Volume 6, No. 11

SENIOR CONSULTANT
The Voice of the Investment Management Consultant

The Upside Potential Ratio: What Are We Trying to Measure?

Frank A. Sortino, Robert van der Meer, Auke Plantinga, and Hal Forsey

Editor's Note: Sortino, et al. answers the most important question that we could be asked in the engagement of our counsel: What are we trying to measure in performance measurement? In doing so, he and his colleagues have created a new and far more effective means of measuring performance in terms more appropriate for the investor than the investment manager. Investors want growth in wealth to be as stable as possible, where a trade-off between risk and return has been made as opposed to the highest return for a given level of risk. We are elevated by the pioneering work of the authors in helping to formulate post-Modern Portfolio Theory.

If you want to see if your manager has earned a return in excess of what would be predicted under general equilibrium conditions, then the Sharpe ratio is an appropriate statistic. If you want to know if your manager has earned a return in excess of some passive benchmark while matching the style of the benchmark, then the information ratio is an appropriate benchmark. If you want to know how well your manager is doing with respect to accomplishing your goals, then the return you must earn at minimum in order to accomplish your goal must be in the performance statistic.

In the past we have measured risk relative to minimal acceptable return (MAR). Now, we propose a new measure of return that is measured relative to the MAR. Instead of searching for the manager who had the highest average return over some period of time, some, if not most investors, would prefer to find those managers who had the highest average returns above their MAR. The basis for this claim is found in the emerging field of behavioral finance and the esoteric area of utility theory.

One of the great pioneers in behavioral finance was the late Amos Tversky, professor of psychology at Stanford University. Some of his empirical studies disputed the assumptions of modern portfolio theory (MPT) that investors are rational. In a discussion of prospect theory, Tversky (1995) called attention to the tendency of investors to make risk-averse choices in gains and risk-seeking choices in losses, resulting in suboptimal portfolios. The S-shaped utility function of prospect theory indicates investors are very risk-averse for small losses but will take on investments with a small chance of very large losses.

While Taversky's work described how investors do behave, Peter Fishburn's normative utility function (1977) described how investors should behave. Rational investors should be risk-averse below the benchmark MAR, and risk-neutral above the MAR, i.e., they should have an aversion to returns that fall below the MAR and the farther they fall below the MAR the more they should dislike them. On the other hand, the higher returns are above the MAR, the more they should like them. Fishburn showed how this utility function was consistent with expected utility theory.

Recent research in the behavioral finance area describes how investors say they want to behave. In general, investors do not seek the highest return for a given level of risk, as portfolio theory assumes. According to Meir Statman (1998), investors seek upside potential with downside protection. Olsen (1998) says, "Investors desire consistency of return and therefore choose decision processes that preserve appropriate future financial flexibility." Rather than maximize the expected return, they want to maximize a "satisfiable" strategy. Sebastiaan de Groot (1998) studied 100 wealthy investors to determine if they made decisions in a manner consistent with expected utility theory or behavioral finance theory. He found that approximately half the questions were answered in a manner consistent with expected utility theory and the other questions were answered in a manner consistent with behavioral finance. But most of these investors said they wanted "wealth growth that is as stable as possible where a trade-off between risk and return has been made ."

What we propose to measure is a manager's upside potential relative to downside risk. Table 1 is a simplistic example of how upside potential differs from the mean and is for illustrative purposes. We do not recommend upside potential be calculated this way. The proper calculation will be explained later.

Both Fund 1 and Fund 2 have the same mean (9.6%). The mean cannot distinguish between them. However, Fund 1 was above the MAR of 8% more often than Fund 2. This information should be useful to an investor, but chance of success does not convey any information about magnitude. Fund 1's upside probability of 70% does not tell the investor how high above the MAR Fund 1's returns were. Upside potential considers both frequency and magnitude. On average,

Fund 2 was 2.5% above the MAR, while Fund 1 only had an average return of 1.8% above the MAR. In this simple illustration, it is clear that Fund 1 never got more than 300 basis points more than the MAR, while Fund 2 got as much as 700 basis points higher than the MAR. Investors looking for managers with upside potential would want to know this.

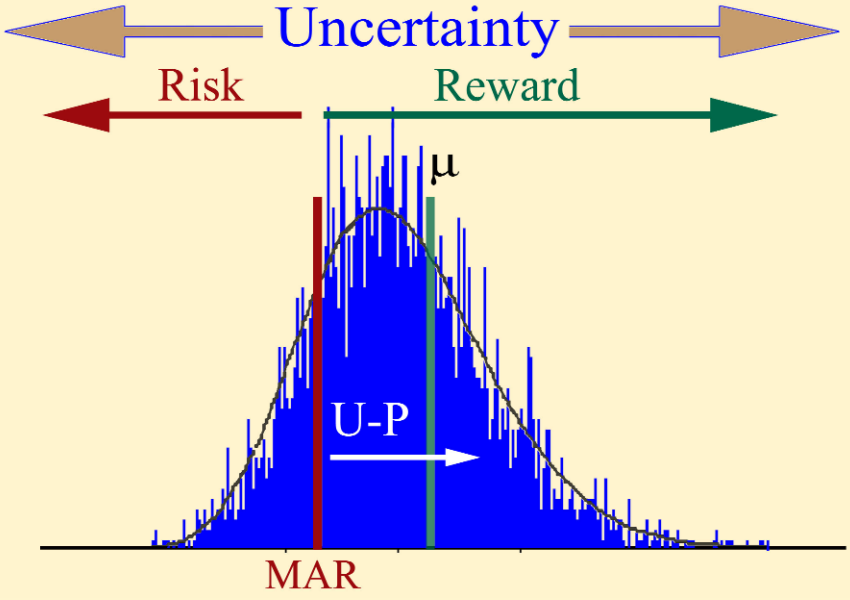
Notice that all returns below the MAR for Fund 2 are set equal to zero (e.g., 4% = -400 bp = 0). Observations below the MAR are recorded to calculate how often the fund was above the MAR, but the return is not recorded. Returns below the MAR are used in the downside risk calculation. A graphic example of the difference between the mean and upside potential can be seen in Figure 1.

Because this distribution is positively skewed, the mean of the entire distribution (the average of all returns) is to the right of the highest point (mode). The white arrow points to the Upside Potential (U-P) and is the average return in excess of the MAR.

Table 1.
Upside Potential vs. Mean and Upside Probability

	Fund 1	Upside	Fund 2	Upside
Year 1	11	3	4	0
Year 2	10	2	6	0
Year 3	10	2	9	1
Year 4	10	2	14	6
Year 5	11	3	6	0
Year 6	11	3	7	0
Year 7	11	3	11	3
Year 8	7	0	10	2
Year 9	7	0	14	6
Year 10	8	0	15	7
Mean	9.6		9.6	
Potential	1.8	18/10	2.5	25/10
Probability	70%		60%	

Figure 1.
Difference Between the Mean and Upside Potential



Estimation Procedure:

We think it is a mistake to try to measure a manager's upside potential or downside risk directly because of the time sensitivity issue. As mentioned in our "Use and Misuse" paper (http://www.sortino.com/htm/ontheu.htm), the performance statistic is very sensitive to the time interval chosen. The way I used to calculate downside risk, falsely indicated managers in 1995 were earning high returns with very little downside risk. That was because the five years ending 1995 had very few negative return observations. Style analysis offers a solution.

William Sharpe (1992_ developed a procedure for identifying a manager's style in terms of a set of passive indexes, which we refer to as the manager's "style benchmark." If a manager's style can be identified in terms of a style benchmark of passive indexes, one can use 20 or more years of data on the style indexes instead of being limited to five years of data, or less, on the manager. Upside potential and downside risk can then be calculated from the distribution of returns of the style benchmark, instead of the manager's return distribution. Sortino, Miller, and Messina (1997) claim that more stable estimates are possible by employing style analysis.

For example,The Russell 1000 value index has an upside potential of 14% based on only the past five years. Bootstrapping 30 years of data yields an upside potential of 10%. Most analysts do not believe the returns of the past five years will be repeated in the next five years, if ever. Therefore, bootstrapping 30 years makes more sense. How investor's *want* to behave and how investors *should* behave can be accommodated in one statistic, the Upside Potential Ratio (U-P Ratio):

$$\frac{\sum_{mar}^{+\infty} (R - MAR)^1 P_r}{\left[\sum_{-\infty}^{mar} (R - MAR)^2 P_r\right]^{1/2}}$$

The numerator of the U-P ratio is the expected return in excess of the MAR for that manager's style and can be thought of as the potential for

success. The denominator is the downside risk of that manager's style and can be thought of as the risk of failure. We prefer to fit a three parameter lognormal distribution to the boot-strapped data of the manager'a style to generate a contiouous distribution. The formula for the continuous distribution is given below:

$$\frac{\int_{mar}^{+\infty} (R - MAR)^1 f(R)dr}{\left[\int_{-\infty}^{mar} (R - MAR)^2 f(R)dr\right]^{1/2}}$$

Now that we have estimated the upside potential and downside risk for a given manager's style, we want to know if the manager can outperform his passive style benchmark. A popular way to answer that question is to employ the "information ratio." We have long argued that for any performance measure to be oriented toward an investment goal, risk must be measured relative to the MAR that will achieve that goal. Now we offer a way to calculate return that is also oriented to the MAR. The upside potential ratio provides a new perspective on risk-return trade-offs that is well suited to investors seeking the highest consistent performance above their MAR, subject to the risk of falling below. ■

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About the Authors

Dr. Frank A. Sortino is director of the Pension Research Institute in San Francisco where he has conducted projects with such firms as Royal Dutch Sell and Aegon Insurance in the Netherlands, Manufactuers Life Insurance Company of Toronto, the California State Teachers Retirement System, the Marin County Employees Retirement System, Mobius Group and LCG Associates. Before returning to academia for graduate work, Frank spent 12 years in the investment business, where he became senior vice president of an investment advisory firm with $1.6 billion under management. He may be reach at (650) 323-6122.

Dr. Robert van der Meer is member of the Executive Board of Fortis, Utrecht, The Netherlands.

Dr. Auke Plantinga is associate professor of Finance at Groningen University, The Netherlands.

Dr. Hal Forsey is professor emeritus of San Francisco State University.

Notes

SENIOR CONSULTANT

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SENIOR CONSULTANT

1457 Crystal Springs Lane
Richmond, Virginia 23231
Ph 804-643-1075 ■ Fax 804-643-1544
WWW.SRCONSULTANT.COM