MONTE CARLO
by John Ehlers

What is a Monte Carlo simulation? Most generally, it is a method of randomizing measured data to produce statistical estimations of the meaning of the data. Specifically, Monte Carlo simulation is the best way to assess performance of a trading system.

The most common method of judging the quality of a trading system is by examining its track record, usually in the form of an equity growth curve. The slope of this equity growth is just the average profit per trade. The parametric descriptions of trading system performance are the Profit Factor and Percent winning trades. Profit Factor is the ratio of gross wins to gross losses, and is analogous to the payout in gaming. We have shown how to create artificial equity curves by randomizing Profit Factor and Percent winning trades (http://www.stockspotter.com/In/TechnicalPapers.aspx). You will see why equity curves are not a good way to judge trading system performance because one can produce awful performance with good parameters or sometimes produce good performance using low quality parameters. You can get Monte Carlo results if you repeat these equity curves thousands of times. When you do this you can see the total spread of the results, but it is difficult to assign meaning to the spread.

At StockSpotter we perform the Monte Carlo simulation in a way to extract more meaningful results. We use all of the trades we have logged into our database over the last three years – there are about 10,000 trades in all. On the first pass we randomly pull a year's worth of trades from the database and log the annual profit. Then we repeat the annualized drawing 5,000 times. Doing this, we have simulated 5,000 years of trading with the StockSpotter algorithm. The results are shown in Figure 1. You can get the current results any time by going to:
 http://www.stockspotter.com/In/MonteCarloProfit.aspx

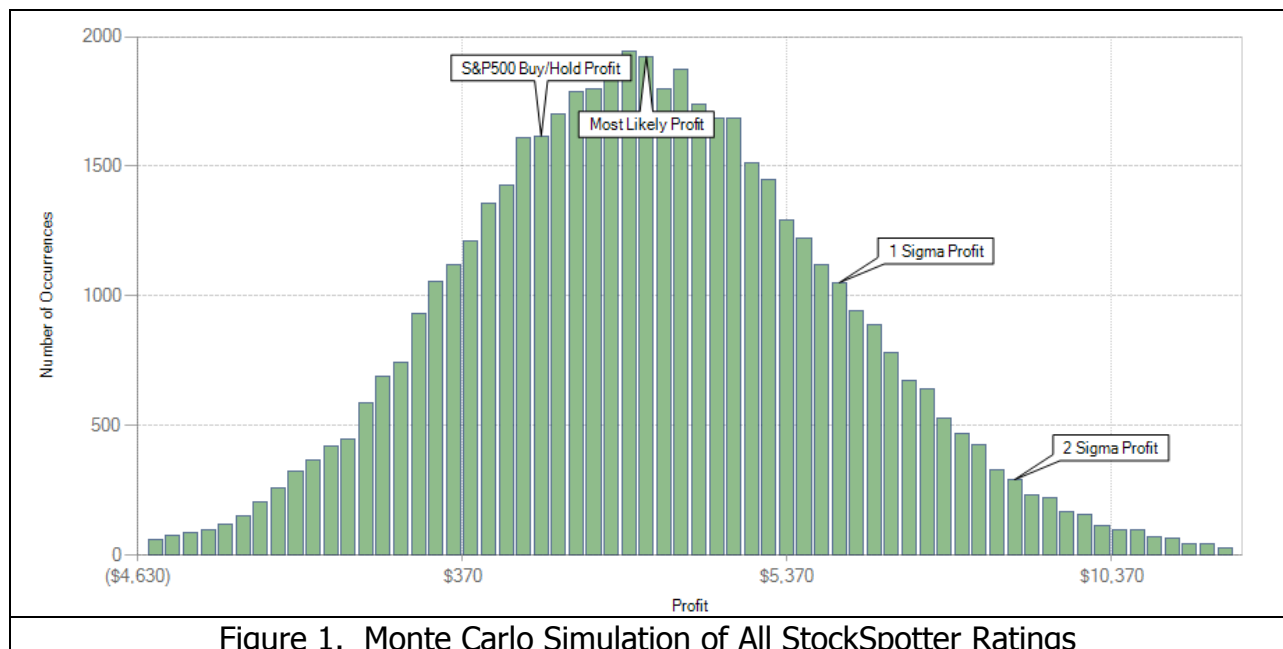Figure 1. Monte Carlo Simulation of All StockSpotter Ratings

Figure 1 is the familiar bell-shaped curve of a Normal Probability Distribution. From it we can easily see the most likely annual profit, the standard deviation, and the probability of exceeding break even for the year. We can also see the statistical significance of using StockSpotter's Star Rating by recomputing the bell curve for each of the ratings.

And we can go further to improve trading results since we know we have an approximate Normal Probability Distribution. In statistics-speak we have only one member of the ensemble when we just select one trade at a time randomly. It is well known among statisticians that doubling the members of the ensemble will reduce the standard deviation by the square root of two. So, if we quadruple the members of the ensemble, we cut the standard deviation in half. In other words, if we take the assumed $10,000 capitalization and divide it four ways to simultaneously trade four randomly selected stocks at a time in a portfolio, we will retain about the same most likely profit but will cut the standard deviation in half. This action greatly enhances the probability of attaining an annual break-even or better. You can see this effect yourself by going to: http://www.stockspotter.com/In/MonteCarloPortfolioProfit.aspx

Of course you can keep extending the portfolio idea, but you quickly reach diminishing returns. First, your workload to keep track of your trades is increased. Your available capital is also reduced by the ensemble number. Finally, the assumption that all trades are statistically independent becomes increasingly stressed. In general, trading a portfolio of four stocks using StockSpotter trading signals seems to be a happy compromise.

Drawdown is an important practical consideration for traders, and drawdown performance can also be assessed by Monte Carlo simulation, using the same procedure as with profits. Drawdown never has a negative number, and therefore the Monte Carlo simulation does not produce a bell-shaped curve. The probability of drawdown is analogous to the probability of an arrow striking a target. There is zero probability of hitting the bull's-eye or of having zero drawdown. The probability increases with radius, rising to a maximum and then falling off. This is called a Rayleigh Probability Distribution. We have done the same Monte Carlo simulation process, with the result shown in Figure 2. You can see the current Drawdown Monte Carlo simulation by going to:
 http://www.stockspotter.com/In/MonteCarloDrawdown.aspx

As with the Monte Carlo simulation of profits, you can easily assess the most likely drawdown and the standard deviations.
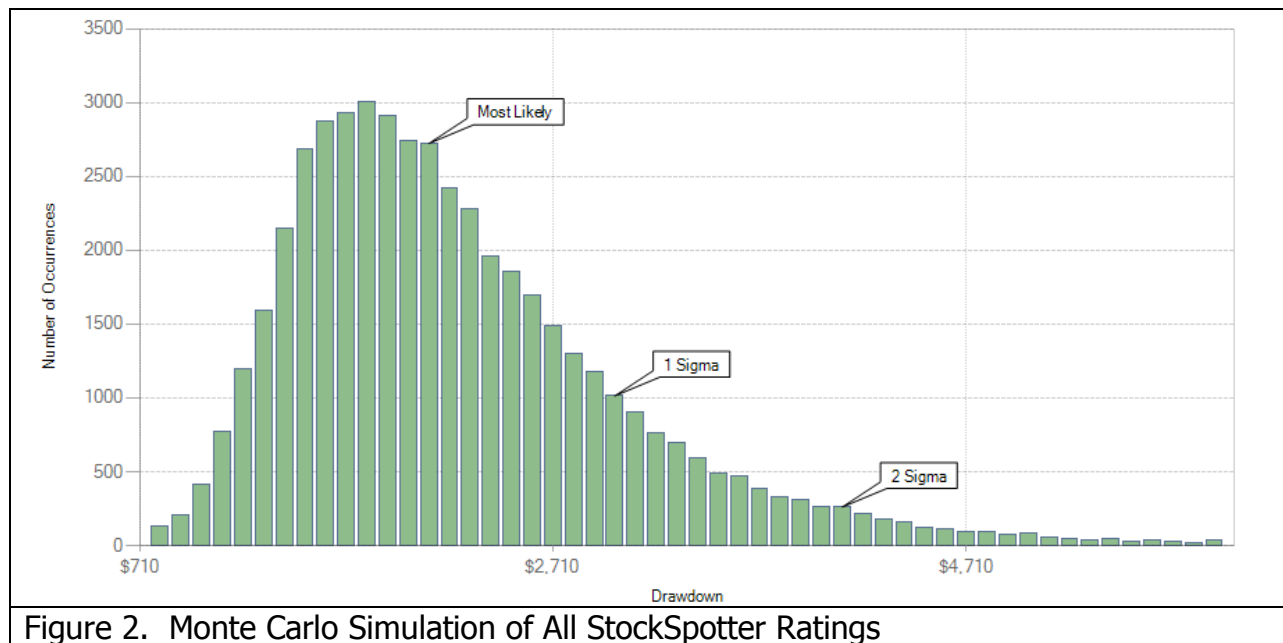
Figure 2. Monte Carlo Simulation of All StockSpotter Ratings

THINGS TO REMEMBER

- Track records are not a good way to predict future performance of a trading system.
- StockSpotter creates Monte Carlo profit statistics using randomized selection of trades in our data base over the last three years.
- Monte Carlo simulation provides a realistic expectation of future performance over a statistically significant number of trades.
- Trading a portfolio of four stocks from StockSpotter trades will significantly reduce the standard deviation.
- Monte Carlo simulation of drawdown also gives an insight in future performance on a statistical basis.