I don’t believe in Sharpe Ratios (I just believe in me)

Papers by:

- Posthuma & van der Sluis, A reality check on hedge fund returns, July 8, 2003
- Andrew Lo, The statistics of Sharpe Ratios, Financial Analysts Journal, July/August 2002
- Goetzmann, Ingersoll, Spiegel & Welch, Sharpening the Sharpe Ratio, working paper, February 2002

Reviewed by Jim Brandon | BAAM GmbH
jim.brandon@baam.ch

Introduction

In his song «God Lyrics», John Lennon offers a simple warning to believers:

I don't believe in magic – I don't believe in I-ching – I don't believe in Bible – I don't believe in tarot – I don't believe in Hitler – I don't believe in Jesus – I don't believe in Kennedy – I don't believe in Buddha – I don't believe in Mantra – I don't believe in Gita – I don't believe in Yoga – I don't believe in kings – I don't believe in Elvis – I don't believe in Zimmerman – I don't believe in Beatles – I just believe in me.

I don’t believe that the Sharpe ratio is very useful for investors in hedge fund (hereafter HF) portfolios. It is a measure of the amount of excess return that an investor receives per unit of standard deviation of return. As such, it is an appropriate measure for comparing portfolios. But it is very inappropriate for comparing individual investments within a portfolio. Most investors have a small allocation to hedge funds in their portfolio and probably do not estimate the Sharpe ratios for individual stocks with similar weights in their portfolio. If that were not reason enough, this review highlights the warnings expressed in three recent papers on the use of Sharpe ratios for hedge funds. The warnings can be easily summarized: Don’t believe in them.

The instant history bias of hedge fund returns is larger than you believe. Posthuma and van der Sluis (hereafter PS) both work for ABP Investments in The Netherlands; van der Sluis is also an Assistant Professor of Finance at the Free University of Amsterdam. The central result of their paper is that the instant history bias of hedge fund returns on the TASS dataset ranges from 1996 to 2002 is +4.3%.

To understand this result, a brief explanation of the various biases in estimating the expected return of a HF might be helpful. Consider the following sample selection rule: An unbiased estimate of the expected return of a HF (from the perspective of an investor) must use a historical sample of returns which reflects the investor’s actual sample in the past.

The well-known survivorship bias is caused by a HF data vendor removing all prior HF returns from the database if the HF stops reporting returns to the data vendor. A better label might be the «deleting-all-past-returns-if-a-HF-stops-reporting» bias, since a HF might stop reporting to the vendor either because it has liquidated (i.e. not survived), or because it has decided to stop advertising its track

record on the vendor's database. Liquidation usually occurs after a period of very negative returns, which induces a positive survivorship bias (the estimate is higher than the true value). On the other hand, a HF usually stops advertising its track record after a period of very high returns (and large investment inflows), which induces a negative survivorship bias (the estimate is lower than the true value). The data vendor practice of «deleting-all-past-returns-if-a-HF-stops-reporting» clearly violates our sample selection rule since the investor's sample in the past would have included the deleted returns.

Once a HF decides to liquidate, then one can be reasonably certain that its returns for the months prior to the actual liquidation were negative, either due to price pressure or due to past losses not reflected in the reported NAV. If the HF does not report these returns to the data vendor, then the estimate of its expected return from the returns included in the database will have a positive liquidation bias, since future negative returns are obviously not included in the sample. An investor might be aware that the HF has stopped reporting and try to redeem immediately. But the exclusion of a few monthly returns violates our sample selection rule because the investor would probably not be able to redeem, either due to redemption rules (quarterly redemptions or redemption notice periods) or due to redemption suspensions. There are no estimates of the size of this bias available in literature.

In a sense, the instant history (or backfill) bias is the «opposite» of the survivorship bias. Whereas the survivorship bias is caused by removing earlier returns after a HF stops reporting to the data vendor, the instant history bias is caused by adding earlier returns to the sample after a HF starts reporting to the data vendor. HFs often start reporting to a data vendor in order to advertise their track record. If the data vendor only included returns from the start-of-reporting-month, no bias is induced. If the data vendor allows the HF to include its past returns, our sample selection rule is violated since those earlier returns were not in the investor's sample in the earlier period. Usually, it is the HFs with very high past returns that wish to start reporting to the vendor, so the instant history bias is usually positive.

The instant history bias has been a source of concern in hedge fund research for some time, and PS cite the various indirect attempts to estimate this bias. They offer a major contribution by providing the first direct calculation of this bias. PS obtained the dates on which HFs first reported to the TASS dataset and then carefully calculated the return of two equally weighted portfolios of HFs: a portfolio which *includes* all returns (including backfilled returns), and a portfolio which *excludes* backfilled returns.

Their key result is that the average annual return of the former (backfilled) portfolio is 4.3% higher than the latter (non-backfilled) portfolio for the years 1996 to 2002. The HF investor who wanted to invest in an equally weighted portfolio of all HFs reporting on the TASS database might estimate the future expected return of the portfolio using the past returns. The naïve investor, who ignores the instant history bias, might estimate a future expected annual return of 10.7%. The sophisticated investor who recognizes the importance of using a sample which satisfies our sample selection rule would estimate only 6.4%. Using a risk free rate of 3% per year, the numerator of the Sharpe ratio would decline from 7.7% to 3.4%. Since backfilled returns probably have a lower standard deviation, Sharpe ratio estimates would be more than doubled by the instant history bias.

PS offer evidence that the size of the instant history bias declines over time. The percentage of funds with backfilled returns has declined from 69% in 1996 to 13% in 2002, resulting in a decline of the backfill bias from 5.5% in 1996 to 0.84% in 2002. So the positive bias in Sharpe ratios can be lessened by using more recent returns, but at the expense of wider confidence intervals. Also, by using equally weighted portfolios, the estimate of the bias by PS are more heavily weighted by HFs with lower assets under management. This probably does not reflect the typical weights of many HF portfolios, and smaller HFs probably have higher instant history biases. On the other hand, investors should be more wary of high Sharpe ratio estimates for the so-called young HF portfolios.

PS offer estimates of the instant history bias for 10 separate HF strategies and for funds of hedge funds. (PS seem to misunderstand Fung and Hsieh's point that fund of hedge

funds do not suffer from various HF biases. But this is a small issue in an early draft of their paper.) They also estimate the effect of the liquidation bias for various scenarios. So there is a wealth of evidence worthy of consideration for the investor who wishes to understand the importance of this bias. In summary, PS offer good reasons for believers in high HF Sharpe ratios to think again.

Annualized Sharpe ratios are lower and confidence intervals are wider than you believe Andrew Lo is an extremely well-regarded professor of finance at MIT, the Chief Scientific Officer of a hedge fund manager, the AlphaSimplex Group, and a frequent contributor to the research literature on HFs. In «The Statistics of Sharpe Ratios», he provides a rigorous analysis of the properties of the estimated confidence interval around the point estimate of the Sharpe ratio (hereafter SR), under the unrealistic assumption of independently and identically distributed (IID) returns as well as under the more realistic assumption of stationary (non-IID) returns (the stationary assumption permits serial correlation, time-varying conditional volatilities and other more realistic properties of hedge fund returns.) It may be surprising that these assumptions do not include a specification of the probability distribution for the returns, e.g. the normal distribution. Lo does not need to make any distributional assumption because his results use asymptotic, or «large sample» statistical theory, in which the Central Limit Theorem is used to show that the asymptotic SR is distributed normally. Given the reliance on a large sample, investors may hesitate to use Lo's estimates of confidence intervals in practice. Nevertheless, Lo demonstrates that investors should reconsider their belief in SR point estimates for a number of reasons.

In particular he demonstrates the hazards of aggregating monthly SRs to annual SRs by multiplying by SQRT(12), which is valid only under the IID returns assumption. I will briefly present two of Lo's results below.

1. Under the unrealistic assumption of IID returns, Lo calculates the asymptotic standard error of the estimate of the Sharpe ratio:

$$SE(\underline{SR}) = SQRT\ [(1+SR^2)/T]$$

where $\underline{SR}$ is the estimated Sharpe ratio, SR is the true Sharpe ratio, and T is the number of observations.

SE(SR) can be estimated by replacing SR with $\underline{SR}$. The immediate insight here is that the estimated confidence interval of a Sharpe ratio point estimate increases with the size of the true Sharpe ratio. Since HFs typically claim high Sharpe ratios, an investor should be cautious about the precision of these estimates, even if the assumption of IID returns were true. Using simulations, Lo estimates the standard error of a Sharpe ratio estimate using 24 observations to be 0.25 for a true Sharpe ratio of 1.0, but almost twice as large, 0.48, for a true Sharpe ratio of 3.0.

2. Under the more realistic assumption of stationary returns, Lo shows that, when aggregating monthly SRs to annual SRs, one should not multiply by SQRT(12) or 3.46, but rather by a complicated function of the serial correlations of the returns. Under the case of first-order autoregressive returns, the k-th order serial correlation coefficient is the autoregressive coefficient to the k-th power. Lo shows the adjustment factors for varying levels of the autoregressive coefficient:

AR Coefficient	Adjustment Factor - SR(1) to SR(12)
90%	1.21
20%	2.88
0%	3.46
-20%	4.17
-90%	12.06

For positive autoregressive coefficients, Lo points out that the adjustment factor is less than the IID factor of 3.46, since the variance of the 12-month returns is more than 12 times the variance of the 1-month returns, yielding a larger denominator in the SR than the IID case. Positive serial correlations are a common characteristic of HF returns, so an IID annual SR estimate, calculated as the one-month SR estimate times 3.46, will likely overstate the true annual SR estimate. Using return data for actual HFs, Lo shows that the annual IID SR estimate overstates the annual non-IID SR estimate by 45% (4.3 vs. 3.0) for a convertible arbitrage fund and by 65% for a mortgage-backed securities fund (4.0 vs. 2.4) due to positive serial correlation. A risk arbitrage fund's annual IID SR is understated by a smaller amount (3.2 vs. 3.8) due to negative serial correlation.

For believers in annual SRs which are aggregated from monthly SRs, Lo offers good reasons for concern about errors induced by serial correlation. For believers in high SRs, Lo offers a caution about the precision of the estimates.

Sharpe ratios can be manipulated more than you believe

Goetzmann, Ingersoll, Spiegel and Welch (hereafter GISW) are all very well regarded finance professors at Yale

University. In their paper, «Sharpening Sharpe Ratios», they «derive the general conditions for achieving the maximum expected Sharpe ratio». For static strategies, they find the best two-option strategy is to short a put and short a call. In other words, a HF manager with no skill who wishes to achieve the highest expected Sharpe ratio would invest to create a return distribution with a truncated right tail and a fat left tail. More concretely, he or she would buy a stock index, sell off a portion of the upside by shorting an out-of-the-money call and increase the risk of a large loss by shorting an out-of-the-money put. The steady income from the premia of the call and the put would generate a low variance return in most months and only rarely would a sharp fall in equities generate a large loss.

A smart investor might imagine that he or she could detect the existence of such a no-skill-high-Sharpe-ratio strategy by examining the historical return distribution. GISW argue that the investor will often not have the necessary large sample of returns required. The HF industry is relatively young and, due to the high attrition rate of hedge funds, many individual HFs have a relatively small number of monthly return observations. This is the so-called peso problem: the sample is too small to include rare catastrophic-loss months. There are three ways to think about this.

A single HF may have too few observations to include the rare event. A single HF manager may hide the rare event by closing down a HF and starting a new HF (and either hiding the earlier failure or spinning the investor as to the true cause). A single HF strategy may, by its nature rather than by manipulation, generate a short-put-short-call return distribution.

GISW suggest that merger arbitrage is a good example. Finally, and most worrisome, GISW warn that the entire HF industry may have too small a sample of observations for the investor to detect the risk of a rare catastrophic loss. As they note: «The documented positive Sharpe ratios of the hedge fund industry, and the short history of the industry, are consistent with providing maximum-Sharpe-ratio-like returns in small sample.»

If GISW's thoughts turn out to be accurate, a short-horizon HF investor can believe in hope, but a long-horizon HF investor cannot.

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