Some studies have shown that it is more difficult to consistently exhibit good market timing skills than it is to consistently exhibit good stock selection skills. This would suggest that traditional hedge fund screening measures might be improved by focusing on stock selection alpha as opposed to market timing alpha. In this paper we use a Kalman Filter to overcome some of the traditional difficulties in calculating selection alpha. We then show that post-screen performance was enhanced with selection alpha relative to traditional methods.

Badon Hill White Paper Series

Improving Hedge Fund Screening

Using the Kalman Filter to Measure Selection Alpha

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Selection Alpha as a Screening Tool

Choosing a hedge fund is a highly subjective business. Each fund presents investors with a specific, and often unique, set of risks and potential rewards which can only be truly appreciated with a detailed qualitative review. Having said that, subjectively reviewing a hedge fund is a labor intensive process and many investors might look to a quantitative scoring system to help narrow down the field of candidates to a more manageable number. Put another way, there are thousands of hedge funds vying for your attention and sometimes you just have to thin the herd a bit.

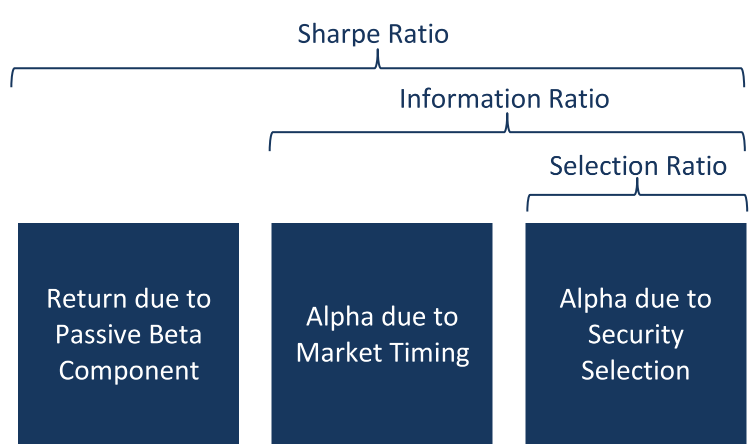
The goal of this paper is three-fold: (1) to suggest that hedge fund investors screen managers based upon a manager's ability to pick stocks, as opposed to time markets, (2) to suggest a method for calculating a manager's stock-picking ability and (3) explain both of the foregoing in as simple and straightforward a way as practicable.

Most professional hedge fund investors already employ some sort of quantitative filter, such as assets under management, minimum track record, Sharpe Ratio, Information Ratio, correlation, alpha, etc. Investors with different objectives may stress one method over another, but we have found that many investors will favor the modified Sharpe Ratio or Information Ratio when focusing on risk-adjusted returns.

However, screening certain hedge fund strategies using Sharpe Ratio and Information Ratio can be problematic because some managers have the ability and inclination to dynamically adjust their market exposure. This is particularly true for managers engaged in Long/Short Equity trading. Managers in this strategy often have different market exposure targets and can dynamically adjust their exposure fairly quickly to adapt to their overall outlook. From the standpoint of the Sharpe Ratio, this makes it difficult to compare managers because ratios will differ based upon how much market exposure a particular manager generally targets.

Screens based upon the Information Ratio, which measures the risk-adjusted alpha of the manager, solve this problem by adjusting for differences in market exposure. Although the Information Ratio is an improvement in this respect, we believe there is room to improve further. For example, the Information Ratio is an analysis of the manager's historical total alpha, but Long/Short Equity managers can generate alpha in two ways: (1) fortuitously increasing and decreasing market exposure ahead of market moves, better known as "market timing," and (2) purchasing stocks that will outperform and shorting stocks that will underperform, also known as "security selection."

In some ways, it should not matter much how a



Selection Ratio is highly focused

manager generates alpha, so long as alpha is produced. However, there have been some academic studies indicating that equity managers are either good at market timing or good at security selection, but rarely good at both (Kao, Cheng, & Chan, 1998). This seems intuitive to us since micro- and macro- analysis are somewhat different skill sets. There is also some academic evidence that, out of market timing and security selection, hedge fund managers show better consistency with security selection (Cutherbertson, Nitzche, & O'Sullivan, 2009 or Gupta, Cerrahoglu, & Daglioglu, 2003) This also seems intuitive to us given the amount of relative competition at the market level vs the stock selection level.

If this premise is true, then separating out security selection alpha from market timing alpha might improve on our ability to identify managers that will outperform in the future, as opposed to those that have just outperformed in the past. The rationale for this would be two-fold: (1) the screen would focus on an attribute that has been shown to have some persistence, which increases the chance of a repeat performance, and (2) the screen might be more effective at eliminating situations where the assessment of a manager's skill is inflated by a few fortuitous, but isolated, market timing calls.

Our own screens seem to indicate that this is the case. During our study period, we found that a screening process biased towards selection alpha would have outperformed those based on either Sharpe Ratio or Information Ratio. We will go into our results further at the end of this paper, but first we should describe our process in a bit more detail.

Developing a measure of selection alpha

Simplistically speaking, measuring selection alpha is fairly straight forward. We effectively use the approach described in Jain, Yongvanich, & Zhou, 2011, except applied to individual hedge fund returns:

1. *Calculate the beta of the manager.*

2. *Use the Beta and the Benchmark return to calculate the alpha of the manager.*

3. *Use the change in Beta to calculate the alpha due to market timing.*

4. *Subtract alpha due to market timing from total alpha to calculate the alpha due to security selection.*

Looking at this in more detail, we first determine the habitual market exposure of the manager, which we call the "habitual beta." The premise here is that each manager has a "habitual" or "neutral" amount of market exposure (beta) in the portfolio which they will gravitate towards in the absence of an opinion on the market. For an Equity Market Neutral hedge fund, this will most likely be close to a beta of zero, but we have found that most equity long/short funds will generally have at least some market exposure in their portfolio even if they have no opinion on the market.

Note: we prefer the term "habitual beta" as opposed to "neutral beta" since the latter could be confused with the term "beta neutral," which refers to a portfolio that has no benchmark exposure. Going forward, we will refer to the "normal" amount of market exposure for a particular manager as that manager's "habitual beta" or "beta habitat."

Second, using this habitual beta, we calculate the total alpha that the manager was able to produce over the benchmark return.

Third, we calculate the manager's selected market exposure for each performance period. We refer to this as the "tactical beta" and we refer to the difference between the tactical beta and the beta habitat as the "tactical overweight/ underweight." Assuming that any deviation from the habitual beta is intentional, this would represent the expression of a market view.

We can then calculate in each period the amount that the tactical overweight/underweight produced in return relative to the habitual beta. In effect, we treat tactical overweights or underweights as having the same effect as taking a long or short position on the market. For example, if the manager has expressed a tactical overweight and the benchmark rises, this will accrue as positive alpha from market timing.

Lastly, we simply subtract the timing alpha that we calculated in step 3 from the total alpha and what remains is selection alpha, assuming no other sources of alpha are concerned.[1]

We have now separated performance into three key components that can be used for screening: the passive return due to benchmark sensitivity (beta), the alpha return due to market timing (timing alpha), and the alpha return due to security selection (selection alpha).

Calculating beta: the Kalman Filter

As you can observe from the process above, steps 1 and 2 require us to estimate the market sensitivity of the manager's portfolio at any given point in time. As it turns out, this is fairly difficult to do since we often do not have timely information on the underlying positions in every manager's portfolio for our target universe.[2] Many hedge fund managers will report a "net long" figure for their portfolios, but we feel that this is not very precise at estimating market sensitivity (see call-out box on Beta vs Net Long).

Typically, practitioners will opt to estimate market sensitivity with a "beta" calculated using historical regression analysis. The problem with this method is that straight-line regression analysis assumes a static beta during the entire calculation period. That is to say, it assigns one beta measure to the whole period. Given the ability and inclination for long/short hedge fund managers to change their beta relatively quickly, this assumption is fairly dangerous.

<u>Estimating market sensitivity: Beta vs "Net Long"</u>

Quite often, hedge funds will describe their market sensitivity with a "net long" number. This represents the underlying dollar value of the items they are long less the underlying dollar value of the items they are short. We feel that "portfolio beta" is a better measure than "net long" since individual stocks themselves have different exposures to the market. For example, consider a portfolio of two stock positions. Position A is long $1mm of a highly market sensitive company, such as AIG (beta of 3.45), and position B is short $1mm of a stock with low market sensitivity, such as Northeast Utilities (beta of 0.47). In the above example, the "net long" of the portfolio is zero, suggesting that the portfolio has no market sensitivity. However, if you look at the beta, or market sensitivities, of the underlying positions, you would say that the portfolio has a beta of 2.98 [+3.45 for the long and -0.47 for the short]. If the benchmark market, which in this case is the S&P 500, should rise by 1.00%, we would expect to gain 3.45% on the long AIG position and lose 0.47% on the short Northeast Utilities position, equating to a net portfolio movement of 2.98%. This is a very different market sensitivity than would be suggested by the "net long" figure.

[1] To the extent that other sources of alpha may exist, they are likely to be structural and therefore would also tend to be persistent.

[2] To the extent that you have position-level data, we believe a more accurate method would be to develop a portfolio beta using the individual betas and correlations of the underlying positions.

This makes the choice of time period very important when calculating beta with regression analysis. If you choose a short period, say 3 months of historical performance, you leave yourself open to excessive noise in your data. For example, if one of a manager's positions is the subject of a takeover and produces a windfall return, this might be incorrectly interpreted as the portfolio having very high equity sensitivity that period. Alternatively, if you choose a long period, for example 5 years of data, you will not be able to identify the tactical changes in beta that have occurred over that time. Using more complicated regressions, such as polynomial regressions and LOESS Fit, improve the situation, but we agree with a developing body of research that points to the Kalman Filter as a better alternative to regression analysis (Das & Ghoshal, 2010).

The Kalman Filter is a bit like a pocket watch, simple on the outside but complicated on the inside. I have found that many people gloss over when they hear the Kalman Filter explained since it is highly tempting to discuss the associated recursive math. Purists may cringe, but here is my explanation of the filter in a nutshell:

The Kalman Filter is continuously looking at the current movement of the portfolio relative to the movement of the market on a rolling, short-term basis. As with the 3-month regression we discussed above, this leaves the filter vulnerable to short-term noise. However, the Kalman Filter also does something special: it tries to decide how much it wants to believe each new data point. If the new data seem to be exhibiting a lot of noise, then it will use cleaner, historical data to estimate what the current beta is. If the new data point looks fairly clean, then it will tend to look more towards the current data point as a reasonable estimate of beta. In fact, much of the time it takes a relative blend of the two depending on how noisy the current data looks relative to the historical data.

In this way, the Kalman Filter looks to capture the important short-term changes in beta while avoiding some of the noise associated with short-term measures. Modern GPS units use this filter to help solve a similar problem: your speed and direction. GPS location is only approximate and, depending on your reception, the GPS may see your position shift 50 feet in a random direction in a split-second. The Kalman Filter helps prevent the GPS from jumping to a hasty conclusion, but it still allows it to be responsive enough to usefully identify actual changes in speed and direction.

Sample Screening Results

To test our screening metrics, we used the constituent index of the HFRI Equity Hedge Fund Index from 2000-2011. Since we are particularly concerned with the beta dynamics of equity long/short managers, we removed Equity Market Neutral funds and Multi-Strategy funds from the dataset (as labeled by HFRI). We also did a size screen, limiting our study group to funds with $100mm or more in assets under management, which we understand is something of a bare minimum for institutional consideration.

Screen	Information Ratio Pickup	Sharpe Ratio Pickup	Alpha Pickup	Std Dev of Information Ratio	Std Dev of Sharpe Ratio	Std Dev of Alpha
SA Screening Metric	0.38	0.35	411 bps	0.53	0.49	656 bps
Information Ratio	0.28	0.26	132 bps	0.55	0.51	1176 bps
Sharpe Ratio	0.28	0.27	154 bps	0.56	0.52	1265 bps
Rolling Regressions	0.25	0.24	233 bps	0.53	0.47	773 bps

Our three screening metrics were:

- Sharpe Ratio (Excess Return / Standard Deviation of Excess Return)
- Information Ratio (Total Alpha / Standard Deviation of Total Alpha)
- Selection Ratio (Selection Alpha / Standard Deviation of Selection Alpha)

We used the Selection Ratio (Selection Alpha / Standard Deviation of Selection Alpha) instead of just Selection Alpha in order to draw a better comparison with the more traditional screening metrics and to attempt to focus on managers that have been consistent at selecting securities as opposed to sporadic.

We attempted to develop a scoring system that would emphasize selection alpha over timing alpha and came up with the following:

Selection Ratio + min(Timing Ratio, Timing Ratio x 0.25)

Essentially, we gave managers full marks for any selection alpha they were able to generate, but only counted 25% of any positive timing alpha they were able to generate. In this way, we expressed our preference for selection alpha over timing alpha while giving funds at least some benefit for having produced positive timing alpha. However, we did fully penalize funds that generated negative timing alpha (as 46% of the funds did in our analysis). At the end of each year starting in 2000, we ranked all the funds based upon the prior 5 years of historical data. We eliminated from consideration funds that did not have 5 years of historical data. We then observed how those funds performed over the next 12 months.

Sticking with the risk-adjusted return theme, we evaluated fund performance using the subsequent 12-month Sharpe Ratio and Information Ratio. We also looked at how much alpha the funds generated on a non-risk adjusted basis.

In order to mitigate survivorship bias in our results, we looked at both the top and bottom decile funds and subtracted the performance of the bottom ranked funds from the top ranked funds, effectively looking at performance on a relative basis instead of an absolute basis. To the extent that dead funds were added back into the analysis, we believe this would have enhanced our results to the extent that funds typically do not close after being ranked in the top decile of performance the prior year. However, due to the problems associated with studying survivorship effects, we will leave this as a course of future study.

Our results are below. As you can see, the funds that scored in the top decile based upon our selection ratio screening factor subsequently went on to produce a Sharpe Ratio that was 0.35 higher and an Information Ratio that was 0.38 higher than their counterparts in the lowest decile. This represented an improvement of 0.07-0.12 points over screens based on Sharpe Ratio or Information Ratio alone with slightly better consistency (lower standard deviation).

The average alpha pickup of the top decile over the lowest decile was at 411bps vs only 132bps and 154bps for the Information Ratio and Sharpe Ratio-based screens, respectively. In addition, the alpha pickup was more consistent with the Selection Ratio based metric, having a standard deviation of only 656bps vs 1176bps and 1265bps for the Information and Sharpe Ratio-based metrics, respectively.

As an added note, we also found that the Kalman Filter produced better results than standard linear regression. When we ran the same study using a simple 12-month rolling regression in lieu of the Kalman Filter, performance was degraded by 0.11 Sharpe Ratio points and 0.13 Information Ratio points.

Conclusion

Our conclusion is that using a selection alpha approach to long/short equity screening has a sound theoretical foundation, which seems to be confirmed, at least in part, by our simple studies. We note that we have kept the scope of this paper in as simple a form as practicable and that there exist many other statistical improvements which could further enhance screening effectiveness, but would also cloud the issue and, ultimately, are not required to examine our target hypothesis.

Furthermore, investors need to think differently when it comes to the beta of many equity long/short funds in that it is not a fixed number. We believe the Kalman Filter can help in these instances, not just for screening purposes, but also for risk management, performance attribution and asset allocation.

Lastly, we wish to point out the potential subjective benefits of separating a manager's historical return stream into a dynamic beta, selection alpha and timing alpha components. By examining each component of return separately, we may be able to highlight portions of a manager's performance that warrant further understanding. For example, if a firm that professes to have a low market exposure shows a high dynamic beta in a particular period, further investigation might be warranted.
Similarly, if a firm prides itself on its stock-picking or market-timing ability, these statements can be examined against the historical record and any indication to the contrary can then be specifically investigated. Note that we say "specifically investigated" instead of "ruled out." It is our belief as practitioners, as we stated at the outset of this paper, that quantitative hedge fund screens should only be used as a tool to focus subjective analysis. All quantitative screens, in our opinion, no matter how robust, are bound to put forth false signals to the detriment of a selection effort. Given the complexity and illiquidity of hedge funds, false signals are highly undesirable. However, the alternative, rigorously examining each and every hedge fund, seems impractical given the amount of resources that would consume.

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