AAR Milestone 3

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Optimal Stop Placement Strategies for Momentum Trades in Equities

I. Primary Research Question

How can an algorithm be developed that sets a stop loss for an equity momentum trade to optimize the trade outcome, based on analysis of that security's historical price?

Clarifications/Definitions:

1. A stop loss is a type of market order where shares in a security are sold if the price drops below a pre-specified limit. A trailing stop loss is similar, but where the lower limit follows the price upwards if it increases.
2. An equity is a tradeable asset that represents ownership of a publically traded company, essentially stocks, ETF (exchange traded funds), etc.
3. A momentum trade relies on the assumption that a stock that has been moving in one direction consistently (based on a quantifiable metric, such as moving average comparison) will continue to move in that direction for some time.
4. (Technical) analysis refers to analyzing the stock's past price, and looking for patterns or trends (Introduction to Chart Patterns).
5. Trade optimization is improvement of the risk return ratio given a portfolio of trades.

II. Abstract

The purpose of our Advanced Authentic Research project is to develop an algorithm that develops a strategy for stop loss placement to optimize trade outcome. What sets this algorithm apart is that it takes into account past historical characteristics of the stock, including but not limited to volume and volatility. Writing this algorithm involves several steps. First, we will acquire data from financial sources such as the S&P 500, and select a few stocks to work with. Then, we will collect a list of existing strategies that we can use to place stop losses. Third, we will write a program that takes as input a signal, a data set, and a stop loss, and returns the output. This will require that we write a program that generates the signals. Lastly, we will optimize the return for one strategy using metrics such as the Sharpe and Sortino ratio, and then test the stop losses with a different strategy. Our final program should be one that uses past history of a security to develop a stop loss value that maximizes the trade outcome.

III. Background and Significance

Research Problem

Investors use stop losses to minimize trading losses when investing in stocks. However, investors do not always account for past history, volatility, and volume of the stock when setting a stop loss (How I Determine Where to Set My Stop Loss). The restrictions placed on them can be too loose (too much money lost) or too tight (shares sold too early). In essence, these stop losses are not always intelligently placed. If investors could smartly place stop losses, each time they invest their money, the associated risk would be much lower (Building a Trading Indicator). Strategies to effectively place stop losses do exist, but they are developed by private parties who stand to get significant financial gain from the exclusive use of those strategies. Therefore, these parties have not made their placement strategies public. Having a public, freely usable strategy for the placement of stop losses, which is what our project aims to achieve, is important. This provides independent traders, who do not have the capital or time to develop complex stop-loss placement strategies, a base to work off of.

Literature Review

From our background research, we have gathered that there are two main avenues of research on stop losses. The first is the practical, application-based aspect. This includes several books on stop loss placement strategies, as well as about using computer software in trading. These materials are designed to be used by investors in the real world. Some examples of these books include *The Encyclopedia of Trading Strategies* (Katz and McCormick), *Design, Testing, and Optimization of Trading Systems* (Pardo), and *Computerized Trading* (Jurik), that we have been reading. The second main aspect of existing research is purely academic. This includes papers by Kathryn Kaminski and Andrew Lo, as well as the Adam Lei and Huihua Li studies.

Examining Our Unique Perspective

After conducting a multitude of research on topics pertaining to stop losses, we have found extensive research on various ways to predict stop losses. However, we have not seen research specific to momentum trades, where the trading strategy and other relevant statistical information on the expected profit from the strategy are laid out. Any strategy that is perfectly optimized is locked up behind the closed-doors of large investment companies, the issue we have addressed with our research problem. Therefore, public research can be done to optimize stock placements. Our project will be to use already existing strategies, and try to predict where a stop loss needs to be to optimize the outcome.

IV. Research Methodology

Steps for Project Completion

1. Conduct background research on stop losses, technical analysis, and related topics.
2. Acquire data on historical values of stocks from a source such as S&P 500.
3. Collect a list of existing strategies used for placing stop losses.
4. Write a program that develops signals for a specific stock based on historical prices, using one strategy. Signals are indicators of times to buy or sell a stock.
5. Write another program that takes in a data set, a stop loss, and signals from the previous program to return an output.
6. Optimize the return for the one strategy used, with metrics such as the Sharpe and Sortino ratio, and then test the stop losses with a different strategy.

Research Type: Our research type is applied. Our program solves a real-world problem of stop losses, and has a potentially useful application in the investment sector.
Data Type: Our data is quantitative. First of all, our program will take in a table of stock prices, obviously numbers. Second, our program will return values that are numbers, such as the value of the Sharpe ratio, the value of the Sortino ratio, and the max drawdown.
Methodology Type: Our methodology type is experimental. We will conduct numerical experiments using computer simulations.
Population Being Studied: The general 'population' that we will study is the historical stock prices of several companies. A subset of the population will be the specific companies that we choose to use to test our program.
Population Selection Criteria: We will start with a subset of 10 or so randomly chosen stocks and test our algorithm on them first. Once we are satisfied, we can test our algorithm on a much broader range of stocks.
Data Collection Methods We will collect data through the simulations that will be run based off of the signal-generation program, but through the return-calculation program.
Data Analysis Methods We will analyze our data by tabulating and plotting the results from the aforementioned simulations to see what conditions optimize the return the best.
Timeline We would like to avoid a more 'divide-and-conquer' approach, and instead intend to work together on most parts of the project. Our preliminary timeline is as follows:

August-November: Background research
December-January: Coding the library (data collection, strategy selection, etc.)
January (end of): Run first simulations
February: Enhance code, complete project execution
March-May: Poster board and Research Paper

V. Human Subjects

This section is not applicable to our project.

VI. Citations

Kaminski, Kathryn M., and Andrew W. Lo. "When Do Stop-Loss Rules Stop Losses?" *MIT Sloan School of Management*, alo.mit.edu/wp-content/uploads/2015/06/When_Do_Stop-Loss_Rules_Stop_Losses.pdf. Accessed 5 Oct. 2016

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Katz, Jeffrey Owen, Ph.D., and Donna L. McCormick. *The Encyclopedia of Trading Strategies*. McGraw-Hill Education, 2000.

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