A new approach to detect suspicious funds

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A. Background and project goals

Fund managers have an incentive to manipulate, without additional information, performance scores such as the Sharpe ratio because their compensation is usually based on them. Investors select funds based on fund performance scores. Detecting suspicious funds is a critical issue for financial market participants, but existing approaches, such as bias ratio calculations, conditional correlation tests, and discontinuity analysis, are complicated for investors to understand or hard to apply to small sample sizes. Goetzmann et al. (2007) derived a manipulation-proof performance measure (MPPM) that we extend here as a measure for detecting suspicious funds. This project proposes a new simple method of detection based on the MPPM and empirically compares it with current methods.

B. Significance and innovation

Several methods of detection have been introduced in both academia and practice. The bias ratio technique proposed by Abdulali (2006) is practical for filtering out suspicious funds. It calculates the ratio of the frequency of positive returns to the frequency of negative returns to within one standard deviation of the observed return distribution. Bollen and Pool (2008, 2009) presented conditional serial correlation and discontinuity analysis using time series analysis and Gaussian kernel density estimations, respectively. However, their methods have several weaknesses and critical shortcomings, so this study will provide an alternative to overcome these problems.

This project is significant and innovative in three ways. (1) The bias ratio's critical shortcoming is that it consists of nothing more than a distribution's degree of asymmetry. For example, let there be a fund with an expected monthly return of 1% and a sample standard deviation of 1%. Although the manager is honest, this fund's bias ratio is extremely high because the probability of a negative return within one standard deviation is almost zero. A high bias ratio may not directly indicate a suspicious fund and is statistically less sound. Our method is derived from the MPPM from von Neumann and Morgenstern's utility function and involves a fund's implied risk aversion (IRA). It is thus consistent with economic theory and has a solid statistical foundation.

(2) Although Bollen and Pool's conditional serial correlation (2008) and discontinuity analysis (2009), based on time series analysis and Gaussian kernel density estimations, respectively, are rigorous approaches, they are complicated to understand and apply in the real world. Investors must have an in-depth knowledge of statistics and the ability to use statistical models and software to implement those techniques. The measure we propose is computed from two MPPM scores with different degrees of risk aversion, so that it can be easily calculated by very simple tools such as Microsoft Excel.

(3) When individual hedge funds are examined by the three aforementioned methods, sample size is usually very limited, but a sufficiently large sample is necessary to compute robust and stable measures. Limited samples lead to kernel estimations overfitting the actual return histogram and make significant conditional serial correlations difficult. Bollen and Pool's (2009) discontinuity analysis fits only pooled distributions, not individual distributions. The conditional serial correlation method assumes that observed returns are stationary but the estimated coefficient may not be robust under conditions of regime switching, non-stationarity, or heteroskedastic volatility.

A fund's IRA is less affected by sample size than by other measures and we also examine its sensitivity to sample size.

C. Approach

This project proposes a new simple measure for detecting suspicious funds based on the MPPM. The MPPM is derived from a utility function that imposes more penalties on negative excess returns and which is a decreasing function of relative risk aversion, given observed returns and a risk-free rate:

$$\mathrm{MPPM}_{\rho\text{-}1} \equiv \hat{\Theta}(r) \equiv \frac{1}{(1-r)\Delta t}\ln\left(\frac{1}{T}\sum_{t=1}^{T}\left[\frac{1+r_t}{1+r_{f,t}}\right]^{1-r}\right)$$

As the constant relative risk aversion r increases, the MPPM score decreases. A particular constant relative risk aversion produces an MPPM score of zero and that value is defined as the specific fund's IRA. For example, suppose a fund has a constant positive expected excess return every time and each return is the same, $r_1 = r_2 = \ldots = r_T$. Each of its MPPM scores is also the same for different risk aversions, $\hat{\Theta}(2) = \hat{\Theta}(3) = \hat{\Theta}(4) = \ldots$; thus its IRA is infinity. This fund is very attractive to even the most risk-averse investors. More importantly, investors can always take an arbitrage gain while using the fund without risk, but this is impossible.

Bernard and Boyle (2009) described the MPPM score for Madoff's Fairfield Sentry returns with relative risk aversions of 2 to 10. The values hardly change as r increases and the fund's IRA is also about 200, according to our calculations. If a fund has an unusually high IRA, its returns were possibly manipulated or can be the result of fraud. The IRA is satisfied following

$$\frac{1}{(1-\hat{r})\Delta t}\ln\left(\frac{1}{T}\sum_{t=1}^{T}\left[\frac{1+r_t}{1+r_{f,t}}\right]^{1-\hat{r}}\right) = 0 \;\Rightarrow\; \sum_{t=1}^{T}\left[\frac{1+r_t}{1+r_{f,t}}\right]^{1-\hat{r}} = T$$

where r_t and r_{ft} are, respectively, the non-annualized realized return and the risk-free rate at time *t*. However, solving the equation is very complicated, so we use linear interpolation. Fortunately, the value of the natural log of the risk-adjusted average geometric monthly excess return is around 1 in almost all cases and changes even less as risk aversion increases; the value of the natural log function near 1 is almost linear. Consequently, we can use linear interpolation to find the IRA instead of solving the previous complicated equation and derive the following:

$$IRA = \frac{\hat{\Theta}(2)}{\hat{\Theta}(2) - \hat{\Theta}(3)} + 1$$

The IRA can be interpreted as a linearly interpolated IRA of a fund. This measure is not the exact IRA and the real IRA may be greater, because the natural log function is concave. However, we would like to mention that the difference between the IRA and the actual IRA is not very great and not important enough to affect the identification of suspicious funds, because the key element in determining such funds is only an extremely high IRA.

Compared with other approaches, our proposed IRA has the following advantages. First, it is much simpler to calculate than other measures. Second, it does not require investors to have an in-depth statistical background to understand it, since it is related only to the difference between two MPPM scores with different degrees of risk aversion. Third, our measure does not employ additional assumptions, so it is not affected by serious changes in external economic conditions and the analysis window. Therefore, it is suitable for even very small samples.

References

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