to the S&P500 is only -0.07, both statistically and economically insignificant).

<sup>7</sup> Because both the “winner” and “loser” portfolios include hundreds of funds, their idiosyncratic risk will be negligible. The scaling factor is calculated monthly based on the ratio of volatilities of the “loser” to the “winner” portfolio over the previous 36-months with no hindsight.

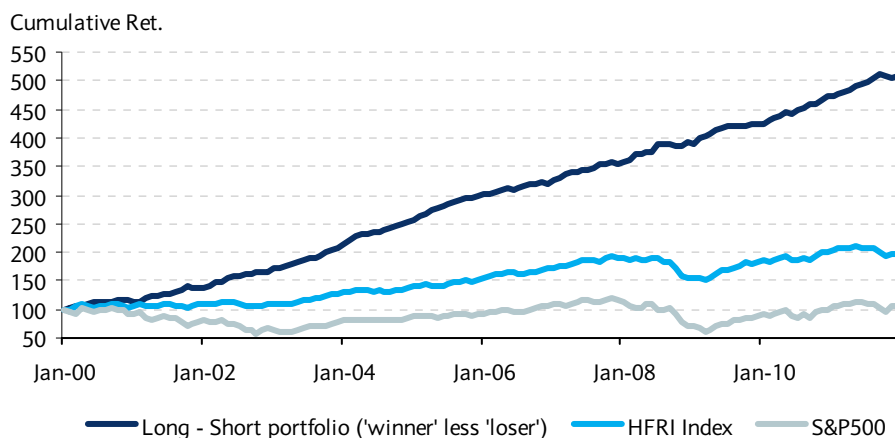
Figure 8: Performance of Long “Winner” - Short “Loser” Portfolio vs. HFRI Composite and S&amp;P500 Indices



Note: the Long-short portfolio represents a “long” and “short” positions in the “winner” and “loser” portfolios, respectively, formed based on MMS rankings. The position in the “winner” portfolio is scaled such that its risk *ex-ante* is equalized to that of the “loser” portfolio. For additional details see footnote 7. Source: Bloomberg, Hedge Fund Research, Barclays Research

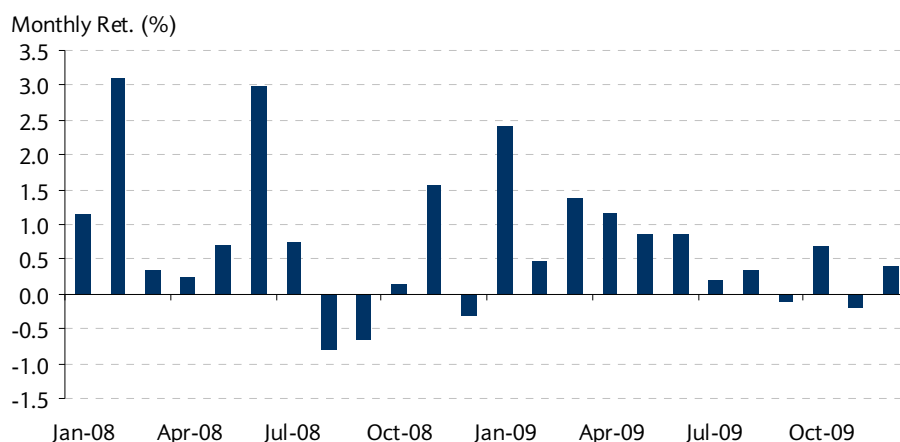
Figure 9 plots the cumulative return of the long-short portfolio along with that of HFRI and S&P500 indices. Over the sample period 2000-2011, the long-short portfolio delivered a monthly average return of 1.15%, which translates into an annualized “alpha” difference between “winner” and “loser” funds of 13.75%. Furthermore, the long-short portfolio had an annualized volatility of only 4.27% with a hit ratio of 89%. As a result, the long-short portfolio boasted an information ratio of 3.22, and increased more than five-fold from 2000 to 2011, while the S&P 500 was almost unchanged during that time.

Figure 9: Cumulative Return of Long “Winner” - Short “Loser” portfolio



Note: the Long-short portfolio represents a “long” and “short” positions in the “winner” and “loser” portfolios respectively, formed based on MMS rankings. The position in the “winner” portfolio is scaled such that its risk *ex-ante* is equalized to that of the “loser” portfolio. For additional details see footnote 7. Source: Bloomberg, Hedge Fund Research, Barclays Research

Perhaps even more impressive is the difference between the results in Figure 2 and the performance of the long-short portfolio based on *MMS* rankings in 2008-09 shown in Figure 10. The annual returns of the portfolio in 2008 and 2009 were very similar. The long-short portfolio earned 9.27% and 9.88% in 2008 and 2009, respectively, while the S&P 500 was down 37% in 2008 and up 26% in 2009. In addition, the long-short portfolio experienced just five down months during the period, with August 2008 representing the worst month with a loss of only 0.81%.

**Figure 10: Performance of Long “Winner” - Short “Loser” Portfolio in 2008-09**

Note: the Long-short portfolio represents a “long” and “short” positions in the “winner” and “loser” portfolios, respectively, formed based on MMS rankings. The position in the “winner” portfolio is scaled such that its risk *ex-ante* is equalized to that of the “loser” portfolio. For additional details see footnote 7. Source: HFR, Barclays Research

The quartile portfolios Q1-Q4 are well diversified and consist of a few hundred funds each. How will the performance of portfolios formed using MMS change if the number of constituent funds is smaller? Will the relation between past ranking and future performance be equally strong?

This question is of particular importance as the number of hedge funds held in investors’ portfolios is typically limited to several dozen or less. To address it, we form ten equally populated portfolios (ie, deciles), based on MMS rankings, as well as the two ranking statistics we used previously: average returns and Sharpe ratios. Figure 11 displays the Sharpe ratios of the different portfolios based on their post-formation returns.

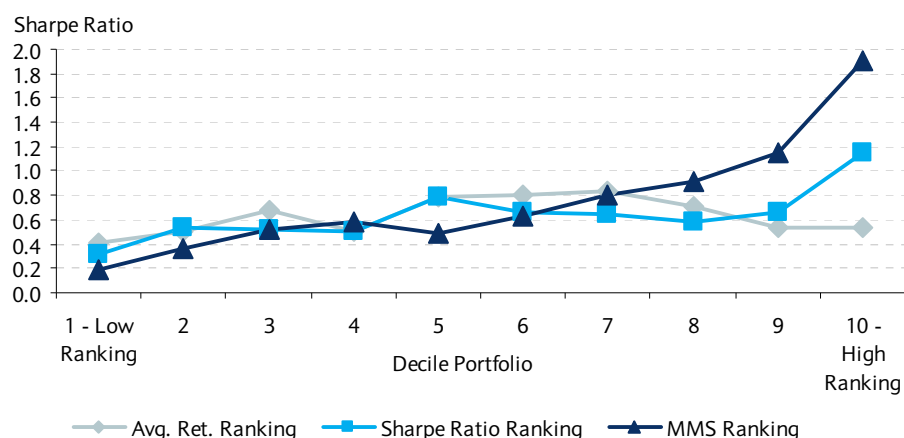
The chart indicates that the relation between MMS rankings and future performance is still monotone, despite the fact that the number of constituent funds in each portfolio has declined by more than half. The highest decile portfolio delivered a Sharpe ratio of 1.90 over the 15-year period from 1997, ten times that of the portfolio with the lowest MMS-ranked funds (0.19). In contrast, the performance of the portfolios populated based on average return exhibit no relation at all, and the pattern for those based on Sharpe ratio is very weak and inconclusive.

### Sources of Outperformance

The results so far indicate a clear monotone relation between *MMS* scores and subsequent performance. Funds with higher *MMS* scores not only earn higher returns but also exhibit substantially lower risk and attrition rate. While we argued that the results reflect the ability of *MMS* to effectively identify high “alpha” generators, there are also several alternative explanations.

One possible explanation is that the outperformance is driven by fund characteristics known to be correlated with performance such as size, and *MMS* is simply more likely to pick on such funds. Another less likely possibility is that funds with higher *MMS* scores have more exposure to systematic risk, which leads to better performance. A third option is that our results reflect the formation frequency and data used and are not robust to other specifications. We examine each of these issues in turn.

Figure 11: Sharpe Ratios of Decile Portfolios by Ranking Statistic



Note: Funds were assigned into decile portfolios every December between 1997 and 2010 based on one of the ranking statistics (MMS, Sharpe ratio or average return) computed over the previous 12 months. Sharpe ratios were computed based on the decile portfolios post-formation return time-series using the 1m Libor rate. Source: HFR, Barclays Research

### Fund Characteristics

Figure 12 displays various characteristics found to be correlated with hedge funds' performance, for each quartile portfolio as of the last ranking date based on MMS (January 1, 2011).<sup>8</sup> It also shows the subsequent performance during the year.

The figure reveals several differences among the portfolios, but none of them can account for the performance patterns we found. First, funds with higher rankings are actually larger with "winner" funds having an average AUM of \$274mn, about \$50mn more than those in the "loser" portfolio. This is likely a result of positive inflows during the period used for ranking, in which higher ranked funds exhibited better performance. Hence, the "size effect" is not the driver of "winner" portfolios' superior performance. Second, funds with higher rankings are typically younger (the average age of funds in the "winner" portfolio is 6.23 years compared with 7.53 years for those in the "loser" portfolio) but the difference is statistically insignificant, in particular among the Q1-Q3 portfolios despite the performance difference among them. Funds with higher rankings also tend to charge higher fees consistent with the idea that they possess higher skill, but not sufficiently (due to lack of variation in the industry fee structure) to equate the *net-of-fee performance* across portfolios.

Figure 12: Fund Characteristics of Portfolios Formed by MMS

|                       | Q1 (Loser) | Q2     | Q3     | Q4 (Winner) |
|-----------------------|------------|--------|--------|-------------|
| As of 12/31/2010      |            |        |        |             |
| Number of Funds       | 673        | 675    | 675    | 674         |
| Avg. AUM (\$million)  | 225.20     | 230.68 | 237.25 | 274.19      |
| Avg. History (months) | 90.48      | 86.46  | 86.08  | 74.87       |
| Avg. Management Fee   | 1.53       | 1.56   | 1.60   | 1.62        |
| Avg. Incentive Fee    | 18.63      | 18.60  | 18.68  | 19.07       |
| Performance in 2011   |            |        |        |             |
| Cumulative Return (%) | -8.65      | -7.47  | -4.97  | -0.76       |
| Ann. Volatility (%)   | 8.73       | 8.31   | 6.45   | 5.18        |

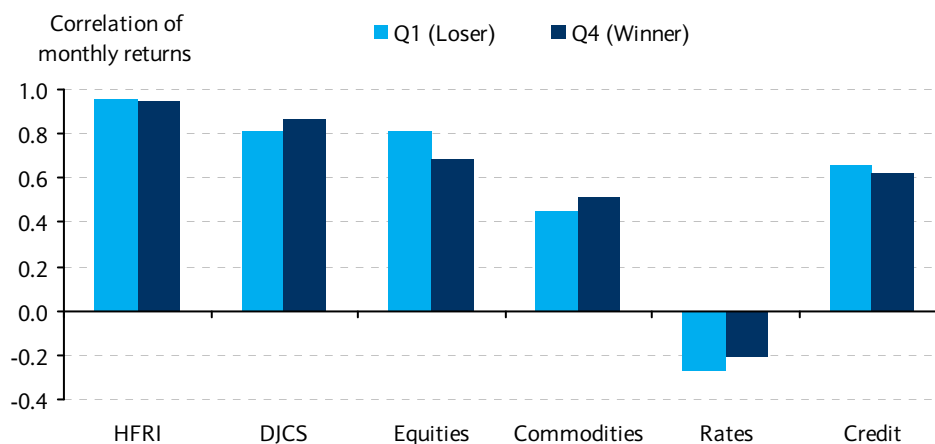
Note: Funds were assigned into quartile portfolios Q1-Q4 on December 31, 2010 based on their MMS scores computed over the previous 12 months. Funds termed "winner" and "loser" were ranked in the top and bottom 25% of funds, respectively. Performance statistics were calculated based on post-formation returns in 2011. Source: Hedge Fund Research, Barclays Research

<sup>8</sup> Examining the average characteristics over the entire sample generates very similar results.

### Systematic Risk

If the performance difference between the “loser” and “winner” portfolios is driven at least in part by systematic risk, the correlations of the two portfolios with major asset classes should be different. However, as Figure 13 indicates, the correlations are remarkably similar, suggesting that our findings are not driven by systematic exposures. In fact, the largest difference is in comparison to the S&P500 Index, with which the “loser” portfolio actually has a higher correlation than the “winner” portfolio (0.80 versus 0.68, respectively).

**Figure 13: Correlations of “Winner”/“Loser” Portfolio with Major Markets**



Note: HFRI and DJCS are the HFRI Composite Index and Dow Jones Credit Suisse Hedge Fund Index, respectively; Equities is the S&P 500 Total Return Index; Commodities is the Dow Jones UBS Commodity Excess Return Index; Rates and Credit are represented by the 10-year Treasury future and the Barclays U.S. High Yield Index returns. Funds were assigned to quartile portfolios Q1-Q4 every December based on their *MMS* scores computed over the previous 12 months. Funds termed “winner” and “loser” were ranked in the top and bottom 25% of funds, respectively. The chart shows the correlation between each of the portfolios post-formation monthly returns and those of the respective index using data between January 1997 and December 2011. Source: Bloomberg, Hedge Fund Research, Barclays Research

### Ranking Frequency

The results presented so far were based entirely on a 12-month rebalancing frequency of the portfolios. The choice of the rebalancing frequency took into account practical limitations (e.g., restrictions on redemptions and subscriptions) as well as the possibility of significant changes in a fund, such as in its strategy or key personnel.

How sensitive are our findings to the rebalancing frequency? Figure 14 presents the performance statistics shown in Figure 6, when portfolios were rebalanced every 3 or 18 months instead, along with the original results.<sup>9</sup> The table suggests that a higher ranking frequency magnifies the dispersion among the portfolios in terms of returns and volatilities and thus Sharpe ratios. For example, in the case of quarterly rebalancing, the Sharpe ratio of the “winner” portfolio increases from 1.31 to 1.56, while that of the “loser” portfolio decreases from 0.28 to 0.08. This supports the view that the *MMS* scores are informative and hence employing them with more timely information would lead to better ranking of funds. It is important to note, however, that the relation between past rankings and future performance is preserved even when portfolios were rebalanced over a relatively long horizon of 18 months.

<sup>9</sup> Notice that having an 18-month rebalancing frequency required a longer ranking period and consequently the post-formation returns are available only since January 1998 rather than 1997 as in Figure 6.

Figure 14: Effect of Ranking Frequency (1998 – 2011)

|                               | Q1 - Loser | Q2     | Q3     | Q4 - Winner |
|-------------------------------|------------|--------|--------|-------------|
| Panel A: 12-month Rebalancing |            |        |        |             |
| Mean Return (%/mo)            | 0.48       | 0.64   | 0.68   | 0.85        |
| Volatility (%/mo)             | 2.80       | 2.56   | 2.24   | 1.58        |
| 5th Percentile                | -4.25      | -3.43  | -2.69  | -1.63       |
| Worst Month                   | -9.33      | -8.72  | -8.92  | -4.98       |
| Maximum Drawdown              | -31.32     | -26.31 | -21.62 | -12.81      |
| Sharpe Ratio (Ann.)           | 0.28       | 0.51   | 0.65   | 1.31        |
| Panel B: 3-month Reblancing   |            |        |        |             |
| Mean Return (%/mo)            | 0.33       | 0.64   | 0.78   | 0.96        |
| Volatility (%/mo)             | 2.89       | 2.52   | 2.15   | 1.56        |
| 5th Percentile                | -4.36      | -3.49  | -2.55  | -1.39       |
| Worst Month                   | -10.64     | -9.02  | -6.54  | -4.81       |
| Maximum Drawdown              | -32.48     | -27.29 | -19.11 | -11.84      |
| Sharpe Ratio (Ann.)           | 0.08       | 0.52   | 0.84   | 1.56        |
| Panel C: 18-month Reblancing  |            |        |        |             |
| Mean Return (%/mo)            | 0.53       | 0.67   | 0.66   | 0.73        |
| Volatility (%/mo)             | 2.88       | 2.52   | 2.28   | 1.67        |
| 5th Percentile                | -3.98      | -3.44  | -2.71  | -1.73       |
| Worst Month                   | -9.54      | -8.29  | -7.52  | -7.28       |
| Maximum Drawdown              | -33.72     | -25.26 | -22.05 | -13.31      |
| Sharpe Ratio (Ann.)           | 0.33       | 0.57   | 0.61   | 0.97        |

Note: Funds were assigned into quartile portfolios Q1-Q4 every 3, 12 or 18 months based on their *MMS* scores computed over the previous 12 or 18 months. “Winner” and “loser” funds were ranked in the top and bottom 25% of funds, respectively. Performance statistics were calculated based on post-formation returns. Source: Hedge Fund Research, Barclays Research

### Data

Because reporting by hedge funds to a commercial database is voluntary, they often choose to initiate it following a streak of good performances. As a result, using return data prior to the date of inclusion in the database has been shown to generate upward-bias estimates of hedge funds returns. While our objective is not to evaluate the performance of hedge funds as an asset class, the “inclusion bias” may still influence our results if its effect on performance is not uniformly distributed across portfolios.

To eliminate the possible effect of “inclusion bias,” we eliminate return data prior to the funds’ inclusion date.<sup>10</sup> Figure 15 compares the performance statistics of the Q1-Q4 portfolios based on the full dataset with those using only the post-inclusion returns.

The results indicate that the effect of the inclusion bias in *absolute terms* is material (the Sharpe ratio of the “winner” group drops from 1.36 to 1.01 after correcting the bias), but the decline is quite uniform. In particular, the drop in Sharpe ratio for the “loser” portfolio is 0.29, which is similar to the 0.35 drop by the “winner” portfolio. Consequently, the performance difference between the “winner” and “loser” portfolio is almost unchanged.

<sup>10</sup> HFR database includes information on each fund inclusion date as far back as May 1996. As a result, the first rebalance date occurred on April 30, 1997, instead of December 31, 1996.

Figure 15: Effect of “Inclusion Bias” on Performance of Quartile Portfolios

|                                    | Q1 - Loser | Q2     | Q3     | Q4 - Winner |
|------------------------------------|------------|--------|--------|-------------|
| Panel A: Using all Available Data  |            |        |        |             |
| Average Return (%/mo)              | 0.55       | 0.67   | 0.73   | 0.88        |
| Volatility (%/mo)                  | 2.85       | 2.57   | 2.25   | 1.57        |
| 5% Percentile                      | -4.07      | -3.36  | -2.56  | -1.60       |
| Worst Month                        | -9.33      | -8.72  | -8.92  | -4.98       |
| Maximum Drawdown                   | -31.32     | -26.31 | -21.62 | -12.81      |
| Ann. Sharpe Ratio                  | 0.34       | 0.54   | 0.71   | 1.36        |
| Panel B: Using Post-Inclusion Data |            |        |        |             |
| Average Return (%/mo)              | 0.31       | 0.47   | 0.58   | 0.78        |
| Volatility (%/mo)                  | 2.87       | 2.73   | 2.39   | 1.74        |
| 5% Percentile                      | -4.62      | -4.17  | -3.19  | -1.89       |
| Worst Month                        | -9.39      | -10.55 | -8.39  | -5.05       |
| Maximum Drawdown                   | -32.71     | -30.31 | -24.25 | -13.37      |
| Ann. Sharpe Ratio                  | 0.05       | 0.26   | 0.46   | 1.01        |

Note: Funds were assigned into quartile portfolios Q1-Q4 every year based on their *MMS* scores computed over the previous 12 months. “Winner” and “loser” funds were ranked in the top and bottom 25% of funds, respectively. Performance statistics were calculated based on post-formation returns between May 2007 and December 2011. Source: Hedge Fund Research, Barclays Research

## Summary

Hedge funds are an increasingly important asset class but present unique challenges for investors. Due to their variety and complexity, simple measures using past returns offer limited insight into their future performance and are unable to identify managers who exhibit persistent skill over time.

We discuss some of the challenges in identifying performance persistence in hedge funds and introduce *MMS* – a proprietary measure of a manager’s skill that addresses them. We form portfolios of hedge funds based on *MMS* scores and find that funds in the top quartile of *MMS* scores have a 65% probability of being ranked above the median in the following year. Furthermore, an equally weighted portfolio of these funds delivered a Sharpe ratio of 1.37 over a 15-year period since 1997, compared with 0.32 for the portfolio of funds with the lowest 25% of *MMS* scores over the same period.

*MMS* scores are computed for individual funds and can be easily applied to portfolios comprised of multiple funds, by aggregating the scores. Since the measure is probabilistic in nature and the empirical success rates can be estimated on average (ie, the likelihood a fund with a certain ranking is above a certain percentile of the population in the following period), an investor can use *MMS* scores to compute the probability his portfolio of hedge funds will outperform peers, given its current composition.

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