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Trading System Development

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An Interactive Qualifying Project
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by
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Abstract

The purpose of this IQP is to scientifically develop either a profitable automated trading system or a profitable manual trading system. To accomplish this, members of the group researched fundamental concepts and theories about trading and how to develop trading systems. The members then began to implement techniques and tools to develop the trading systems. Next, team members scientifically developed their own systems that an ordinary citizen could follow. The team performed back testing and analyzed the systems through historical data to see how the systems previously performed. Members allocated funds into each different system through discussion of the team acting as a hedge fund. The team used data tools to recover the performance of their different trading systems to give thorough analysis.

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Table of Contents

Table of Figures

Introduction

In today's economy the financial security of every household is of great importance. Retirement planning and personal growth of wealth have brought to attention many different options of fund management for individuals to practice. Many people do not take their finances into their own hands, rather keeping cash stagnant in a savings account or trusting their employer with correct allocation into various 401K-plan options. Even those entering the free markets take the risk of allowing a stockbroker to find the profitable trades to make with an individual's funds. With the emergence of TradeStation and other available online trading platforms, the individual can enter any free market with total control over their financial future from any place of convenience. This freedom heightens economic risk yet gives the user a viable source to personally improve personal wealth and a stable financial future.

The purpose of our Interactive Qualifying Project is to scientifically develop a consistently profitable automated trading system. In creation of this system, group members engaged in fundamental research of trading and the free markets. By using scientific analysis and optimization tools, the group was able to create a portfolio of systems that fulfilled the team's goals and proved a positive return on investment. This report discusses the testing processes and analysis results that shaped our sophisticated system.

Background

An Introduction to Asset Classes

There is an array of asset classes that one can invest in. Asset classes include stocks, bonds, options, futures contract, currency pairs, commodities, exchange traded funds (ETF's), and mutual funds. Each asset is independent of itself and is a part of its own market.

Stocks

A stock, commonly referred to as equity, is a share of ownership within a corporation. As an owner of a corporation's stock, the investor has a part of the corporation's assets and equities. Stocks are a great way for a corporation to raise capital through selling an investor a share, which is an ownership position. As an owner, the stockholder is entitled to their share of the company's earnings and may have any voting rights attached to the stock. In today's age, the stock certificates (proof of ownership) are kept electronically at the brokerage. These documents being held electronically allow for stocks to be traded easier and often by the click of a mouse.

As a shareholder, the person is entitled to a portion of the company's profits and has a claim on assets. Profits can be paid out in the form of dividends, where the more shares a person hold the larger the percentage of profit they will receive. Though this may sound like a good thing, there are adverse circumstances. If a company liquidates itself and files bankruptcy, shareholders will not receive any money until all the banks and bondholders have been paid out. This is why equities are a risky asset to invest in due to the chance to either profit largely or to lose an entire investment.

The major reason companies issue stocks is to raise capital. The first stock that a private company sells is called the initial public offering (IPO). Companies can also take out a loan from a bank, issue bonds, or sell part of the company, which is known as equity financing. Stocks of different companies differ in their own ways, one major difference being whether or not they pay

dividends. Most investors purchase stock for the expected appreciation in the open market rather than to receive dividends. Trading stocks involve a great return investment and involve large risk.

Bonds

Bonds are a type of debt security and work similar to loans, but can be easily traded. This is a good asset to use when needing to be able to transfer debt easily. A bond is an agreement on a series of cash flows between two parties. They are a form of debt in which a person loans money to a company, city, or government with an agreement that they will be paid in full, with regularly scheduled interest payments. By purchasing bonds an investor becomes a creditor to the corporation (or government) (investopedia).

Many investors buy bonds when the stock market is too volatile in order to diversify their portfolio and balance out risk. Bonds are not risk-free and like other investments, the riskier the bond, the higher the return. The biggest risk is whether the bond issuer will make its payments. This risk makes it so less credit-worthy issuers pay a higher yield or interest rate. The riskiest type of bond is a high-yield bond and they are not that popular in the world of bonds. Bonds that are issued by the U.S. government are known as Treasuries and they are deemed the safest and are close to risk-free. Treasury bonds pay lower yields than bonds issued by companies that are of investment grade. Investment grade companies are ones with the best histories of issuing bonds. How much a bond yields is determined by how long a person holds a bond. The longer the money is lent to the bond issuer, the higher the yield. 10-year bonds pay higher yields because the investment is being tied up for a longer period of time.

Unlike stocks, a bondholder doesn't share in the profits if a company is performing well; they are only bound to the principal plus interest. The advantage to being a bondholder is that

they have a higher claim on assets than shareholders. In the case of liquidation or bankruptcy, a bondholder will get paid before a shareholder. In general there is less risk in owning bonds than there is in owning stocks, but it comes at a cost of a lower return.

Options

Options present a world of opportunity to sophisticated investors. They are very versatile and enable you to adapt or adjust the position according to the situation at hand. They can either be as speculative or as conservative as the buyer wants. However, they are complex securities and can be extremely risky. An option is a contract that gives the buyer the right, but not obligation, to buy or sell an underlying asset at a specific price on or before a certain date (investopedia). If the buyer chooses to let the expiration date pass, the investment is lost and all money paid is lost. Options are referred to as derivatives because they derive their value from an underlying asset that is usually either a stock or index.

There are two fundamental types of options, namely calls and puts. A call gives the option holder the right to buy an asset at a certain price within a specific period of time. Buyers of calls hope that the stock will increase substantially before the option expires. Calls are similar to taking a long position on a stock. A put gives the holder the right to sell an asset at a certain price within a specified period of time. Puts are similar to taking a short position on a stock. Buyers of puts hope that the price of the stock will fall before the option expires.

There are four possible positions to hold in the options market: a person may buy or sell calls, as well as buy or sell puts. People who buy options are called holders, while those who sell options are called writers. Holders of either calls or puts have the choice to buy or sell an asset if they choose to, but are not obligated to do so. Writers of either calls or puts are obligated to sell or buy, however a writer is expected to make good of their promise to buy or sell the underlying asset.

Forward Contracts and Futures Contract

Forwards and Futures are financial contracts which are similar in nature but have a few distinct differences. Futures contracts are highly standardized whereas the terms of each forward contract can be privately negotiated. Futures are traded on an exchange whereas forwards are traded over-the-counter.

A forward contract is a contractual agreement to exchange an asset at a future date. The involved parties agree upon the type of asset/commodity, the quantity to be exchanged, the price that will be paid, and the logistics of the transaction. This allows the investor to have the ability to lock in a specific price on an asset/commodity that they wish to purchase in the future, protecting them from any movement that may have occurred to the price before the transaction.

Futures contracts are forward contracts that can be traded like stocks on an exchange. Since they are standardized and traded through an exchange, they have specific delivery trades, locations, and procedures. Futures contracts are settled daily, rather than at the expiration of the contract. Thus, the value of contracts is continually being recalculated and a price change would result in a loss for one party and a gain for the other party at the end of the day.

Buyers and sellers of futures contracts are required to post a performance bond with the broker, so that they securely are able to cover a specified loss on a position. This is known as the margin and it gains interest over the duration of the contract. If the balance drops below a certain specified level, the broker places a margin call that will require additional deposits into the balance. This protects the involved parties against the risk that the other party may fail to fulfill their obligation to the contract.

Currency Pairs

The value of a currency is determined by its comparison to another currency. Currency pairs represent the relationships between the values of different currencies. All foreign exchange trades involve the buying of one currency and selling of another currency.

The first currency of a currency pair is called the base currency and the second is called the quote currency. The currency pair shows the amount of the quote currency needed to purchase one unit of the base currency. A buyer of a currency pair buys the base currency and sells the quote currency. The bid (buy price) represents the amount of the quote currency needed to get one unit of the base currency. When a currency pair is sold, the base currency is being sold and the quote currency is being received. The ask (sell price) for the pair represents how much you will receive in the quote currency for selling one unit of the base currency.

For example, if the USD/CAD currency pair is quoted as being USD/CAD = 2 and a buyer purchases the pair, this means that for every 2 loonies (Canadian Dollars) sold, the buyer receives US $1. The quote for CAD/USD would be .5, meaning it costs half a US dollar to purchase 1 loony.

When purchasing a currency pair, if the buyer takes a long position they are betting that the base currency will increase in value compared to the quote currency. A trader would sell a pair and take a short position if they anticipate a decrease in value. There are a lot less currency pairs than stocks, but the foreign exchange market is more liquid and stable.

Commodities

The asset that has been traded the longest amount of time is the commodity. The trading of goods in exchange for items or services has been around the world since the earliest settlements and civilizations. The essential distinction between commodities that are traded and

other products is that commodities are generally invariant in quality. This means that commodities are generally raw materials or goods.

Commodity trading originally aimed to allow traders to receive the goods they needed, but now commodities are traded to people who are looking to turn a profit off reselling later. In today's time, the purchaser of the commodity never even has to physically receive the physical items. Commodities are frequently traded using futures contracts and options, which are traded without any physical exchange of goods.

Exchange Traded Funds

An Exchange Traded Fund (ETF) is a security whose price follows an index, a commodity, bond, or a basket of assets. An ETF trades like a common stock on a stock exchange, as it experiences price changes throughout the day as it is bought and sold. However, unlike other asset classes, shareholders of ETF's do not directly own or have any direct claim to be the underlying investments in the fund. Shareholders are entitled to a proportion of the profits, such as dividends paid. In the case of bankruptcy, or liquidation, the shareholder may get a residual value of the fund.

Mutual Funds

A mutual fund is an investment vehicle that is made up of a pool of funds collected from many investors. These funds serve the purpose of investing in securities such as stocks, bonds, money market instruments and similar assets (Investopedia). Each stakeholder shares all the gains and losses by a mutual fund proportionally. Money managers, who invest the fund's capital in an attempt to produce capital gains and income for the fund's investors, operate most mutual funds. A fund's portfolio is structured and maintained to match the investment objectives stated in its prospectus.

Sources of Data/Exchanges

Indexes

A stock market index is an aggregate value produced by combining several stocks or other investment vehicles together and expressing their total values against a base value from a specific date (Investopedia). In simpler terms, it is a measurement of the value of a section of the stock market. The different indexes represent different sections of an entire stock market; therefore they track the changes of the market over time.

Dow Jones Industrial Average (DJIA)

The Dow Jones Industrial Average is an index that can be traced back to 1896. Wall Street Journal editor Charles Dow created it. He developed the index by using averages of the top 12 stocks in the market to show whether or not the market as a whole was progressing or regressing. Presently, the Dow is a price-weighted average of 30 major American stocks that are traded over the New York Stock Exchange. The DIJA includes companies like General Electric, Disney, Microsoft, and Exxon. This index is primarily used to see if the market is in a bullish or bearish trend and investors use it to gain a sense of market performance.

Hang Seng

The Hang Seng Index (HSI) is a market capitalization-weighted index of 40 of the largest that trade on the Hong Kong Exchange. The HSI original publication was in 1969 and is the main index used to determine the status of the Hong Kong Market. It is also noted as the benchmark for the economy of Hong Kong. A subsidiary of the Hang Seng Bank maintains the HSI. The index covers approximately 65% of the Hong Kong Exchange's total market capitalization.

NASDAQ Composite

The NASDAQ Composite Index is a market-capitalization weighted index of more than 3,000 common equities listed on the NASDAQ stock exchange. The index includes all NASDAQ listed stocks that are not derivatives, preferred shares, funds, exchange-traded funds, or debentures. The types of securities in the index include American depositary receipts, common stocks, real estate investment trusts and tracking stocks. Unlike other indexes, the NASDAQ composite is not limited to companies that have U.S. headquarters. It is comprised of all domestic and international based common type stocks listed on the NASDAQ stock market.

Nikkei 225

The Nikkei 225 Stock Average is the leading and most-respected index of Japanese Stocks. The index is comprised of Japan's top 225 blue-chip companies on the Tokyo Stock Exchange. It is based on the same principals as the U.S.' Dow Jones, in that it is a price-weighted index. The Nikkei 225 is the leading benchmark for all Japanese traded stocks and has been calculated since 1950.

Russell 1000, 2000, 3000

All Russell U.S. Indexes are subsets of the Russell 3000 Index. The Russell 1000 is a large-cap stock market index of 1,000 stocks in the Russell 3000 Index. The Russell 1000 is the benchmark for mutual funds that identify as large-cap. The Russell 2000 Index is a small-cap stock market index of the bottom 2,000 stocks in the Russell 3000 Index. The Russell 2000 is the most common benchmark for mutual funds that identify as small-cap in the U.S. The Russell 3,000 Index is made up of 3,000 of the biggest U.S. stocks.

Standard & Poor 500 (S&P 500)

Along with the Dow Jones and NASDAQ Composite, the S&P 500 is one of the most watched indexes. The index is comprised of 500 stocks chosen for market size, liquidity, and industry grouping, among other factors. The S&P Index Committee, a team of analysts and economists at Standard & Poor's, selects companies included in the index. It is designed to be a leading indicator of large-cap U.S. equities and the risk/return characteristics of these equities. It mainly reflects the performance of the large-cap market. The S&P 500 is a market value weighted index, in that each stock's weight is proportionate to its market value.

Wilshire 5000

Wilshire associates started the Wilshire 5000 Index in 1974, shortly after computers made the daily computation of such a large index possible. The Index is considered the total market index and is designed to track the value of the entire stock market. It is comprised of every stock that meets three criteria: the firm's headquarters are based in the U.S., the stock is actively traded on a U.S. exchange, and the stock has widely available pricing information. The index actually contains around 6,700 stocks, contrary to the deception of the name. It is market cap weighted, meaning that firms with the highest market value account for a larger portion of the index.

Exchanges

A financial market is a market in which financial assets are traded (Mishkin). An exchange is a marketplace in which securities, commodities, derivatives, and other financial instruments are traded. Its main function is to ensure fair and orderly trading, as well as dissemination of price information for any securities trading on that exchange. Companies, governments, and other groups utilize exchanges for a platform to sell securities to the investing public. It may be a physical location where traders meet or an electronic platform where only one investor is needed.

Auction Exchanges

Auction Exchanges, commonly referred to as Auction Markets, are security exchanges in which buyers make bids and sellers make offers in order to make transactions in a security. The price a stock is traded at represents the lowest price a seller is willing to sell at and the highest price that a buyer is willing to pay. Matching bids and offers are then paired and orders are executed. Brokers acting for buyers compete against each other on the exchange floor, as brokers acting for sellers do, in order to get the best price.

New York Stock Exchange (NYSE)

The NYSE is an exchange based in New York City and is known to be one of the largest equity based exchanges in the world. Until recently, the NYSE relied on the open outcry system, commonly referred to as a trading pit, to focus on floor trading. In today's age, more than half of the trades made are electronically although there are still floor traders that set prices on different securities.

Electronic Exchanges

Electronic Exchanges are securities exchanges in which the traders never physically meet to buy and sell the securities. All of the trading done in these exchanges takes place in a

computer system, which may be operated from almost anywhere in the world. These exchanges may or may not have specified trading hours, and ultimately depends on the platform being used.

National Association of Securities Dealers Automated Quotations (NASDAQ)

The NASDAQ was created by the National Association of Securities Dealers (NASD) to enable investors to trade securities on a computerized, speedy and transparent system. It was created and established in 1971.

Electronic Communication Networks (ECNs)

An electronic communication network is a system for trading financial instruments that takes place outside of the markets. This type of network is part of an exchange class called alternative trading systems (ATS). ECNs are overseen and sanctioned by the SEC (Securities and Exchange Commission). These markets connect buyers and sellers of financial instruments over a network enabling them to trade available currencies and securities. As a result of it being electronic, there is no need for brokers or investment banks. Instead, the ECN is the intermediary and charges transaction fees per share or amount traded, or automatically adjust prices slightly up or down, profiting from the price difference. These networks allow individuals the ability to communicate almost instantly regardless of their geographic location. ECNs provide an alternative mean to trade stocks listed on the NASDAQ, as well as other exchanges like foreign exchanges.

Over-The-Counter (OTC) Exchanges

An over the counter security is traded through a dealer network rather than through a centralized, formal exchange. In other words, it is a market where trading in stocks and bonds occurs with no actual stock exchange. This exchange is commonly referred to as the off-board market. Private securities dealers who negotiate directly with buyers and sellers typically trade assets that are traded through OTC exchanges. The main reason a stock is traded OTC is because

the company may be too small to meet formal exchange listing requirements. OTC stocks are usually listed in the Over the Counter Bulletin Board (OTCBB) and/or on pink sheets. Bonds are considered to be over the counter due to the fact they aren't traded on a formal exchange.

An Introduction to Trading Platforms

A trading platform is software that traders can open, close, and manage positions in the market (Investopedia). With the onset of the Internet over the past 20 years, software developers have created trading platforms to allow easy access to the U.S and global financial markets. Trading platforms allow an everyday person to be able to invest their money the way they intend, and do not have to go through a traditional stockbroker. This eliminates brokerage fees (although there is normally a "brokerage fee" in the form of a commission for using the platform), and gives the individual a sense of control over their money. Trading platforms provide accurate data feeds of market information, provide investment options such as stocks, currencies, futures, and options; some trading platforms provide chart analysis software, allowing the individual to analyze charts and make decisions based off of indicators and other technical analysis methods.

TradeStation

The trading platform that was used for this IQP is called TradeStation, an online brokerage company that is based in Plantation Florida. Tradestation is best known for its analysis software. The software allows the purchasing of all kinds of ETFs, including stocks, options, futures, and currencies. The main uses of TradeStation for this project are to buy or sell stocks and currencies. TradeStation also includes the capability of writing EasyLanguage code, and executing the code for automated systems. This gives the versatility of being able to design programs and strategies, and performing the strategies. Strategy automation for some people can be the only way to apply a specific strategy consistently, having the execution of the code take positions for you. The built in EasyLanguage editor is very convenient, and when code is changed in the editor and saved and verified, TradeStation will automatically refresh to show the execution of the new code changes.

Different Types of Trading/Active Investing Systems

Theories

Dow Theory

The Dow Theory is a method of technical analysis that was derived from several articles by Charles H. Dow (Langager & Murphy). The Dow Theory consists of six basic tenets that ultimately tell the trade that the market is trending up when one of the averages, either industrial or transportation, progresses pass a previous vital high and is followed by similar progression in the other average.

The first tenet of the Dow Theory states the market has three different movements, the "main movement", "medium swing" and "short swing". The "main movement" is the major trend that can last anywhere from less than a year to couple of years and can either bullish or bearish. The "medium swing" is the secondary reaction that can last anywhere from couple of days to couple of months and traces about 33% to 66% of any primary price change that occurs. The "short swing" is the minor movement that can last a couple hours up to a couple of weeks and varies on the trader's opinion.

The second tenet of the Dow Theory states that the market trends have three different phases, an accumulation phase, absorption phase and a distribution phase. During the accumulation phase, the traders with prior knowledge about a stock are actively buying and selling shares against the general opinion of the market. The stock prices don't change too much during this phase because the traders are a minority when there is supply in the market. Eventually when other traders begin to trade, the market shifts to the second phase. During the absorption phase, there is rapid price movement due to the increase in demand from other traders. When the whole market is aware of the trend, the market shifts to the last phase. During the distribution phase, wise investors begin to distribute their holdings to the market.

The third tenet of the Dow Theory states that the market reflects all news. Once new information becomes available, the stock prices will immediately incorporate it. The stock prices will begin to change based on the news that is released.

The fourth tenet of the Dow Theory states that the market averages must agree with each other. It is difficult to predict a new trend in the market if the averages aren't in agreement with each other. The theory is also affected by the condition of the market along with businesses, the market only performs well if the business is in a good condition.

The fifth tenet of the Dow Theory states that the market trends are confirmed by volume. When the prices and the trend are moving in the same direction, the volume should increase. When they both are moving in different directions, the volume should decrease. A large volume in the market confirms a strong trend, and the volume decreasing in an upward trend confirms a weak trend.

The sixth tenet of the Dow Theory states that the market trends exist until there is a definitive signals verifies it has ended. The market will fluctuate temporarily and oppose the direction of the trend, but the market will resume to the initial direction. It is very difficult to whether or not the reversal is the start of a new trend.

CAN SLIM

CAN SLIM is theory that essential for anyone who is beginning to learn to trade that was developed by William J. O'Neil, co-founder of Investor's Business Daily (Investopedia). The main objective of the strategy is to isolate leading stocks before they make major price advances. CAN SLIM is an acronym that stands for the seven key factors to look for in a company.

The C represents current earnings. The current earnings correspond to the earnings per share of the company. The earnings per share should be about 25%. The current quarterly

earnings per share should have increased significantly from the quarter's earnings from the previous year.

The A represents annual earnings. The annual earnings should be up 25% or more in each of the last three years. Also the annual returns on equity should be 17% or more.

The N represents new product or services. The company should have a new idea that shows potential growth and increase in the two previous factors above. The future of the company is essential to the increase of the stock prices.

The S represents supply and demand. The company should have a small supply with a large demand; this causes excess demand, which allows the stock prices to increase. A company that obtains their own stock reduces the market supply, which indicates the expectation of profit in the future.

The L represents leader or laggard. Markets can either be considered a leader or laggard based on the relative price strength rating (RSPR) of the stock. RSPR is an index that was designed to measure the price of stock over the past year in comparison to the rest of the market. The company should score better than at least 70% of the market.

The I represents institutional sponsorship. The company should have some of its shares owned by mutual funds in the most recent quarter, but shouldn't be over owned.

The M represents market indexes. The specific stock should follow the general market indexes such as Dow Jones, S&P 500 and NASDAQ.

Gap Trading

Gaps are when the price of the stock either sharply increases or decreases with minimum or no trading occurs (Kuepper). During an upward trend, a gap occurs when the highest price of the previous day is lower than the next day's lowest price. During a downward trend, a gap

occurs when the lowest price of the previous day is higher than the next day's highest price. There are four different types of gaps that each have a unique implication.

The first type of gap is a breakaway gap. This gap occurs at the end of a price pattern and signal the beginning of a new trend, breaks away from an area of congestion. If the volume is heavy after the gap forms, chances are that the market doesn't return to fill the gap. If the volume is low when the price breaks away, chances are the gap will get filled prior to the prices returning to their trend.

The second type of gap is an exhaustion gap. This gap occurs close to the end of a price pattern and signals the end of a move. When the gap forms at the top with heavy volume, it is very probable that the market is exhausted. Prevailing trend is at halt and usually followed by some area pattern development, this type of gap shouldn't be considered a major reversal

The third type of gap is a common gap. This gap represents where the price has gapped, not placed in a price pattern. Generally the price will go up or move back in order to fill the gap in the coming days. If the gap does get filled, little forecasting significance is presented.

The fourth type of gap is a measuring gap. This gap occurs in the middle of a price pattern and a rush of buyers and sellers who all believe in the underlying stock's future direction. It is used to measure how much further a move will go, they aren't usually filled for a reasonable period of time.

Swing Trading

Swing trading is good trading system for a new trader who is beginning to trade, but also offers potential profit for intermediate and advanced traders. The idea behind swing trading is to try to profit off of price changes or swings within one to four days. The trader isn't interested the fundamental value of the stock, but instead focuses on the price trends and patterns. The trader uses some form of technical analysis to find stocks that have short-term price momentum. It is

difficult to decide when to enter or exit a trade, the goal is to enter or exit ac close to the upper or lower channel as possible but timing doesn't have to be perfect for swing traders. Returns over time are made from small consistent earnings.

Manual Vs. Automated Trading Systems

In trading all types of asset classes, the trader must decide between manual and automatic trading methods. Both procedures can be mastered for profitable success if rules are followed and executed unconditionally. The choice between manual and auto trading is dependent upon the individual's time availability to be present in the markets, as well as the psychological strength necessary while risking capital in trades.

Manual trading is the traditional investment choice for most active traders. This practice involves strictly human choice and constant studying of ever changing dynamics in the market. Manual investors frequently use fundamental analysis of stocks by studying and evaluating market conditions and the success of firms in the market. Data for fundamental analysis is retrieved from company news and announcements as well as both national and international politics. Manual trading requires rules to get in and out of trades that must be followed in order to ensure system success and to avoid emotion based exits for losses of capital. Human decision-making is the main reason that the manual approach carries a high risk. Some individuals do not have the psychological integrity to execute their rules of trading, and should not trade manually. For those who can maintain their composure as trades cycle between profit and loss, they will be able to use their fundamental analysis to gain efficient, educated profits.

Auto trading relieves some psychological pressure as trades are in progress, allowing trades to be fully executed without interruption. This separation from the constant fluctuations of the market will let the systems perform with accuracy, in some cases more effectively than

manual trading. Auto trading is also more suitable for trading markets at all times regardless of personal affairs or differing time zones. In order to select an asset investing method, the user must evaluate personal strengths and weaknesses and consider available times for trading.

Fundamental Vs. Technical Trading Systems

Fundamental analysis is the traditional procedure for stock and security forecasting. The fundamental approach includes quantitative and qualitative factors of the company, as well as the industry. Quantitative analysis is the study of revenue, expenses, assets, liabilities and other valuable financial aspects of a company. (Investopedia) Investors gather this data from balance sheets and income statements in order to gain awareness of a company's future performance. Qualitative analysis evaluates a company's business model and its interactions regarding competitors. Fundamental analysis is a method normally used for long-term investments, but can also be effective for short term trades.

Technical analysis revolves around market dynamics of stocks. This methodology helps predict the movement of stock price by using recent numerical data of both price and volume. Technical analysts use tools such as charts to identify market trends and price patterns. Technicians operate on smaller timetables than fundamental traders because of quick reactions to the market. Some traders use technical analysis or fundamental analysis exclusively, yet others use a combination of both in order to make quality investment decisions.

Strategies

Basic Ideas

Trend following

A trend in a market, or market trend, is when a market moves in a particular up or down direction. A trend can be found and confirmed by the use of a trend line, connecting one of the four main points of a candlestick, and examining if other candlesticks will touch the same line at the same point. If a line gets touched three times by the candlestick at the same point, the trend can be confirmed. A trend following strategy is exactly how it sounds, a strategy that attempts to exploit and take advantages of newly created trends within the market. Trend following strategies usually use trend spotting or confirming indicators, such as moving averages, Average True Range (ATR), RSI (relative strength indicator), etc. Using a combination of these indicators, strategies attempt to get into the market at the beginning of a trend, and ride the trend either up or down, and exit at the correct time. Trend following strategies normally aim to stay in the market for longer periods of time (buy/sell and hold), and have a goal of catching big movements in the market, whether it's on hourly time frames or daily time frames. One form of a trend strategy is Turtle trading system. The Turtle trading system consists of two break out point, one long and one short (up to discretion). Once these breakout points have been crossed, there is a decision to either buy or selling depending on the conditions met. Normally, the breakout points are a high value and low value over a certain amount of time, with the idea that if a high point over a long period of time is broken, then that point will then become an area of support, and vice versa.

Volatility expansion

A volatility expansion strategy, or also called a volatility break system, is considered a form of swing trading, and aims to analyze only price movement (Raschke). In a volatility expansion strategy, the long term trend or "bigger picture" within the market is not a point of

interest, but more of how much a price moves between bar to bar. The idea behind the volatility expansion strategy is that is the price moves a certain amount or percentage from its previous price, then the probability of the continuation of the short trend will be higher. Volatility expansion strategies vary, and use indicators such as Bollinger bands, Keltner channels, or some type of equation designed to measure the volatility over a certain period. Exit points can also vary, but for a Turtle trend following system, the stop set is based off of an average true range (ATR).

Basic Tools

Japanese candlesticks

The Japanese candlestick bars, although used mainly as a way of representing data in a more intuitive, visual way, Japanese candlesticks can also be used as an indicator in a variety of ways. Japanese candlesticks are represented like a box and whisker plot, only each bar plotted represents a certain time frame. Each Japanese candlestick has four main data points, which include the high and low of the session, and the open price and the close price. If the bar closes greater than it's opening price, than the candlestick will be green, and represent bullish activity for that time frame. If the candlestick closes lower than it's opening price, than the candle will be red, representing bearish activity. The Japanese candlesticks can be used to determine price movement and potential market sentiment by the size of both the bodies (space between the open and close) and wicks (high and low) of the candle. Indicators of Japanese candlesticks range in 1 bar, 2 bar, and 3 bar patterns, and vary in size. Japanese candlesticks allow for a quick visualization of what the market activity is like at a given point in time.

Trend lines

A trend line is a technical analysis tool used to identify whether a market is trending (moving) up or down, and can also be used to identify levels of support and resistance. The trend line is used by drawing a line to connect each bar by either its high, low, open, or close. The choice of which point at which to connect each bar is preference. The more bars that touch the same point on the same line give strength to the resistance level of the line, and three or more touches of the line at the same points on the bar confirms the direction of the trend.

Moving Average lines

Moving Averages are lagging indicators that help traders better analyze the direction of stock price by filtering out some dynamics of price fluctuations (Investopedia). This technical analysis tool can be used for manual and automated traders in order to identify trend direction as well as for use in studying support and resistance. Filtering of price is mainly attributed to the indicators ability to allow low frequency activity to pass through its rigid analysis, rather focusing on higher frequency market activity.(Katz and McCormick 110). The smooth data is easy to analyze yet can be late to show changes in the time series relative to the indicators general direction. This is the issue of the "lagging" properties of the moving average. To combat delay of the indicator, while still reducing noise of low filter price fluctuation, traders have created many types of adaptive moving averages. Adaptive moving averages are developed to gain a speedier response by adapting to market behavior.

ATR (average true range)

The average true range is an indicator used for measuring volatility in the market (Stockcharts). The ATR was originally created to trade on daily bars of commodity markets, being that commodities are normally more volatile than a regular stock. The calculation for the ATR is based off of 14 periods, and although originally made for a daily time frame, intraday,

daily, weekly, and monthly time frames can all be used. To calculate the ATR, first multiply the previous 14 day ATR by 13, add the most recent days true range number, and divide that total by 14. The equation can look like this; ATR = ((Prior ATR x 13)+current TR)/14. Although the ATR is used to measure volatility, the ATR can also be used to gauge how strong a move or breakout is within a market. If a support or resistance line is broken, or reversal of trend happens, and the ATR increases with the observed movement, the movement can be slightly more valid because strong bullish or bearish movements tend to have larger gaps. ATR is often used as an indicator to confirm price movement in a particular direction.

Ichimoku Cloud

The Ichimoku Cloud, or Ichimoku Kinko Hiyo, is a Japanese indicator created in 1969, and translates into "one look equilibrium chart" ("Ichimoku Clouds"). The Ichimoku Cloud, or "Ichi Cloud" for short, consists of five lines, four in which are based off of the average of the high and low over a given period of time. The five lines consist of the Tenkan-sen line, Kijun-sen line, Senkou span A, Senkou span B, and the Chikou line. The Tenkan-sen line, also called the conversion line, represents the average of the high and low over 9 periods. The equation is, Tenkan = (9 period high + 9 period low)/2 . The Kijun-sen line, also called the base line, represents the average of the high and low over 26 periods. The equation is, Kijun = (26 period high + 26 period low)/2. The Senkou Span A represents the midpoint between the Tenkan-sen and Kijun-sen lines. The equation for this is, Senkou_A = (Tenkan + Kijun)/2. The Senkou Span B represents the average of the high and low over 52 periods. The equation for this is, Senkou_B = (52 period high + 52 period low)/2. Both the Senkou Span A and Senkou Span B lines create the boundary for the "cloud", or Kumo, in Japanese. The cloud projects 26 periods into the future, and gives an idea of potential support and resistance areas. The Ichimoku Cloud indicator is the only indicator that has a future prediction of the market. The Chikou line is simply the

close of the current bar plotted 26 periods in the past. The Ichimoku Cloud has a variety of signals, and can be applied to almost any time frame (though longer time frames are more accurate). The Ichi Cloud is meant to give you a general idea of price direction by a first glance. If the price is above the cloud, then the market is bullish and in an uptrend. If the price is below the cloud, than the market is bearish, and in a downtrend. If the price is in the cloud, than the market is sideways and undetermined. Signals vary in combination of lines used, and in strength of the signal. Signals can include price, or can be solely based on where lines are or are crossing, much like regular moving averages.

Time filter

A time filter in developing an automated system is a piece of code that tells the program what specific times of the day to turn on and off. This can be used to tailor an automated trading system to trade during times of high volume and apparent trend, or during times of foreign market activity.

Order Types

Market Order

When entering the market there are several ways an order can be placed. For immediate entrance into a trade, a market order is used which fills an order at the current assets price. There is a guaranteed filled position with a market order, which gives it a distinct advantage. A market order is effective because of its quick nature and convenience. It is usually the default order type for most online platforms. However, the market order can fill imprecise trades in cases of high volatility between the time the trader sees the price, and the order is filled. This effect is called slippage and it can be avoided by the use of other order types.

Limit Order

Limit orders are a delayed order type relative to a market order. A limit order waits for an optimal, specified price before the order is filled. This helps obtain precision in price entry and in turn can help maximize profit from the start. It can also be specified how long the limit can be ongoing before it is canceled. (Investopedia) However, if the price is not reached, the order will not be filled, which could leave the investor out of the trade.

Stop Order

Stop orders are triggers that initiate market or limit orders when a specific price is reached. The stop level sets the boundary for the respective trade. Buy orders are filled higher than the market price, whereas sell orders are placed below the market. Stop orders are commonly used as exit strategies in trading systems as well as to confirm market trends.

Strategies

Strategy Objectives

High Winning Percentage

The goal of each team members system is to achieve a winning percentage for the time period the system is in the market. It is essential that the systems developed have a high winning percentage to ensure an investor that the system would be beneficial for them, resulting in as much profit as possible. Although a system with a low winning percentage can result in profit, this doesn't ensure the investor that they will profit because they will see that the system has more losing trades than it does winning.

Using an automatic system to trade offers a better chance to achieve a higher winning percentage when positions are long rather than short. With the condition of the market in the past couple years, an overall bearish trend that has begun to recover, and ambiguity of the economy,

it is difficult to develop an automatic system that has an overall high winning percentage. Reasoning and logic will have to go into each system to try to obtain as high of a winning percentage as possible. The trader needs to be assured that even though they won't win every single trade, they will profit and win a very good percent of the trades made over the period of time.

High Annual Return

Along with a high winning percentage, a high annual return is important to any investor. It is also important that the investor is aware of the risk that accompanies a high return rate.

In each members system we believe that the risk is as important as the return is. If a system proposes a high return, but also has a high risk it would have a higher disadvantage compared a system that proposes a lower return but also with a lower risk. A lower risk is more assuring even in the return is higher, with the higher risk anything is possible. The Sharpe Ratio is a way to measure the return of risk in the financial world. The formula for the Sharpe Ratio is defined by: $\frac{E[R_s]-R_f}{\sigma_s}$. $E[R_s]$ represents the expected value of return for the traded financial instrument, R_f represents the risk-free return and σ_s represents the standard deviation for the traded financial instrument.

Low Draw-Down

To complement a high winning percentage, a low draw-down is ideal for each members system. Draw-down is defined by the highest loss that the system has during the trading period. It would be best if each system had both a high winning percentage and a low draw-down. This would make the investor more comfortable trading with the system if they knew that it would win more trades than it lost, and the trades that lost wouldn't be losing too much.

Robust Across Different Market

With the different types of markets, it is very difficult to develop a system that is robust in all of them. Systems work better in certain markets compared to others. Some markets trend more while others are more volatile. There are systems that are developed for each scenario of these scenarios. The goal for each member was while developing a system for a certain market, to try to have that system work in different markets as well. We are aware that this is a very difficult task to complete, but it would be desirable if the systems were robust to other markets along with the market focused on.

Low Time Commitment

Using an automatic system doesn't require much of the trader's time. With an automatic system, sets of rules to follow are written out and all the trader is required to do is run their system. When trading manually, the trader has to pay attention to the market and follow their set of rules. This can be more challenging because when the market fluctuates the trader can be tempted to break their rules, which can be stressful. The team members developed an automatic system to prevent making a big time commitment to trading.

Spend a Reasonable Amount of Time in the Market

Each member will try to develop a system that spends a reasonable amount of time in the market. Spending a large amount of time in the market has advantages along with disadvantages. The more time a system spends in the market, the more likely it is to catch a big jump in price. However, it also has a higher risk to lose if it doesn't get out at an appropriate time. The market is unpredictable and anything can happen at any time so it is hard to determine how long a system should stay in the market. Members must decide what the reasonable amount of time

their system should be in the market to maximize profit and minimize loss, each system will spend a different amount of time in the market.

Description of Systems

Strategy Terminology

Adaptive Moving Average Trading

The Adaptive Moving Average system uses a simple moving average indicator in conjunction with an adaptive moving average indicator implemented as a trading strategy, by utilizing crossovers of the fast average with the adaptive moving average. The fast moving average is a short term analyzing average that considers price over a smaller time period relative to a slow moving average. Its shorter look back period is very beneficial in reducing lag, yet can be vulnerable to whipsaw effects. In this Adaptive Moving Average system the fast average indicator complements the adaptive moving average indicator, which adjusts to market volatility, by switching to shorter-term look back periods of historical data when there is an upward trend, and a longer- term look back period when markets are sideways. (Currency Trader PDF august 2006). The crossovers occur when the fast average crosses above the adaptive moving average, a buy order is triggered, and when the fast average crosses below the adaptive moving average, a sell order is triggered. This system only trades with long positions with the intent to take advantage of signaled upward trends.

With the use of moving average crossovers, timely exits and risk management are essential to maintain profits and reduce losses from quick market reversals, late to be seen by the moving averages. Pat's system uses multiple exits including a stop loss, percent-trailing stop loss, dollar-trailing stop loss and a profit target. This exit strategy was implemented to achieve certain goals in profits, and to make faster exits than the moving average would be able to execute. The goal of using multiple exits is to decrease the strategies draw down, while allowing the system to continue following upward trends when in long positions. The numerical values for each stop position are determined by the individual stock, varying for each, based upon specific stock

dynamics and price. When selecting exit prices for the stop loss and dollar trailing positions it was important to evaluate reasonable losses that did not inhibit the strategy goals. The percent-trailing stop added the dynamic of a specific profit level that had to be reached before a stop loss was calculated, based off a percentage value of the desired profit. This exit aided in maintaining profits while giving the strategy a chance to continue profiting off an upward trend. Profit targets were implemented to close positions once a certain profit goal was reached which locked in gains deemed successful for each stock. Each exit has been back tested and selected by trial and error to ensure that the strategy is not inhibited by exits, yet is able to secure profitable trades.

This adaptive moving average strategy works well with relatively expensive stocks that fluctuated in a smooth manner on daily charts. The strategy trades on daily bar charts for each individual stock. The selection process for the use of time frame is attributed to the noise cancellation properties of the daily bar charts, which also reduced the amount of trades that the strategy ordered. The overall time in the market is also reduced with the use of this time frame. Daily charts were chosen because the system usually exits trades within 1- 2 days, generating average to moderate profit, and exiting as the trend periodically falls to the designated exit values, or a crossover initiates a sell order.

The stocks chosen for Pat's portfolio consist of Google Inc. Class A, Nike Inc. B, IBM and Tesla Motors Inc. These four companies are highly productive and have above average stock prices, which fit the criteria that the Adaptive Moving Average strategy performs ideally with. Each of these stocks were profitable in Trade Station back-testing performance results with above average percent profitable values for trend following strategies, ranging from 40 to 60

percent. The strategy when applied to these four stocks also reached profit factors of up to 15 over the 5-year back testing period.

Ichimoku Trading

The "Ichi Strategy" is a trend following strategy based off of the technical indicator called the *Ichimoku Kinkō Hyō*, or Ichimoku Cloud for short. This indicator is composed of six separate lines (refer to *Ichimoku Kinkō Hyō*), all of which have their own function. The Ichimoku cloud indicator gives several signals, all varying in strength. This strategy aims to exploit a signal made by the Kijun-sen line on a daily bar time frame. There are several signals given by the indicator that use the Kijun-sen line, but this strategy attempts to exploit a signal only involving price, both high and low of the current bar, and the Kijun-sen. The idea of the strategy is that when the low of the current bar crosses above Kijun-sen line, then the strategy produces a long entry. If the high of the current bar crosses below the Kijun-sen bar, then the strategy produces a sell signal to close the long position. This strategy only produces long entries, with the idea to take advantage of strong upward trends in the market.

The main idea of the "Ichi Strategy" is to take advantage of upward trends in the market with daily bars as a time frame. Daily bars were used due to the significantly lower amount of noise that can be generated. This makes for better signals to be generated, attempts to eliminate the chance of a fake out from the market, and reduces the amount of trades made within the total time period of trading. This overall reduces the amount of time spent in the market, which is a broader form of risk that this strategy implements. Another risk managing detail that was implemented into the strategy was a stop loss. A stop loss of $100 dollars was set to the strategy. Along with the stop loss, a trailing dollar stop of $50 was set. This is to try and minimize drawdown, but not have a stop that's too tight, and the trailing stop is to attempt to maximize

profits. The stop loss of $100 was felt to be a stop that was a reasonable loss, but also not too much of a drawdown. Mixed with the trailing stop, the idea is to try and take a guaranteed profit after the entry price has risen above a 50-dollar profit, and the trailing stop moves as needed. The $50 trailing stop could be considered small, but because of the nature of the strategy (ride upward trends), if the strategy enters at the correct time, the $50 mark will be reached quickly. There is a better chance of making a profit with the dollar trailing if the set-trailing amount is reached quickly. The other benefit of the trailing stop was to minimize the amount of time in the market. If the dollar-trailing stop is reached successfully, it is a small margin for the price to retrace back to in order to be closed, which causes less time in the market due to the noise that can occur.

The market that the strategy was implemented to was the Foreign Exchange market, with the Japanese Yen in particular. The Ichimoku Cloud indicator is a Japanese indicator, used predominantly by traders in Asian geographic areas. The use of a popular Japanese indicator on a few Japanese currencies seemed like a logical decision. This concept can be linked to the various forms of psychology that can be founds amongst traders when participating in the markets. The idea stems from the idea of an indicator being so widely used that it is "destined" to be right. Obviously nothing is guaranteed ever when it comes to any market in the world, but the thought is that if everyone is watching the same thing, and making decisions based off of the same information, there is a form of validity in the indicator. According to some market theories, the movement of the market is entirely determined on the choice of the person, and the value that the person gives to the potential trade that could be made. The same concept is used for other technical analysis indicators as well, such as the Fibonacci lines.

The specific currency pairs that were chosen for this strategy were the USDJPY, GBPJPY, EURJPY, and AUDJPY. The Japanese Yen has been decreasing in value the past years due to the process of quantitative easing implemented by Japan. Since the value has been decreasing for some time, this has given opportunity for long positions to possibly be taken in a variety of the Yen currency pairs, and profit made. This was the main reason why all of the currencies that the Ichi Strategy traded on were part of the Japanese Yen currency pair. The idea of the Ichi strategy is to make profit with long positions, so the Yen currencies suited this aspect the most.

Turtle Trading

Trend following strategies are intended to follow the trends of the market which can be very beneficial for catching big jumps in the market, but can also be vulnerable to noise resulting in big market loses. This being said, a lot of money can be lost just as easy as it can be made depending on which directions the market is trending. The ultimate goal for the trend following strategy implemented for this project was to try to avoid volatility and stay in the market for longer when trending up than when trending down. To achieve this goal, a modified turtle trading system was designed.

The modified turtle trading strategy that was developed was a very simple strategy that would be easy for somebody with no prior knowledge of trading would to understand. The system would buy 500 shares if the closing price of the current day was greater than the closing price two days ago and if the closing price two days ago was less than the closing price five days ago. The strategy would sell 500 shares if the closing price of the current day was less than the closing price two days ago and if the closing price two days ago was greater than the closing price five days ago. The strategy is intended to buy and sell at the peaks of the market, by doing

this the strategy will minimize how much it is affected by volatility because it will be checking peaks, two days ago, five days back. If the market drops briefly but then goes back up, the strategy won't get out of the market right away and maximize the profit. The parameters for selling and buying are slightly different to attempt to minimize as best as possible. If the market is trending down the idea is to get out as soon as possible, but if it is trending up the idea is to stay in for as long as possible. The strategy used daily bars and traded over a span of five years starting on April 27, 2010 and ending on April 27, 2015.

This wasn't developed for any specific stock, but was intended to be a general strategy that could be used on any stock of choice. This doesn't necessarily mean the result would be the same for each stock; the system will work differently on each stock as each market differs from the others. Research done on stocks that were known to trend and picked based off of popularity and personal interest. Amazon, Nike, Twitter, Google, Facebook, Netflix, IBM Apple and GoPro were some of the many stocks for consideration to be traded. The four stocks that were chosen were Amazon (AMZN), Apple (AAPL), Google (GOOG) and Netflix (NFLX). These stocks were chosen based on product sales and companies that began to become more popular in the desired time span for the strategy.

Volatility Trading

The Volatility Strategy is based off of trend following strategies, but adapted with a volatility expansion twist. It functions based off of how volatile the particular currency pair is and can be adapted to perform for specific currency pairs. The inputs used in this strategy are length, as well as percent above and below. By selecting the length as 200, the code will begin to look back 200 bars for data. The percent above and below will then calculate data based off the inputs selected for each. The code uses these indicators to develop situations where trading is acceptable.

The strategy's design intends to utilize two filters as variables, a time filter and a volume filter. The reasoning behind the time filter is to ensure that the trading session is volatile. By selecting to only trade from 1 am to 9 am, the system utilizes the volatility of the London Foreign Exchange market. London's market is seen to be the most volatile due to traders from the U.S. just stopping trades as the London market opens, and the contrary for the Japanese Market beginning trade as the London market closes. This time filter can be adjusted to match the currency pair being traded if there is a more ideal time session. The volume filter utilizes the closing day's range and then computes the 12-day average of daily ranges. The data value calculated from this will be the volatility score that will determine if trades are taken or not. If the volatility falls between the specific ranges of values selected, then the volume filter is seen as true and will take trades in the current mark environment. If both the time and volume filters are true, then the strategy will take trades. If the close crosses below the lower band then the system buys long at the next bar at market price. However, if the close crosses above the upper band then the system sells short at the next bar at market price. Finally, if the close is greater than the lower band the system sells next bar at market price and contrarily if the close is less than the upper band the system buys to cover next bar at market price. The strategy would buy/sell one lot of the desired currency pair. No stop losses were implemented in the strategy. 60-minute bars were used due to the thought that within an hour's time there would be enough trading for volatility to occur.

The market that was selected for trading this system was the Foreign Exchange market. The thought process behind this was that the ForEx market is the most liquid of all markets. Due to that fact, the thought process was that volume would bring volatility because of the mass

amounts of trading being performed. The London Market in particular was chosen because of it being renounced as the most liquid time period.

The specific currency pair chosen for this strategy was the GBPCAD. Trading a non-US currency pair was appealing, especially when it holds stronger than both the quote and base currency. This market worked extremely well for the Volatility strategy. Other currency pairs did not deem well with this strategy. It seemed that short trades were losing too much money to turn profits. Going forward with this strategy, a stop loss of some sort would be a good idea to make profit gains. Also switching the time and volume filters might result in bettering profits.

Analysis of Systems

Adaptive Moving Average System

AMA Strategy Analysis- Tesla Motors Inc

The analysis of the Adaptive Moving Average strategy when implemented on Tesla stock begins with an account size of $100,000 with the opportunity to trade up to 1,000,000 shares. The multiple exit values assigned to the Google stock is as follows; 1. $500 Stop Loss 2. ($1500,15%) Percent-Trailing Stop 3. $450 Dollar Trailing Stop 4. $5,000 Profit Target Exit. The strategy's trades plotted in relation to equity available at each individual trade can be found in **Figure 1.**

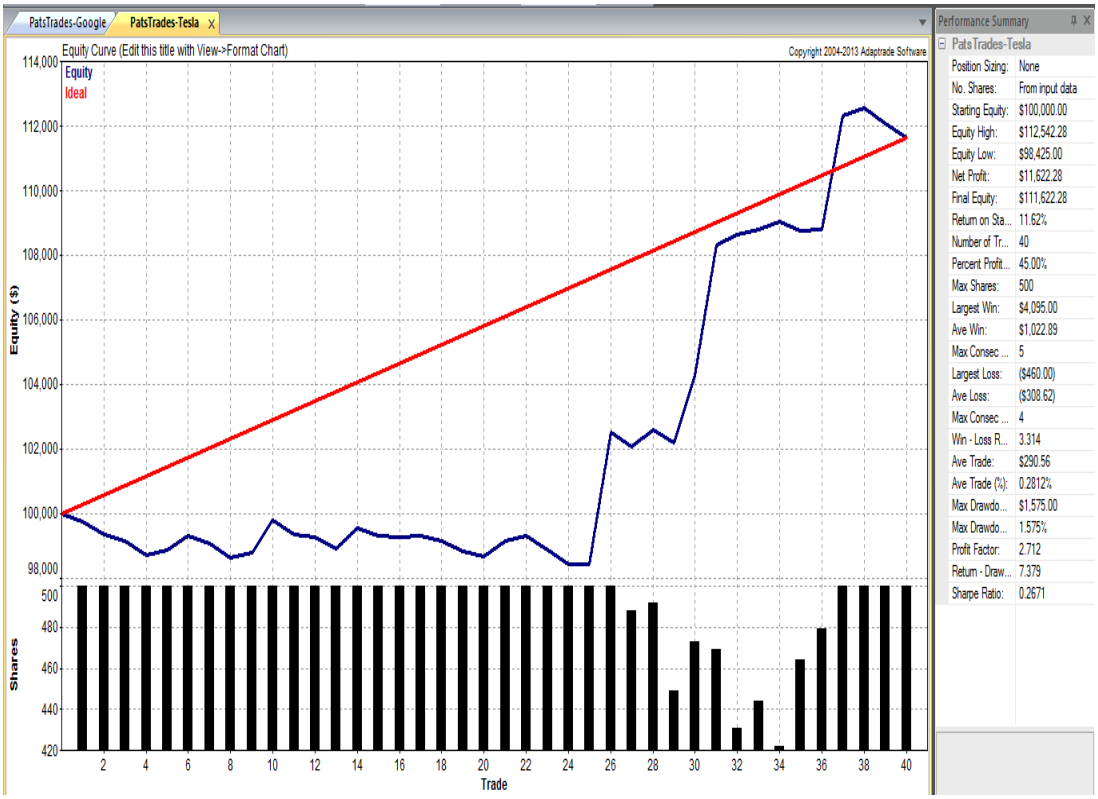


Figure 1 Tesla Performance Summary (TSLA)

The system traded 40 times obtaining $11,622 of net profit. The profit factor of the system was 2.712, trading profitably 45% of the time. The average winning trade for Tesla stock

was $1,022.89 while the average losing trade was $290.56. The rate of return of the Adaptive Moving Average system reached 11.62% and the max draw down was 1.575%.

Running the AMA strategy through Monte Carlo analysis helps better forecast the performance of the system by randomizing the trades 10,000 times in order to test the strategy's validity. The Monte Carlo analysis for the AMA strategy implemented on Tesla stock can be found in **Figure 2.** Accompanying the Monte Carlo analysis is its corresponding performance report found in **Figure 3** and **Figure 4.**

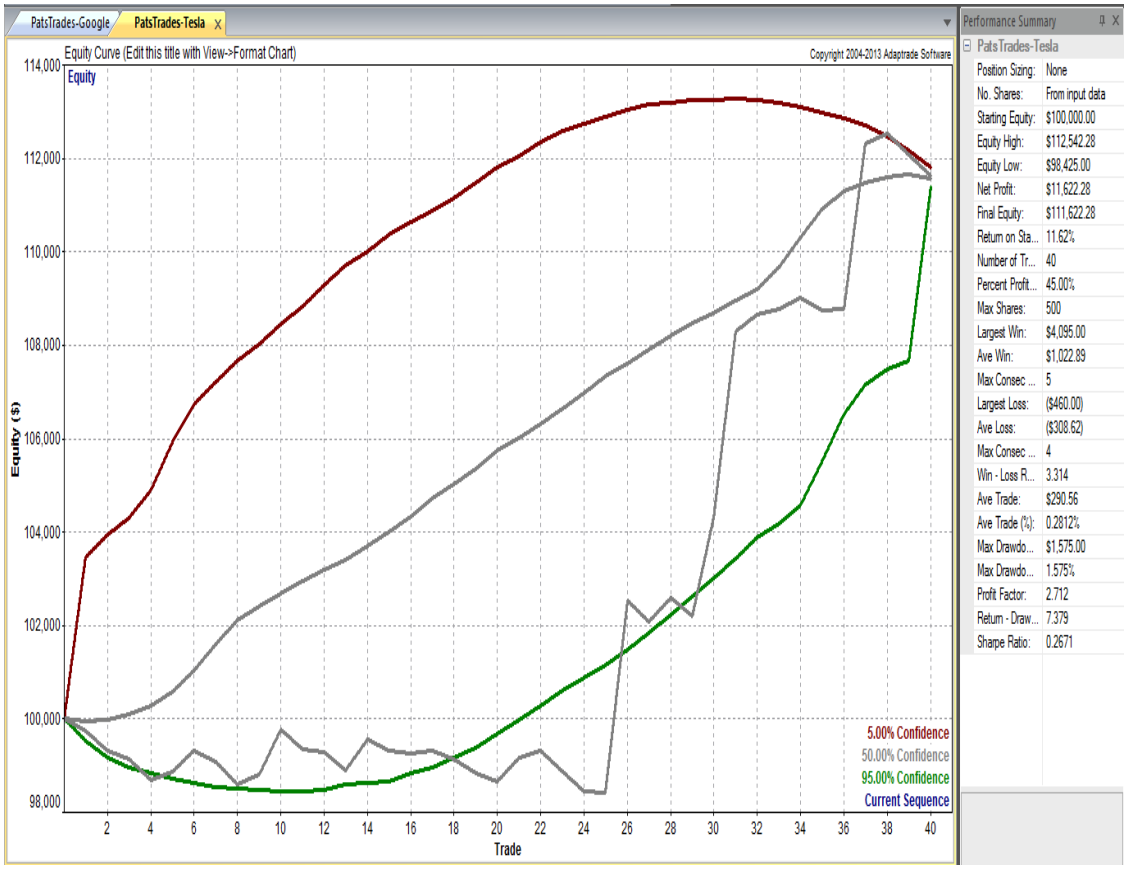


Figure 2 Monte Carlo Analysis (TSLA)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $11,395.37	Max Number of Shares: 500
Final Account Equity: $111,395.37	Minimum Number of Shares: 384
Return on Starting Equity: 11.40%	Average Number of Shares: 484
Profit Factor: 2.678	
Largest Winning Trade: $4,095.00	Largest Losing Trade: ($460.00)
Largest Winning Trade (%): 3.846%	Largest Losing Trade (%): -0.4651%
Average Winning Trade: $1,008.85	Average Losing Trade: ($311.00)
Average Winning Trade (%): 0.9664%	Average Losing Trade (%): -0.3010%
Average Trade: $284.88	Win/Loss Ratio: 3.273
Average Trade (%): 0.2759%	Win/Loss Ratio (%/%): 3.273
Trade Standard Deviation: $1,163.02	Max Consecutive Wins: 3
Trade Standard Deviation (%): 1.120%	Max Consecutive Losses: 8
Worst Case Drawdown: ($3,403.71)	Return/Drawdown Ratio: 3.646
Worst Case Drawdown (%): 3.181%	Modified Sharpe Ratio: 0.2508
Average Drawdown: ($1,402.43)	
Average Drawdown (%): 1.310%	

Figure 3 Monte Carlo Analysis (TSLA)

Market System: PatsTrades-Tesla

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	-2.270	3.280	0.000	-0.1370
60	-2.820	3.668	0.000	-0.1728
70	-3.415	4.114	0.000	-0.2147
80	-4.030	4.628	0.000	-0.2594
85	-4.425	4.945	0.000	-0.2880
90	-4.885	5.365	0.000	-0.3262
91	-5.010	5.475	0.000	-0.3362
92	-5.140	5.580	0.000	-0.3460
93	-5.280	5.695	0.000	-0.3577
94	-5.455	5.825	0.000	-0.3708
95	-5.620	5.970	0.000	-0.3855
96	-5.815	6.140	0.000	-0.4022
97	-6.025	6.333	0.000	-0.4250
98	-6.335	6.595	0.000	-0.4517
99	-6.805	7.060	0.000	-0.4941
100	-9.415	9.415	0.000	-0.7505

Figure 4 Monte Carlo Confidence Results (TSLA)

The analysis plots the potential shaded area for trades to be made with limits of 5% confidence and 95% confidence. The bands in this analysis are rather far apart and the confidence levels as seen in **Figure 4**, entail that the system statistically is not profitable for Tesla because within the probability distribution the rate of return is negative.

When forecasting the probability that a strategy will remain effective in the future, MSA can predict 30 trades into the future, allowing another Monte Carlo analysis to take place, as seen

in **Figure 5**. The downward slope in combination with a rather large separation between the bands shows a confident prediction of future loss. The corresponding analysis reports are located in **Figure 6** and **Figure 7.** The future Monte Carlo analysis agreed with confidence parameters entailing that the system may have been over fit to back- testing results as the future probability shows a negative rate of return.

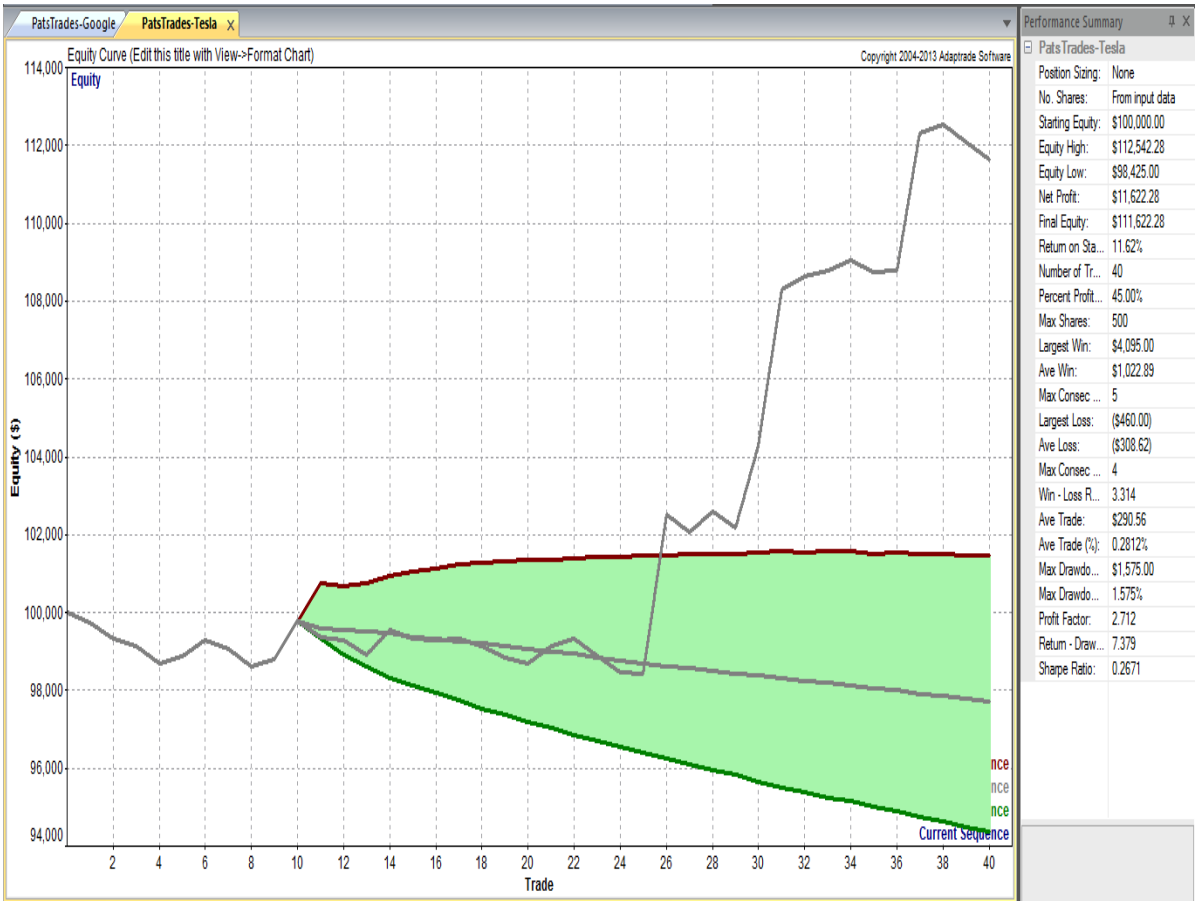


Figure 5 "30 Trades Ahead" Monte Carlo Analysis (TSLA)

Market System: PatsTrades-Tesla

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	-2.270	3.280	0.000	-0.1370
60	-2.820	3.668	0.000	-0.1728
70	-3.415	4.114	0.000	-0.2147
80	-4.030	4.628	0.000	-0.2594
85	-4.425	4.945	0.000	-0.2880
90	-4.885	5.365	0.000	-0.3262
91	-5.010	5.475	0.000	-0.3362
92	-5.140	5.580	0.000	-0.3460
93	-5.280	5.695	0.000	-0.3577
94	-5.455	5.825	0.000	-0.3708
95	-5.620	5.970	0.000	-0.3855
96	-5.815	6.140	0.000	-0.4022
97	-6.025	6.333	0.000	-0.4250
98	-6.335	6.595	0.000	-0.4517
99	-6.805	7.060	0.000	-0.4941
100	-9.415	9.415	0.000	-0.7505

Figure 6 "30 Trades Ahead" Monte Carlo Report (TSLA)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: ($5,620.00)
Final Account Equity: $94,380.00
Return on Starting Equity: -5.620%
Profit Factor: 0.4210

Largest Winning Trade: $985.00
Largest Winning Trade (%): 0.9970%
Average Winning Trade: $297.78
Average Winning Trade (%): 0.3020%

Average Trade: ($140.50)
Average Trade (%): -0.1437%
Trade Standard Deviation: $476.57
Trade Standard Deviation (%): 0.4781%

Worst Case Drawdown: ($5,975.00)
Worst Case Drawdown (%): 5.970%
Average Drawdown: ($5,720.00)
Average Drawdown (%): 5.720%

Max Number of Shares: 500
Minimum Number of Shares: 500
Average Number of Shares: 500

Largest Losing Trade: ($460.00)
Largest Losing Trade (%): -0.4834%
Average Losing Trade: ($372.22)
Average Losing Trade (%): -0.3771%

Win/Loss Ratio: 0.8657
Win/Loss Ratio (%/%): 0.8675
Max Consecutive Wins: 2
Max Consecutive Losses: 10

Return/Drawdown Ratio: 0.000
Modified Sharpe Ratio: -0.3855

Figure 7 "30 Trades Ahead" Monte Carlo Report (TSLA)

MSA offers a position sizing input that allows a fixed position size percentage, strategy specific to the individual stock. This position size can be optimized to achieve the highest net profit possible. The optimization begins with a 2% of equity position size and was optimized to 0.5843% as seen in **Figure 8.** This optimization brought the system net profit from $11,622 to 12,199 over the 5 year time frame. The trades plotted over the ideal equity, as well as the optimized performance summary can be observed in **Figure 9** below.

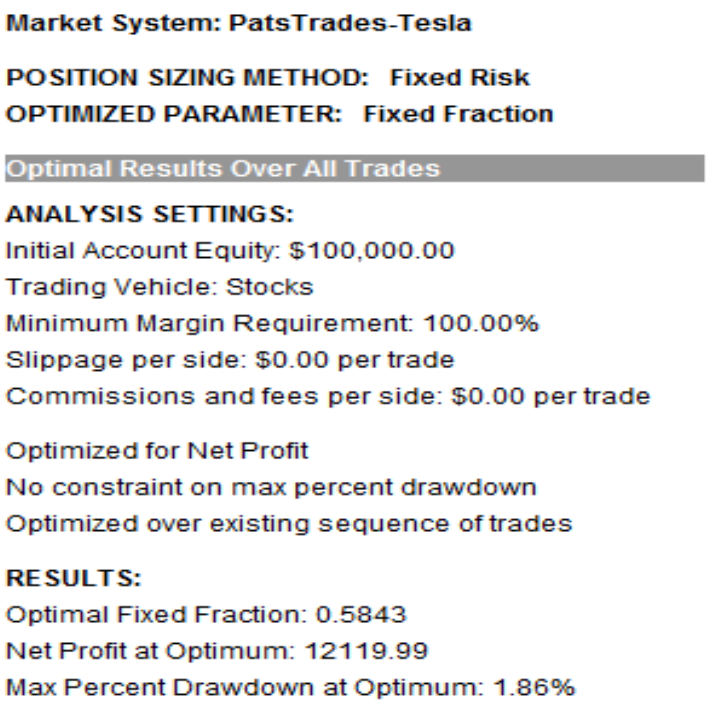


Figure 8 Optimal Position Size for Net Profit Report (TSLA)

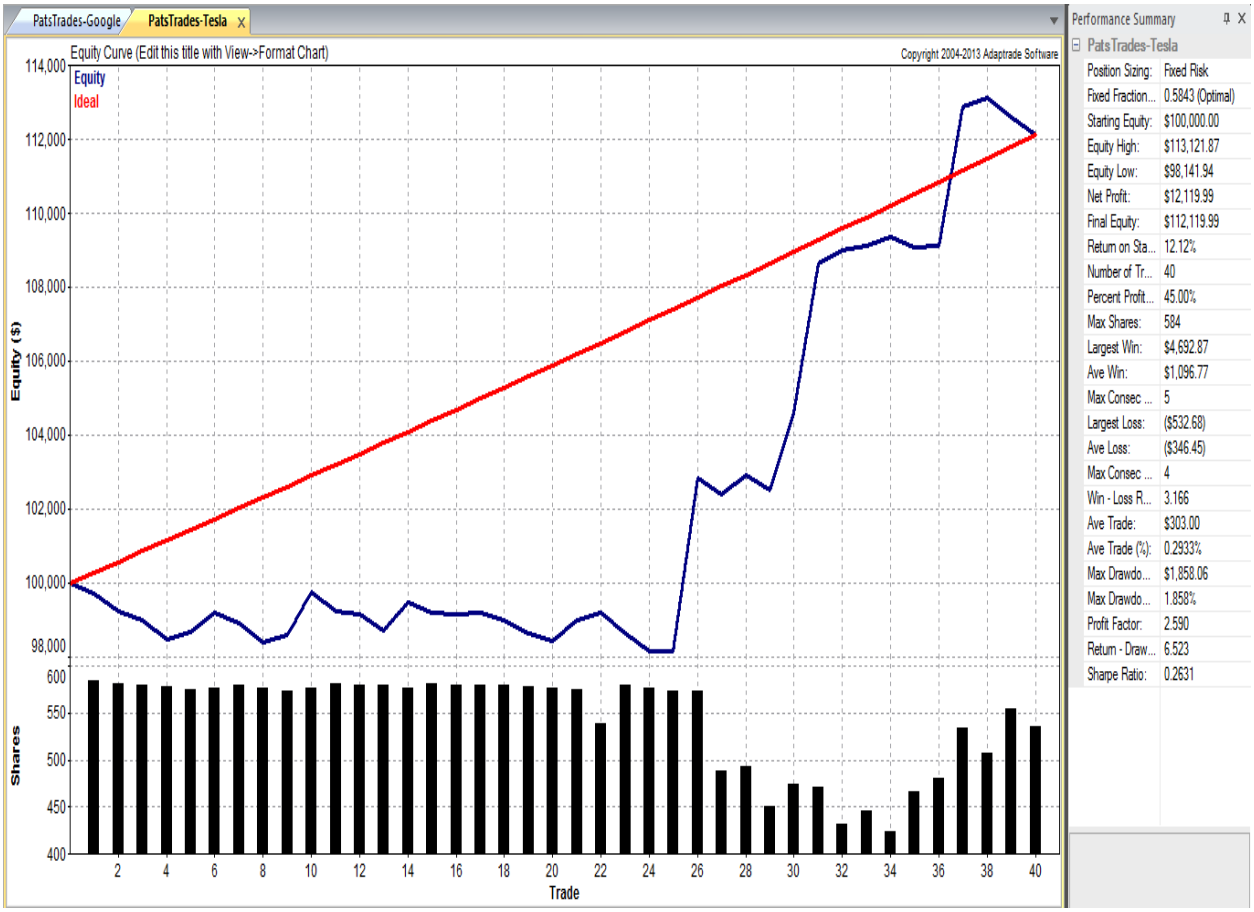


Figure 9 Optimal Position Size for Net Profit Performance (TSLA)

The position sizing optimization for the highest rate of return as shown below in **Figure 10**, remained the same as the value for net profit at 0.5843%, which had a rate of return of 12.12% and a max draw down of 1.86%. This is a small fraction of equity for a position size, yet its profitability is effective to add to the portfolio. **Figure 11** shows the performance graph of the optimal rate of return position size.

Market System: PatsTrades-Tesla

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 0.5843
Rate of Return at Optimum: 12.12
Max Percent Drawdown at Optimum: 1.86%

Figure 10 Optimal Position Sizing for Rate of Return Report (TSLA)

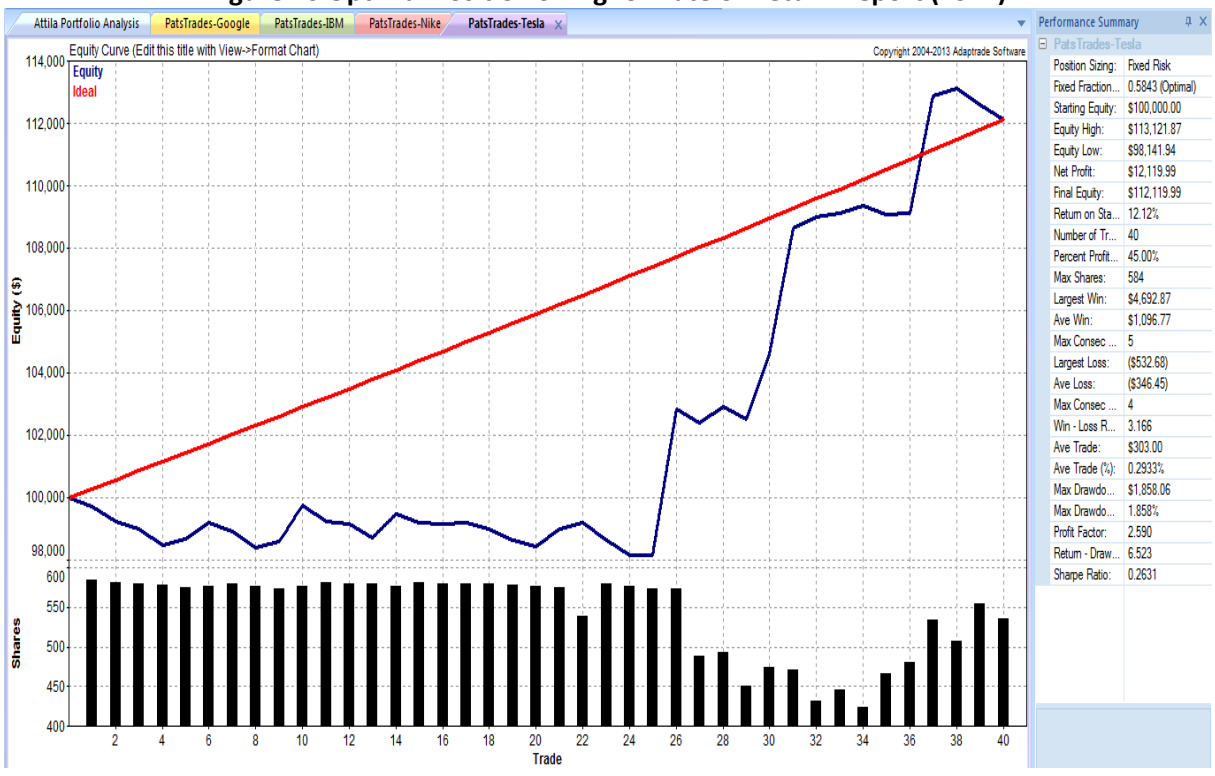


Figure 11 Optimal Position Sizing for Rate of Return Performance

AMA Strategy Analysis- IBM INC

The analysis of the Adaptive Moving Average strategy when implemented on IBM stock begins with an account size of $100,000 with the opportunity to trade up to 1,000,000 shares. The multiple exit values assigned to the IBM stock are as follows; 1. $500 Stop Loss 2. ($2000,15%) Percent Trailing Stop 3. $500 Dollar Trailing Stop 4. $5,000 Profit Target Exit. The strategy's trades plotted in relation to equity available at each individual trade can be found in **Figure 12.**

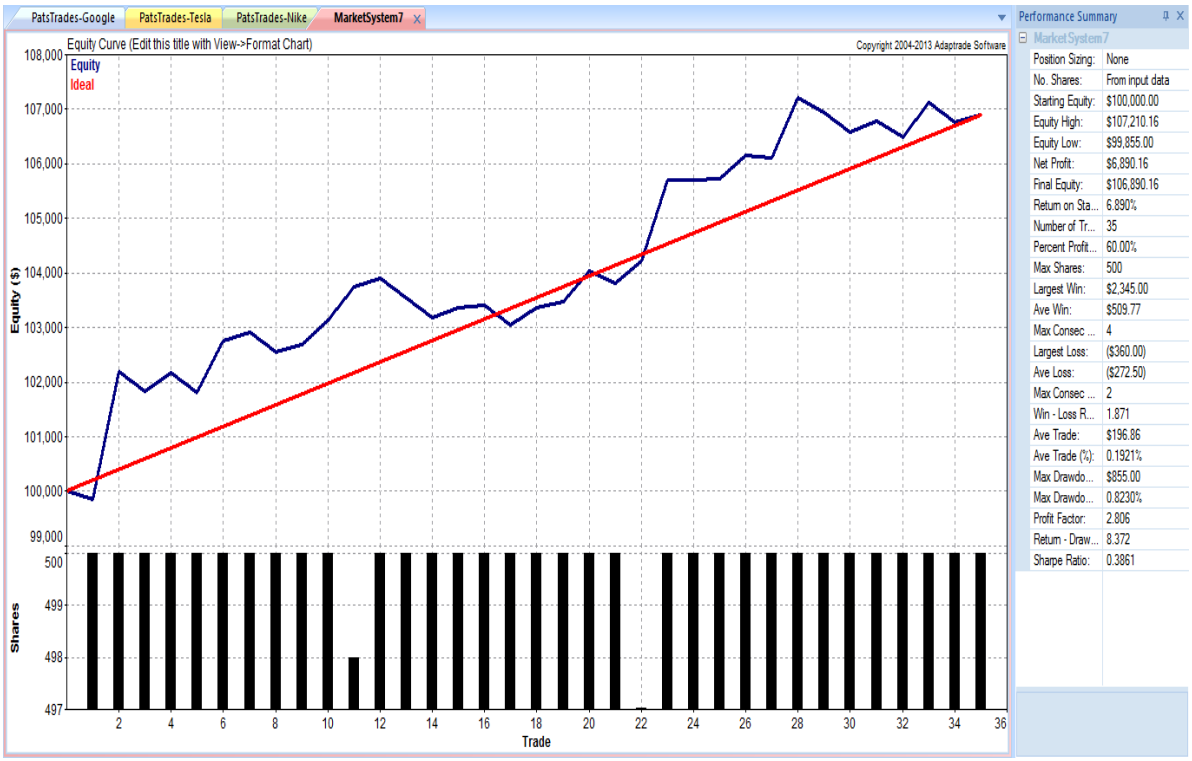


Figure 12 Performance Report (IBM)

Over the 5 year time frame of Trade Station back testing the Adaptive Moving Average Strategy implemented on IBM Inc stock gained a net profit of $6,890.16, making profitable trades 60% of the time out of 35 trades. The system had a rate of return of 6.890% and a max draw down of only $855.00. The profit factor for this strategy reached 2.86 with average winning trades of $509.77 and average losing trades of $272.50.

To ensure strategic validity for the AMA strategy with IBM stock, the system was tested with Monte Carlo analysis to gain a more confident probability distribution because of the randomness of trades. The graph complete with the confidence bands can be seen below in **Figure 13.** It can be observed that these bands are rather far apart showing a wide probability distribution and a positive upward trend.

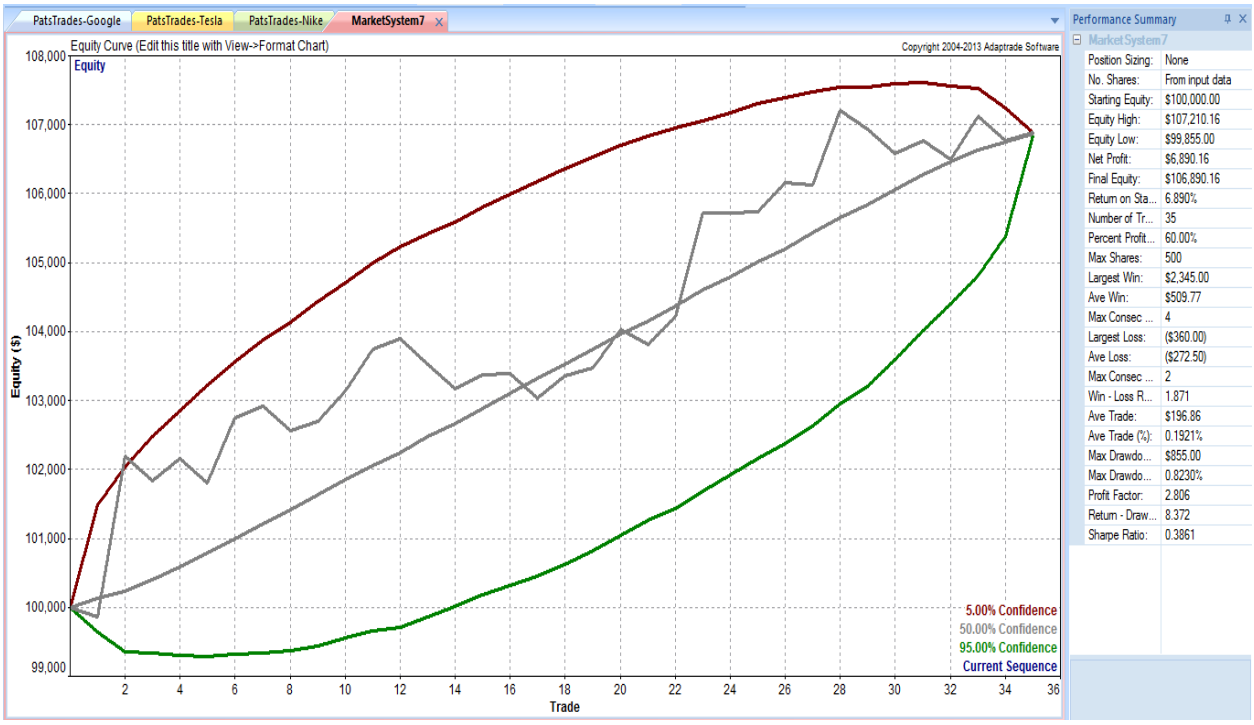


Figure 13 Monte Carlo Analysis (IBM)

The Monte Carlo analysis reports shown below in **Figure 14** and **Figure 15** entail that the system has a 95% probability of gaining 6.841% return on starting equity. There is a 50% confidence level of reaching 6.872% and 100% confidence level of reaching 6.785% rate of return. These numbers are rather consistent and statistically show a stable implementation of the AMA strategy upon IBM stock.

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $6,841.28	Max Number of Shares: 500
Final Account Equity: $106,841.28	Minimum Number of Shares: 477
Return on Starting Equity: 6.841%	Average Number of Shares: 498
Profit Factor: 2.794	
Largest Winning Trade: $2,345.00	Largest Losing Trade: ($360.00)
Largest Winning Trade (%): 2.237%	Largest Losing Trade (%): -0.3626%
Average Winning Trade: $507.33	Average Losing Trade: ($272.50)
Average Winning Trade (%): 0.4913%	Average Losing Trade (%): -0.2689%
Average Trade: $195.47	Win/Loss Ratio: 1.863
Average Trade (%): 0.1908%	Win/Loss Ratio (%/%): 1.851
Trade Standard Deviation: $586.80	Max Consecutive Wins: 4
Trade Standard Deviation (%): 0.5775%	Max Consecutive Losses: 5
Worst Case Drawdown: ($1,834.80)	Return/Drawdown Ratio: 3.891
Worst Case Drawdown (%): 1.765%	Modified Sharpe Ratio: 0.3317
Average Drawdown: ($847.50)	
Average Drawdown (%): 0.8131%	

Figure 14 Monte Carlo Analysis Report (IBM)

Market System: MarketSystem7

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	6.872	1.067	6.439	0.3355
60	6.868	1.152	5.963	0.3350
70	6.863	1.259	5.455	0.3344
80	6.857	1.380	4.979	0.3336
85	6.853	1.465	4.685	0.3332
90	6.848	1.581	4.347	0.3326
91	6.847	1.608	4.269	0.3325
92	6.846	1.639	4.188	0.3323
93	6.845	1.679	4.085	0.3321
94	6.843	1.717	3.997	0.3319
95	6.841	1.765	3.891	0.3317
96	6.839	1.822	3.767	0.3314
97	6.837	1.887	3.642	0.3310
98	6.834	1.987	3.455	0.3305
99	6.829	2.116	3.236	0.3298
100	6.785	2.898	2.371	0.3264

Figure 15 Monte Carlo Confidence Levels (IBM)

Using Market System Analysis to forecast the future trades of the strategy, 30 trades are developed to ensure that the strategy will hold true to previous analysis. As you can see below in

Figure 16, the graph shows a positive upward sloping line with the bands averagely far apart. The confidence levels from **Figure 17** and **Figure 18** range from a 50% level, with a rate of return of 17.14%, to the 99% confidence level which has a 4.34% rate of return. The 95% confidence level had a rate of return of 7.695%.

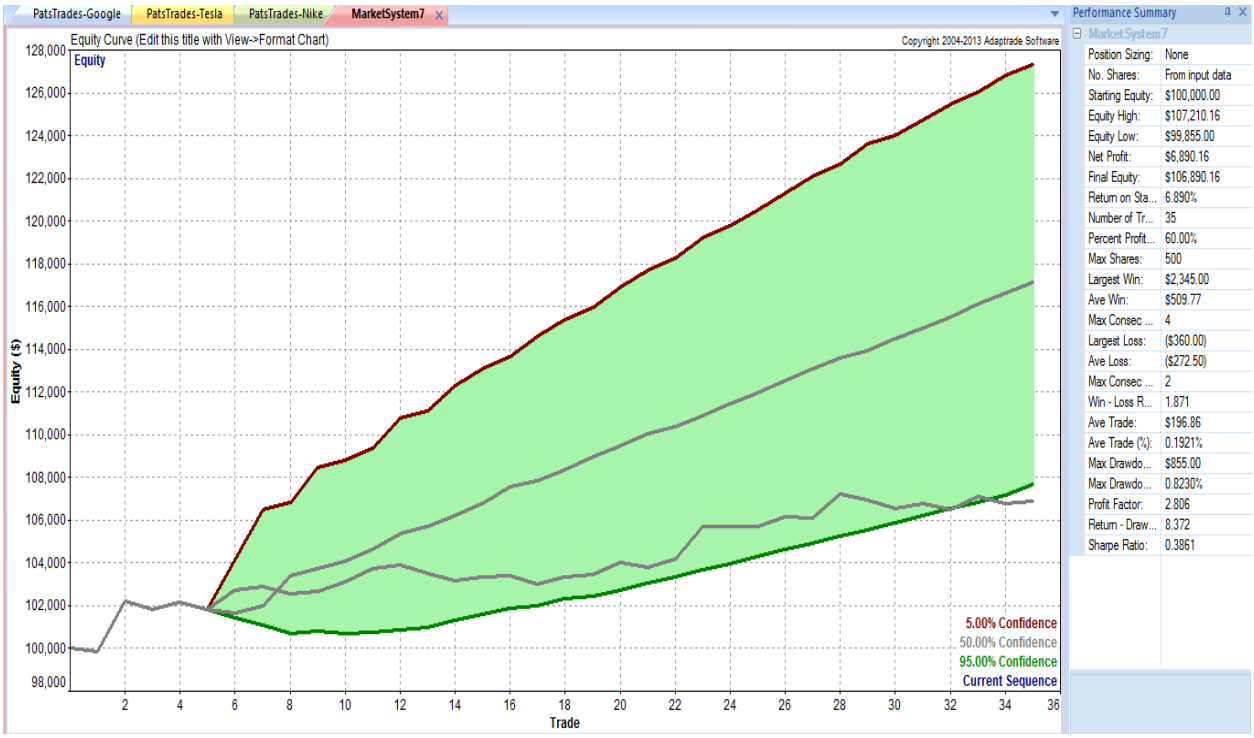


Figure 16 "30 Trades Ahead" Monte Carlo Analysis (IBM)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $7,695.00	Max Number of Shares: 500
Final Account Equity: $107,695.00	Minimum Number of Shares: 500
Return on Starting Equity: 7.695%	Average Number of Shares: 500
Profit Factor: 2.161	
Largest Winning Trade: $2,345.00	Largest Losing Trade: ($360.00)
Largest Winning Trade (%): 2.348%	Largest Losing Trade (%): -0.3579%
Average Winning Trade: $956.25	Average Losing Trade: ($334.71)
Average Winning Trade (%): 0.9173%	Average Losing Trade (%): -0.3126%
Average Trade: $219.86	Win/Loss Ratio: 3.119
Average Trade (%): 0.2158%	Win/Loss Ratio (%/%): 3.148
Trade Standard Deviation: $1,224.06	Max Consecutive Wins: 2
Trade Standard Deviation (%): 1.107%	Max Consecutive Losses: 8
Worst Case Drawdown: ($2,735.00)	Return/Drawdown Ratio: 3.425
Worst Case Drawdown (%): 2.576%	Modified Sharpe Ratio: 0.2425
Average Drawdown: ($1,038.33)	
Average Drawdown (%): 0.9808%	

Figure 17 "30 Trades Ahead" Monte Carlo Report (IBM)

Market System: MarketSystem7

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	17.14	1.304	13.02	0.4482
60	15.59	1.443	10.95	0.4163
70	14.00	1.608	9.042	0.3847
80	12.20	1.830	7.052	0.3456
85	11.08	1.990	5.987	0.3209
90	9.715	2.202	4.888	0.2895
91	9.320	2.263	4.631	0.2820
92	9.030	2.324	4.408	0.2743
93	8.595	2.400	4.047	0.2659
94	8.125	2.500	3.793	0.2546
95	7.695	2.576	3.425	0.2425
96	7.050	2.707	3.099	0.2281
97	6.365	2.849	2.700	0.2095
98	5.600	3.028	2.188	0.1866
99	4.345	3.374	1.569	0.1557
100	-2.220	5.920	0.000	-0.09372

Figure 18 "30 Trades Ahead" Monte Carlo Report (IBM)

MSA has the unique feature of a fixed position size that can be optimized to obtain the highest level of net profit, profit factor, rate of return and many other applications. Starting with a 2% fixed position and optimizing for maximum possible net profit, the position size calculated

was 10%. This optimization brought the net profit levels from $6,890.16 to $7,545.55 as shown in **Figure 19** and **Figure 20** below. The max draw down of this optimization fraction was 0.89%.

Market System: MarketSystem7

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Net Profit at Optimum: 7545.55
Max Percent Drawdown at Optimum: 0.89%

Figure 19 Optimal Position Sizing for Net Profit Report (IBM)

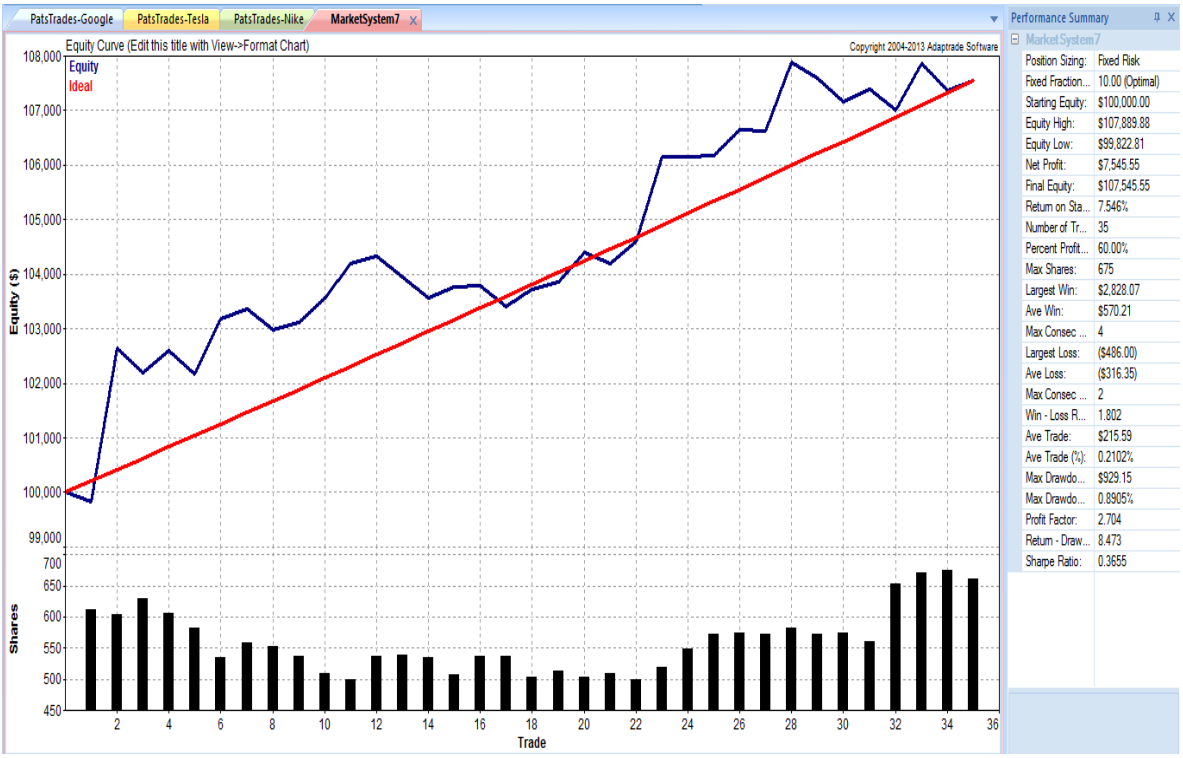


Figure 20 Optimal Position Size for Net Profit Performance (IBM)

The optimal position sizing for maximum rate of return stayed consistent with the net profit optimization at 10%. This optimization as shown in **Figure 21** and **Figure 22** increased the rate of return from 6.890% to 7.546% with a max draw down of 0.89%

Market System: PatsTrades-IBM

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 7.546
Max Percent Drawdown at Optimum: 0.89%

Figure 21 Optimal Position Sizing for Rate of Return Report (IBM)

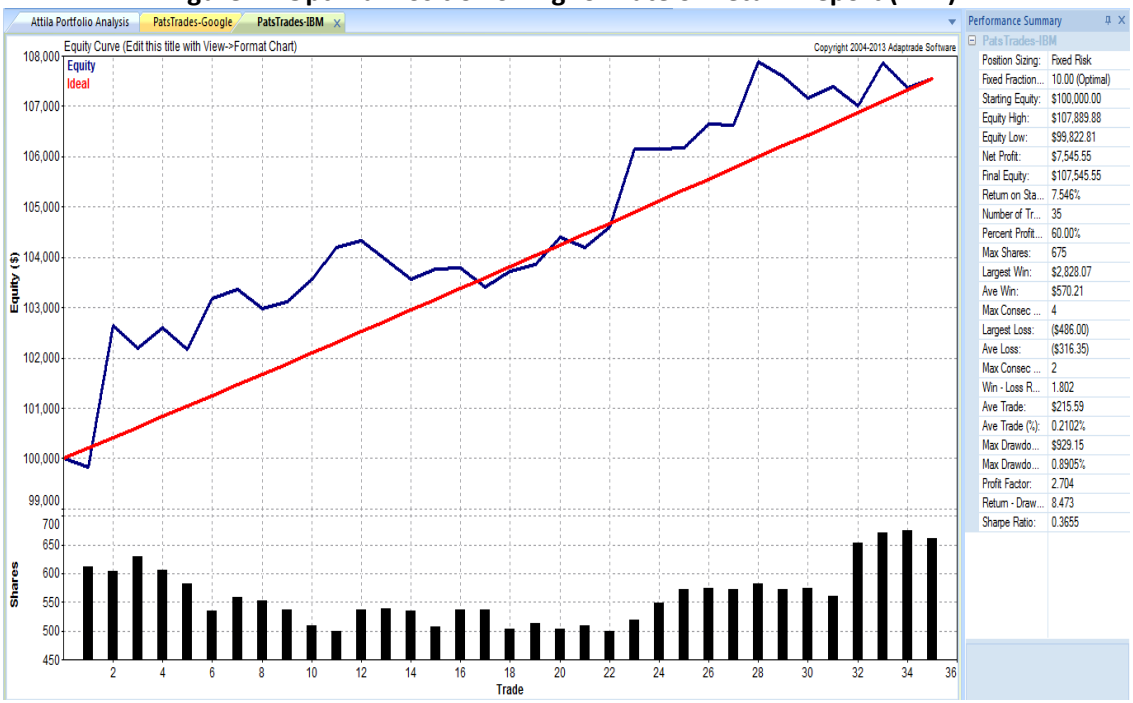


Figure 22 Optimal Position Sizing for Rate of Return Performance (IBM)

AMA Strategy Analysis- Nike Inc

The analysis of the Adaptive Moving Average strategy when implemented on Nike stock begins with an account size of $100,000 with the opportunity to trade up to 1,000,000 shares. The multiple exit values assigned to the NKE stock are as follows; 1. $500 Stop Loss 2. ($1500,15%) Percent Trailing Stop 3. $450 Dollar Trailing Stop 4. $5,000 Profit Target Exit. The strategy's trades plotted in relation to equity available at each individual trade can be found in **Figure 23.**

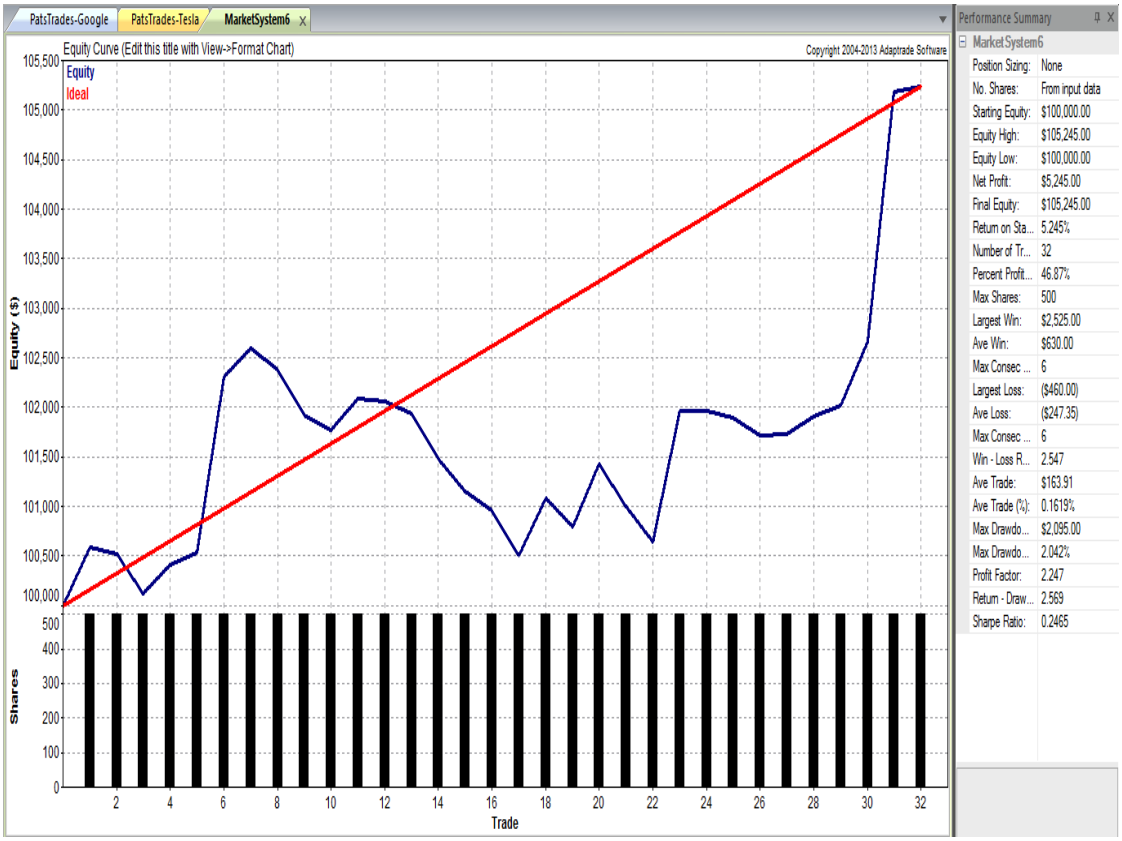


Figure 19 Performance Summary (NKE)

As shown in the performance summary of **Figure 23** above, the strategy traded 32 times over the 5 year back-testing period achieving a net profit of $5,245 with a profit factor of 2.247. The strategy was profitable in 46.87% of trades averaging $630.00 per winning trade and $247.35 per losing trade. The max draw down was 2.042% and the rate of return for the Adaptive Moving Average strategy was 5.245% for Nike stock.

The Monte Carlo analysis tested for the AMA strategy on Nike stock can be seen below in **Figure 24.** This test allows a more confident analysis of the strategies success based of 10,000 runs of randomization. The corresponding Monte Carlo performance reports are shown below in **Figure 25** and **Figure 26.** The graph of the Monte Carlo Analysis in **Figure 24** shows an upward trend with a rather large probability distribution between the two outer confidence bands. The confidence levels remain the same for the rate of return through **Figure 26**, reaching 5.245%.

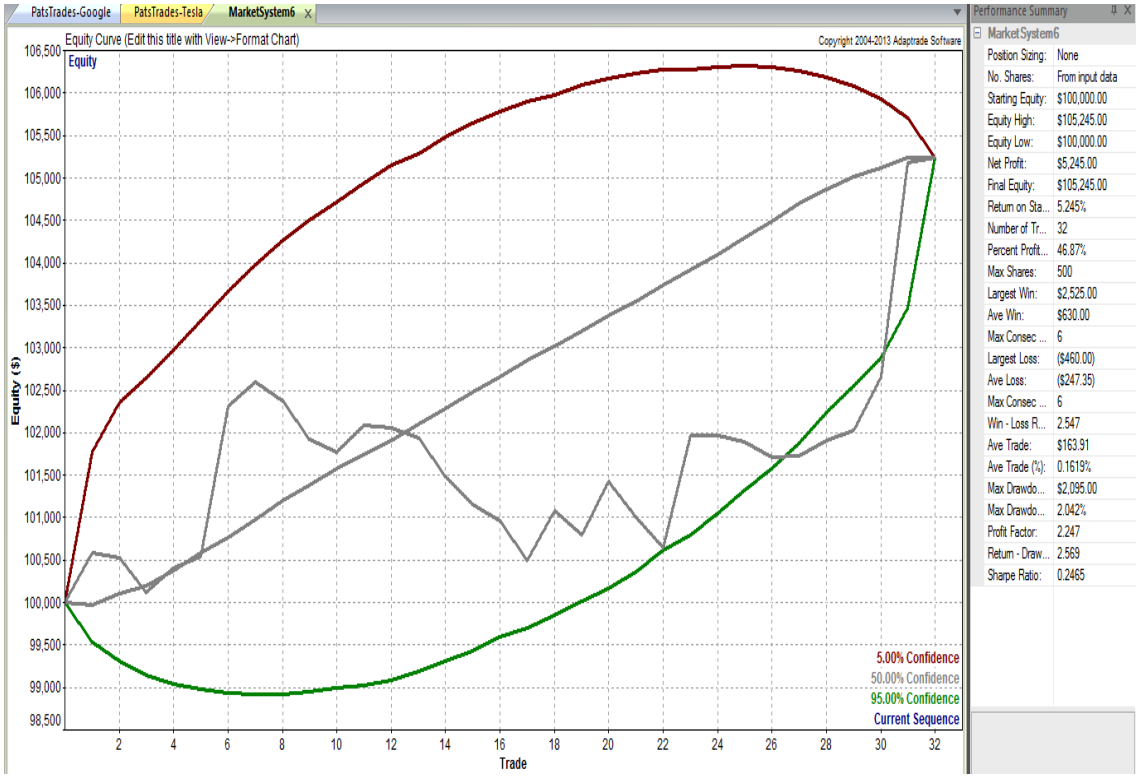


Figure 24 Monte Carlo Analysis (NKE)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $5,245.00	Max Number of Shares: 500
Final Account Equity: $105,245.00	Minimum Number of Shares: 500
Return on Starting Equity: 5.245%	Average Number of Shares: 500
Profit Factor: 2.247	
Largest Winning Trade: $2,525.00	Largest Losing Trade: ($460.00)
Largest Winning Trade (%): 2.439%	Largest Losing Trade (%): -0.4640%
Average Winning Trade: $630.00	Average Losing Trade: ($247.35)
Average Winning Trade (%): 0.6124%	Average Losing Trade (%): -0.2460%
Average Trade: $163.91	Win/Loss Ratio: 2.547
Average Trade (%): 0.1619%	Win/Loss Ratio (%/%): 2.538
Trade Standard Deviation: $664.65	Max Consecutive Wins: 2
Trade Standard Deviation (%): 0.6603%	Max Consecutive Losses: 7
Worst Case Drawdown: ($2,355.00)	Return/Drawdown Ratio: 2.314
Worst Case Drawdown (%): 2.266%	Modified Sharpe Ratio: 0.2453
Average Drawdown: ($1,083.33)	
Average Drawdown (%): 1.047%	

Figure 25 Monte Carlo Report (NKE)

Market System: MarketSystem6

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	5.245	1.395	3.760	0.2480
60	5.245	1.506	3.482	0.2476
70	5.245	1.626	3.225	0.2472
80	5.245	1.785	2.938	0.2466
85	5.245	1.901	2.759	0.2463
90	5.245	2.046	2.564	0.2459
91	5.245	2.084	2.517	0.2458
92	5.245	2.114	2.481	0.2457
93	5.245	2.157	2.431	0.2456
94	5.245	2.206	2.378	0.2455
95	5.245	2.266	2.314	0.2453
96	5.245	2.341	2.241	0.2451
97	5.245	2.417	2.170	0.2449
98	5.245	2.526	2.077	0.2446
99	5.245	2.698	1.944	0.2441
100	5.245	3.477	1.509	0.2418

Figure 26 Monte Carlo Analysis Report (NKE)

In order to determine if the tested strategy will hold in the future, MSA uses a feature that projects the predicted 30 future trades. Taking these trades and running Monte Carlo analysis tests upon them allows further confidence of future success based off probability. The graph of these future projections can be seen below in **Figure 27**. The bands of the Monte Carlo analysis are close together, which is a good sign for the probability distribution, however, the trade line plotted breaks through the lower band suggesting the confidence levels will be towards the lower end of the probability distribution. **Figure 28** and **Figure 29** show the Monte Carlo analysis reports with each confidence level and corresponding rate of return values and max draw down percentages.

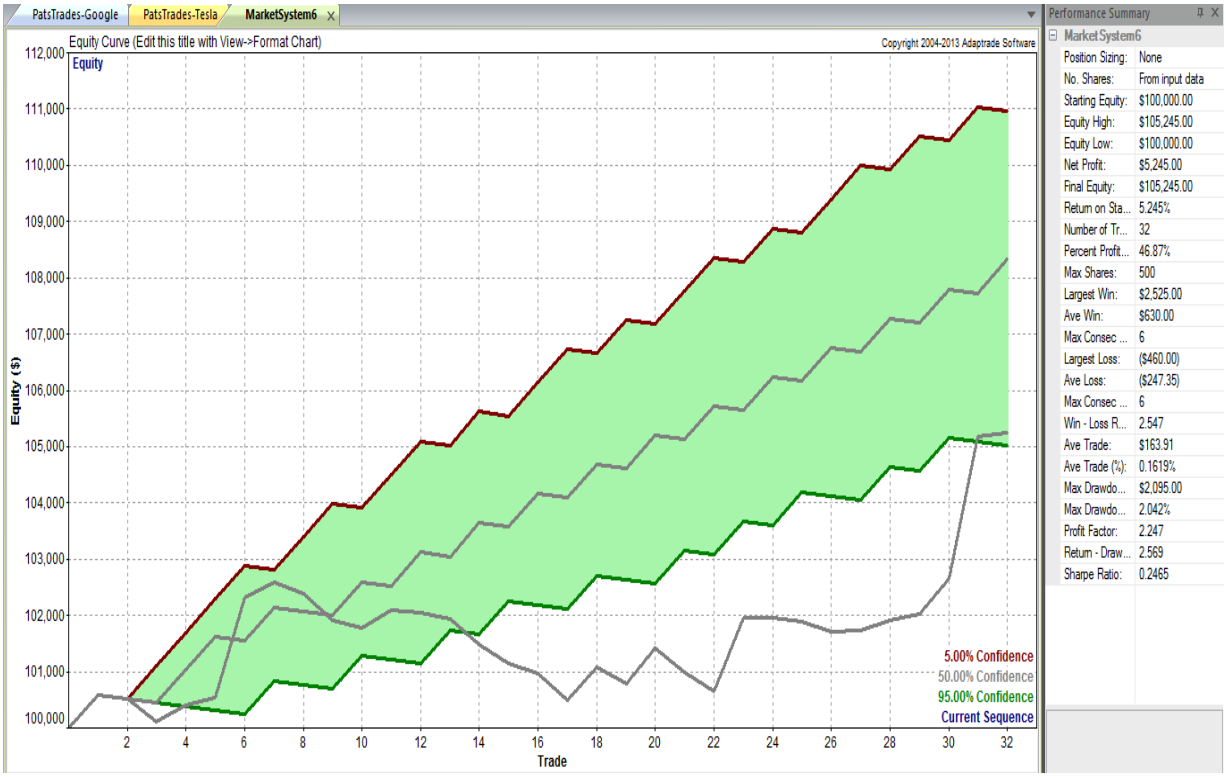


Figure 27 "30 Trades Ahead" Monte Carlo Analysis (NKE)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $5,020.00
Final Account Equity: $105,020.00
Return on Starting Equity: 5.020%
Profit Factor: 4.415

Largest Winning Trade: $590.00
Largest Winning Trade (%): 0.5900%
Average Winning Trade: $590.00
Average Winning Trade (%): 0.5609%

Average Trade: $156.88
Average Trade (%): 0.1537%
Trade Standard Deviation: $335.28
Trade Standard Deviation (%): 0.3237%

Worst Case Drawdown: ($560.00)
Worst Case Drawdown (%): 0.5297%
Average Drawdown: ($210.00)
Average Drawdown (%): 0.2041%

Max Number of Shares: 500
Minimum Number of Shares: 500
Average Number of Shares: 500

Largest Losing Trade: ($70.00)
Largest Losing Trade (%): -0.06978%
Average Losing Trade: ($70.00)
Average Losing Trade (%): -0.06843%

Win/Loss Ratio: 8.429
Win/Loss Ratio (%/%): 8.347
Max Consecutive Wins: 2
Max Consecutive Losses: 8

Return/Drawdown Ratio: 11.44
Modified Sharpe Ratio: 0.4946

Figure 28 "30 Days Ahead" Monte Carlo Analysis (NKE)

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

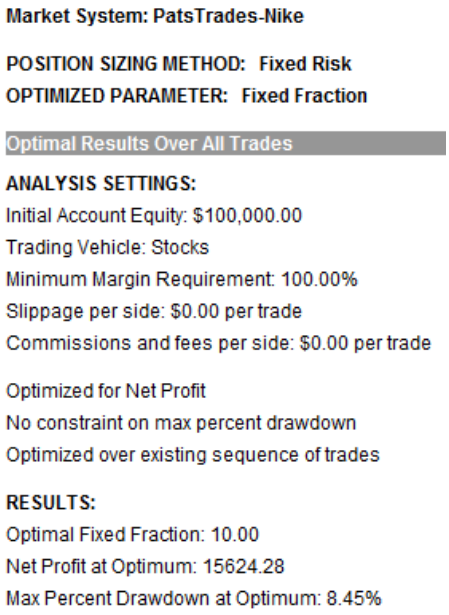
Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	8.320	0.2729	29.68	0.7754
60	7.660	0.2784	25.83	0.7165
70	7.000	0.3373	22.58	0.6605
80	7.000	0.3907	18.55	0.6567
85	6.340	0.4078	16.76	0.6024
90	5.680	0.4594	14.42	0.5494
91	5.680	0.4678	13.82	0.5482
92	5.680	0.4745	13.30	0.5476
93	5.680	0.4813	12.59	0.5471
94	5.680	0.4871	12.04	0.5464
95	5.020	0.5297	11.44	0.4946
96	5.020	0.5451	10.50	0.4936
97	5.020	0.5567	9.532	0.4929
98	4.360	0.6122	8.862	0.4407
99	4.360	0.6693	7.266	0.4385
100	1.720	1.158	1.556	0.2061

Figure 29 "30 Days Ahead Monte Carlo Analysis (NKE)

Upon optimizing the fixed position size for the AMA strategy on Nike stock, the net profit increased substantially from $5,245 to $15,624. The results can be seen in **Figure 30** and **Figure 31** This increase in net profit did increase the draw down from 2.042% to 8.45% at the optimum position size, which could be an area of concern. The optimal position size for maximum net profit was 10%.


Market System: PatsTrades-Nike

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Net Profit at Optimum: 15624.28
Max Percent Drawdown at Optimum: 8.45%

Figure 30 Optimal Position Sizing for Net Profit Report (NKE)

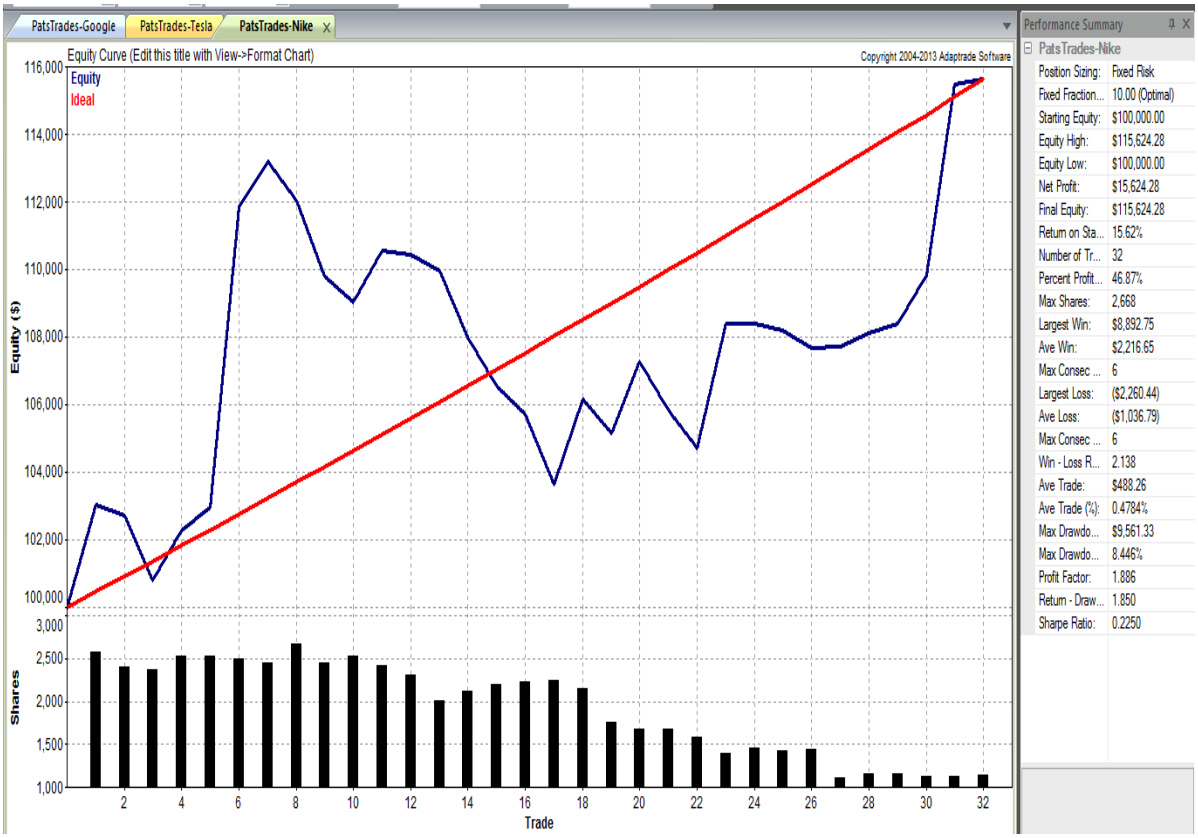


Figure 31 Net Profit Optimal Position Size Performance (NKE)

Upon optimization of position size focused on maximum rate of return, there was no change in the fixed fraction position size of 10%. It can be seen in **Figure 32** and **Figure 33** that the 10% optimal position size was already achieving a rate of return of 15.62%. This is a quality return relative to the initial performance summary which had a rate of return of 5.245%.

Market System: PatsTrades-Nike

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 15.62
Max Percent Drawdown at Optimum: 8.45%

Figure 32 Optimal Position Sizing for Rate of Return Report (NKE)

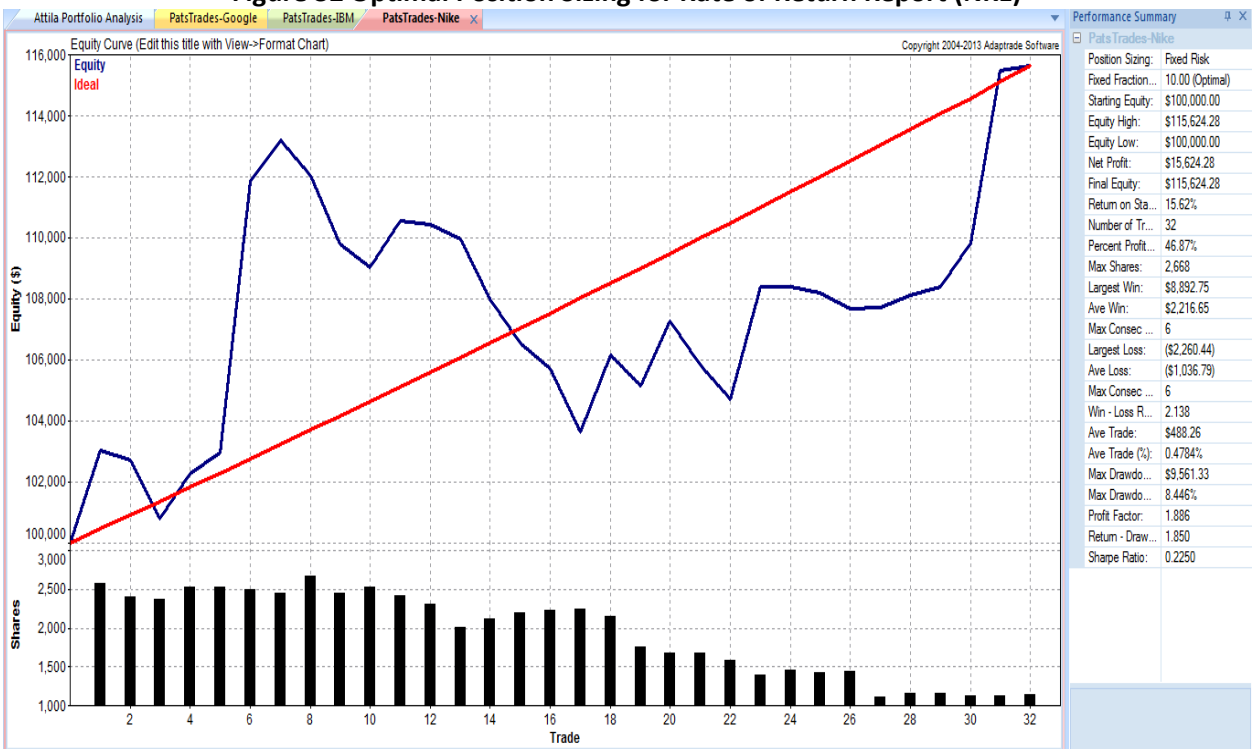


Figure 33 Optimal Position Sizing for Rate of Return Performance (NKE)

AMA Strategy Analysis- Google Inc Class A

The analysis of the Adaptive Moving Average strategy when implemented with Google Class A stock begins with an account size of $100,000 with the opportunity to trade up to 1,000,000 shares. The multiple exit values assigned to the Google stock are as follows; 1. $800 Stop Loss 2. ($9000,15%) Percent Trailing Stop 3. $800 Dollar Trailing Stop 4. $10,000 Profit Target Exit. The strategy's trades plotted relative to available equity at each individual trade can be found in **Figure 34.**

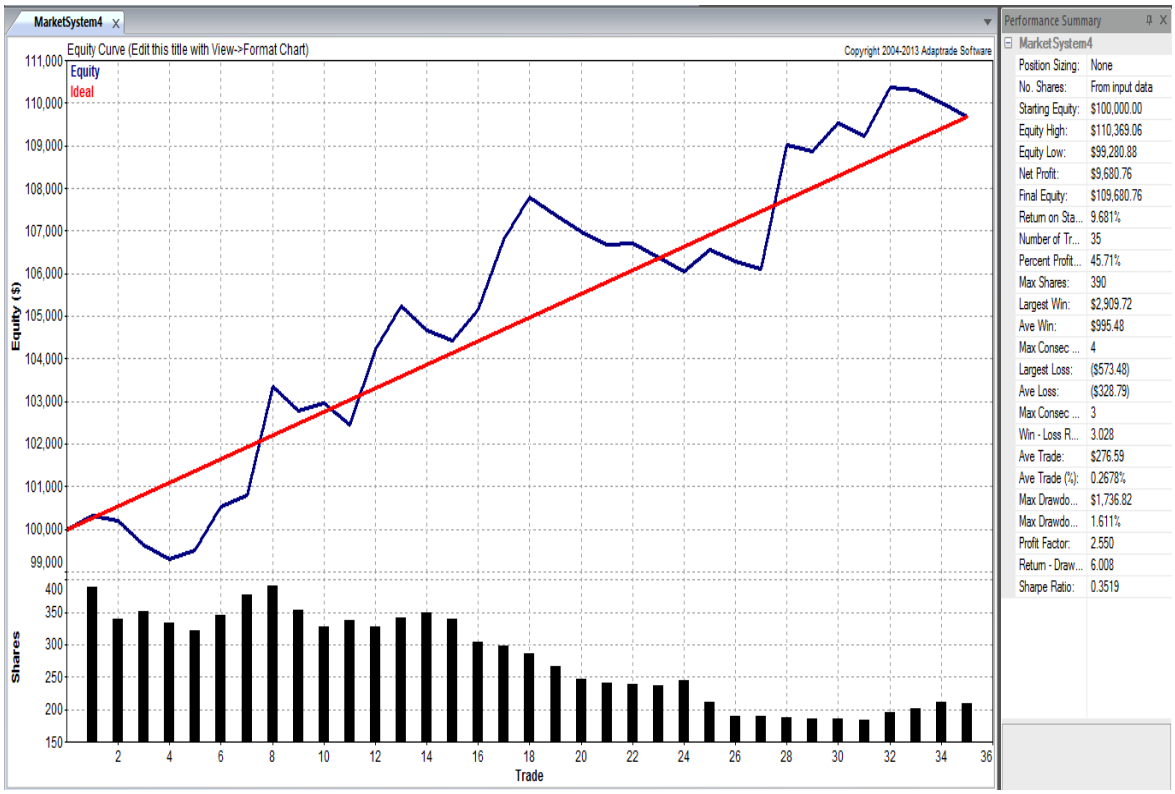


Figure 34 Back Testing Performance Report (GOOGL)

The above graph in **Figure 34** shows the plotted trades in blue with the ideal equity curve in red. The AMA strategy when implemented on Google Class A stock traded 35 times for 45.71% profitability over the 5 year back testing period. Its net profit reached $9,680.76 with an average winning trade of $995.48 and an average losing trade of $328.79. The max draw down

reached 1.611% and the rate of return of the system was 9.681%. The AMA strategy had a profit factor of 2.550.

Running the AMA strategy through Monte Carlo analysis helps better forecast the performance of the system by randomizing the trades 10,000 times in order to test the strategy's validity. The Monte Carlo analysis for the AMA strategy implemented on Google stock can be found in **Figure 35.** Accompanying the Monte Carlo analysis is its corresponding performance report found in **Figure 36** and **Figure 37.**

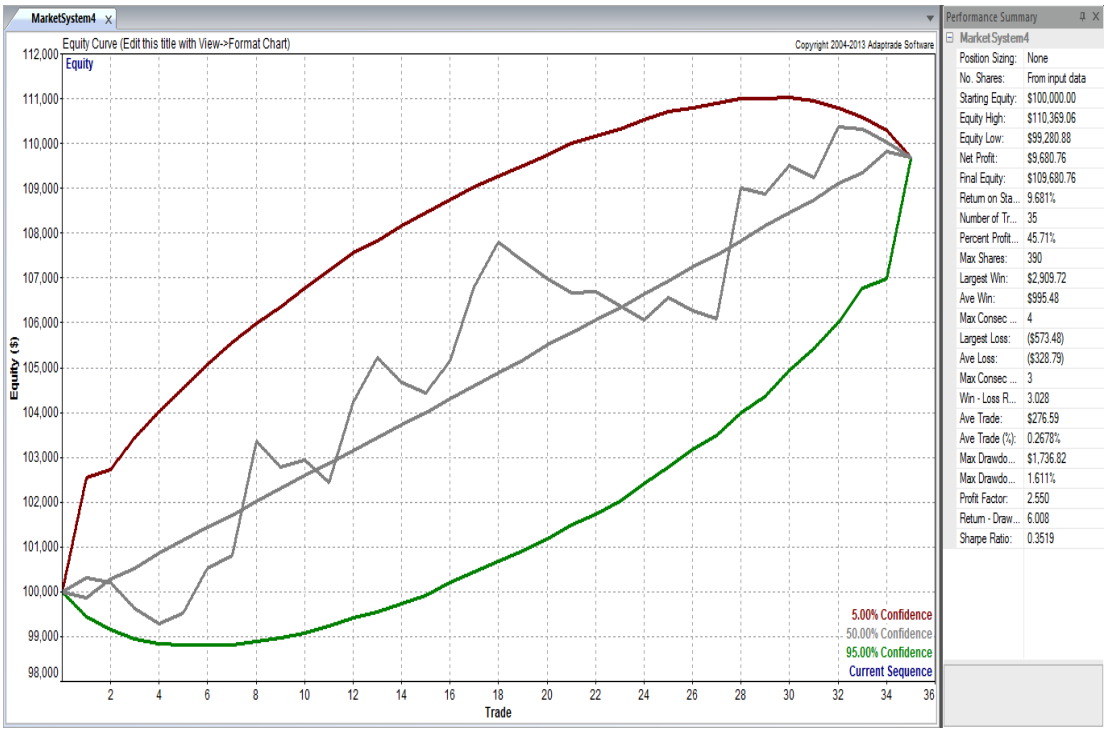


Figure 35 Monte Carlo Analysis (GOOGL)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $9,673.78
Final Account Equity: $109,673.78
Return on Starting Equity: 9.674%
Profit Factor: 2.509

Max Number of Shares: 395
Minimum Number of Shares: 167
Average Number of Shares: 272

Largest Winning Trade: $2,723.00
Largest Winning Trade (%): 2.738%
Average Winning Trade: $982.63
Average Winning Trade (%): 0.9561%

Largest Losing Trade: ($630.18)
Largest Losing Trade (%): -0.5697%
Average Losing Trade: ($337.68)
Average Losing Trade (%): -0.3122%

Average Trade: $276.39
Average Trade (%): 0.2676%
Trade Standard Deviation: $893.27
Trade Standard Deviation (%): 0.8480%

Win/Loss Ratio: 2.980
Win/Loss Ratio (%/%): 3.063
Max Consecutive Wins: 2
Max Consecutive Losses: 8

Worst Case Drawdown: ($2,981.94)
Worst Case Drawdown (%): 2.797%
Average Drawdown: ($1,193.62)
Average Drawdown (%): 1.127%

Return/Drawdown Ratio: 3.460
Modified Sharpe Ratio: 0.3160

Figure 36 Monte Carlo Report (GOOGL)

Market System: MarketSystem4

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	9.684	1.734	5.588	0.3162
60	9.683	1.862	5.201	0.3161
70	9.681	2.014	4.810	0.3161
80	9.679	2.215	4.371	0.3161
85	9.677	2.349	4.123	0.3161
90	9.676	2.525	3.837	0.3160
91	9.676	2.567	3.774	0.3160
92	9.675	2.615	3.703	0.3160
93	9.675	2.663	3.637	0.3160
94	9.674	2.728	3.549	0.3160
95	9.674	2.797	3.460	0.3160
96	9.673	2.890	3.352	0.3160
97	9.672	3.008	3.221	0.3160
98	9.671	3.179	3.044	0.3160
99	9.670	3.427	2.827	0.3159
100	9.662	4.432	2.187	0.3158

Figure 37 Monte Carlo Analysis Confidence Levels (GOOGL)

The Monte Carlo Analysis graph shows the plotted trades staying consistent with the equity line and bandwidths at an average distance apart. The confidence levels are unanimously consistent between 9.684% and 9.662% rate of return across the board. The 95% confidence level has a 9.674% rate of return with a max draw down of 2.797%.

In order to check strategy stability for future trades, MSA offers a projection of the next 30 predicted trades, of which Monte Carlo analysis can test for a better forecast of the future

success of the system. The 30 trade ahead Monte Carlo analysis can be found in **Figure 38** along with the analysis report in **Figures 39** and **40**. It can be seen in both the Monte Carlo analysis graph and the Monte Carlo report that statistically the strategy will not be as successful in future trades. It can be observed that the span of the confidence lines are rather close together and trending downward. The confidence levels are also all predicting negative rates of return. The 95% confidence level has a rate of return of -8.687%, the 96% confidence level had a rate of return of -8.816% and the 97% confidence level had a rate of return of -9.016%. These factors also agree with the graph that the probability of trades will statistically be negative.

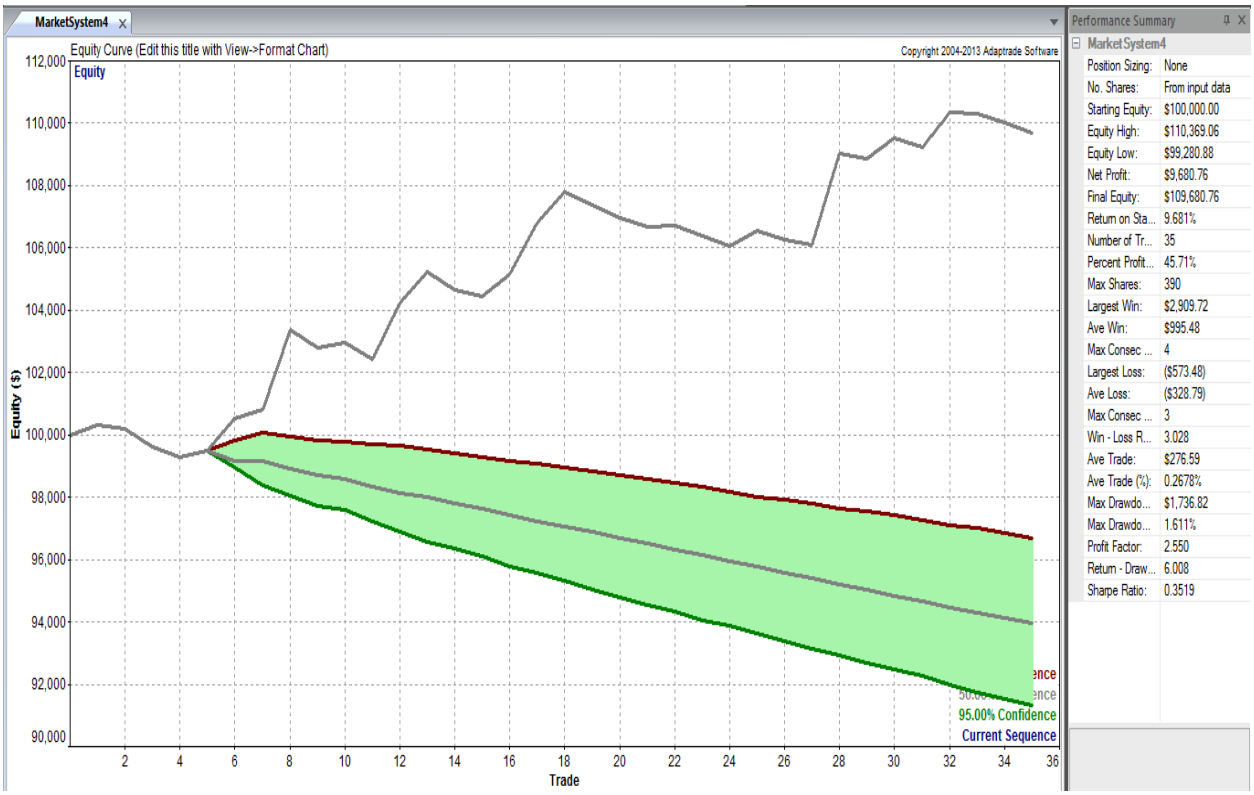


Figure 38 "30 Trades Ahead" Monte Carlo Analysis (GOOGL)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: ($8,687.35)
Final Account Equity: $91,312.65
Return on Starting Equity: -8.687%
Profit Factor: 0.1539

Max Number of Shares: 389
Minimum Number of Shares: 300
Average Number of Shares: 329

Largest Winning Trade: $322.87
Largest Winning Trade (%): 0.3230%
Average Winning Trade: $249.69
Average Winning Trade (%): 0.2561%

Largest Losing Trade: ($570.24)
Largest Losing Trade (%): -0.5698%
Average Losing Trade: ($390.20)
Average Losing Trade (%): -0.4028%

Average Trade: ($248.21)
Average Trade (%): -0.2588%
Trade Standard Deviation: $346.00
Trade Standard Deviation (%): 0.3545%

Win/Loss Ratio: 0.6789
Win/Loss Ratio (%/%): 0.6770
Max Consecutive Wins: 1
Max Consecutive Losses: 15

Worst Case Drawdown: ($9,055.48)
Worst Case Drawdown (%): 9.026%
Average Drawdown: ($9,055.48)
Average Drawdown (%): 9.026%

Return/Drawdown Ratio: 0.000
Modified Sharpe Ratio: -0.8688

Figure 39 "30 Trades Ahead" Monte Carlo Report (GOOGL)

Market System: MarketSystem4

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	-6.045	6.473	0.000	-0.5540
60	-6.465	6.890	0.000	-0.5991
70	-6.924	7.340	0.000	-0.6479
80	-7.454	7.838	0.000	-0.7091
85	-7.748	8.127	0.000	-0.7448
90	-8.081	8.459	0.000	-0.7932
91	-8.193	8.556	0.000	-0.8055
92	-8.284	8.660	0.000	-0.8161
93	-8.406	8.781	0.000	-0.8317
94	-8.534	8.873	0.000	-0.8485
95	-8.687	9.026	0.000	-0.8688
96	-8.816	9.187	0.000	-0.8917
97	-9.016	9.375	0.000	-0.9157
98	-9.296	9.633	0.000	-0.9572
99	-9.632	9.995	0.000	-1.021
100	-11.74	12.02	0.000	-1.366

Figure 40 "30 Trades Ahead" Monte Carlo Report (GOOGL)

Starting at an initial position size of 2%, MSA optimized the position size in efforts to obtain maximum net profit. The optimal position size shown in **Figure 41** and **Figure 42** was 10%, which achieved a net profit of $9,680.76 with a max draw down of 1.61%. This position size kept net profits constant as well as max draw down percentages.

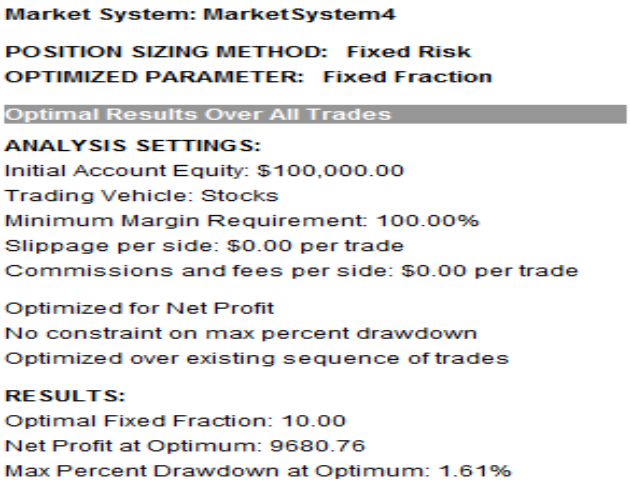


Figure 41 Optimal Position Sizing for Net Profit Report (GOOGL)

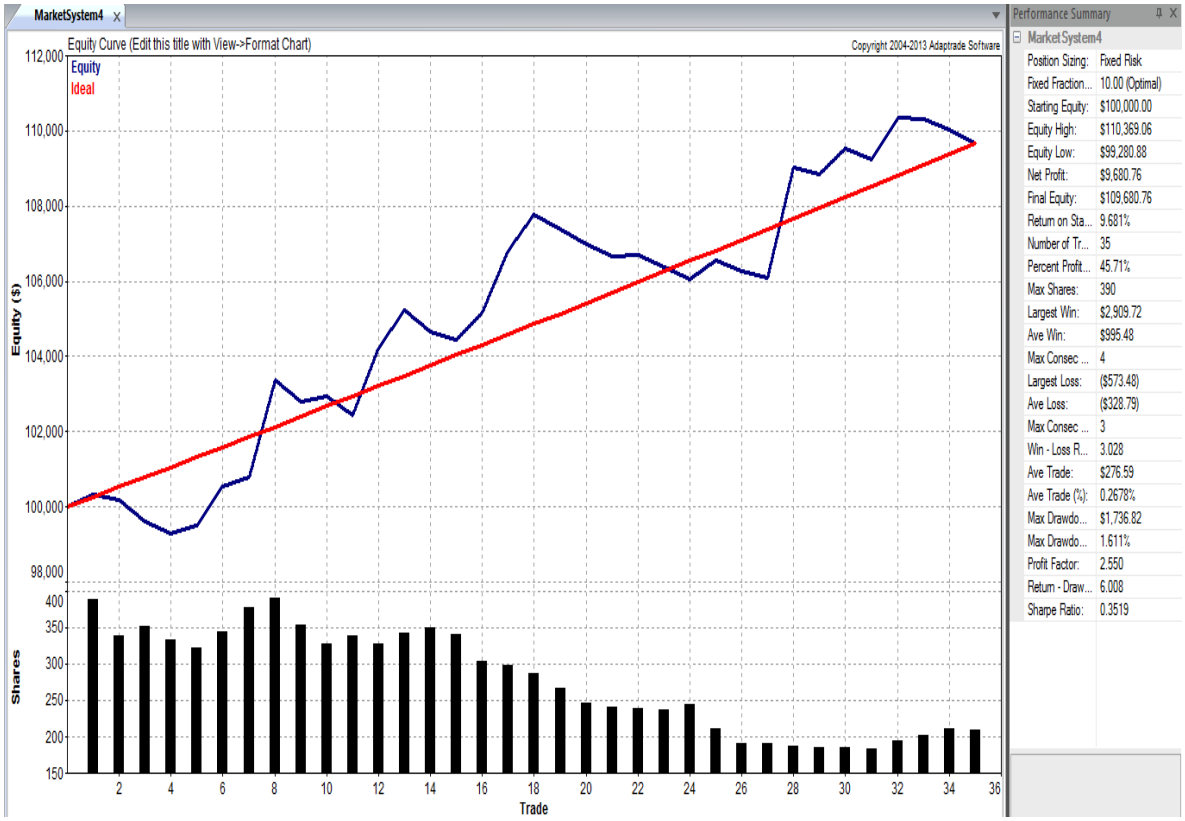


Figure 42 Optimal Position Sizing for Net Profit Performance (GOOGL)

MSA's optimization of position sizing when ran for maximum rate of return also remained at 10%. As shown below in the performance data of **Figure 43 and Figure 44** the 10% position size maintained a 9.681% maximum rate of return with a consistent max draw down of 1.61%. The net profit optimization and rate of return optimizations are the same and show that the optimal position size for this stock is 10%.

Market System: PatsTrades-Google

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 9.681
Max Percent Drawdown at Optimum: 1.61%

Figure 43 Optimal Position Sizing for Rate of Return Report (GOOGL)

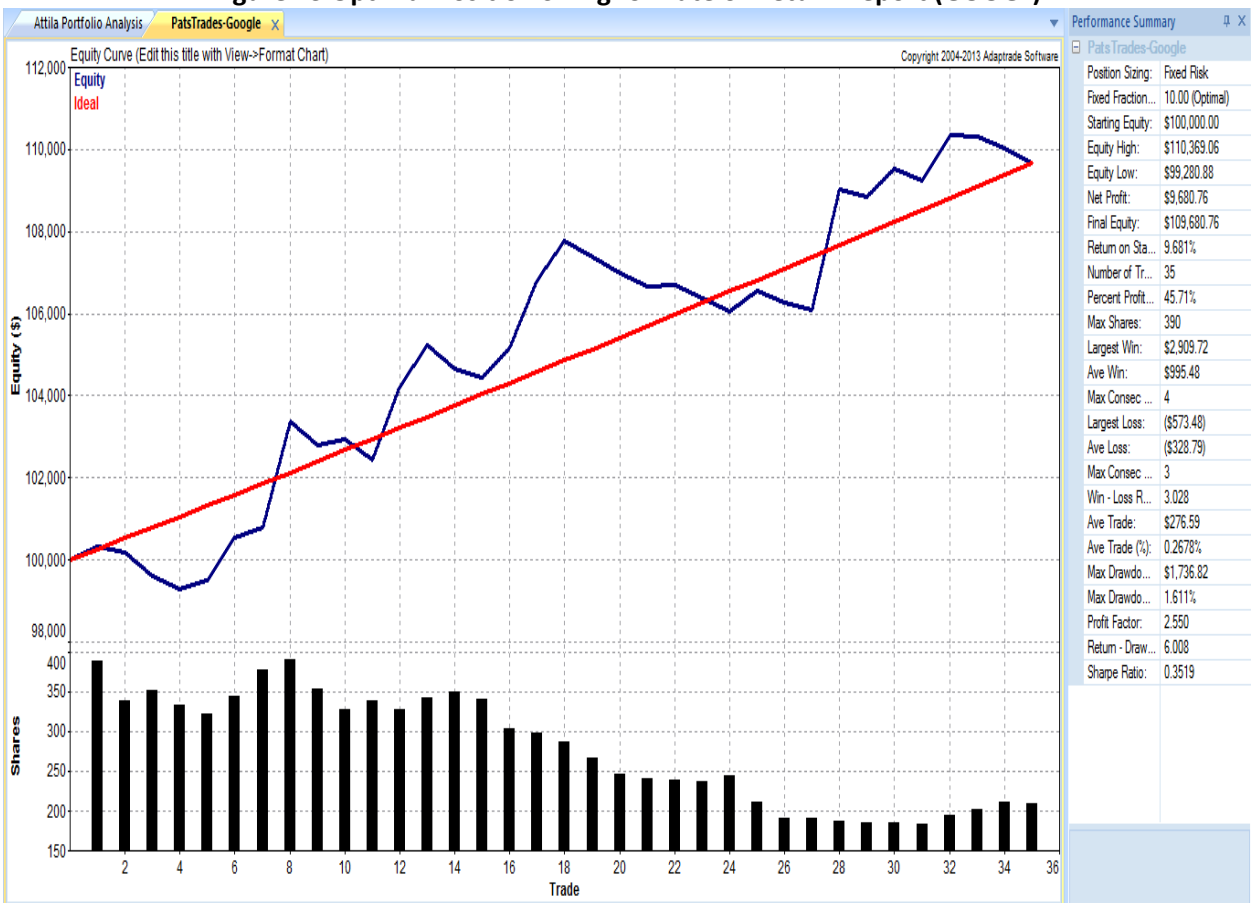


Figure 44 Optimal Position Sizing for Rate of Return Performance (GOOGL)

AMA Strategy Analysis- Full Portfolio

The Adaptive Moving Average Strategy results when applied to the entire portfolio can be seen in **Figure 45** below. The strategy as a whole profited $33,083.04, trading profitably 49.30% of the time over 142 trades. The rate of return achieved by the strategy was 33.08% and the max draw down was 3.385%. The AMA strategy had a profit factor of 2.564 with average winning trades of $774.86 and average losing trades of $293.85.

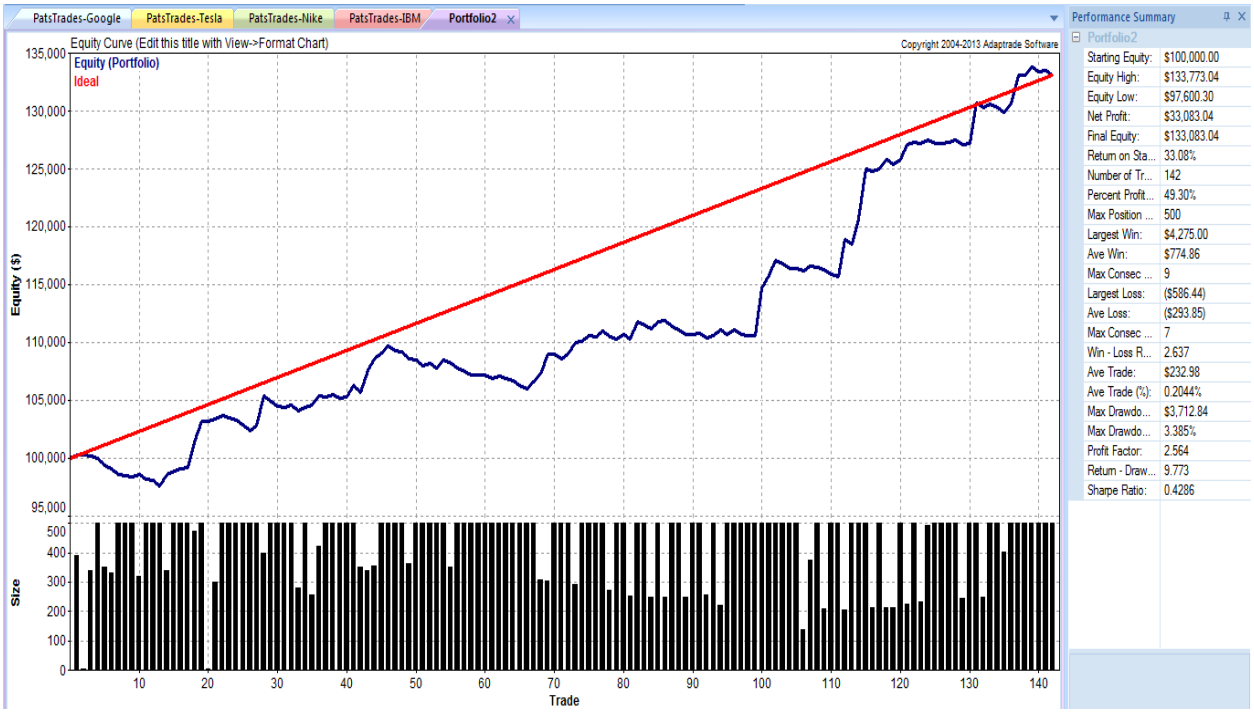


Figure 45 Back Testing Performance Report (Portfolio)

Running the AMA strategy through Monte Carlo analysis helps better forecast the performance of the system by randomizing the trades 10,000 times in order to test the strategy's overall validity. The Monte Carlo analysis for the AMA strategy implemented on the entire portfolio can be found in **Figure 46.** Accompanying the Monte Carlo analysis is its corresponding performance report found in **Figure 47** and **Figure 48**.

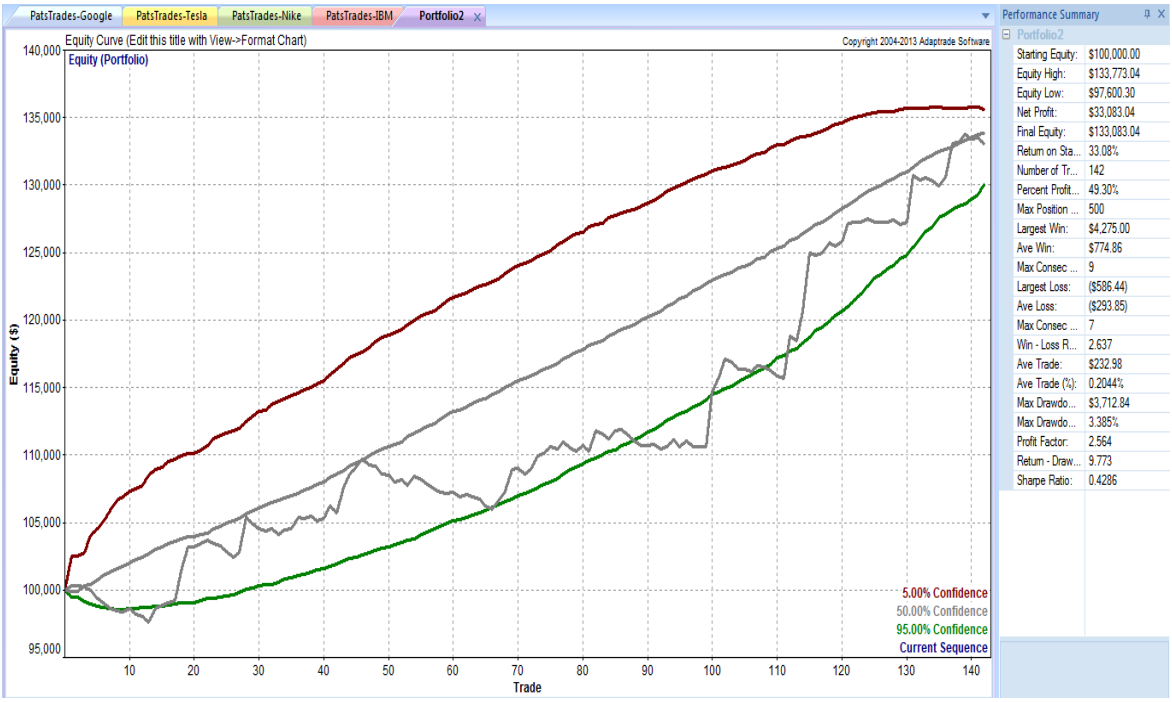


Figure 46 Monte-Carlo Analysis Performance (Portfolio)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $30,066.35	Maximum Position Size: 500
Final Account Equity: $130,066.35	Minimum Position Size: 1
Return on Starting Equity: 30.07%	Average Position Size: 434
Profit Factor: 2.415	
Largest Winning Trade: $4,095.00	Largest Losing Trade: ($756.54)
Largest Winning Trade (%): 3.351%	Largest Losing Trade (%): -0.5697%
Average Winning Trade: $741.24	Average Losing Trade: ($302.82)
Average Winning Trade (%): 0.6522%	Average Losing Trade (%): -0.2645%
Average Trade: $213.31	Win/Loss Ratio: 2.507
Average Trade (%): 0.1892%	Win/Loss Ratio (%/%): 2.527
Trade Standard Deviation: $897.77	Max Consecutive Wins: 4
Trade Standard Deviation (%): 0.7826%	Max Consecutive Losses: 9
Worst Case Drawdown: ($4,372.70)	Return/Drawdown Ratio: 8.984
Worst Case Drawdown (%): 3.654%	Modified Sharpe Ratio: 0.2588
Average Drawdown: ($1,010.67)	
Average Drawdown (%): 0.8662%	

Figure 47 Monte Carlo Analysis Report (Portfolio)

Portfolio: Portfolio2

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	33.86	2.322	14.41	0.2751
60	33.50	2.486	13.46	0.2730
70	33.04	2.674	12.45	0.2705
80	32.41	2.941	11.34	0.2674
85	31.91	3.093	10.73	0.2653
90	31.13	3.316	9.999	0.2627
91	30.97	3.371	9.846	0.2620
92	30.75	3.428	9.645	0.2613
93	30.52	3.482	9.465	0.2606
94	30.32	3.561	9.249	0.2597
95	30.07	3.654	8.984	0.2588
96	29.83	3.771	8.698	0.2579
97	29.51	3.920	8.340	0.2565
98	29.08	4.152	7.942	0.2549
99	28.36	4.556	7.280	0.2517
100	25.55	5.977	5.500	0.2355

Figure 48 Monte Carlo Analysis Report (Portfolio)

The Monte Carlo analysis shows a tight span between confidence intervals as well as an upward sloping line which entails that the system should trade relatively close to the plotted trades from its prior performance. At a 95% confidence level the system has a rate of return of 30.07% and a max draw down of 3.654%. At 97% the rate of return is 29.51% with a draw down of 3.920% for the portfolio.

In order to determine if the tested strategy will hold for this portfolio in the future, MSA uses a feature that projects the predicted next 30 trades. Taking these trades and running Monte Carlo analysis tests upon them allows further confidence of future success based off probability. The graph of these future projections can be seen below in **Figure 49**. The bands of the Monte Carlo analysis are close together, which is a good sign for the probability distribution, **Figure 50** and **Figure 51** show the Monte Carlo analysis reports with each confidence level and corresponding rate of return values and max draw down percentages.

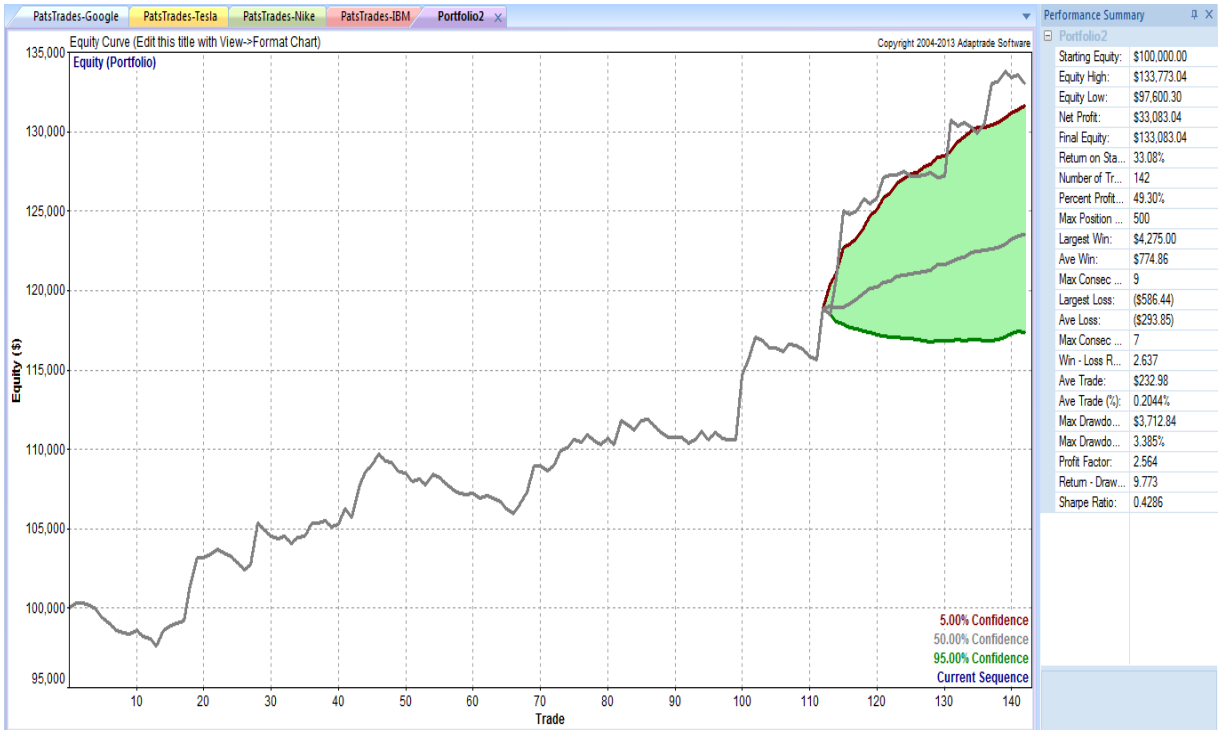


Figure 49 "30 Trades Ahead" Monte Carlo Performance (Portfolio)

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $17,386.22	Maximum Position Size: 500
Final Account Equity: $117,386.22	Minimum Position Size: 2
Return on Starting Equity: 17.39%	Average Position Size: 441
Profit Factor: 1.720	
Largest Winning Trade: $4,095.00	Largest Losing Trade: ($703.08)
Largest Winning Trade (%): 3.703%	Largest Losing Trade (%): -0.5695%
Average Winning Trade: $658.02	Average Losing Trade: ($307.78)
Average Winning Trade (%): 0.6050%	Average Losing Trade (%): -0.2789%
Average Trade: $122.44	Win/Loss Ratio: 2.211
Average Trade (%): 0.1151%	Win/Loss Ratio (%/%): 2.233
Trade Standard Deviation: $872.30	Max Consecutive Wins: 9
Trade Standard Deviation (%): 0.7711%	Max Consecutive Losses: 9
Worst Case Drawdown: ($4,052.08)	Return/Drawdown Ratio: 5.033
Worst Case Drawdown (%): 3.385%	Modified Sharpe Ratio: 0.1724
Average Drawdown: ($1,468.72)	
Average Drawdown (%): 1.331%	

Figure 50 "30 Trades Ahead" Monte Carlo Report (Portfolio)

Portfolio: Portfolio2

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	23.51	3.385	6.943	0.2166
60	22.48	3.385	6.638	0.2097
70	21.41	3.385	6.319	0.2025
80	20.16	3.385	5.946	0.1938
85	19.46	3.385	5.722	0.1884
90	18.56	3.385	5.433	0.1817
91	18.36	3.385	5.370	0.1802
92	18.15	3.385	5.289	0.1786
93	17.90	3.385	5.210	0.1764
94	17.65	3.385	5.123	0.1745
95	17.39	3.385	5.033	0.1724
96	17.10	3.488	4.906	0.1699
97	16.70	3.655	4.710	0.1663
98	16.10	3.877	4.366	0.1619
99	15.36	4.291	3.826	0.1554
100	11.27	6.546	1.752	0.1166

Figure 51

The futures trades agree with the past Monte Carlo analysis yet are not as profitable. There is still an upward trend with relatively close confidence bands but the confidence levels show a smaller rate of return. The 95% confidence level shows a 17.39% rate of return with a 3.385% max draw down percentage. The 97% confidence level shows a 16.10% rate of return with a 3.655 max draw down percentage. These values are still profitable but less optimistic than the back tested Monte Carlo Analysis.

Upon optimization of position sizes of each stock in effort to gain the most net profit for the portfolio, the position parameters were calculated as shown in **Figure 52.** Nike stock received 20% of equity for its position as the other three stocks received only 0.5% position sizes. With these position sizes the performance of the portfolio can be seen in **Figure 53.** The net profit rose from $33,083 to $42,417. This allocation of funds within the AMA portfolio is mainly due to negative future expectancies of Tesla and Google based off of the 30 trade ahead Monte Carlo analysis and Nike's positive future expectancy and optimization success. IBM had a positive future forecast yet worked more efficiently with a low position size.

Analysis Settings

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

Optimized for Net Profit

No constraint on max percent drawdown

Optimized over existing sequence of trades

Optimization Results

Net Profit at Optimum: 42417.93

Max Percent Drawdown at Optimum: 8.06%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	Fixed Risk	ff = 0.5645%
2	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	Fixed Risk	ff = 0.5840%
3	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	Fixed Risk	ff = 20.56%
4	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	Fixed Risk	ff = 0.5840%

Figure 52 Optimal Position Size for Net Profit Report (Portfolio)

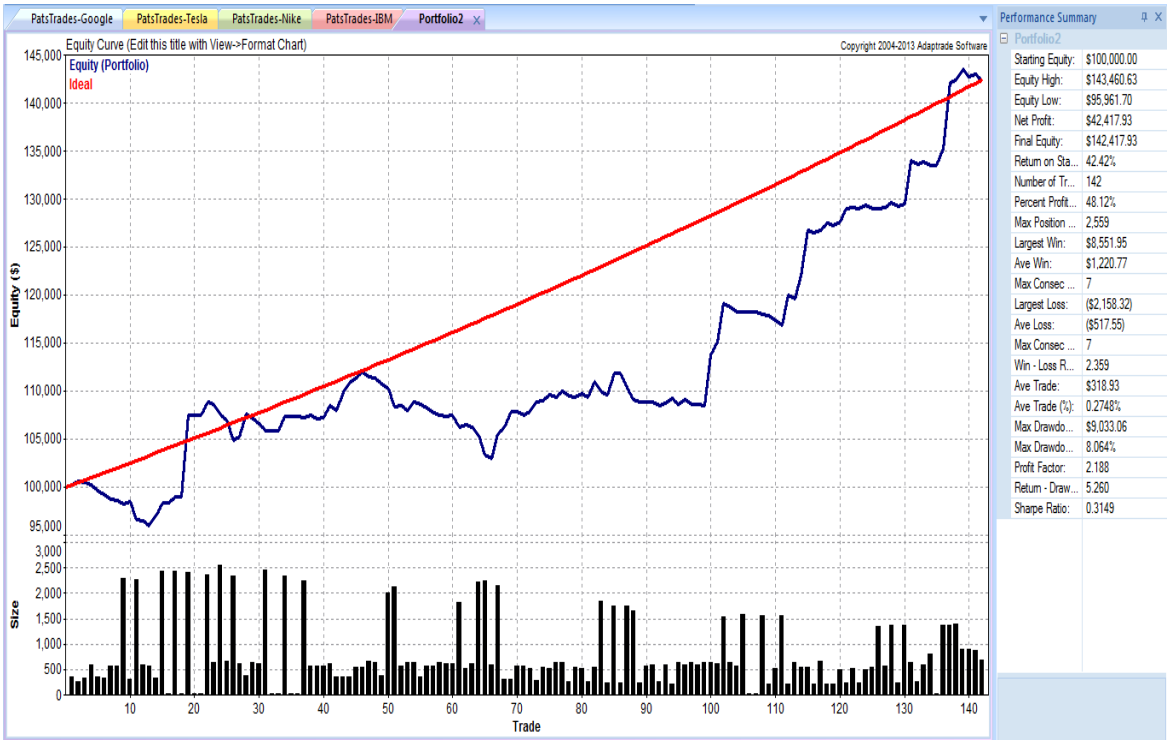
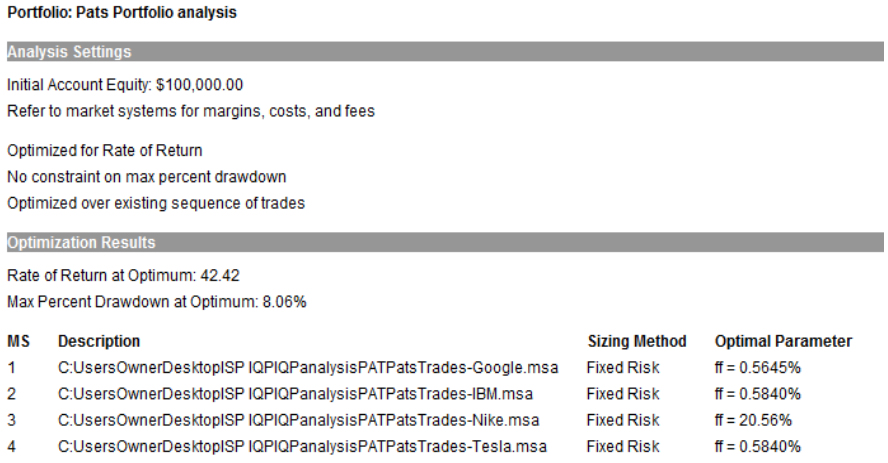


Figure 53 Optimal Position Size for Net Profit Performance (Portfolio)

The optimal position size for the portfolio when calculated for maximum rate of return was the same as the net profit optimization. Nike received 20% of the portfolio position size whereas IBM, Google and Tesla all received 0.5 % for their performances. The maximum rate of return reached 42.42% with a max draw down of 8.06%. This data can be seen below in **Figure 54** and **Figure 55** and it is the exact same data as the net profit optimization entails. These optimal parameters for each stock are the ideal percentages for the success of the AMA strategy portfolio.



Portfolio: Pats Portfolio analysis

Analysis Settings

Initial Account Equity: $100,000.00
Refer to market systems for margins, costs, and fees

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

Optimization Results

Rate of Return at Optimum: 42.42
Max Percent Drawdown at Optimum: 8.06%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	Fixed Risk	ff = 0.5645%
2	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	Fixed Risk	ff = 0.5840%
3	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	Fixed Risk	ff = 20.56%
4	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	Fixed Risk	ff = 0.5840%

Figure 54 Optimal Position Size for Rate of Return Report (Portfolio)

Figure 55 Optimal Position Size for Rate of Return Performance (Portfolio)

Ichimoku System

Ichi Strategy Analysis: USDJPY

The analysis for the Ichi Strategy implemented on the USDJPY currency pair used a starting account size of $100,000, and a maximum trade size limit of 1,000,000 units, or 10 standard lots. The trades plotted in relation to how much account equity is available at that trade can be seen in **Figure 56**.

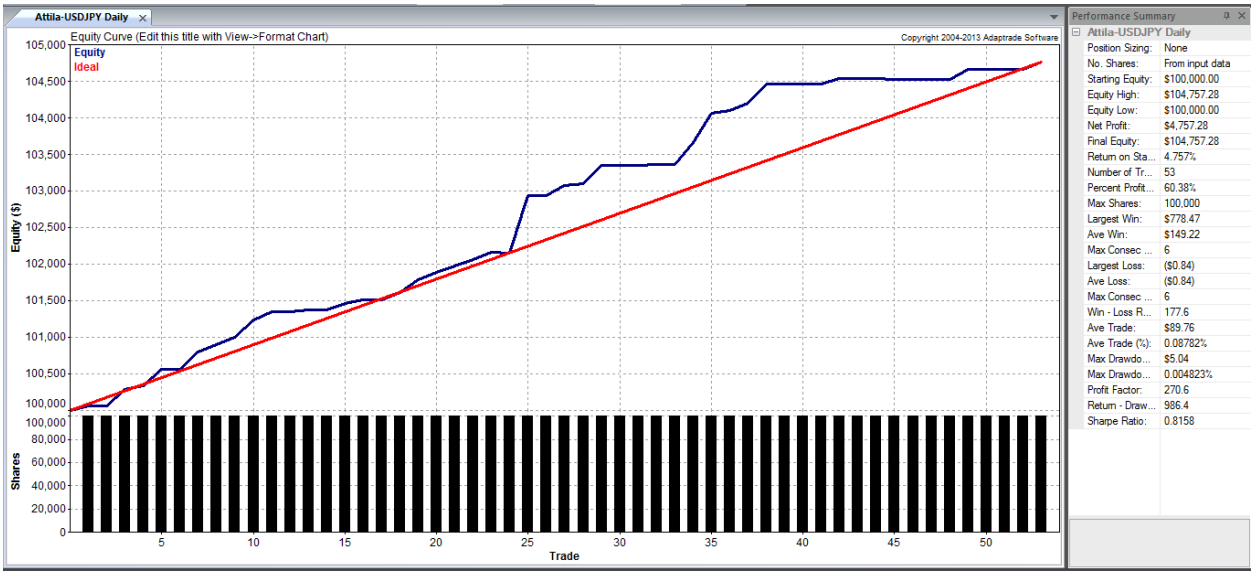


Figure 56- Equity curve of USDJPY

Before a Monte Carlo analysis, this graph shows the ideal equity curve in red, and the trades made as the blue line. When applied to the USDJPY currency pair, the Ichi Strategy made a net profit of $4,757.28 over the course of 5 years, with 53 trades made. The system was 60.38% profitable, with an average winning trade of $149.22, and an average losing trade of $0.84. The max drawdown of the system was $5.04 and the profit factor of this system was 270.6.

Once the Monte Carlo analysis has been run on the system, a more confident prediction of probability can be made on the system. Statistically speaking, the Monte Carlo analysis aims to show how valid a system can be by randomizing all of the trades, and showing a confidence

range of where the trades could possibly lie. The Monte Carlo analysis for the USDJPY currency pair can be seen in **Figure 57**, and the corresponding performance report of the analysis in **Figure 58** and **Figure 59**.

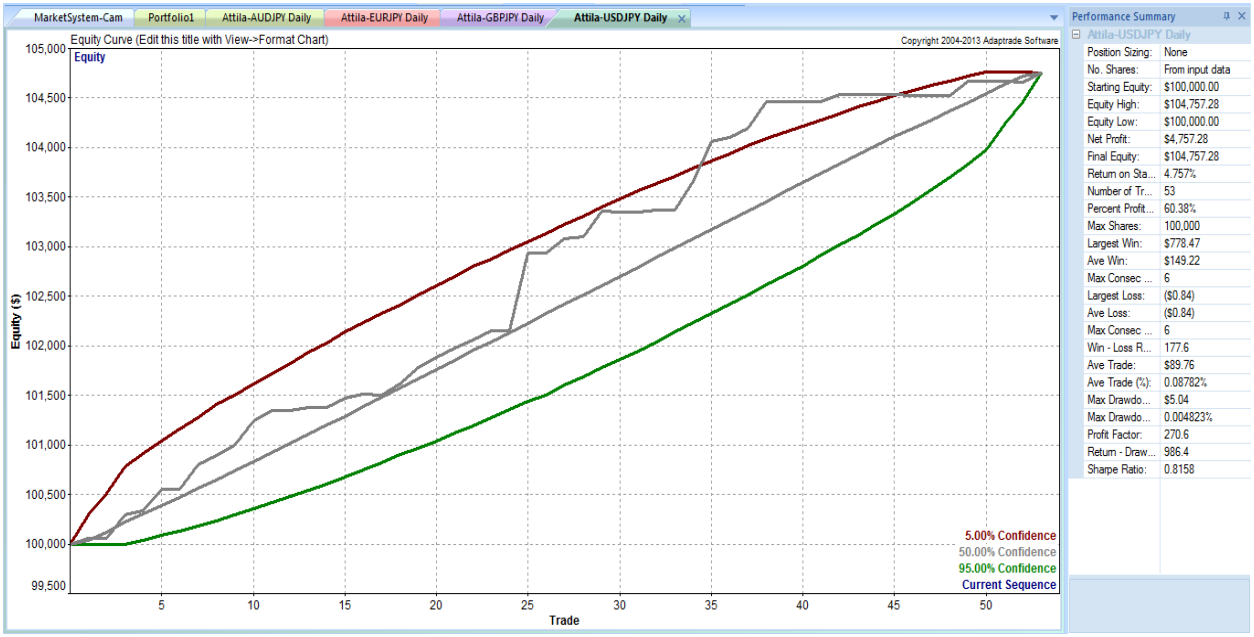


Figure 57- Monte Carlo analysis of USDJPY

Market System: Attila-USDJPY Daily

Trading Parameters

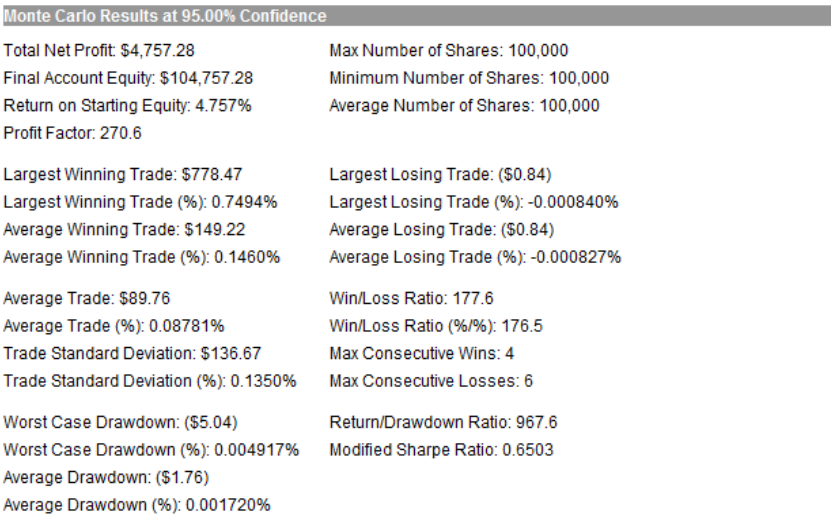
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	4.757	0.003239	1469.	0.6560
60	4.757	0.003290	1446.	0.6548
70	4.757	0.003334	1427.	0.6536
80	4.757	0.004038	1178.	0.6523
85	4.757	0.004107	1158.	0.6517
90	4.757	0.004175	1139.	0.6510
91	4.757	0.004189	1136.	0.6509
92	4.757	0.004201	1132.	0.6507
93	4.757	0.004834	984.1	0.6505
94	4.757	0.004878	975.3	0.6504
95	4.757	0.004917	967.6	0.6503
96	4.757	0.004968	957.6	0.6501
97	4.757	0.005016	948.4	0.6499
98	4.757	0.005667	839.5	0.6496
99	4.757	0.005828	816.3	0.6493
100	4.757	0.01008	471.8	0.6481

Figure 58- Monte Carlo analysis report USDJPY part 1



Monte Carlo Results at 95.00% Confidence

Total Net Profit: $4,757.28	Max Number of Shares: 100,000
Final Account Equity: $104,757.28	Minimum Number of Shares: 100,000
Return on Starting Equity: 4.757%	Average Number of Shares: 100,000
Profit Factor: 270.6	
Largest Winning Trade: $778.47	Largest Losing Trade: ($0.84)
Largest Winning Trade (%): 0.7494%	Largest Losing Trade (%): -0.000840%
Average Winning Trade: $149.22	Average Losing Trade: ($0.84)
Average Winning Trade (%): 0.1460%	Average Losing Trade (%): -0.000827%
Average Trade: $89.76	Win/Loss Ratio: 177.6
Average Trade (%): 0.08781%	Win/Loss Ratio (%/%): 176.5
Trade Standard Deviation: $136.67	Max Consecutive Wins: 4
Trade Standard Deviation (%): 0.1350%	Max Consecutive Losses: 6
Worst Case Drawdown: ($5.04)	Return/Drawdown Ratio: 967.6
Worst Case Drawdown (%): 0.004917%	Modified Sharpe Ratio: 0.6503
Average Drawdown: ($1.76)	
Average Drawdown (%): 0.001720%	

Figure 59- Monte Carlo analysis report USDJPY part 2

The graph of the 10,000 run Monte Carlo analysis shows that after randomly scrambling the trades 10,000 times, the system has the potential to trade anywhere within the shaded area. For this particular Monte Carlo analysis of this currency, the fact that the two bands are pretty tight is good. There is confidence that the potential trades in the future will stay close to the already plotted trades. The original trades do break through the top of these two spans, indicating a potential outlier. When the results of the Monte Carlo analysis are observed, across all confidence intervals, the analysis is confident that the system will make a return of 4.757%.

A way to see if the strategy will hold in the future is to project a prediction of 30 trades into the future, and run a Monte Carlo analysis on the predicted 30 trades. In **Figure 60**, it can be seen that the predicted 30 trades into the future do not necessarily agree with the confidence bands of the Monte Carlo analysis. The future trades break through the top of the bands, indicating that the future trades may be more likely to stay within the range of the bands. This is positive considering that the bands aren't spread out that much, and project in an upward fashion. In **Figure 61** and **Figure 62**, the report of the Monte Carlo analysis of the predicted 30 trades can be seen. Out of this report, we can see that from the analysis, there can be 97% confidence that

the strategy have a 4.177% rate of return, 96% confidence of a 4.232% rate of return, and a 95% confidence of a 4.274% rate of return.

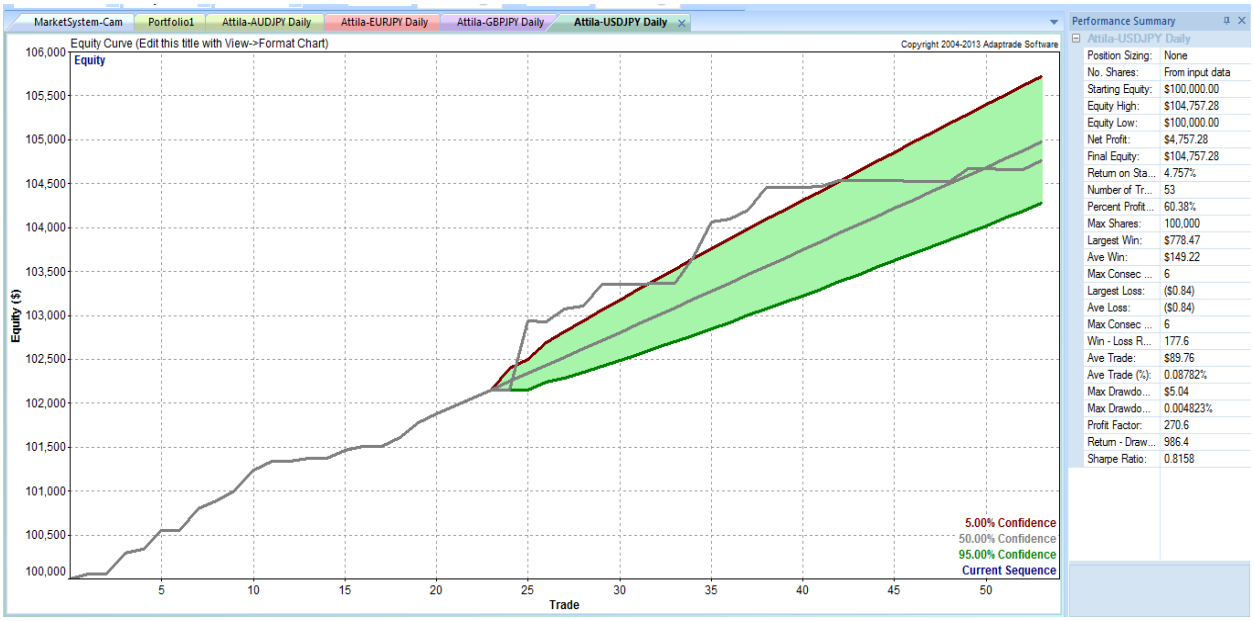


Figure 60- 30 Predicted future trades for USDJPY

Market System: Attila-USDJPY Daily

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	4.971	0.001627	3062.	1.181
60	4.862	0.001635	2935.	1.159
70	4.743	0.001642	2759.	1.135
80	4.608	0.002418	2093.	1.108
85	4.526	0.002437	1958.	1.092
90	4.414	0.002455	1832.	1.070
91	4.387	0.002459	1802.	1.065
92	4.363	0.002462	1770.	1.060
93	4.336	0.002465	1723.	1.054
94	4.309	0.002468	1659.	1.049
95	4.274	0.003221	1567.	1.041
96	4.232	0.003241	1467.	1.032
97	4.177	0.003262	1403.	1.022
98	4.110	0.003280	1313.	1.006
99	4.010	0.004050	1179.	0.9868
100	3.536	0.005728	772.9	0.8543

Figure 61- 30 Predicted future trade analysis report USDJPY part 1

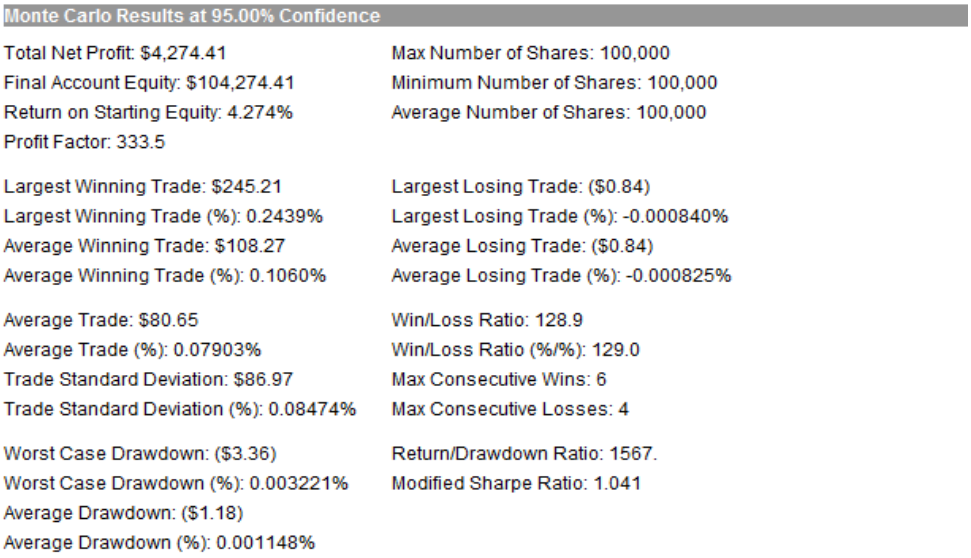


Figure 62- 30 Predicted future trade analysis report: USDJPY part 2

MSA has the feature to set a fixed rate position size percentage to the system being worked with. The position size can then be optimized to maximize certain specifications, such as net profit, profitability, or rate of return. A position size of 2% of the account equity per trade was set, and then optimized for both maximum net profit, and for maximum rate of return. The optimization done of the position size to maximize net profit can be seen in **Figure 63** and **Figure 64**. When the position size was optimized for maximum net profit, the net profit rose from $4,757.28 to $47,572.79 over the 5 year time period. The optimal position size percentage that was found was a fixed rate of 10%

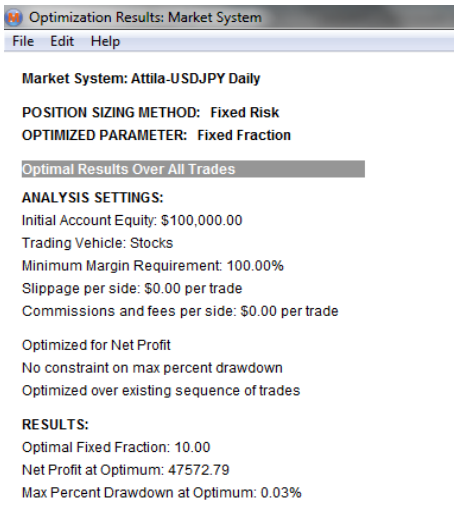


Figure 63- Position size optimization report for net profit: USDJPY

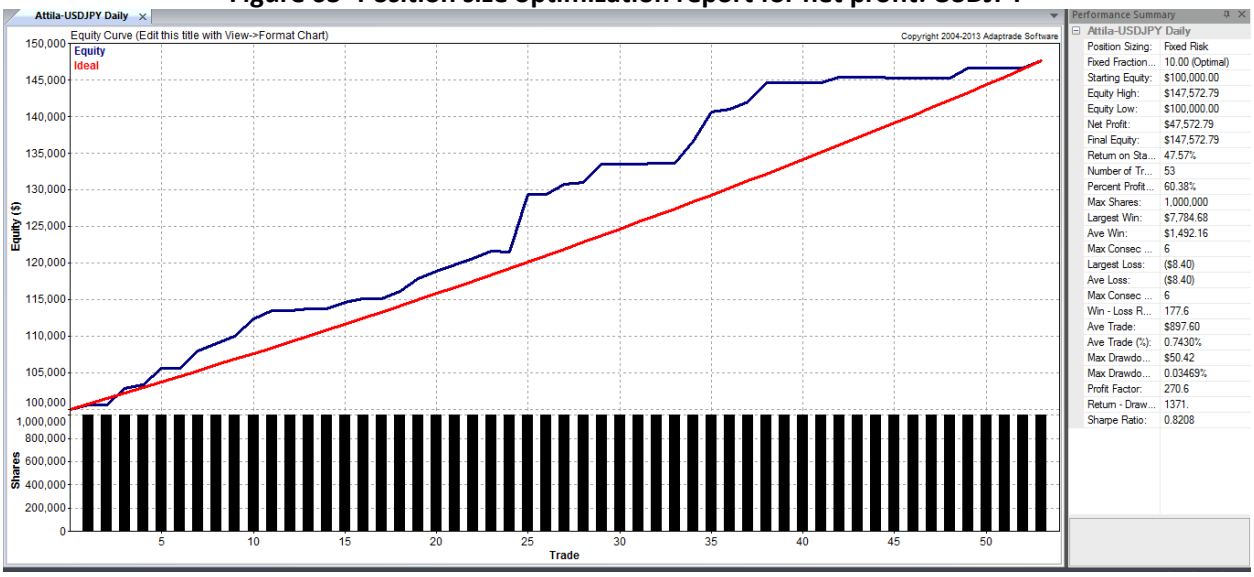


Figure 64 – Position size optimization for net profit graph: USDJPY

Another optimization done to the position sizing was to maximize the rate of return. In **Figure 65** the optimization report can be seen with an optimized position size of 10%, a rate of return of 47.57%, and a net profit of $47,572.79. There is no particular difference between this optimization and the last because they both have the same position size percentage, the same rate of return, and the same net profit. The graph of the optimized position size for maximum rate of return can be seen in **Figure 66**.

Figure 65- Position size optimization report for rate of return: USDJPY

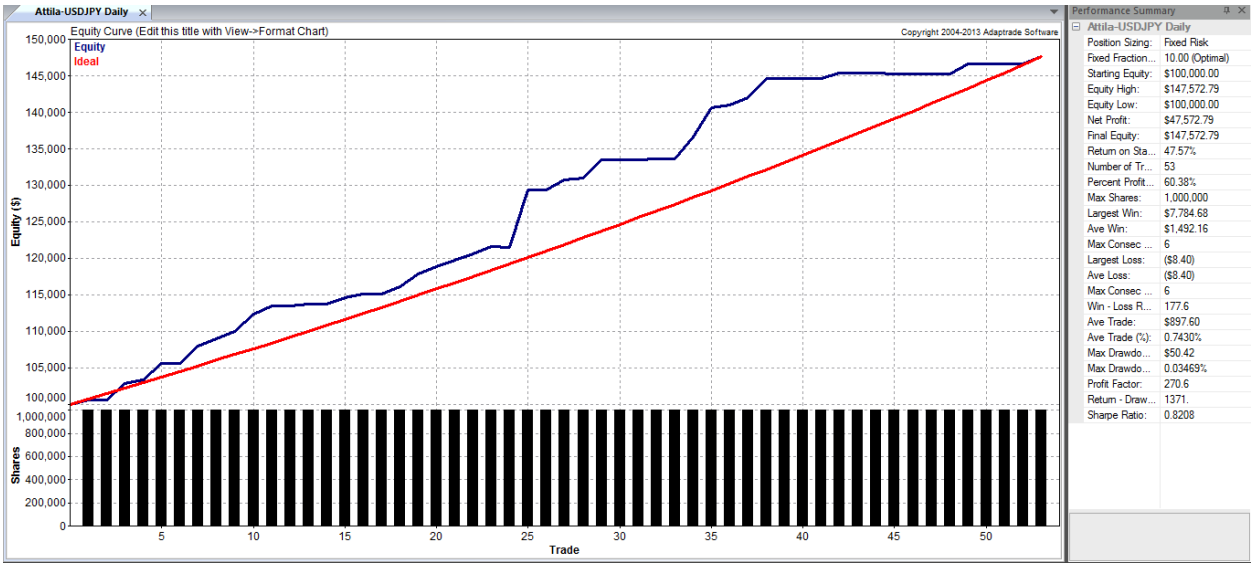


Figure 66- Position size optimization for rate of return graph: USDJPY

Ichi Strategy Analysis: GBPJPY

The analysis for the Ichi Strategy implemented on the GBPJPY currency pair used a starting account size of $100,000, and a maximum trade size limit of 1,000,000 units, or 10 standard lots. The trades plotted in relation to how much account equity is available at that trade can be seen in **Figure 67**.

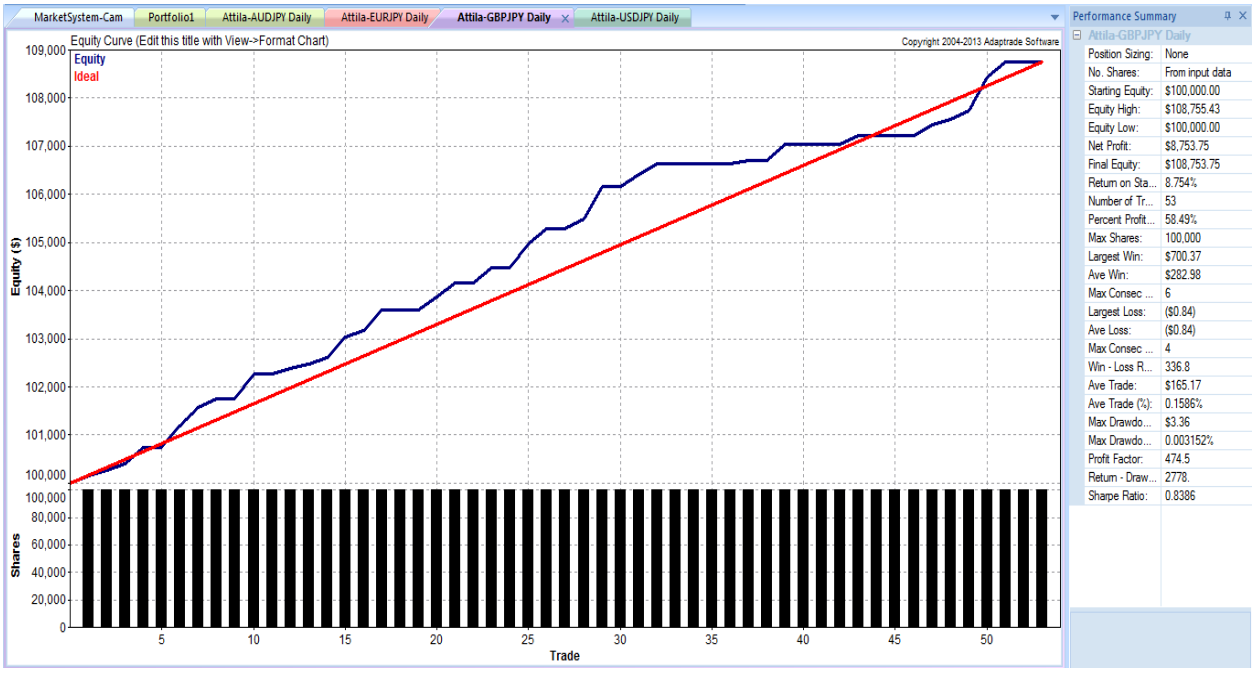


Figure 67- Equity curve of GBPJPY

This graph shows the ideal equity curve in red, and the trades made as the blue line. When applied to the GBPJPY currency pair, the Ichi Strategy made a net profit of $8,753.75 over the course of 5 years, with 53 trades made. The system was 58.49% profitable, with an average winning trade of $282.98, and an average losing trade of $0.84. The largest losing trade for the whole 5 years was also $0.84. The max drawdown of the system was $3.36 and the profit factor of this system was 474.5.

Once the Monte Carlo analysis has been run on the system, a more confident prediction of probability can be made on the system. Statistically speaking, the Monte Carlo analysis aims to show how valid a system can be by randomizing all of the trades, and showing a confidence range of where the trades could possibly lie. The Monte Carlo analysis for the GBPJPY currency pair can be seen in **Figure 68**, and the corresponding performance report of the analysis in **Figure 69** and **Figure 70**.

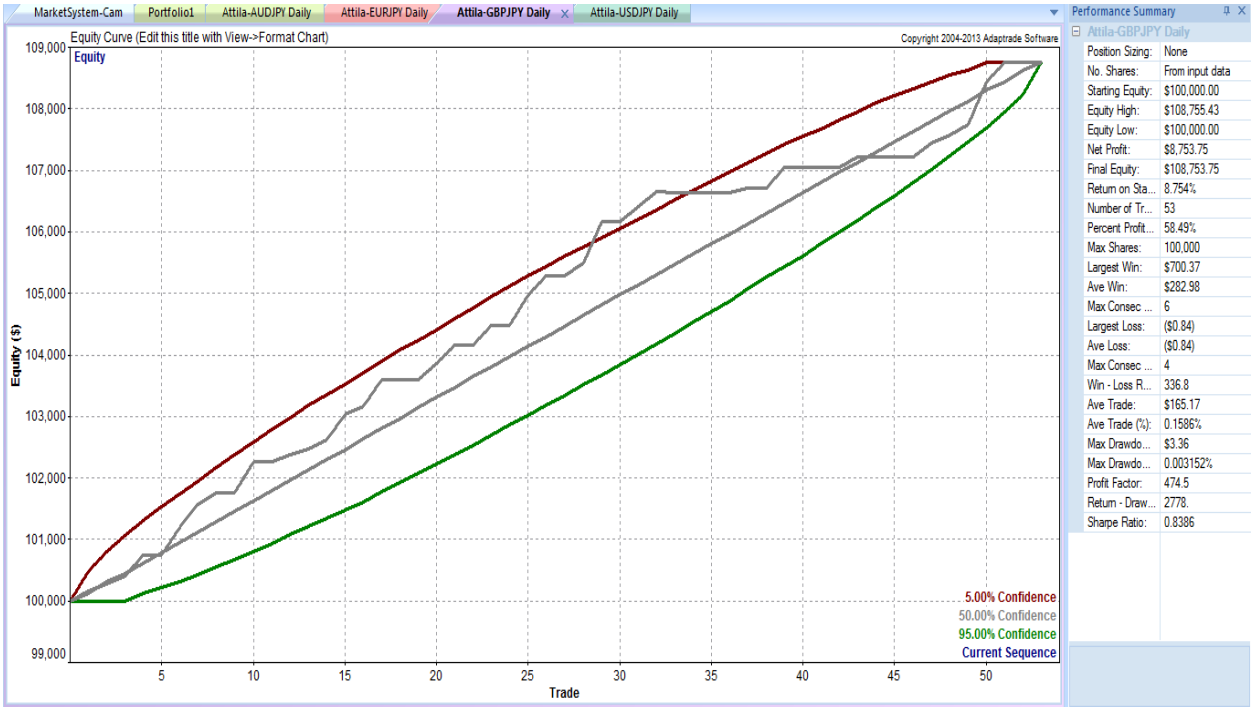


Figure 68- Monte Carlo analysis for GBPJPY

Market System: Attila-GBPJPY Daily

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	8.754	0.003198	2737.	0.8788
60	8.754	0.003278	2670.	0.8777
70	8.754	0.003351	2613.	0.8765
80	8.754	0.004003	2187.	0.8751
85	8.754	0.004113	2128.	0.8744
90	8.754	0.004201	2084.	0.8734
91	8.754	0.004687	1868.	0.8732
92	8.754	0.004748	1844.	0.8729
93	8.754	0.004807	1821.	0.8726
94	8.754	0.004872	1797.	0.8723
95	8.754	0.004943	1771.	0.8719
96	8.754	0.005008	1748.	0.8716
97	8.754	0.005472	1600.	0.8711
98	8.754	0.005676	1542.	0.8706
99	8.754	0.006204	1411.	0.8696
100	8.754	0.01017	861.1	0.8663

Figure 69 - Monte Carlo analysis report GBPJPY part 1

Monte Carlo Results at 95.00% Confidence	
Total Net Profit: $8,753.75	Max Number of Shares: 100,000
Final Account Equity: $108,753.75	Minimum Number of Shares: 100,000
Return on Starting Equity: 8.754%	Average Number of Shares: 100,000
Profit Factor: 474.5	
Largest Winning Trade: $700.37	Largest Losing Trade: ($0.84)
Largest Winning Trade (%): 0.6516%	Largest Losing Trade (%): -0.000840%
Average Winning Trade: $282.98	Average Losing Trade: ($0.84)
Average Winning Trade (%): 0.2717%	Average Losing Trade (%): -0.000815%
Average Trade: $165.17	Win/Loss Ratio: 336.8
Average Trade (%): 0.1586%	Win/Loss Ratio (%/%): 333.4
Trade Standard Deviation: $187.72	Max Consecutive Wins: 4
Trade Standard Deviation (%): 0.1819%	Max Consecutive Losses: 6
Worst Case Drawdown: ($5.04)	Return/Drawdown Ratio: 1771.
Worst Case Drawdown (%): 0.004943%	Modified Sharpe Ratio: 0.8719
Average Drawdown: ($1.85)	
Average Drawdown (%): 0.001755%	

Figure 70 - Monte Carlo analysis report GBPJPY part 2

The graph of the Monte Carlo analysis shows that after randomly scrambling the trades 10,000 times, the system has the potential to trade anywhere within the shaded area. For this particular Monte Carlo analysis of this currency, the difference between the two bans isn't particularly big, causing for the shaded area to be smaller. It is wanted to have a tighter margin amongst the two bans. There is confidence that the potential trades in the future will stay close to the already plotted trades. When the results of the Monte Carlo analysis are observed, across all confidence intervals, the analysis is confident that the system will make a return of 8.754%.

A way to see if the strategy will hold in the future is to project a prediction of 30 trades into the future, and run a Monte Carlo analysis on the predicted 30 trades. In **Figure 71**, it can be seen that the predicted 30 trades into the future slightly agree with the confidence bands of the Monte Carlo analysis. The predicted trade bands are tight, and project in a positive linear direction. Even though the predicted trades cross the bottom band, it is still a good sign that the strategy may make profit in the future. The bottom band is the 95% confidence interval, and since this line shows the lowest points that the strategy could possibly make. Since the lower

band doesn't dip, and stays in a positive linear fashion, there can be potential confidence that the strategy will stay profitable in the future. In **Figure 72** and **Figure 73**, the report of the Monte Carlo analysis of the predicted 30 trades can be seen. Out of this report, we can see that from the analysis, there can be 97% confidence that the strategy have a 4.177% rate of return, 96% confidence of a 4.232% rate of return, and a 95% confidence of a 4.274% rate of return.

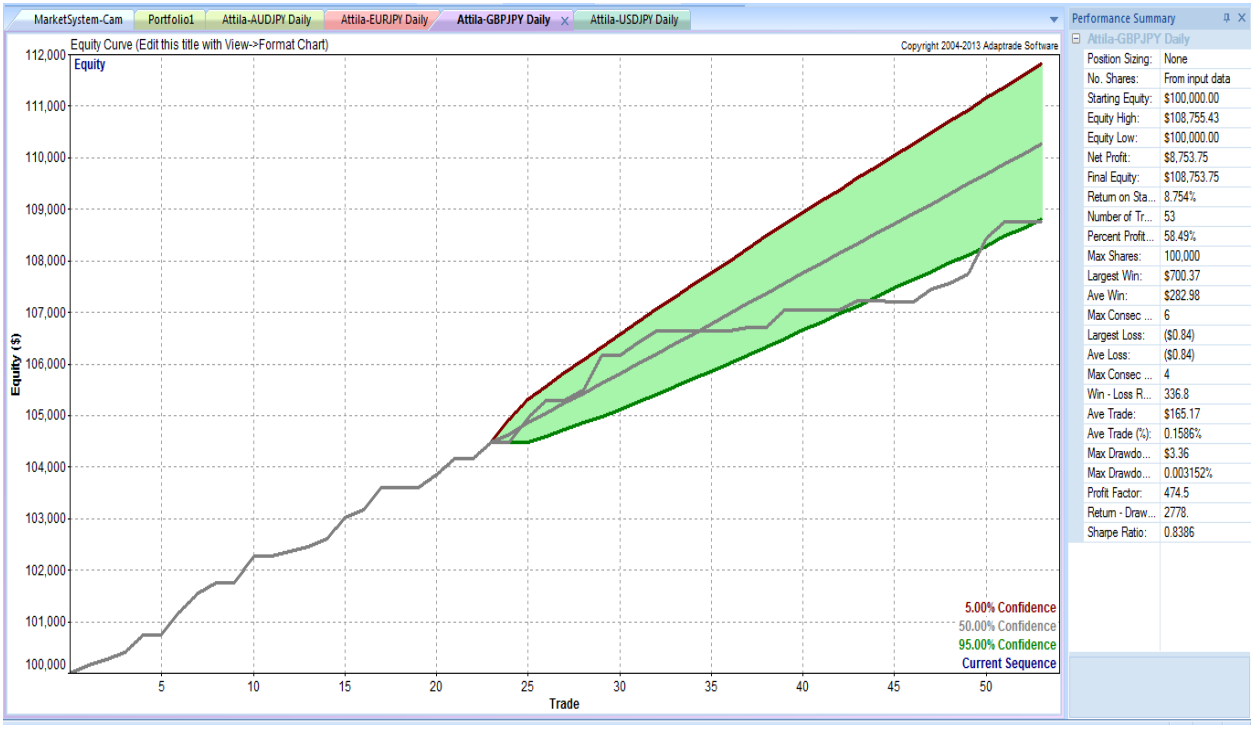


Figure 71- 30 Predicted future trades for GBPJPY

Market System: Attila-GBPJPY Daily

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	10.27	0.001622	6072.	1.162
60	10.02	0.001622	5719.	1.138
70	9.772	0.002317	4544.	1.112
80	9.498	0.002372	4125.	1.084
85	9.320	0.002396	3892.	1.066
90	9.114	0.003065	3432.	1.046
91	9.058	0.003092	3294.	1.041
92	9.001	0.003111	3165.	1.036
93	8.939	0.003132	3081.	1.030
94	8.874	0.003154	2998.	1.023
95	8.802	0.003178	2911.	1.016
96	8.709	0.003198	2805.	1.007
97	8.603	0.003217	2652.	0.9954
98	8.451	0.003905	2418.	0.9805
99	8.224	0.003999	2194.	0.9557
100	6.952	0.007206	1003.	0.8450

Figure 72- 30 Predicted future trade analysis report GBPJPY part 1

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $8,802.46
Final Account Equity: $108,802.46
Return on Starting Equity: 8.802%
Profit Factor: 588.0

Largest Winning Trade: $518.98
Largest Winning Trade (%): 0.5101%
Average Winning Trade: $238.39
Average Winning Trade (%): 0.2283%

Average Trade: $166.08
Average Trade (%): 0.1594%
Trade Standard Deviation: $179.32
Trade Standard Deviation (%): 0.1703%

Worst Case Drawdown: ($3.36)
Worst Case Drawdown (%): 0.003178%
Average Drawdown: ($1.33)
Average Drawdown (%): 0.001267%

Max Number of Shares: 100,000
Minimum Number of Shares: 100,000
Average Number of Shares: 100,000

Largest Losing Trade: ($0.84)
Largest Losing Trade (%): -0.000834%
Average Losing Trade: ($0.84)
Average Losing Trade (%): -0.000805%

Win/Loss Ratio: 283.7
Win/Loss Ratio (%/%): 285.1
Max Consecutive Wins: 6
Max Consecutive Losses: 4

Return/Drawdown Ratio: 2911.
Modified Sharpe Ratio: 1.016

Figure 73- 30 Predicted future trade analysis report GBPJPY part 2

MSA has the feature to set a fixed rate position size percentage to the system being worked with. The position size can then be optimized to maximize certain specifications, such as net profit, profitability, or rate of return. A position size of 2% of the account equity per trade

was set, and then optimized for both maximum net profit, and for maximum rate of return. The optimization done of the position size to maximize net profit can be seen in **Figure 74** and **Figure 75**. When the position size was optimized for maximum net profit, the net profit rose from $8,753.75 to $87,537.52 over the 5 year time period. The optimal position size percentage that was found was a fixed rate of 10%.

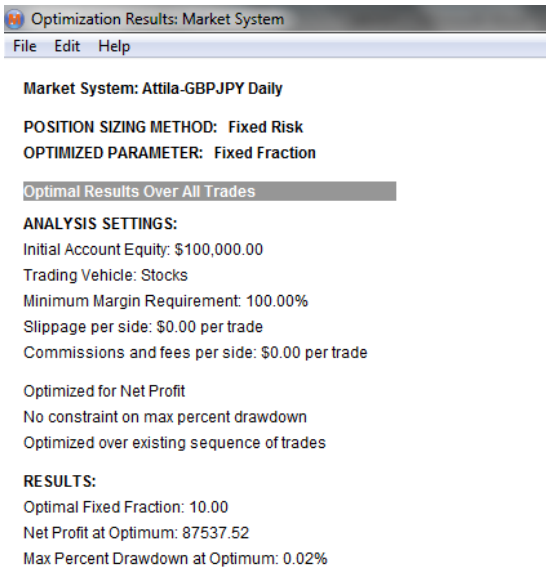


Figure 74- Position size optimization report for net profit: GBPJPY

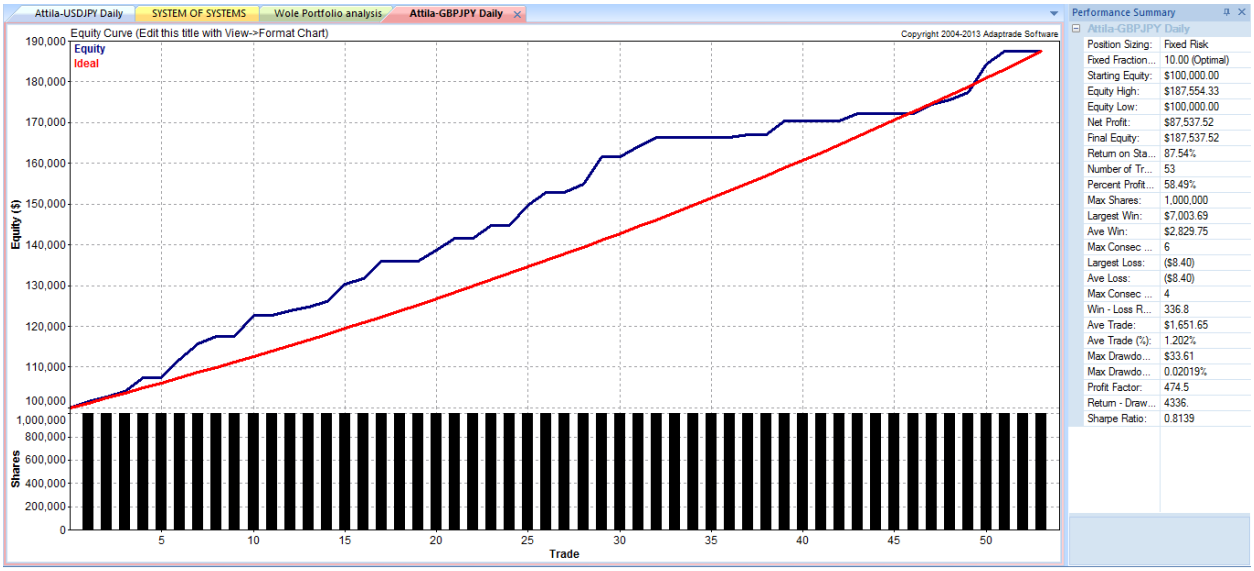


Figure 75- Position size optimization for net profit graph: GBPJPY

Another optimization done to the position sizing was to maximize the rate of return. In **Figure 76** the optimization report can be seen with an optimized position size of 10%, a rate of return of 87.54%, and a net profit of $87,537.52. There is no particular difference between this optimization and the last because they both have the same position size percentage, the same rate of return, and the same net profit. The graph of the optimized position size for maximum rate of return can be seen in **Figure 77**.

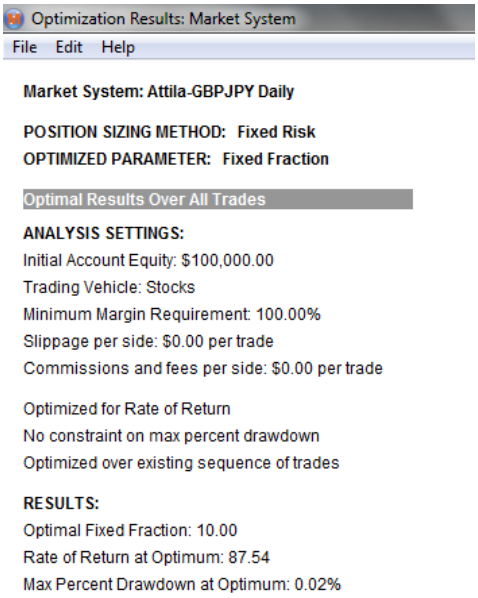


Figure 76- Position size optimization report for rate of return: GBPJPY

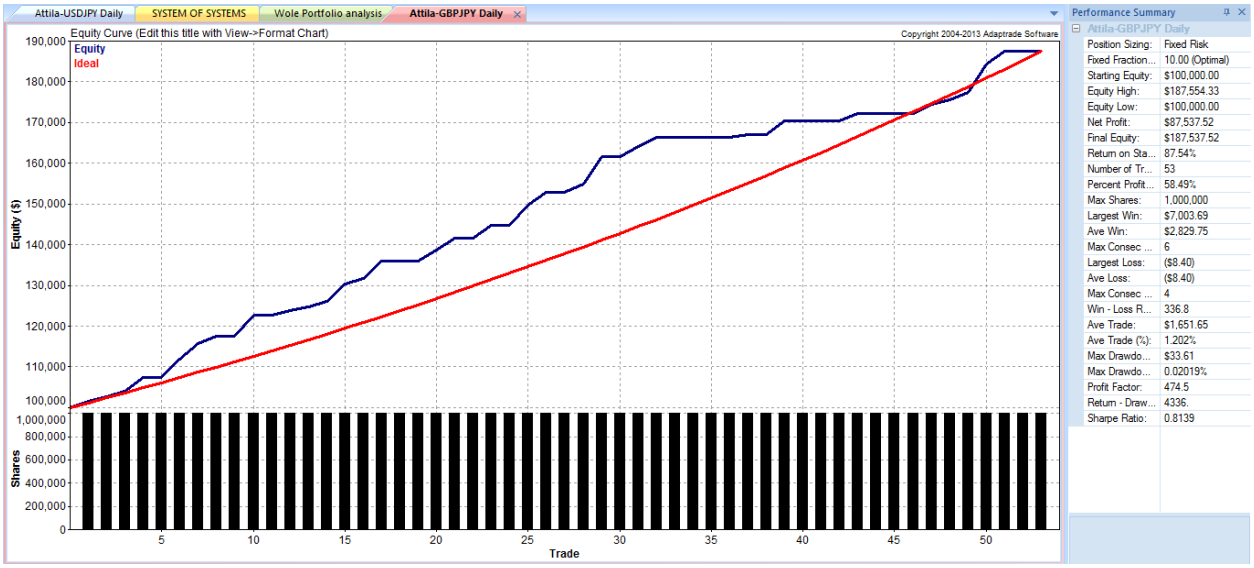


Figure 77- Position size optimization for rate of return graph: GBPJPY

Ichi Strategy Analysis: EURJPY

The analysis for the Ichi Strategy implemented on the EURJPY currency pair used a starting account size of $100,000, and a maximum trade size limit of 1,000,000 units, or 10 standard lots. The trades plotted in relation to how much account equity is available at that trade can be seen in **Figure 78**.

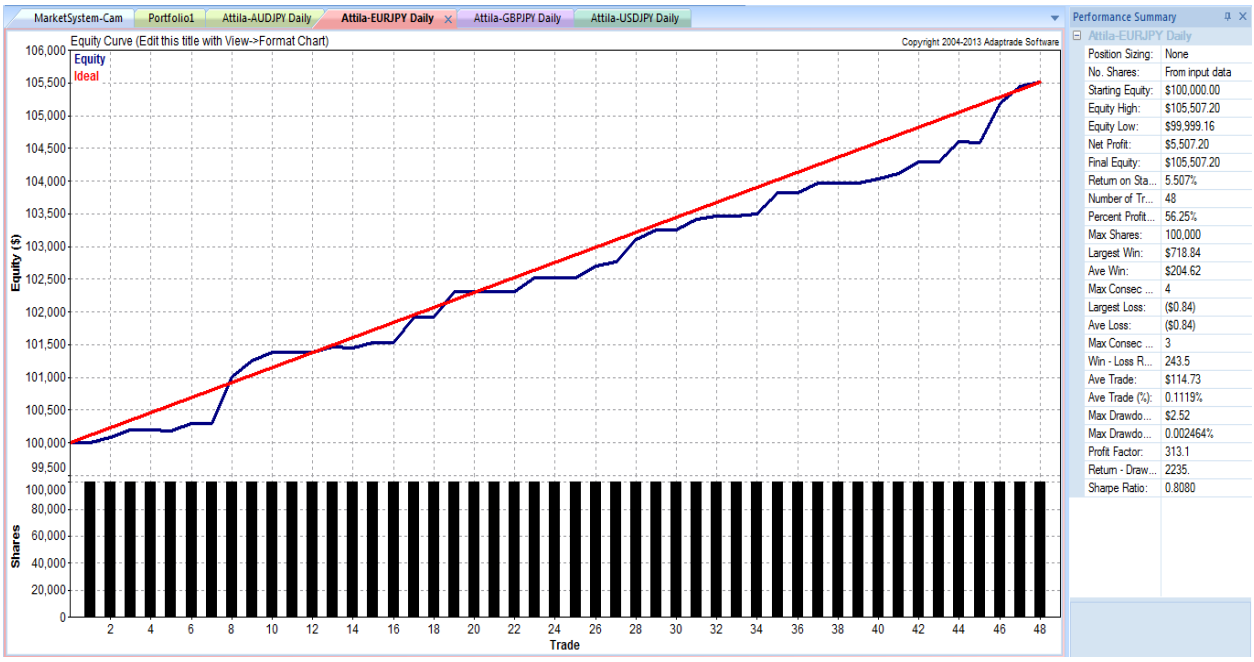


Figure 78- Equity curve of EURJPY

This graph shows the ideal equity curve in red, and the trades made as the blue line. When applied to the EURJPY currency pair, the Ichi Strategy made a net profit of $5,507.20 over the course of 5 years, with 48 trades made. The system was 56.25% profitable, with an average winning trade of $204.62, and an average losing trade of $0.84. The largest losing trade for the whole 5 years was also $0.84. The max drawdown of the system was $2.52 and the profit factor of this system was 313.1.

Once the Monte Carlo analysis has been run on the system, a more confident prediction of probability can be made on the system. Statistically speaking, the Monte Carlo analysis aims to show how valid a system can be by randomizing all of the trades, and showing a confidence range of where the trades could possibly lie. The Monte Carlo analysis for the EURJPY currency pair can be seen in **Figure 79**, and the corresponding performance report of the analysis in **Figure 80** and **Figure 81**.

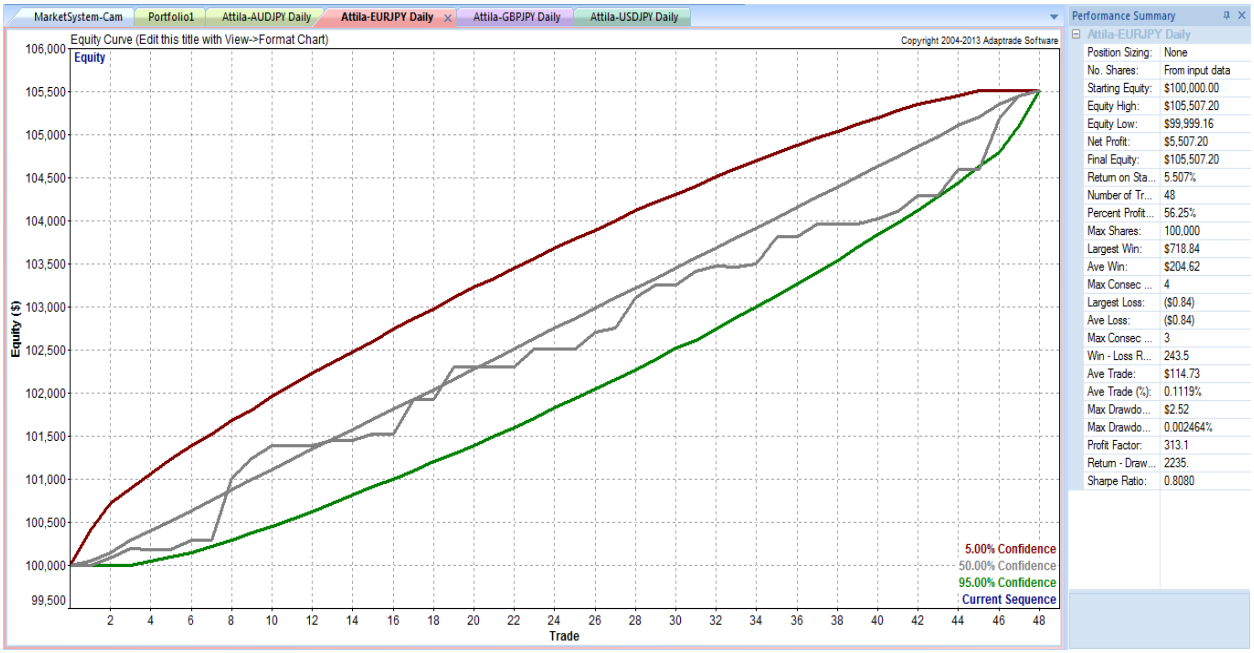


Figure 79- Monte Carlo analysis for EURJPY

Market System: Attila-EURJPY Daily

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	5.507	0.003276	1681.	0.7033
60	5.507	0.003324	1657.	0.7025
70	5.507	0.003984	1382.	0.7016
80	5.507	0.004114	1339.	0.7007
85	5.507	0.004175	1319.	0.7001
90	5.507	0.004840	1138.	0.6994
91	5.507	0.004879	1129.	0.6993
92	5.507	0.004914	1121.	0.6991
93	5.507	0.004949	1113.	0.6989
94	5.507	0.004983	1105.	0.6987
95	5.507	0.005024	1096.	0.6985
96	5.507	0.005600	983.4	0.6982
97	5.507	0.005681	969.4	0.6979
98	5.507	0.005806	948.5	0.6976
99	5.507	0.006470	851.1	0.6971
100	5.507	0.01069	515.3	0.6950

Figure 80- Monte Carlo analysis report EURJPY part 1

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $5,507.20
Final Account Equity: $105,507.20
Return on Starting Equity: 5.507%
Profit Factor: 313.1

Largest Winning Trade: $718.84
Largest Winning Trade (%): 0.6865%
Average Winning Trade: $204.62
Average Winning Trade (%): 0.1995%

Average Trade: $114.73
Average Trade (%): 0.1119%
Trade Standard Deviation: $162.97
Trade Standard Deviation (%): 0.1602%

Worst Case Drawdown: ($5.04)
Worst Case Drawdown (%): 0.005024%
Average Drawdown: ($1.96)
Average Drawdown (%): 0.001891%

Max Number of Shares: 100,000
Minimum Number of Shares: 100,000
Average Number of Shares: 100,000

Largest Losing Trade: ($0.84)
Largest Losing Trade (%): -0.000840%
Average Losing Trade: ($0.84)
Average Losing Trade (%): -0.000825%

Win/Loss Ratio: 243.5
Win/Loss Ratio (%/%): 241.9
Max Consecutive Wins: 4
Max Consecutive Losses: 6

Return/Drawdown Ratio: 1096.
Modified Sharpe Ratio: 0.6985

Figure 81- Monte Carlo analysis report EURJPY part 2

The graph of the Monte Carlo analysis shows that after randomly scrambling the trades 10,000 times, the system has the potential to trade anywhere within the shaded area. For this

particular Monte Carlo analysis of this currency, the difference between the two bans is a bit wider than the previous two, causing for the shaded area to be a bit bigger. This allows for more variation of trades. It is wanted to have a tighter margin amongst the two bands. When the results of the Monte Carlo analysis are observed, across all confidence intervals, the analysis is confident that the system will make a return of 5.507%.

A way to see if the strategy will hold in the future is to project a prediction of 30 trades into the future, and run a Monte Carlo analysis on the predicted 30 trades. In **Figure 82**, it can be seen that the predicted 30 trades into the future agree with the confidence bands of the Monte Carlo analysis.The predicted future trade fall right in the middle of the Monte Carlo analysis bands, and runs along the 50% confidence band. It is already a good sign that the predicted trades fall within the shaded region, but the shaded region is also not very big, and it goes in a positive linear manor. Since the lower band doesn't dip, and stays in a positive linear fashion, there can be potential confidence that the strategy will stay profitable in the future. In **Figure 83** and **Figure 84**, the report of the Monte Carlo analysis of the predicted 30 trades can be seen. Out of this report, we can see that from the analysis, there can be 97% confidence that the strategy have a 3.610% rate of return, 96% confidence of a 3.712% rate of return, and a 95% confidence of a 3.804% rate of return.

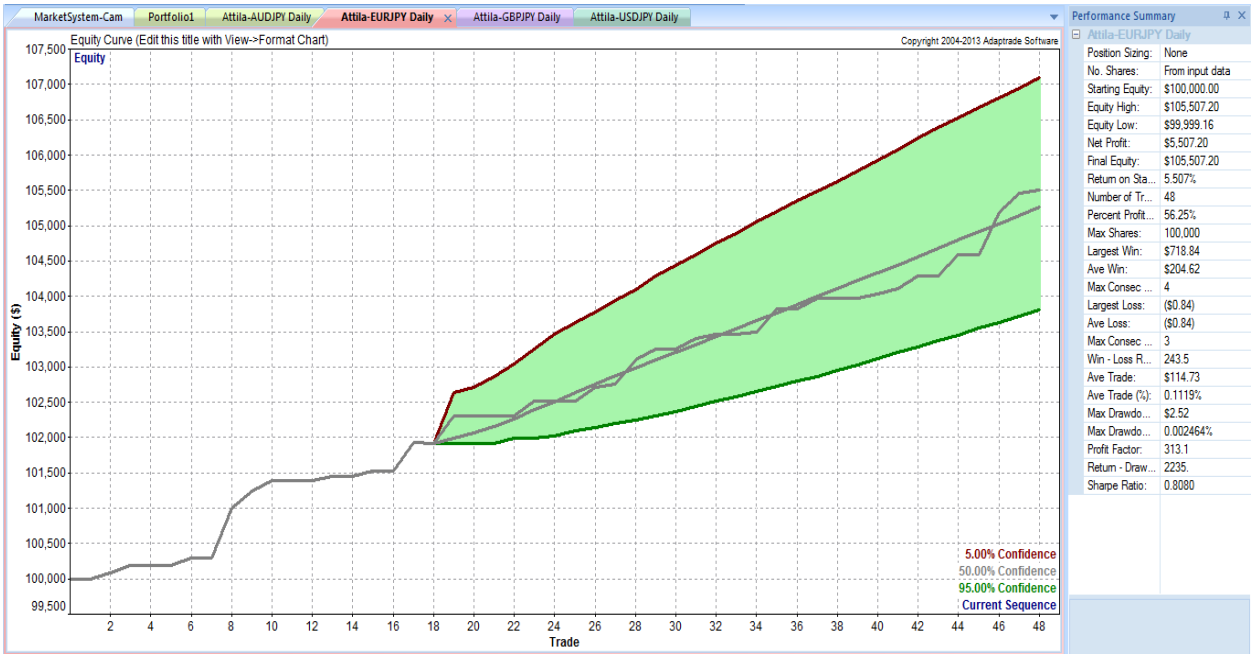


Figure 82- 30 Predicted future trades for EURJPY

Market System: Attila-EURJPY Daily

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	5.261	0.003233	1711.	0.6086
60	5.005	0.003279	1509.	0.5942
70	4.747	0.003997	1325.	0.5792
80	4.453	0.004099	1144.	0.5618
85	4.284	0.004736	1042.	0.5514
90	4.093	0.004909	929.7	0.5392
91	4.046	0.004930	899.9	0.5360
92	3.995	0.004946	872.2	0.5323
93	3.933	0.004946	841.9	0.5287
94	3.877	0.005645	807.8	0.5246
95	3.804	0.005701	770.8	0.5195
96	3.712	0.005752	735.3	0.5153
97	3.610	0.006425	684.4	0.5078
98	3.460	0.006565	623.5	0.4985
99	3.286	0.007362	542.9	0.4847
100	2.710	0.01235	267.3	0.4198

Figure 83- 30 Predicted future trade analysis report EURJPY part 1

Monte Carlo Results at 95.00% Confidence	
Total Net Profit: $3,804.14	Max Number of Shares: 100,000
Final Account Equity: $103,804.14	Minimum Number of Shares: 100,000
Return on Starting Equity: 3.804%	Average Number of Shares: 100,000
Profit Factor: 172.2	
Largest Winning Trade: $718.84	Largest Losing Trade: ($0.84)
Largest Winning Trade (%): 0.7168%	Largest Losing Trade (%): -0.000840%
Average Winning Trade: $165.15	Average Losing Trade: ($0.84)
Average Winning Trade (%): 0.1621%	Average Losing Trade (%): -0.000824%
Average Trade: $79.25	Win/Loss Ratio: 196.5
Average Trade (%): 0.07791%	Win/Loss Ratio (%/%): 197.1
Trade Standard Deviation: $225.36	Max Consecutive Wins: 3
Trade Standard Deviation (%): 0.2184%	Max Consecutive Losses: 7
Worst Case Drawdown: ($5.88)	Return/Drawdown Ratio: 770.8
Worst Case Drawdown (%): 0.005701%	Modified Sharpe Ratio: 0.5195
Average Drawdown: ($1.75)	
Average Drawdown (%): 0.001707%	

Figure 84- 30 Predicted future trade analysis report EURJPY part 2

MSA has the feature to set a fixed rate position size percentage to the system being worked with. The position size can then be optimized to maximize certain specifications, such as net profit, profitability, or rate of return. A position size of 2% of the account equity per trade was set, and then optimized for both maximum net profit, and for maximum rate of return. The optimization done on the position size to maximize net profit can be seen in **Figure 85** and **Figure 86**. When the position size was optimized for maximum net profit, the net profit rose from $5,507.20 to $55,071.98 over the 5 year time period. The optimal position size percentage that was found was a fixed rate of 10%.

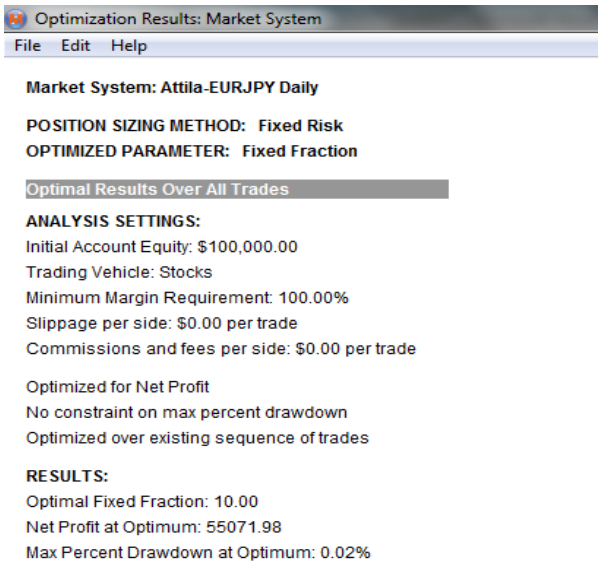


Figure 85- Position size optimization report for net profit: EURJPY

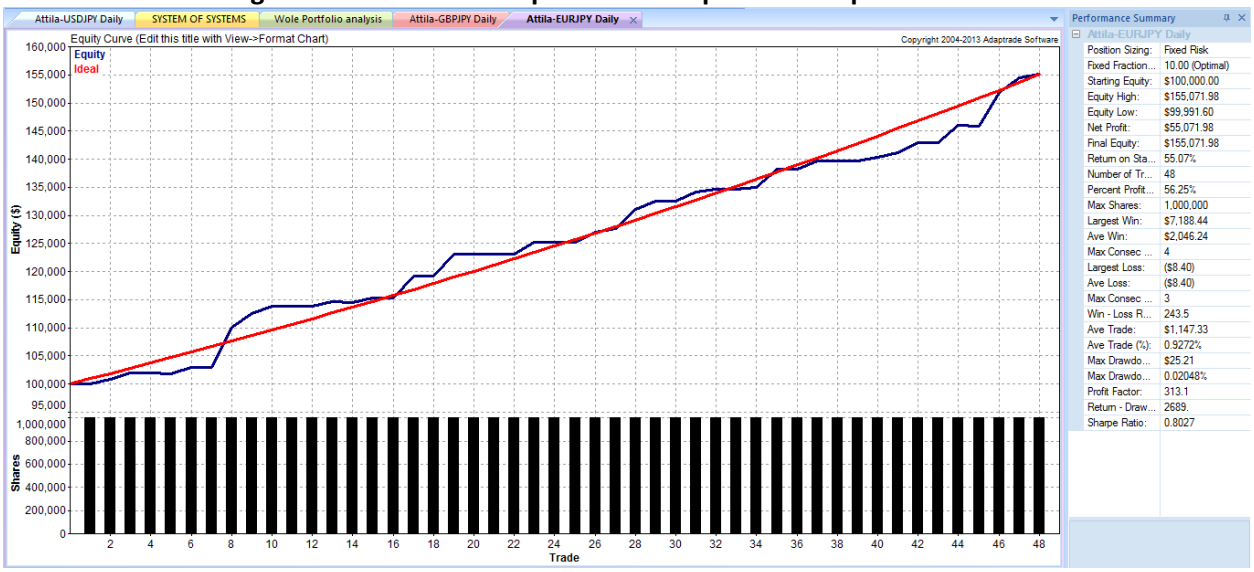


Figure 86- Position size optimization for net profit graph: EURJPY

Another optimization done to the position sizing was to maximize the rate of return. In **Figure 87** the optimization report can be seen with an optimized position size of 10%, a rate of return of 55.07%, and a net profit of $55,071.98. There is no particular difference between this optimization and the last because they both have the same position size percentage, the same rate

of return, and the same net profit. The graph of the optimized position size for maximum rate of return can be seen in **Figure 88**.

Optimization Results: Market System

File Edit Help

Market System: Attila-EURJPY Daily

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 55.07
Max Percent Drawdown at Optimum: 0.02%

Figure 87- Position size optimization report for rate of return: EURJPY

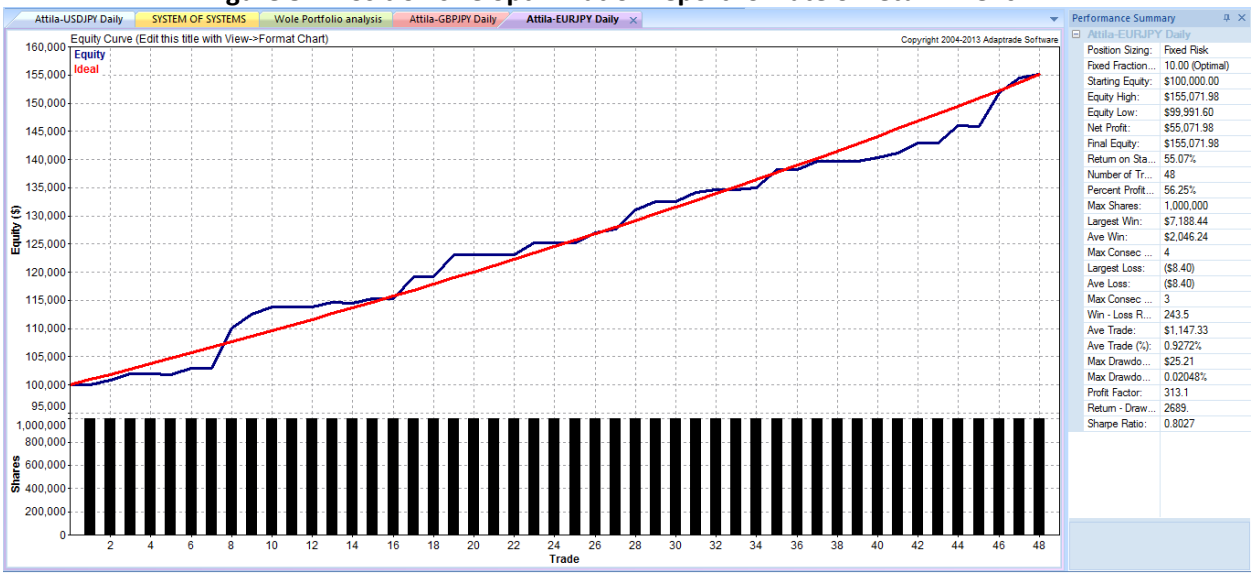


Figure 88- Position size optimization for rate of return: EURJPY

Ichi Strategy Analysis: AUDJPY

The analysis for the Ichi Strategy implemented on the AUDJPY currency pair used a starting account size of $100,000, and a maximum trade size limit of 1,000,000 units, or 10

standard lots. The trades plotted in relation to how much account equity is available at that trade can be seen in **Figure 89**.

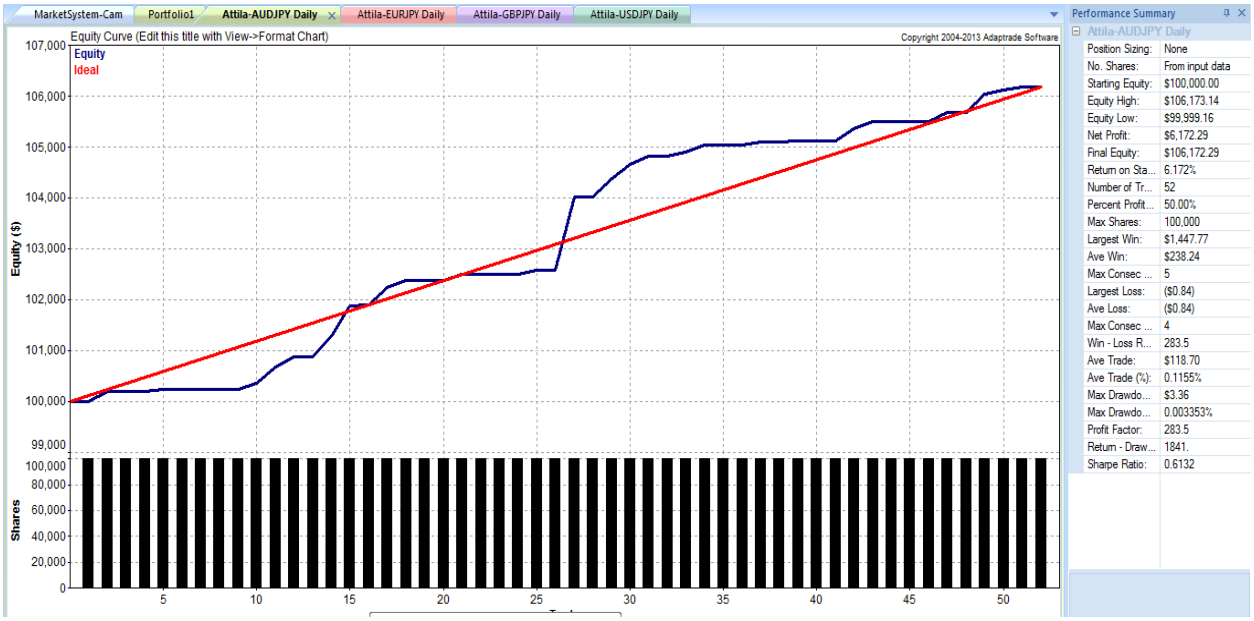


Figure 89- Equity curve of AUDJPY

This graph shows the ideal equity curve in red, and the trades made as the blue line. When applied to the AUDJPY currency pair, the Ichi Strategy made a net profit of $6,172.29 over the course of 5 years, with 52 trades made. The system was 50% profitable, with an average winning trade of $238.24, and an average losing trade of $0.84. The largest losing trade for the whole 5 years was also $0.84. The max drawdown of the system was $3.36 and the profit factor of this system was 283.5.

Once the Monte Carlo analysis has been run on the system, a more confident prediction of probability can be made on the system. Statistically speaking, the Monte Carlo analysis aims to show how valid a system can be by randomizing all of the trades, and showing a confidence range of where the trades could possibly lie. The Monte Carlo analysis for the AUDJPY currency pair can be seen in **Figure 90**, and the corresponding performance report of the analysis in **Figure 91** and **Figure 92**.

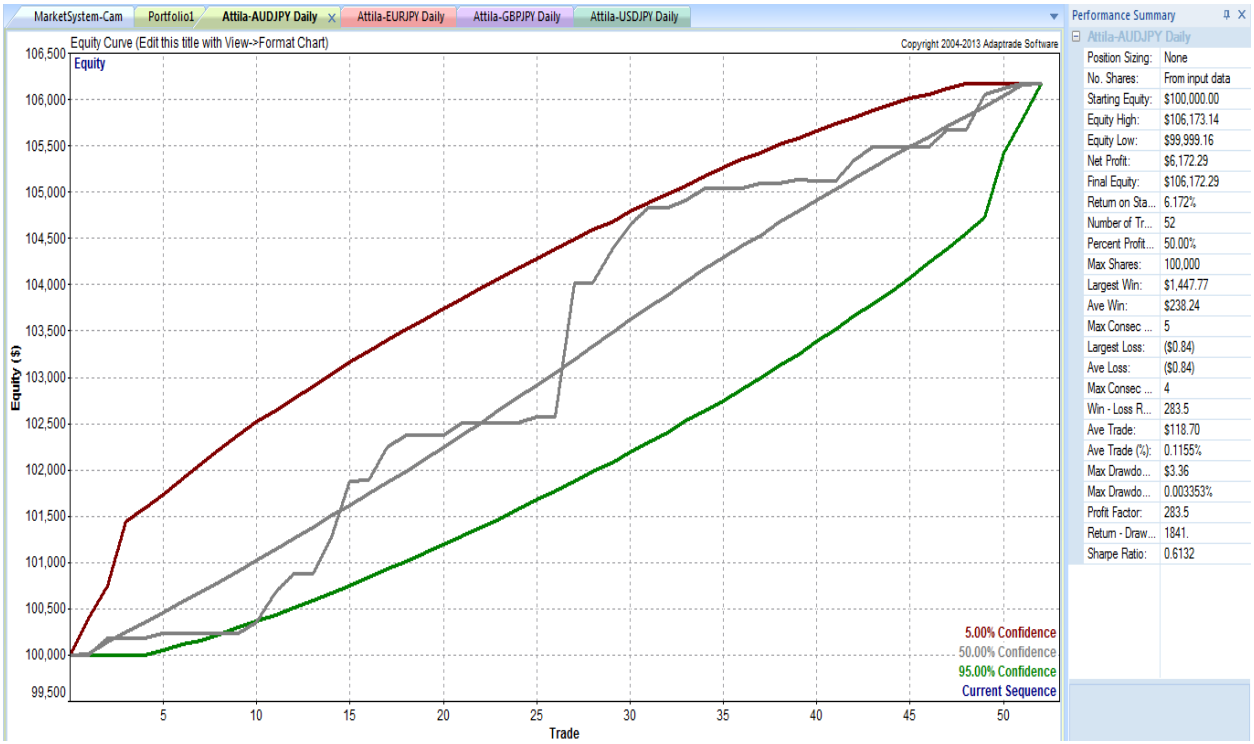
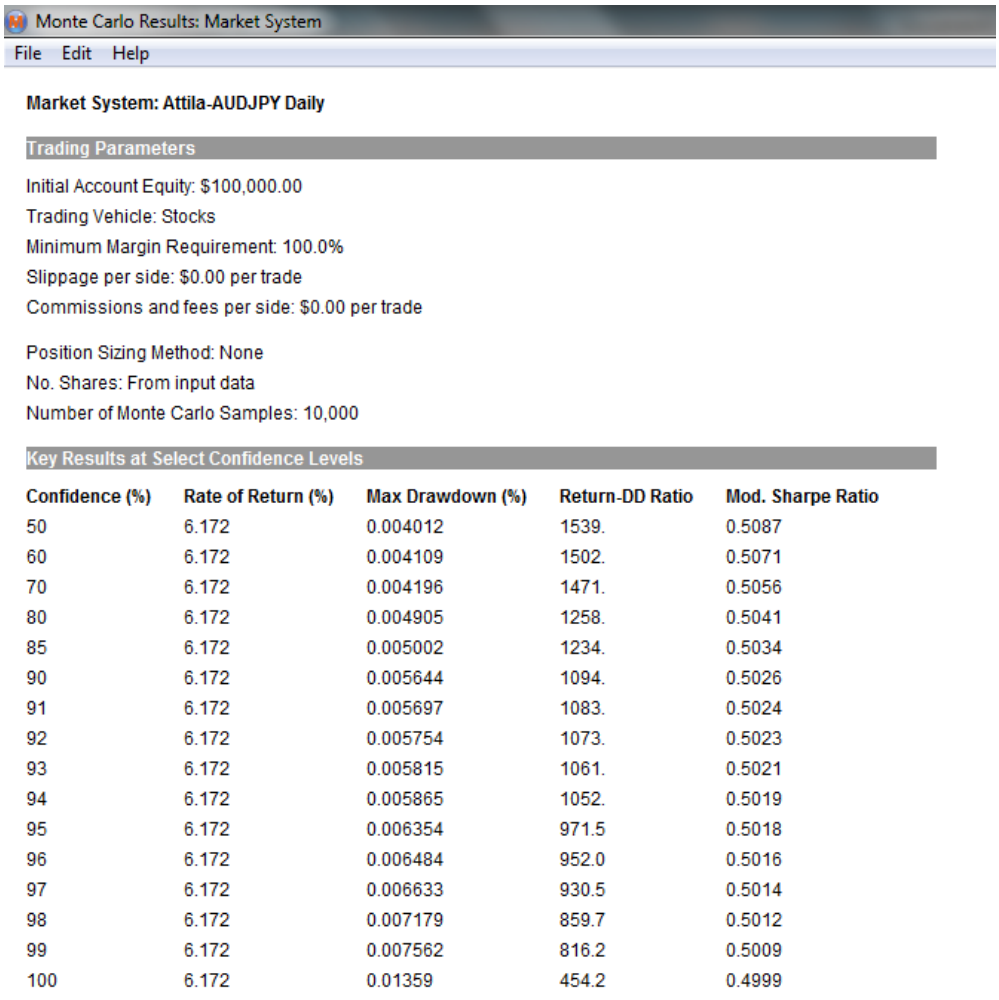


Figure 90- Monte Carlo analysis of AUDJPY



Monte Carlo Results: Market System

File Edit Help

Market System: Attila-AUDJPY Daily

Trading Parameters

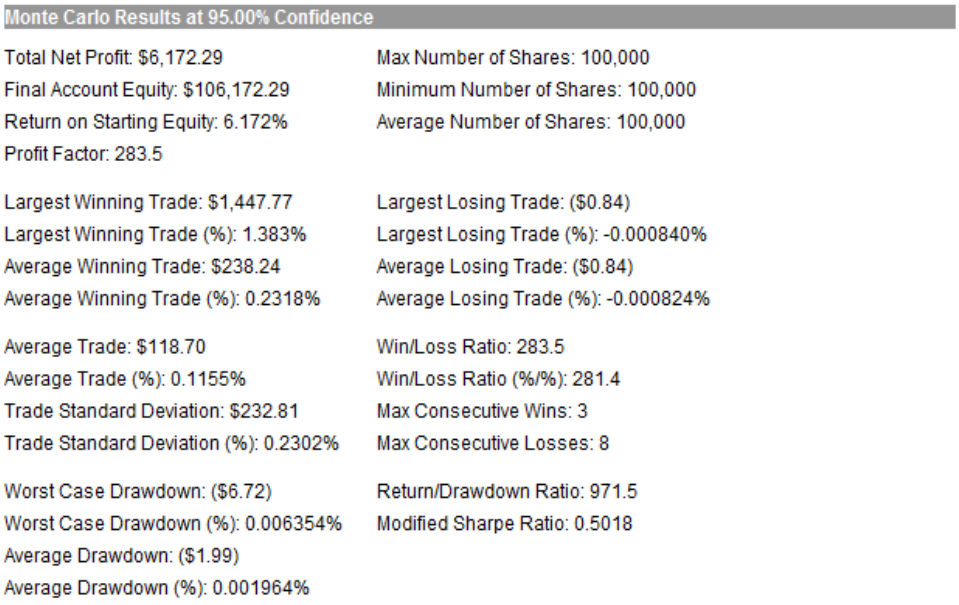
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	6.172	0.004012	1539.	0.5087
60	6.172	0.004109	1502.	0.5071
70	6.172	0.004196	1471.	0.5056
80	6.172	0.004905	1258.	0.5041
85	6.172	0.005002	1234.	0.5034
90	6.172	0.005644	1094.	0.5026
91	6.172	0.005697	1083.	0.5024
92	6.172	0.005754	1073.	0.5023
93	6.172	0.005815	1061.	0.5021
94	6.172	0.005865	1052.	0.5019
95	6.172	0.006354	971.5	0.5018
96	6.172	0.006484	952.0	0.5016
97	6.172	0.006633	930.5	0.5014
98	6.172	0.007179	859.7	0.5012
99	6.172	0.007562	816.2	0.5009
100	6.172	0.01359	454.2	0.4999

Figure 91- Monte Carlo analysis report AUDJPY part 1



Monte Carlo Results at 95.00% Confidence

Total Net Profit: $6,172.29
Final Account Equity: $106,172.29
Return on Starting Equity: 6.172%
Profit Factor: 283.5

Max Number of Shares: 100,000
Minimum Number of Shares: 100,000
Average Number of Shares: 100,000

Largest Winning Trade: $1,447.77
Largest Winning Trade (%): 1.383%
Average Winning Trade: $238.24
Average Winning Trade (%): 0.2318%

Largest Losing Trade: ($0.84)
Largest Losing Trade (%): -0.000840%
Average Losing Trade: ($0.84)
Average Losing Trade (%): -0.000824%

Average Trade: $118.70
Average Trade (%): 0.1155%
Trade Standard Deviation: $232.81
Trade Standard Deviation (%): 0.2302%

Win/Loss Ratio: 283.5
Win/Loss Ratio (%/%): 281.4
Max Consecutive Wins: 3
Max Consecutive Losses: 8

Worst Case Drawdown: ($6.72)
Worst Case Drawdown (%): 0.006354%
Average Drawdown: ($1.99)
Average Drawdown (%): 0.001964%

Return/Drawdown Ratio: 971.5
Modified Sharpe Ratio: 0.5018

Figure 92- Monte Carlo analysis report AUDJPY part 2

The graph of the Monte Carlo analysis shows that after randomly scrambling the trades 10,000 times, the system has the potential to trade anywhere within the shaded area. For this particular Monte Carlo analysis of this currency, the difference between the two bans is a bit wider than the previous 3, causing for the shaded area to be a bit bigger. This allows for more variation of trades. It is wanted to have a tighter margin amongst the two bands. When the results of the Monte Carlo analysis are observed, across all confidence intervals, the analysis is confident that the system will make a return of 6.172%.

A way to see if the strategy will hold in the future is to project a prediction of 30 trades into the future, and run a Monte Carlo analysis on the predicted 30 trades. In **Figure 93**, it can be seen that the predicted 30 trades into the future agree with the confidence bands of the Monte Carlo analysis. It can be seen that the predicted trades broke through the upper 5% confidence band, which can give insight to potential outliers of the strategy. Since the lower band doesn't dip, and stays in a positive linear fashion, there can be potential confidence that the strategy will stay profitable in the future. In **Figure 94** and **Figure 95**, the report of the Monte Carlo analysis of the predicted 30 trades can be seen. Out of this report, we can see that from the analysis, there can be 97% confidence that the strategy have a 4.522% rate of return, 96% confidence of a 4.599% rate of return, and a 95% confidence of a 4.667% rate of return.

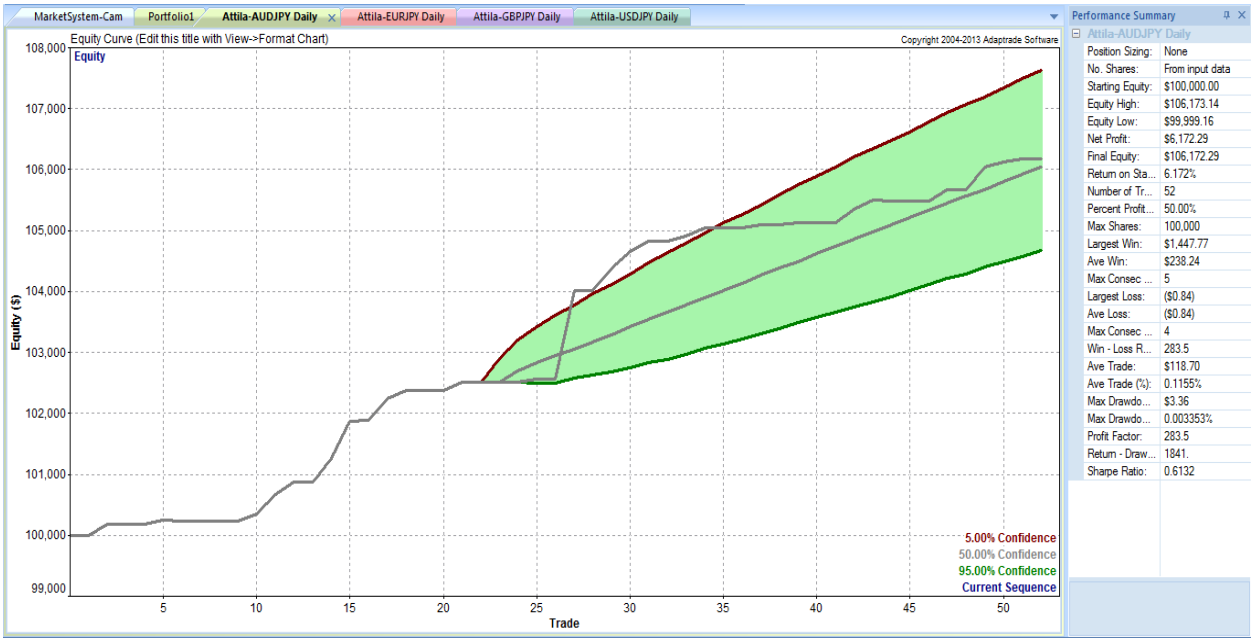


Figure 93- 30 Predicted future trades for AUDJPY

Market System: Attila-AUDJPY Daily

Trading Parameters

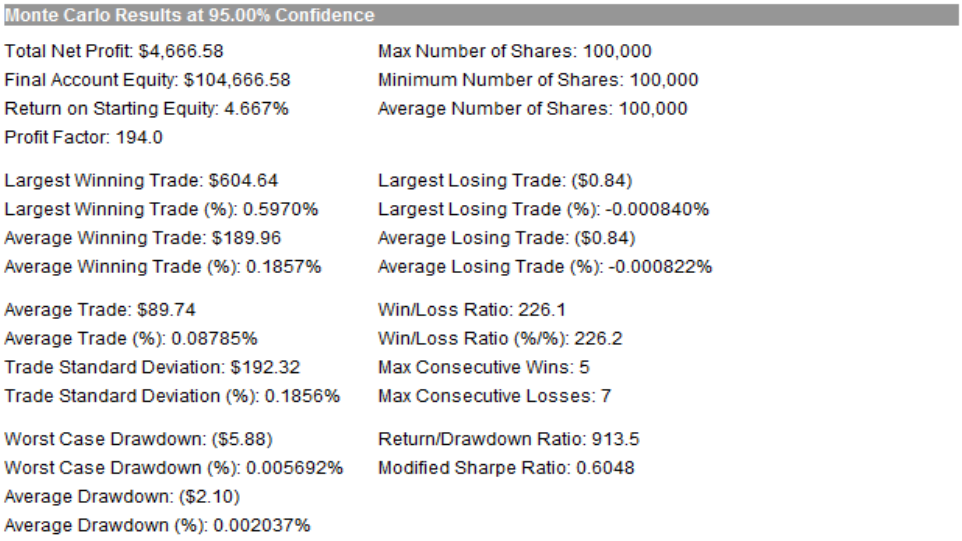
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	6.041	0.003353	1718.	0.7037
60	5.814	0.003353	1614.	0.6877
70	5.579	0.003991	1485.	0.6711
80	5.313	0.004086	1322.	0.6516
85	5.155	0.004793	1211.	0.6396
90	4.943	0.004893	1079.	0.6251
91	4.900	0.004912	1055.	0.6222
92	4.843	0.004918	1023.	0.6189
93	4.788	0.005595	992.6	0.6148
94	4.725	0.005645	959.6	0.6100
95	4.667	0.005692	913.5	0.6048
96	4.599	0.005735	868.9	0.5984
97	4.522	0.006411	818.6	0.5909
98	4.400	0.006516	759.1	0.5816
99	4.196	0.007308	684.3	0.5652
100	3.063	0.01230	281.6	0.4723

Figure 94- 30 Predicted future trade analysis report AUDJPY part 1



Monte Carlo Results at 95.00% Confidence

Total Net Profit: $4,666.58	Max Number of Shares: 100,000
Final Account Equity: $104,666.58	Minimum Number of Shares: 100,000
Return on Starting Equity: 4.667%	Average Number of Shares: 100,000
Profit Factor: 194.0	
Largest Winning Trade: $604.64	Largest Losing Trade: ($0.84)
Largest Winning Trade (%): 0.5970%	Largest Losing Trade (%): -0.000840%
Average Winning Trade: $189.96	Average Losing Trade: ($0.84)
Average Winning Trade (%): 0.1857%	Average Losing Trade (%): -0.000822%
Average Trade: $89.74	Win/Loss Ratio: 226.1
Average Trade (%): 0.08785%	Win/Loss Ratio (%/%): 226.2
Trade Standard Deviation: $192.32	Max Consecutive Wins: 5
Trade Standard Deviation (%): 0.1856%	Max Consecutive Losses: 7
Worst Case Drawdown: ($5.88)	Return/Drawdown Ratio: 913.5
Worst Case Drawdown (%): 0.005692%	Modified Sharpe Ratio: 0.6048
Average Drawdown: ($2.10)	
Average Drawdown (%): 0.002037%	

Figure 95- 30 Predicted future trade analysis report AUDJPY part 2

MSA has the feature to set a fixed rate position size percentage to the system being worked with. The position size can then be optimized to maximize certain specifications, such as net profit, profitability, or rate of return. A position size of 2% of the account equity per trade was set, and then optimized for both maximum net profit, and for maximum rate of return. The optimization done on the position size to maximize net profit can be seen in **Figure 96** and **Figure 97**. When the position size was optimized for maximum net profit, the net profit rose from $6,172.29 to $61,722.95 over the 5 year time period. The optimal position size percentage that was found was a fixed rate of 10%.

Optimization Results: Market System

File Edit Help

Market System: Attila-AUDJPY Daily

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Net Profit at Optimum: 61722.95
Max Percent Drawdown at Optimum: 0.03%

Figure 96- Position size optimization report for net profit: AUDJPY

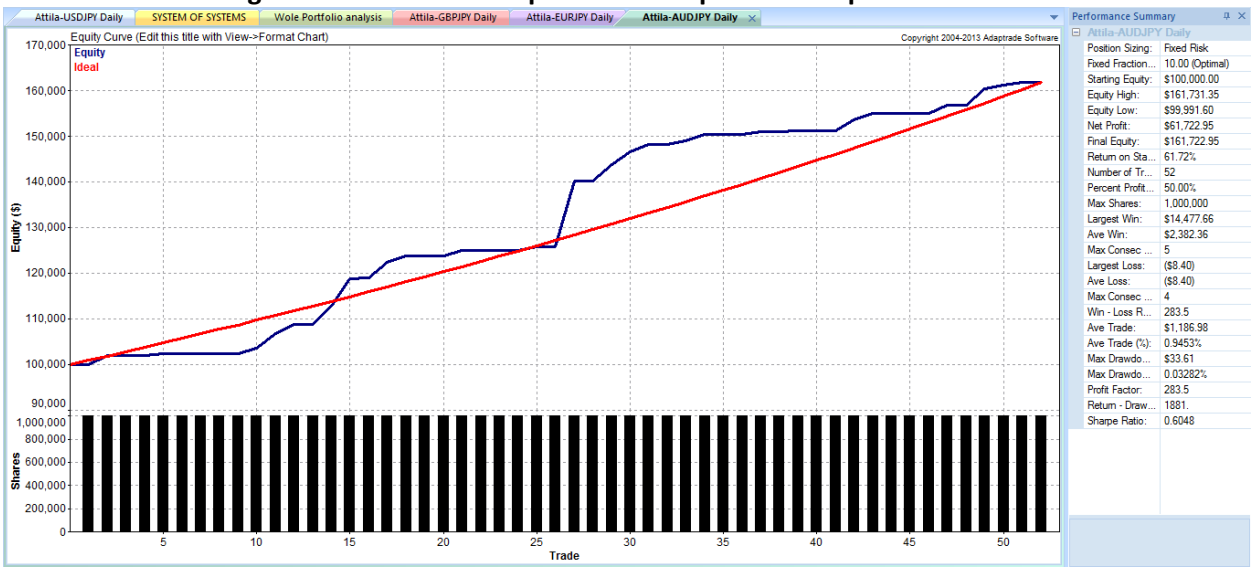


Figure 97- Position size optimization for net profit graph: AUDJPY

Another optimization done to the position sizing was to maximize the rate of return. In **Figure 98** the optimization report can be seen with an optimized position size of 10%, a rate of return of 61.72%, and a net profit of $61,722.95. There is no particular difference between this optimization and the last because they both have the same position size percentage, the same rate

of return, and the same net profit. The graph of the optimized position size for maximum rate of return can be seen in **Figure 99**.

Optimization Results: Market System

File Edit Help

Market System: Attila-AUDJPY Daily

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 61.72
Max Percent Drawdown at Optimum: 0.03%

Figure 98- Position size optimization report for rate of return: AUDJPY

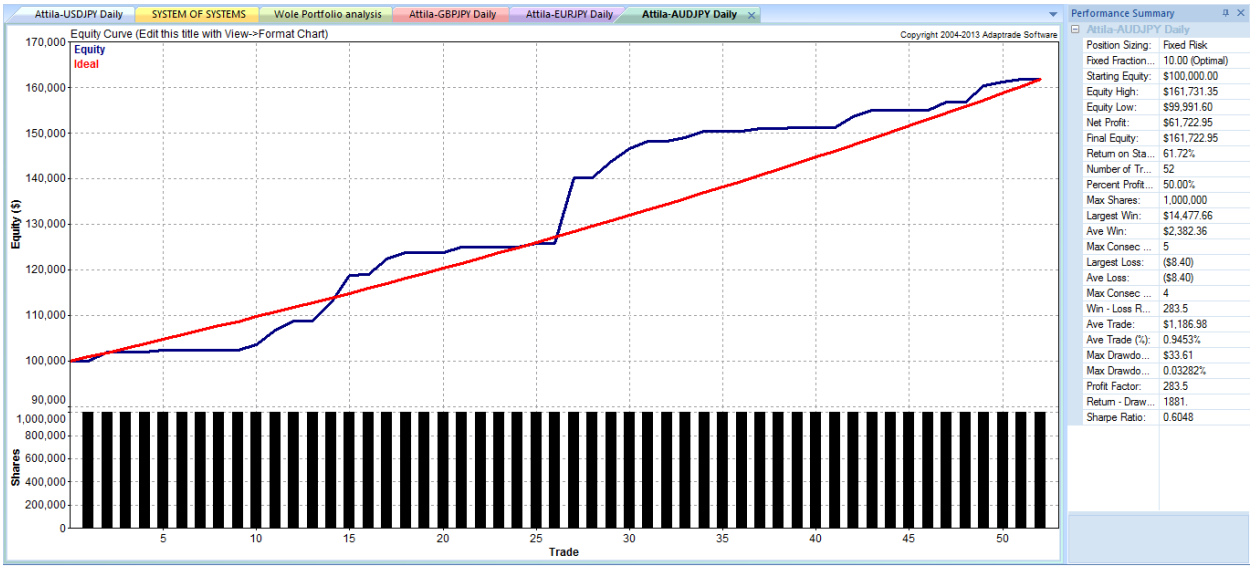


Figure 99- Position size optimization for rate of return: AUDJPY

Ichi Strategy Analysis: Portfolio

The analysis for the Ichi Strategy implemented on the portfolio of currency pairs used a starting account size of $100,000, and a maximum trade size limit of 1,000,000 units, or 10 standard lots. The trades plotted in relation to how much account equity is available at that trade can be seen in **Figure 100**.

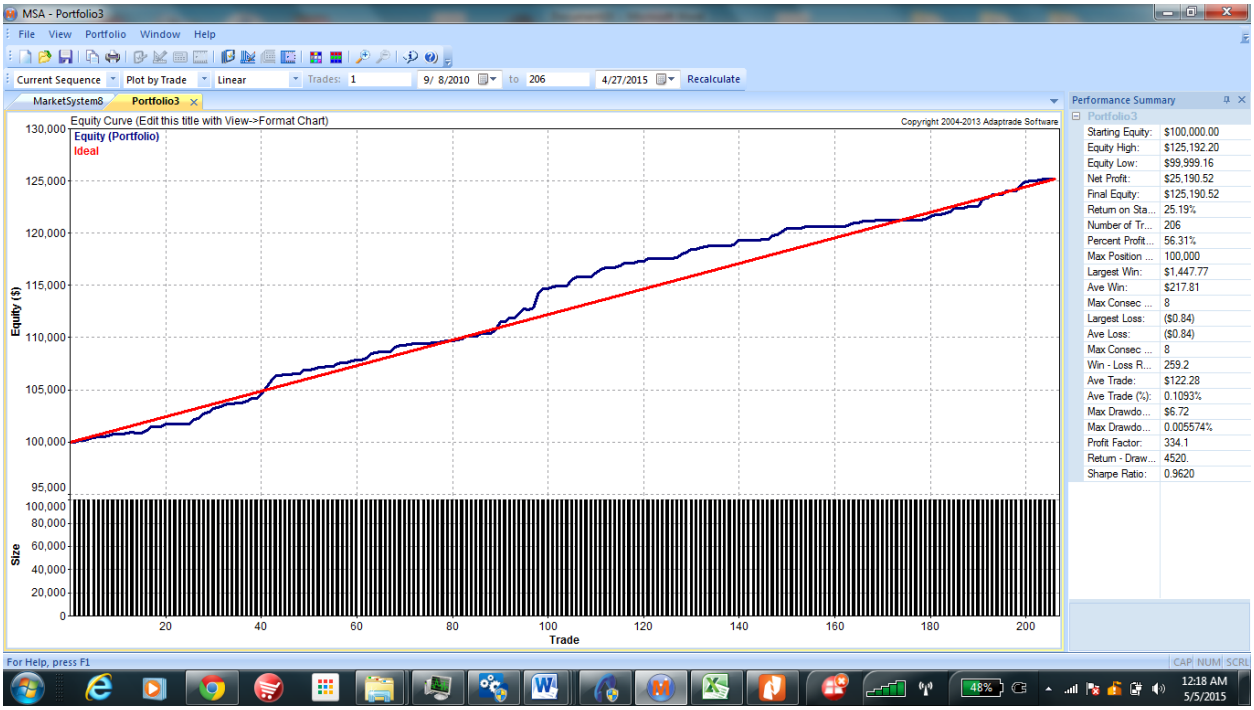


Figure 100- Equity curve for Portfolio

This graph shows the ideal equity curve in red, and the trades made as the blue line. When applied to the entire portfolio of currency pairs, the Ichi Strategy made a net profit of $25,190.52 over the course of 5 years, with 206 trades made. The system was 56.31% profitable, with an average winning trade of $217.81, and an average losing trade of $0.84. The largest losing trade for the whole 5 years was also $0.84. The max drawdown of the system was $6.72 and the profit factor of this system was 334.1.

Once the Monte Carlo analysis has been run on the system, a more confident prediction of probability can be made on the system. Statistically speaking, the Monte Carlo analysis aims

to show how valid a system can be by randomizing all of the trades, and showing a confidence range of where the trades could possibly lie. The Monte Carlo analysis for all of the currency pairs used can be seen in **Figure 101**, and the corresponding performance report of the analysis in **Figure 102** and **Figure 103**.

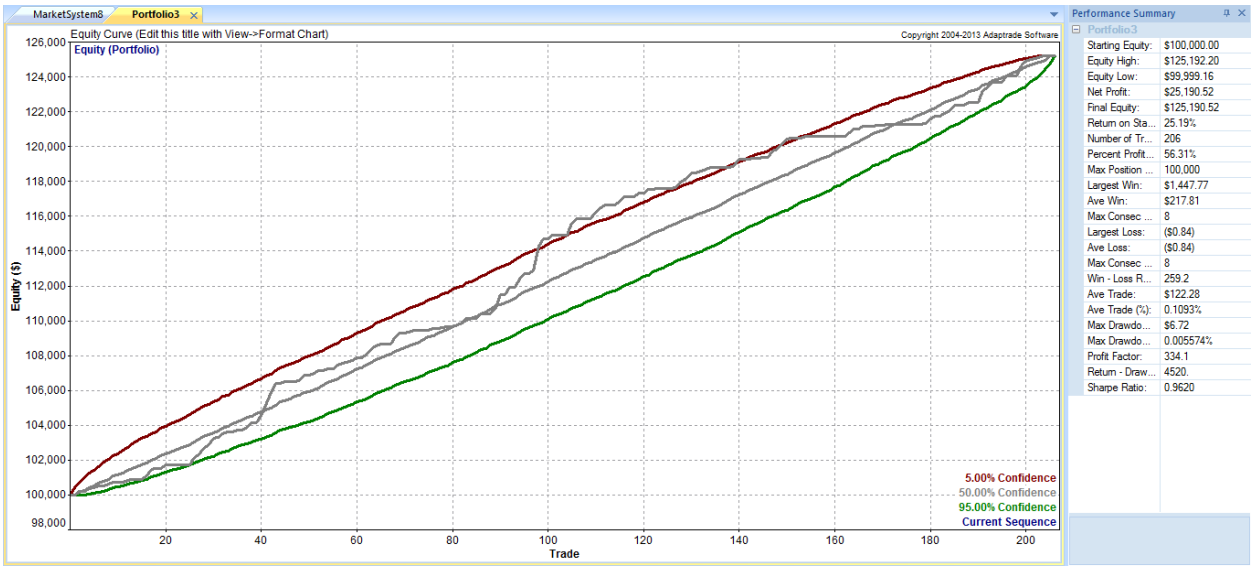


Figure 101- Monte Carlo analysis of Portfolio

Monte Carlo Results: Portfolio

File Edit Help

Portfolio: Portfolio3

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	25.19	0.004201	5996.	0.6590
60	25.19	0.004560	5524.	0.6546
70	25.19	0.004868	5174.	0.6515
80	25.19	0.005239	4808.	0.6484
85	25.19	0.005561	4530.	0.6468
90	25.19	0.005854	4303.	0.6450
91	25.19	0.005932	4246.	0.6446
92	25.19	0.006107	4125.	0.6442
93	25.19	0.006255	4028.	0.6437
94	25.19	0.006390	3942.	0.6432
95	25.19	0.006526	3860.	0.6427
96	25.19	0.006687	3767.	0.6421
97	25.19	0.007000	3599.	0.6414
98	25.19	0.007324	3440.	0.6404
99	25.19	0.007944	3171.	0.6392
100	25.19	0.01264	1993.	0.6328

Figure 102- Monte Carlo analysis report Portfolio part 1

Figure 103- Monte Carlo analysis report Portfolio part 2

The graph of the Monte Carlo analysis shows that after randomly scrambling the trades 10,000 times, the system has the potential to trade anywhere within the shaded area. For the Monte Carlo analysis of the four currency pairs, it can be seen that the bands are pretty tight. This can be reassuring as to whether the trades will stay close to the original trade line. The original trade line does go through the top of the band slightly, which can be a sign some outliers, but because the line stays relatively close to the top band, it isn't very concerning. It is wanted to have a tighter margin amongst the two bands. When the results of the Monte Carlo analysis are observed, across all confidence intervals, the analysis is confident that the system will make a return of 25.19%.

A way to see if the strategy will hold in the future is to project a prediction of 30 trades into the future, and run a Monte Carlo analysis on the predicted 30 trades. In **Figure 104**, it can be seen that the predicted 30 trades into the future agree with the confidence bands of the Monte Carlo analysis. Since the lower band doesn't dip, and stays in a positive linear fashion, there can be potential confidence that the strategy will stay profitable in the future. In **Figure 105** and **Figure 106**, the report of the Monte Carlo analysis of the predicted 30 trades can be seen. Out of this report, we can see that from the analysis, there can be 97% confidence that the strategy have

a 23.28% rate of return, 96% confidence of a 23.38% rate of return, and a 95% confidence of a 23.44% rate of return.

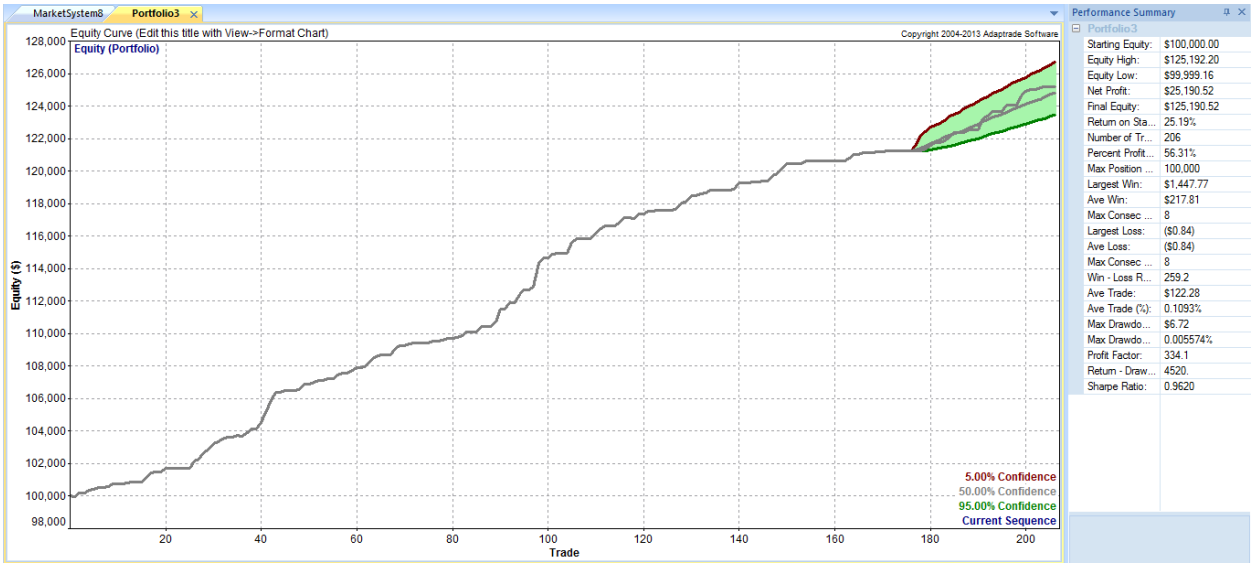


Figure 104- 30 Predicted future trades for Portfolio

Monte Carlo Results: Portfolio

File Edit Help

Portfolio: Portfolio3

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	24.82	0.005574	4448.	0.6544
60	24.59	0.005574	4404.	0.6499
70	24.34	0.005574	4356.	0.6448
80	24.07	0.005574	4302.	0.6381
85	23.92	0.005574	4265.	0.6334
90	23.72	0.005574	4217.	0.6277
91	23.67	0.005574	4203.	0.6260
92	23.63	0.005574	4190.	0.6244
93	23.56	0.005574	4168.	0.6228
94	23.51	0.005574	4137.	0.6209
95	23.44	0.006089	4080.	0.6187
96	23.38	0.006236	3945.	0.6160
97	23.28	0.006236	3814.	0.6129
98	23.16	0.006929	3564.	0.6086
99	22.97	0.007622	3241.	0.6032
100	22.28	0.01178	1922.	0.5705

Figure 105- 30 Predicted future trade analysis report of Portfolio part 1

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $23,440.44	Maximum Position Size: 100,000
Final Account Equity: $123,440.44	Minimum Position Size: 100,000
Return on Starting Equity: 23.44%	Average Position Size: 100,000
Profit Factor: 298.5	
Largest Winning Trade: $1,447.77	Largest Losing Trade: ($0.84)
Largest Winning Trade (%): 1.283%	Largest Losing Trade (%): -0.000840%
Average Winning Trade: $206.02	Average Losing Trade: ($0.84)
Average Winning Trade (%): 0.1850%	Average Losing Trade (%): -0.000742%
Average Trade: $113.79	Win/Loss Ratio: 245.2
Average Trade (%): 0.1024%	Win/Loss Ratio (%/%): 249.9
Trade Standard Deviation: $205.53	Max Consecutive Wins: 8
Trade Standard Deviation (%): 0.1803%	Max Consecutive Losses: 9
Worst Case Drawdown: ($7.56)	Return/Drawdown Ratio: 4080.
Worst Case Drawdown (%): 0.006089%	Modified Sharpe Ratio: 0.6187
Average Drawdown: ($1.61)	
Average Drawdown (%): 0.001414%	

Figure 106- 30 Predicted future trade analysis report of Portfolio part 2

MSA has the feature to set a fixed rate position size percentage to the system being worked with. The position size can then be optimized to maximize certain specifications, such as net profit, profitability, or rate of return. A position size of 2% of the account equity per trade was set, and then optimized for both maximum net profit, and for maximum rate of return. The optimization done on the position size to maximize net profit can be seen in **Figure 107** and **Figure 108**. When the position size was optimized for maximum net profit, the net profit rose from $25,190.52 to $251,905.24 over the 5 year time period. The optimal position size percentages that were found for each currency pair were 20% for the pairs AUDJPY, EURJPY, and USDJPY. The optimal position size for the pair GBPJPY was 10%.

Optimization Results: Portfolio

File Edit Help

Portfolio: Attila Portfolio Analysis

Analysis Settings

Initial Account Equity: $100,000.00
Refer to market systems for margins, costs, and fees

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

Optimization Results

Net Profit at Optimum: 251905.24
Max Percent Drawdown at Optimum: 0.04%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	Fixed Risk	ff = 20.00%
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	Fixed Risk	ff = 20.00%
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	Fixed Risk	ff = 10.00%
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	Fixed Risk	ff = 20.00%

Figure 107-Position size optimization report for net profit: Portfolio

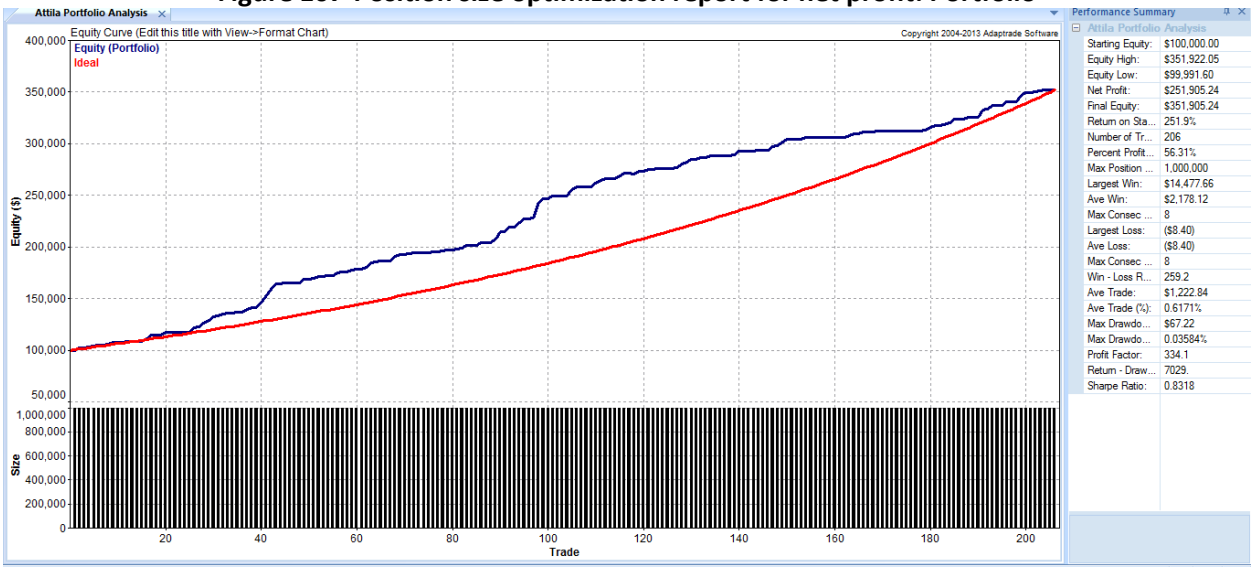


Figure 108- Position size optimization for net profit graph: Portfolio

Another optimization done to the position sizing was to maximize the rate of return. In **Figure 109** the optimization report can be seen with an optimized position size of 10% for the pairs AUDJPY, EURJPY, and USDJPY. The currency pair GBPJPY had an optimal position size of 10%. The rate of return was 251.91%, and had a net profit of $251.905.24. The graph of the optimized position size for maximum rate of return can be seen in **Figure 110**.

Optimization Results: Portfolio

File Edit Help

Portfolio: Attila Portfolio Analysis

Analysis Settings

Initial Account Equity: $100,000.00
Refer to market systems for margins, costs, and fees

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

Optimization Results

Rate of Return at Optimum: 251.91
Max Percent Drawdown at Optimum: 0.04%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	Fixed Risk	ff = 10.00%
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	Fixed Risk	ff = 10.00%
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	Fixed Risk	ff = 20.00%
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	Fixed Risk	ff = 10.00%

Figure 109- Position size optimization report for rate of return: Portfolio

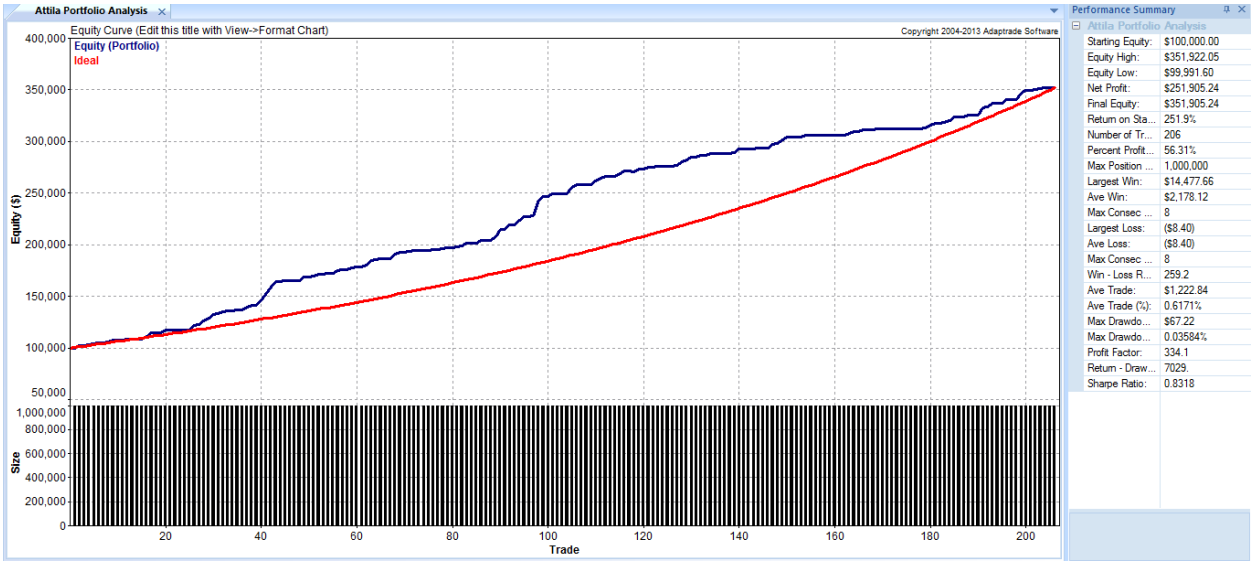


Figure 110- Position size optimization for rate of return graph: Portfolio

Turtle Trend Following System

For the turtle trend following system back-testing, a 30 day future analysis and 2% equity per trade was completed in five different parts. After these analysis were ran, optimization for the net profit and for the return rate were done to improve and compare the results. First the back-testing and 30 day future analysis was completed for each of the four stocks separately and then it was completed for the portfolio of the four stocks together. The back-testing goes back in time to complete the trades for a given time period and the results show how the system did, while the 30 day future analysis runs the system in ahead of present time to predict how the strategy would do in the future. Like mentioned previously, the strategy traded from April 27, 2010 and ending on April 27, 2015 using daily bars.

Apple (AAPL)

The results from the back testing for the Apple (AAPL) stock are shown in **Figure 111** below. The starting equity of the system was $100,000.00 and the result was a net profit of

$36,070.00. The strategy won 47.44% of the 156 trades that were made over the five years, which is around the reasonable 40% profit for a trending strategy, with a profit factor of 1.392. The red line represents the ideal equity for the trades, and the blue line shows what the actual equity was. The strategy was close to the ideal equity, it spent time above the ideal equity then went below but stayed close to the ideal equity. **Figure 112** shows the Monte Carlo results for the trades made over 5 years. The Monte Carlo simulation rearranges the trades 10,000 times to predict the expected outcome of the strategy. The red and green lines represent the maximum, 95% confidence, and minimum, 5% confidence, of the Monte Carlo analysis, which the strategy falls in between. For the most part, the strategy is pretty constant and stays along the 50% confident line, but about half way through it makes a jump down to the 95% confidence maximum for a couple trades before it returns to the constant level. **Figure 113** shows the data from the Monte Carlo Analysis, the system is expected to have a total net profit of $36,070.00. Through the analysis, there is 97% confidence that there will be a return of 36.07% of equity with a max drawdown of 10.34%, 96% confidence that there will be a return of 36.07% of equity with a max drawdown of 9.98% and 95% confidence that there will be a return of 36.07% with a max drawdown of 9.64%. The strategy is predicted to always return 36.07% of the equity, but the drawdown increases with the confidence rate.

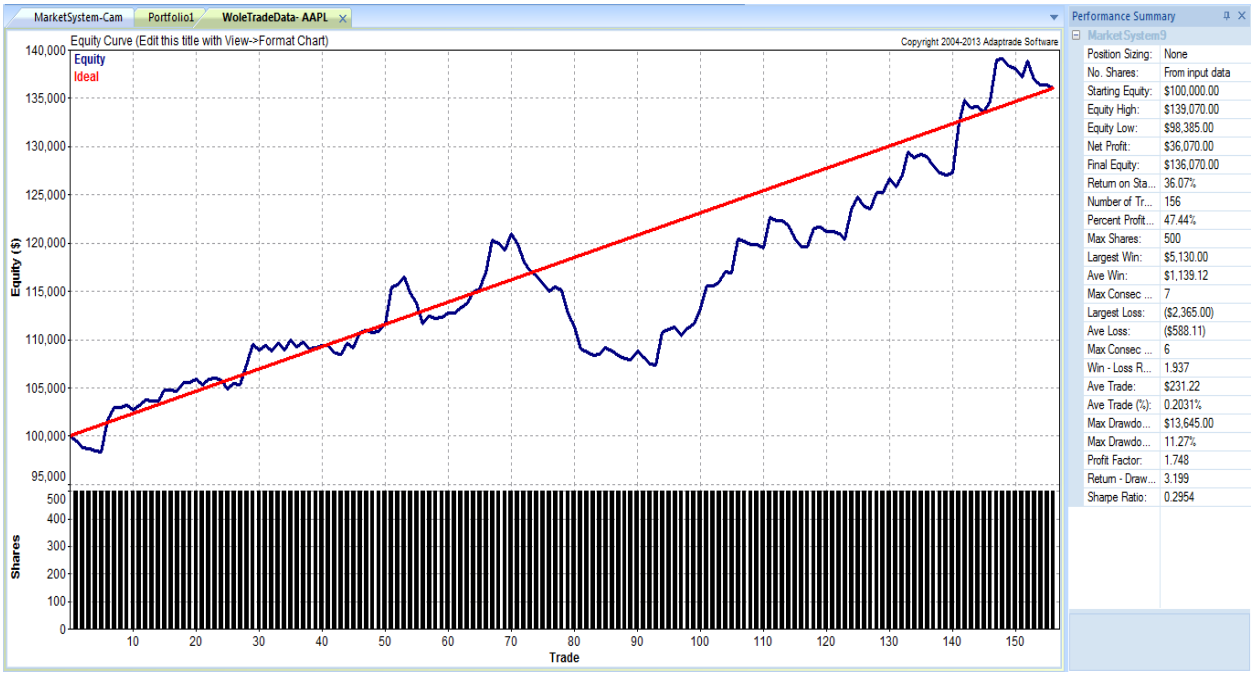


Figure 111: Back-Testing Performance (AAPL)

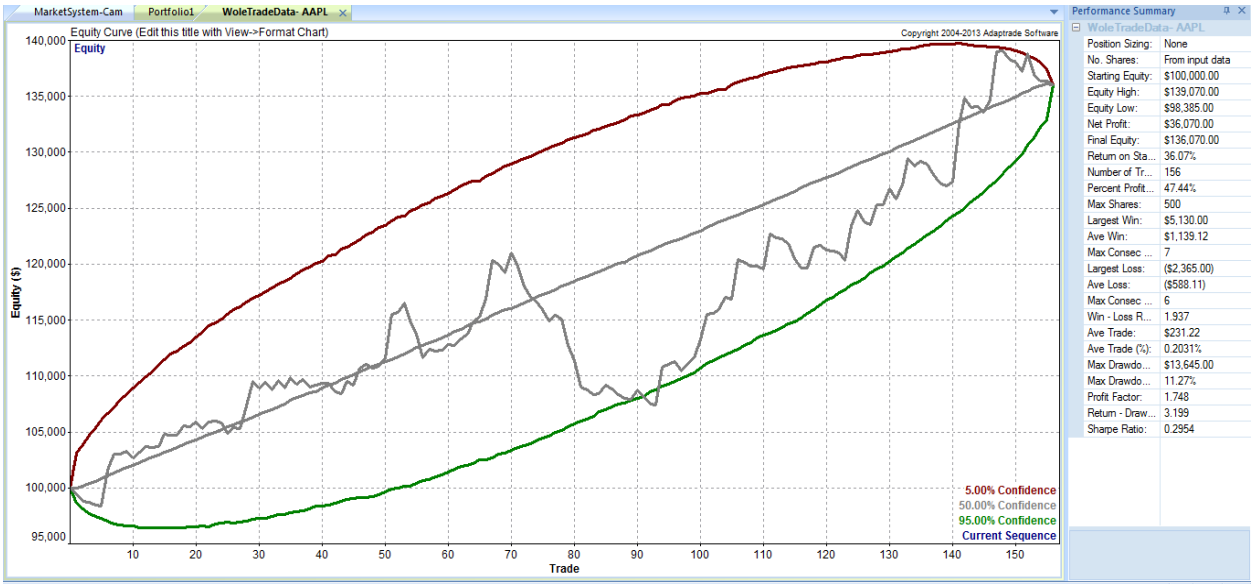


Figure 112: Monte Carlo Performance (AAPL)

Market System: WoleTradeData- AAPL

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	36.07	5.920	6.093	0.1899
60	36.07	6.363	5.669	0.1884
70	36.07	6.876	5.246	0.1869
80	36.07	7.595	4.749	0.1852
85	36.07	8.042	4.485	0.1841
90	36.07	8.670	4.160	0.1827
91	36.07	8.844	4.078	0.1824
92	36.07	8.975	4.019	0.1820
93	36.07	9.170	3.933	0.1816
94	36.07	9.383	3.844	0.1812
95	36.07	9.643	3.741	0.1807
96	36.07	9.977	3.615	0.1801
97	36.07	10.34	3.487	0.1792
98	36.07	10.85	3.325	0.1783
99	36.07	11.93	3.024	0.1767
100	36.07	19.90	1.812	0.1691

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $36,070.00
Final Account Equity: $136,070.00
Return on Starting Equity: 36.07%
Profit Factor: 1.748

Max Number of Shares: 500
Minimum Number of Shares: 500
Average Number of Shares: 500

Largest Winning Trade: $5,130.00
Largest Winning Trade (%): 3.919%
Average Winning Trade: $1,139.12
Average Winning Trade (%): 0.9432%

Largest Losing Trade: ($2,365.00)
Largest Losing Trade (%): -2.376%
Average Losing Trade: ($588.11)
Average Losing Trade (%): -0.5423%

Average Trade: $231.22
Average Trade (%): 0.2027%
Trade Standard Deviation: $1,234.49
Trade Standard Deviation (%): 1.129%

Win/Loss Ratio: 1.937
Win/Loss Ratio (%/%): 1.901
Max Consecutive Wins: 4
Max Consecutive Losses: 10

Worst Case Drawdown: ($11,360.00)
Worst Case Drawdown (%): 9.643%
Average Drawdown: ($2,403.21)
Average Drawdown (%): 2.037%

Return/Drawdown Ratio: 3.741
Modified Sharpe Ratio: 0.1807

Figure 113: Monte Carlo Data (AAPL)

After the Monte Carlo was completed for the back testing, we ran the Monte Carlo for a 30 day future trade. **Figure 114** shows the performances from the Monte Carlo that was ran for 30 trades in the future. The data result for this analysis is shown in **Figure 115.** When the system traded 30 days in the future, the net profit was $19,845.00 with a profit factor of 1.392. The

system is expected to return 18.50% of the equity with an 11.27% max drawdown at 97% confidence, 19.27% of the equity with an 11.27% drawdown at 96% confidence, and 19.84% of the equity with an 11.27% drawdown at 95% confidence. The strategy is also expected to have a max drawdown regardless of the confidence percent. These numbers are lower from the previous Monte Carlo analysis due to the fact that not as many trades were made, but the strategy will continue to make trades and profit in the future. The strategy stays below the 50% confidence level and spends most of the time at the 5% confidence, which isn't assuring for the trader.

Figure 114: Monte Carlo Performance (30 Days In Future) (AAPL)

Market System: WoleTradeData- AAPL

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	29.54	11.27	2.621	0.1723
60	27.96	11.27	2.480	0.1647
70	26.38	11.27	2.340	0.1568
80	24.50	11.27	2.173	0.1474
85	23.37	11.27	2.073	0.1414
90	21.92	11.27	1.945	0.1338
91	21.62	11.27	1.918	0.1323
92	21.25	11.27	1.885	0.1304
93	20.83	11.27	1.848	0.1283
94	20.41	11.27	1.811	0.1258
95	19.84	11.27	1.760	0.1228
96	19.27	11.27	1.709	0.1195
97	18.50	11.27	1.641	0.1151
98	17.62	11.27	1.563	0.1108
99	16.16	11.27	1.434	0.1014
100	8.925	12.70	0.7026	0.05954

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $19,845.00
Final Account Equity: $119,845.00
Return on Starting Equity: 19.84%
Profit Factor: 1.392

Max Number of Shares: 500
Minimum Number of Shares: 500
Average Number of Shares: 500

Largest Winning Trade: $3,860.00
Largest Winning Trade (%): 3.458%
Average Winning Trade: $938.96
Average Winning Trade (%): 0.8314%

Largest Losing Trade: ($2,365.00)
Largest Losing Trade (%): -2.055%
Average Losing Trade: ($633.14)
Average Losing Trade (%): -0.5453%

Average Trade: $127.21
Average Trade (%): 0.1210%
Trade Standard Deviation: $1,209.17
Trade Standard Deviation (%): 1.040%

Win/Loss Ratio: 1.551
Win/Loss Ratio (%/%): 1.587
Max Consecutive Wins: 7
Max Consecutive Losses: 7

Worst Case Drawdown: ($13,645.00)
Worst Case Drawdown (%): 11.27%
Average Drawdown: ($2,350.29)
Average Drawdown (%): 1.985%

Return/Drawdown Ratio: 1.760
Modified Sharpe Ratio: 0.1228

Figure 115: Monte Carlo Data (30 Days in Future) (AAPL)

After the Monte Carlo, a 2% of equity per trade was ran and is shown in **Figure 116**. When 2% of the total equity was allocated to each trade made, the net profit was predicted to be $160,431.38. The increase in the net profit is due to more money being used for trades. The strategy continues to do well with this analysis, and does even better when more money is allocated to each trade.

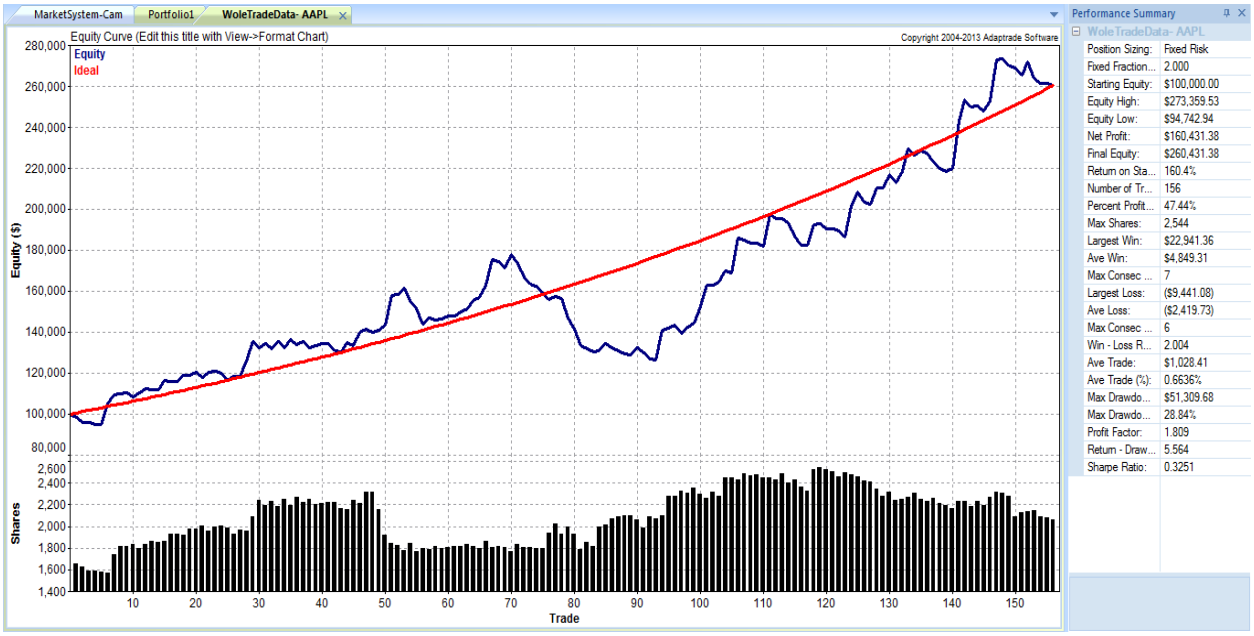


Figure 116: 2% of Equity Per Trade (AAPL)

The last analysis ran for this stock was the optimization for both the net profit and return rate. When optimized, the net profit increased significantly to $193,346.91, shown in **Figure 117**, the return rate increased to 193.34%, shown in **Figure 118,** with a max drawdown was 28.84%. The optimization made significant improvements on the strategy and increased the return rate to guarantee to make more than invested back with the comfort of a fairly low drawdown. **Figure 119** shows the improvement in actual equity versus the ideal equity, with the optimization the actual equity was closer to what is ideal.

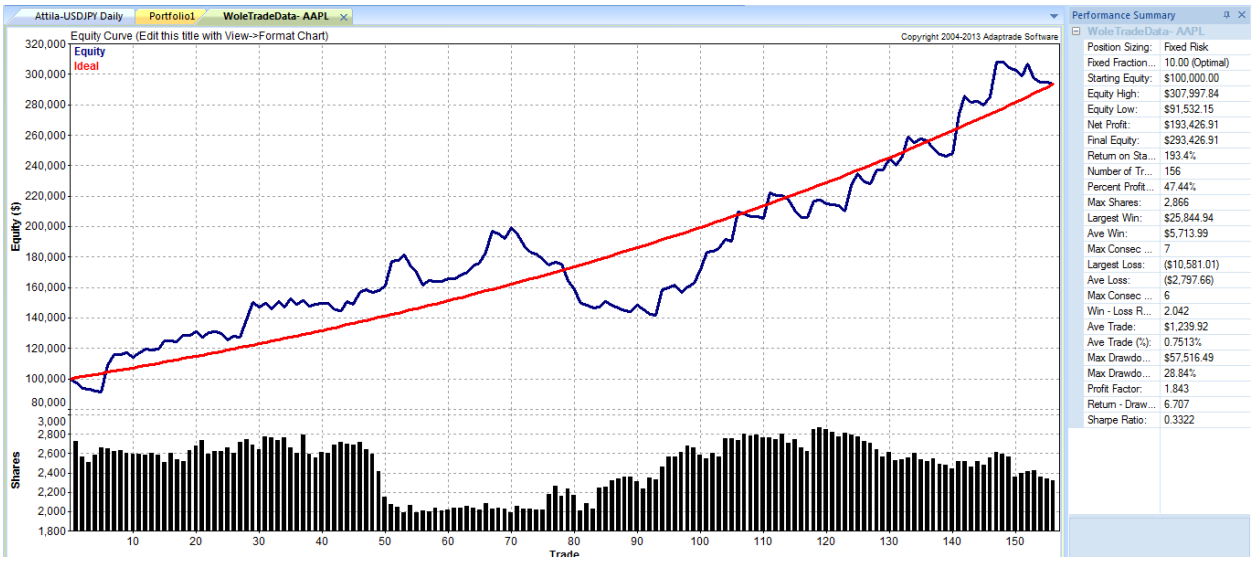


Figure 117: Optimization Performance (AAPL)

Market System: WoleTradeData- AAPL

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Net Profit at Optimum: 193426.91
Max Percent Drawdown at Optimum: 28.84%

Figure 118: Net Profit Optimization (AAPL)

Market System: WoleTradeData- AAPL

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 193.43
Max Percent Drawdown at Optimum: 28.84%

Figure 119: Return Rate Optimization (AAPL)

Amazon (AMZN)

The next stock the strategy was ran on was Amazon (AMZN), the results from the back-testing are shown in **Figure 120** below. The starting equity of the strategy was $100,000.00 and the result was a net profit of $98,900.69. The strategy won 41.52% of the 171 trades that were made over the five years, which is around the reasonable 40% profit for a trending strategy, with a profit factor of 1.432. The strategy fluctuated above and below the ideal equity, but overall was close to the model. Even though the percent factor for this stock is lower compared to the previous one, it resulted in a higher net profit. **Figure 121** shows the Monte Carlo results for the trades made over 5 years. When the Monte Carlo was ran for this stock, the strategy was pretty constant and stayed along the 50% confident line, but towards the end it begins to move towards the 5% confidence then moves towards the 95% confidence. **Figure 122** shows the data from the Monte Carlo Analysis, the strategy is expected to have a total net profit of $80,493.63. Through

the analysis, there is 97% confidence that there will be a return of 79.26% of equity with a max drawdown of 37.48%, 96% confidence that there will be a return of 79.96% of equity with a max drawdown of 36.22% and 95% confidence that there will be a return of 80.49% with a max drawdown of 35.25%. The strategy predicted a much higher rate of return, but the max drawdown is also significantly higher.

Figure 120: Back-Testing Performance (AMZN)

Figure 121: Monte Carlo Performance (AMZN)

Market System: WoleTradeData4- AMZN

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	89.40	22.98	3.896	0.1285
60	87.99	24.46	3.639	0.1266
70	86.47	26.21	3.391	0.1246
80	84.72	28.40	3.113	0.1226
85	83.63	29.92	2.948	0.1214
90	82.44	31.97	2.760	0.1199
91	82.11	32.40	2.723	0.1196
92	81.73	32.96	2.675	0.1192
93	81.36	33.60	2.627	0.1188
94	80.90	34.33	2.579	0.1184
95	80.49	35.25	2.508	0.1179
96	79.96	36.22	2.442	0.1173
97	79.26	37.48	2.362	0.1166
98	78.44	39.02	2.252	0.1156
99	77.04	41.38	2.121	0.1140
100	65.19	52.02	1.678	0.1042

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $80,493.63
Final Account Equity: $180,493.63
Return on Starting Equity: 80.49%
Profit Factor: 1.377

Largest Winning Trade: $17,677.35
Largest Winning Trade (%): 11.98%
Average Winning Trade: $3,763.69
Average Winning Trade (%): 2.797%

Average Trade: $470.72
Average Trade (%): 0.3974%
Trade Standard Deviation: $4,950.76
Trade Standard Deviation (%): 3.631%

Worst Case Drawdown: ($60,113.83)
Worst Case Drawdown (%): 35.25%
Average Drawdown: ($11,615.86)
Average Drawdown (%): 7.772%

Max Number of Shares: 500
Minimum Number of Shares: 200
Average Number of Shares: 414

Largest Losing Trade: ($21,295.00)
Largest Losing Trade (%): -13.70%
Average Losing Trade: ($2,242.75)
Average Losing Trade (%): -1.607%

Win/Loss Ratio: 1.940
Win/Loss Ratio (%/%): 2.040
Max Consecutive Wins: 4
Max Consecutive Losses: 12

Return/Drawdown Ratio: 2.508
Modified Sharpe Ratio: 0.1179

Figure 122: Monte Carlo Data (AMZN)

After the Monte Carlo was completed for the back testing, we ran the Monte Carlo for a 30-day future trade. **Figure 123** shows the performances from the Monte Carlo that was ran for 30 trades in the future. The data result for this analysis is shown in **Figure 124.** When the

strategy traded 30 days in the future, the net profit was $36,064.95 with a profit factor of 1.158. The strategy is expected to return 30.84% of the equity with a 35.31% max drawdown at 97% confidence, 33.71% of the equity with a 34.20% drawdown at 96% confidence, and 36.06% of the equity with a 33.30% drawdown at 95% confidence. The max drawdown is higher or very close to the return rate at higher confidence levels, which isn't convincing to be a strong strategy in the future. The strategy stays around the 50% confidence level and spends some time towards the end close to the 5% confidence, which correspond to the data.

Figure 123: Monte Carlo Performance (30 Days In Future) (AMZN)

Market System: WoleTradeData4- AMZN

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	74.38	20.18	3.703	0.1157
60	68.29	21.65	3.244	0.1091
70	62.06	23.66	2.719	0.1025
80	54.62	26.20	2.168	0.09360
85	50.04	27.77	1.879	0.08821
90	44.60	29.94	1.545	0.08157
91	43.11	30.51	1.478	0.07964
92	41.84	31.06	1.399	0.07789
93	40.14	31.78	1.320	0.07590
94	38.27	32.50	1.229	0.07325
95	36.06	33.30	1.134	0.07076
96	33.71	34.20	1.014	0.06751
97	30.84	35.31	0.8895	0.06345
98	27.51	36.83	0.7547	0.05856
99	21.59	40.18	0.5579	0.05037
100	-21.60	59.41	0.000	-0.02022

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $36,064.95
Final Account Equity: $136,064.95
Return on Starting Equity: 36.06%
Profit Factor: 1.158

Max Number of Shares: 500
Minimum Number of Shares: 353
Average Number of Shares: 494

Largest Winning Trade: $18,075.00
Largest Winning Trade (%): 15.27%
Average Winning Trade: $3,760.18
Average Winning Trade (%): 2.767%

Largest Losing Trade: ($20,315.43)
Largest Losing Trade (%): -11.82%
Average Losing Trade: ($2,320.37)
Average Losing Trade (%): -1.573%

Average Trade: $210.91
Average Trade (%): 0.2338%
Trade Standard Deviation: $4,945.08
Trade Standard Deviation (%): 3.463%

Win/Loss Ratio: 1.709
Win/Loss Ratio (%/%): 1.851
Max Consecutive Wins: 4
Max Consecutive Losses: 9

Worst Case Drawdown: ($64,309.19)
Worst Case Drawdown (%): 33.30%
Average Drawdown: ($8,922.89)
Average Drawdown (%): 5.734%

Return/Drawdown Ratio: 1.134
Modified Sharpe Ratio: 0.07076

Figure 124: Monte Carlo Data (30 Days in Future) (AMZN)

After the Monte Carlo, a 2% of equity per trade was ran and is shown in **Figure 125**. When 2% of the total equity was allocated to each trade made, the net profit was predicted to be $90,674.39. Although the strategy still produces a good net profit, it is lower than it previously was which means the strategy loses more when more money is allocated.

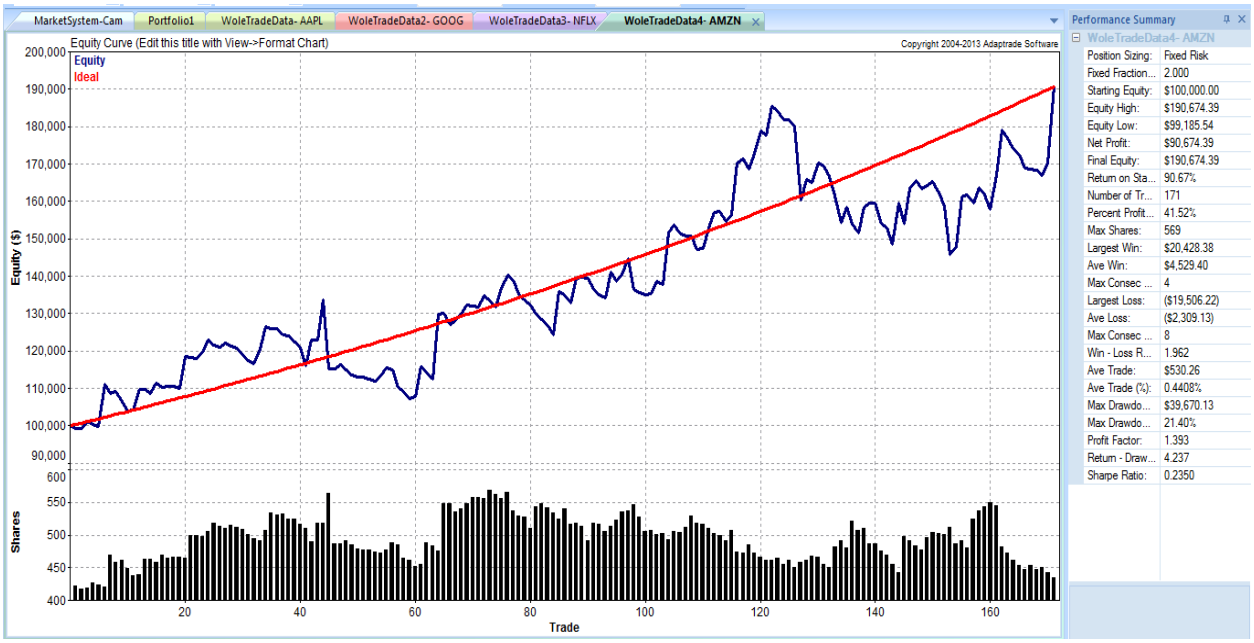


Figure 125: 2% of Equity Per Trade (AMZN)

The last analysis ran for this stock was the optimization for both the net profit and return rate. When optimized, the net profit was slightly increased to $121,922.38, shown in **Figure 126**, the return rate increased to 121.92%, shown in **Figure 127,** with a max drawdown was 21.39%. The improvements from the optimization weren't as significant compared to the previous stock, but the net profit and return rate increased while the max drawdown decreased. **Figure 128** shows the improvement in actual equity versus the ideal equity, bringing the actual equity closer to the model.

Market System: WoleTradeData4- AMZN

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Net Profit at Optimum: 121922.38
Max Percent Drawdown at Optimum: 21.39%

Figure 126: Net Profit Optimization (AMZN)

Market System: WoleTradeData4- AMZN

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 121.92
Max Percent Drawdown at Optimum: 21.39%

Figure 127: Optimization for Return Rate (AMZN)

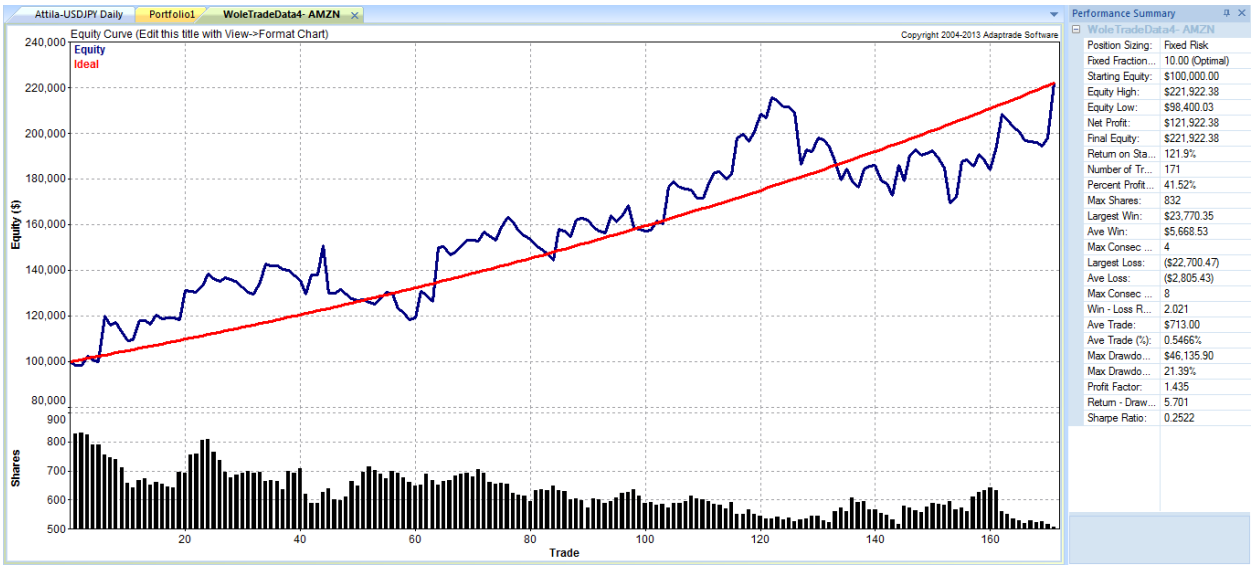


Figure 128: Optimization Performance (AMZN)

Google (GOOG)

The next stock the strategy was ran on was Google (GOOG), the results from the back-testing are shown in **Figure 128** below. The starting equity of the system was $100,000.00 and the result was a net profit of $141,351.25. The system won 49.37% of the 160 trades that were made over the five years, which is around the reasonable 40% profit for a trending strategy, with a profit factor of 1.783. The actual equity was followed the ideal equity pretty accurately, despite jumping up or down a few times. Both the profit factor and percent profit were higher than the two previous stocks. **Figure 129** shows the Monte Carlo results for the trades made over 5 years. When the Monte Carlo was ran for this stock, it was fairly constant along the 50% confident line, but spent more time near the 5% confidence compared to the 95% confidence. **Figure 130** shows the data from the Monte Carlo Analysis, the strategy is expected to have a total net profit of $118,600.91. Through the analysis, there is 97% confidence that there will be a return of 117.2% of equity with a max drawdown of 26.17%, 96% confidence that there will be a return of 118.0% of equity with a max drawdown of 25.30% and 95% confidence that there will be a return of

118.6% with a max drawdown of 24.59%. The strategy predicted return more than is invested, and the max drawdown is at a reasonably low percent.

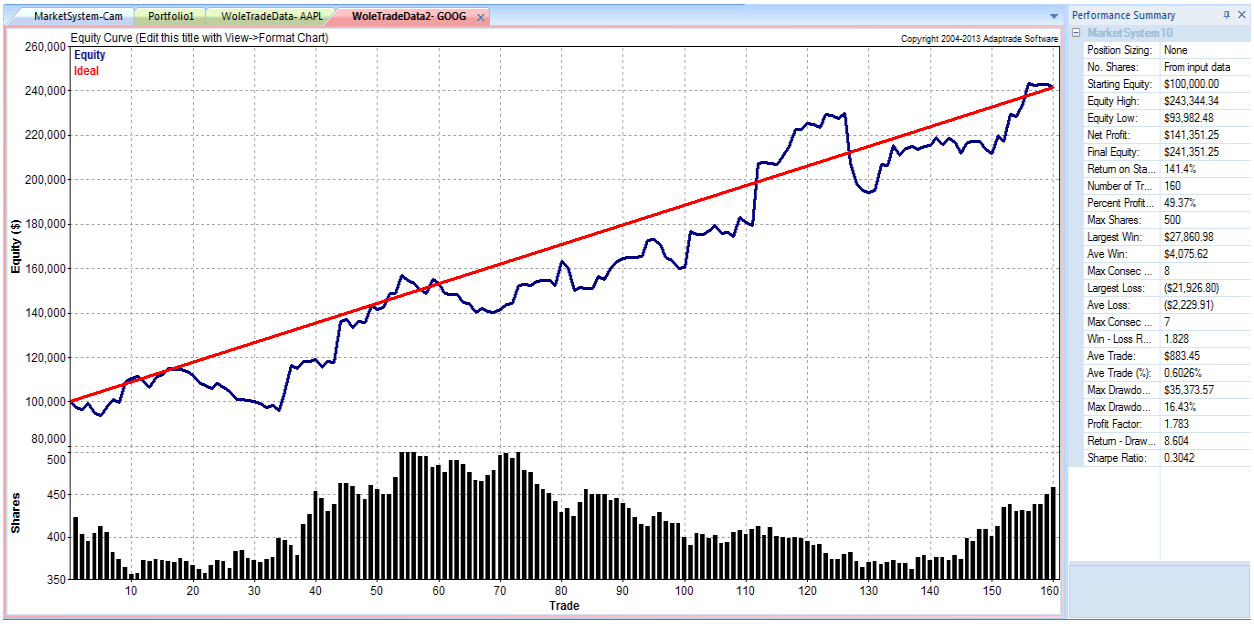


Figure 128: Back-Testing Performance (GOOG)

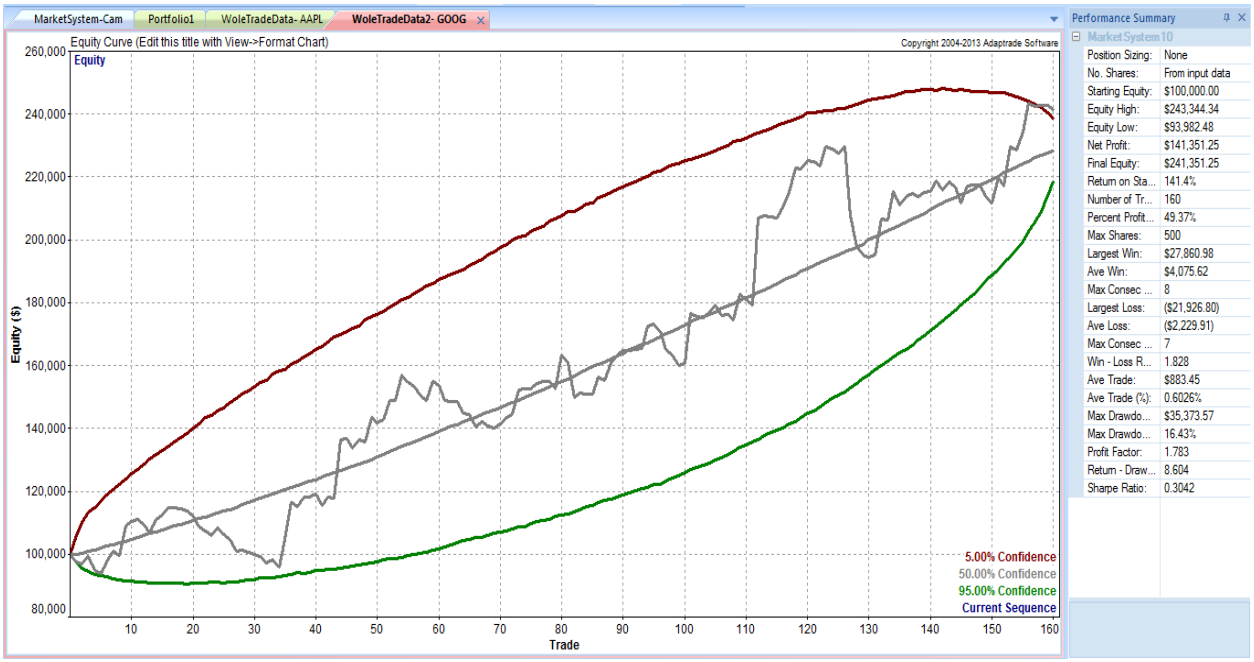


Figure 129: Monte Carlo Performance (GOOG)

Market System: WoleTradeData2- GOOG

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	128.2	16.07	7.945	0.1854
60	126.6	17.16	7.458	0.1840
70	124.9	18.35	6.959	0.1826
80	123.1	19.97	6.400	0.1810
85	122.0	21.05	6.077	0.1802
90	120.6	22.34	5.700	0.1790
91	120.2	22.69	5.615	0.1788
92	119.9	23.11	5.525	0.1785
93	119.6	23.51	5.418	0.1782
94	119.1	24.03	5.290	0.1778
95	118.6	24.59	5.170	0.1775
96	118.0	25.30	5.047	0.1771
97	117.2	26.17	4.862	0.1764
98	116.3	27.15	4.675	0.1758
99	115.1	29.02	4.360	0.1747
100	106.0	37.84	3.064	0.1678

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $118,600.91
Final Account Equity: $218,600.91
Return on Starting Equity: 118.6%
Profit Factor: 1.656

Max Number of Shares: 500
Minimum Number of Shares: 148
Average Number of Shares: 345

Largest Winning Trade: $19,072.20
Largest Winning Trade (%): 15.53%
Average Winning Trade: $3,389.41
Average Winning Trade (%): 2.364%

Largest Losing Trade: ($23,935.80)
Largest Losing Trade (%): -9.565%
Average Losing Trade: ($2,346.20)
Average Losing Trade (%): -1.388%

Average Trade: $741.26
Average Trade (%): 0.5320%
Trade Standard Deviation: $5,170.43
Trade Standard Deviation (%): 3.150%

Win/Loss Ratio: 1.698
Win/Loss Ratio (%/%): 1.825
Max Consecutive Wins: 5
Max Consecutive Losses: 10

Worst Case Drawdown: ($48,172.52)
Worst Case Drawdown (%): 24.59%
Average Drawdown: ($8,674.81)
Average Drawdown (%): 5.206%

Return/Drawdown Ratio: 5.170
Modified Sharpe Ratio: 0.1775

Figure 130: Monte Carlo Data (GOOG)

After the Monte Carlo was completed for the back testing, we ran the Monte Carlo for a 30 day future trade. **Figure 131** shows the performances from the Monte Carlo that was ran for 30 trades in the future. The data result for this analysis is shown in **Figure 132.** When the system traded 30 days in the future, the net profit was $73,235.09 with a profit factor of 1.347. The

system is expected to return 67.67% of the equity with a 30.96% max drawdown at 97% confidence, 70.37% of the equity with a 29.70% drawdown at 96% confidence, and 73.24% of the equity with a 28.89% drawdown at 95% confidence. These numbers are pretty consistent with the previous analysis for the scale of trades being made. The strategy spends most of its time close to the 5% confidence minimum.

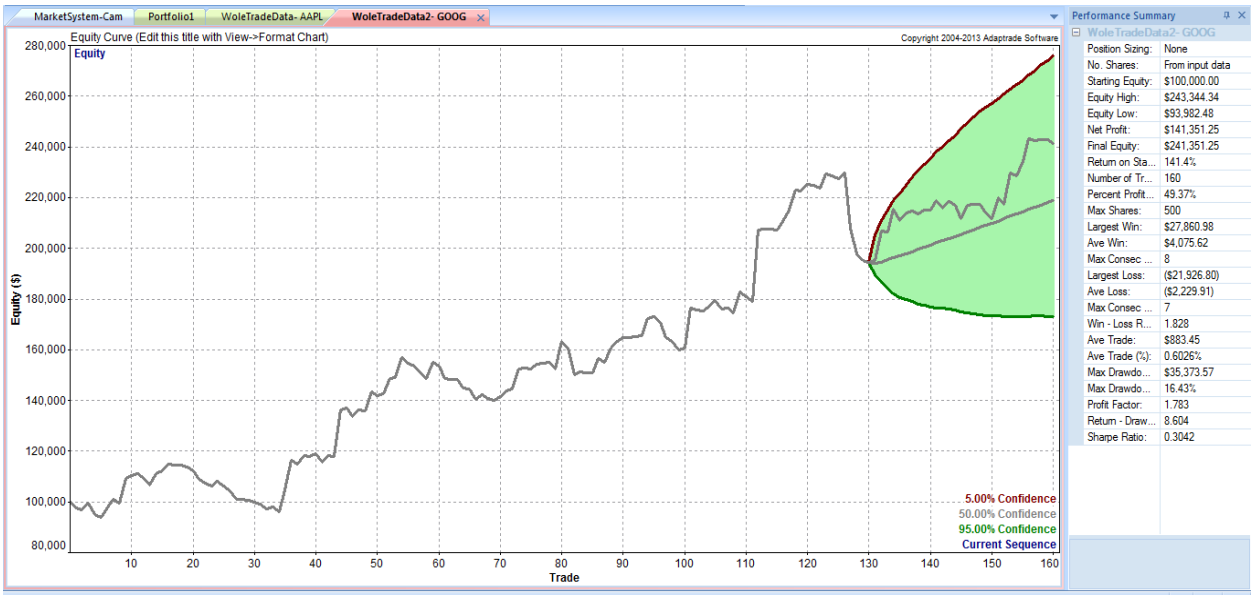


Figure 131: Monte Carlo Performance (30 Days In Future) (GOOG)

Market System: WoleTradeData2- GOOG

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	118.9	17.88	6.582	0.1641
60	111.1	19.11	5.962	0.1575
70	103.0	20.68	5.243	0.1502
80	93.45	22.81	4.308	0.1412
85	88.26	24.13	3.824	0.1356
90	81.92	25.92	3.318	0.1296
91	80.81	26.30	3.198	0.1282
92	79.40	26.81	3.074	0.1262
93	77.34	27.36	2.966	0.1242
94	75.55	28.07	2.819	0.1221
95	73.24	28.89	2.642	0.1193
96	70.37	29.70	2.464	0.1162
97	67.67	30.96	2.245	0.1128
98	62.80	32.92	1.985	0.1072
99	55.12	35.26	1.606	0.09864
100	24.33	47.24	0.5304	0.05626

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $73,235.09
Final Account Equity: $173,235.09
Return on Starting Equity: 73.24%
Profit Factor: 1.347

Largest Winning Trade: $27,860.98
Largest Winning Trade (%): 15.72%
Average Winning Trade: $3,753.72
Average Winning Trade (%): 2.584%

Average Trade: $457.72
Average Trade (%): 0.3966%
Trade Standard Deviation: $5,905.44
Trade Standard Deviation (%): 3.555%

Worst Case Drawdown: ($66,422.61)
Worst Case Drawdown (%): 28.89%
Average Drawdown: ($8,309.73)
Average Drawdown (%): 4.945%

Max Number of Shares: 500
Minimum Number of Shares: 291
Average Number of Shares: 426

Largest Losing Trade: ($21,926.80)
Largest Losing Trade (%): -9.560%
Average Losing Trade: ($2,519.13)
Average Losing Trade (%): -1.577%

Win/Loss Ratio: 1.583
Win/Loss Ratio (%/%): 1.719
Max Consecutive Wins: 8
Max Consecutive Losses: 9

Return/Drawdown Ratio: 2.642
Modified Sharpe Ratio: 0.1193

Figure 132: Monte Carlo Data (30 Days in Future) (GOOG)

After the Monte Carlo, a 2% of equity per trade was ran and is shown in **Figure 133**. When 2% of the total equity was allocated to each trade made, the net profit was predicted to be $135,765.05. The strategy makes more money when more money is used to trade for this stock.

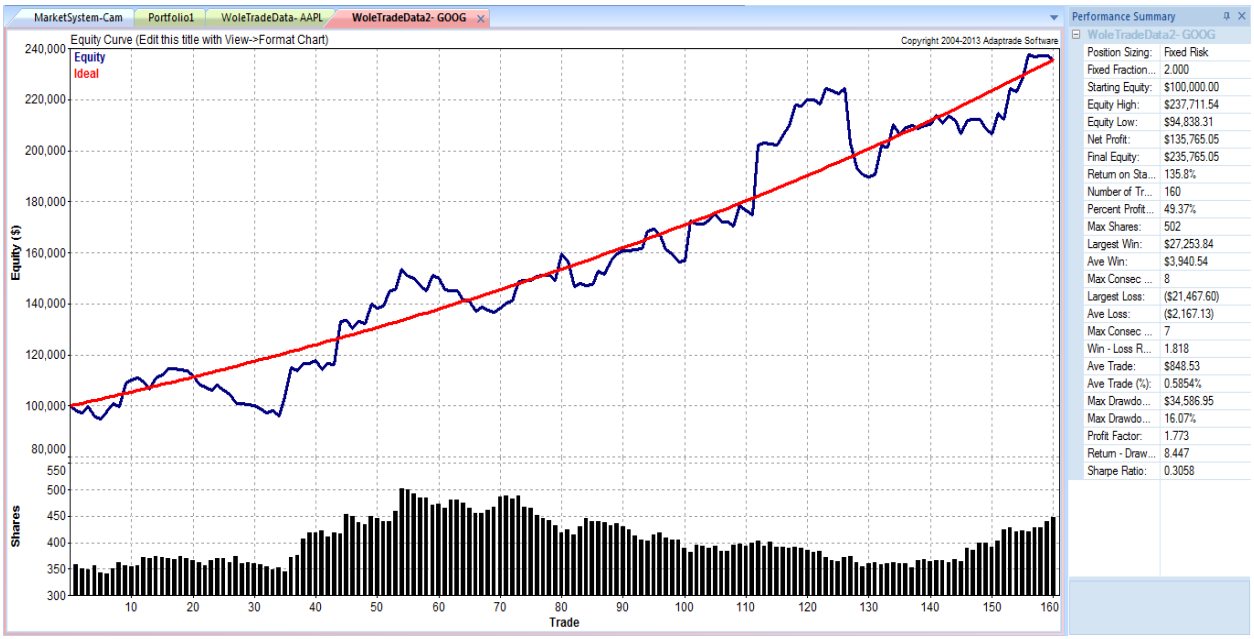


Figure 133: 2% of Equity Per Trade (GOOG)

The last analysis ran for this stock was the optimization for both the net profit and return rate. When optimized, the net profit was slightly increased to $141,606.67, shown in **Figure 134**, the return rate increased to 141.61%, shown in **Figure 135,** with a max drawdown was 16.43%. The max drawdown was decreased and the net profit and return rate increased, which is a good improvement to assure a beneficial strategy. **Figure 136** shows the improvement in actual equity versus the ideal equity, decreases the gap between the actual equity and the model.

Market System: WoleTradeData2- GOOG

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Net Profit at Optimum: 141606.67
Max Percent Drawdown at Optimum: 16.43%

Table 134: Net Profit Optimization (GOOG)

Market System: WoleTradeData2- GOOG

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 10.00
Rate of Return at Optimum: 141.61
Max Percent Drawdown at Optimum: 16.43%

Table 135: Optimization for Return Rate (GOOG)

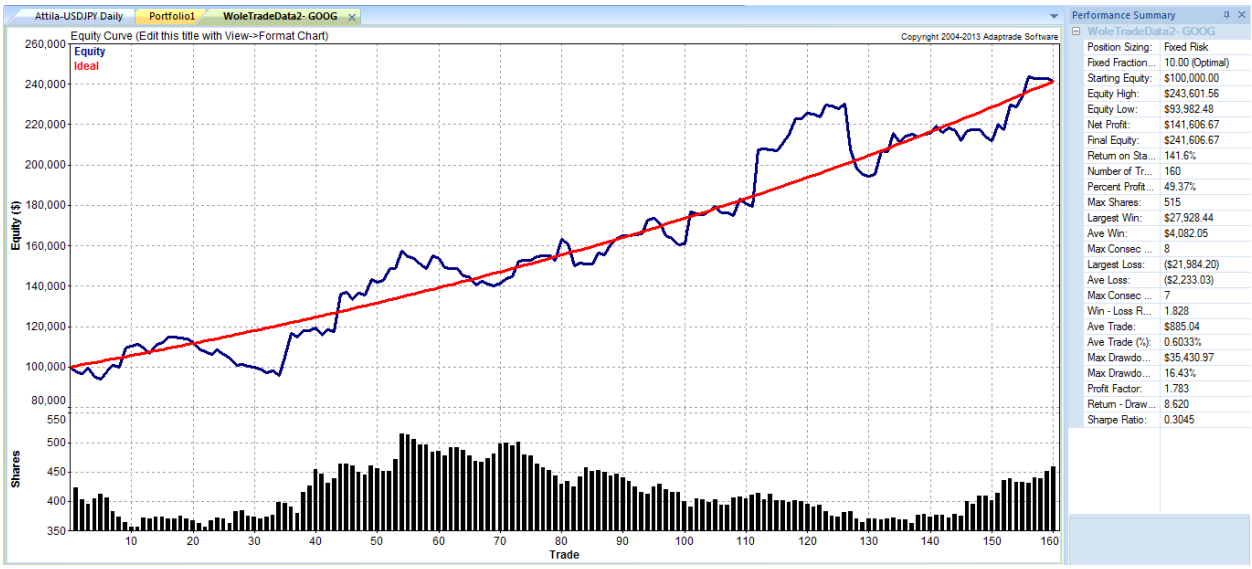


Figure 136: Optimization Performance (GOOG)

Netflix (NFLX)

The last stock the strategy was ran on was Netflix (NFLX), the results from the back-testing are shown in **Figure 137** below. The starting equity of the system was $100,000.00 and the result was a net profit of $130,833.21. The system won 43.45% of the 168 trades that were made over the five years, which is around the reasonable 40% profit for a trending strategy, with a profit factor of 1.499. The actual equity was well below the ideal equity for the majority of the time/This stock was predicted to make the most out of the four that were chosen. **Figure 138** shows the Monte Carlo results for the trades made over 5 years. When the Monte Carlo was ran for this stock, it spent most of the time near the 95% confidence, and managed to cross the 95% confidence a few times. **Figure 139** shows the data from the Monte Carlo Analysis, the strategy is expected to have a total net profit of $92,469.90. Through the analysis, there is 97% confidence that there will be a return of 88.94% of equity with a max drawdown of 52.20%, 96% confidence that there will be a return of 91.07% of equity with a max drawdown of 50.28% and

95% confidence that there will be a return of 92.47% with a max drawdown of 49.00%. The strategy predicted a fairly high return rate, but the max drawdown was also higher than wanted.

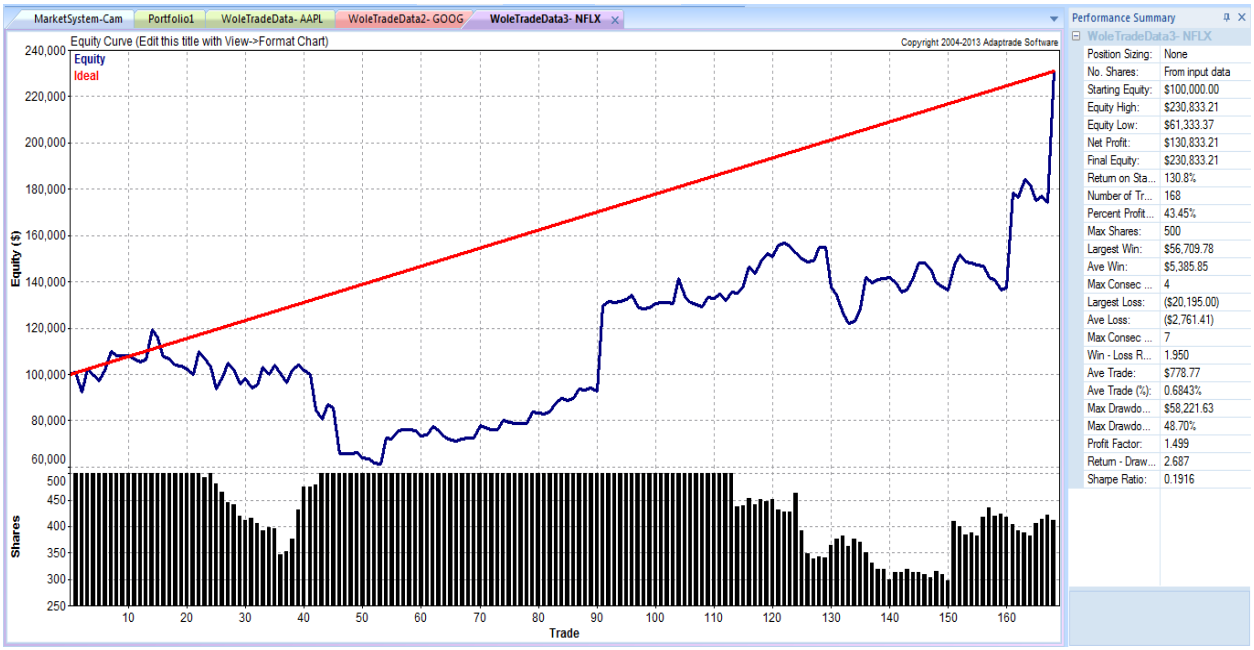


Figure 137: Back-Testing Performance (NFLX)

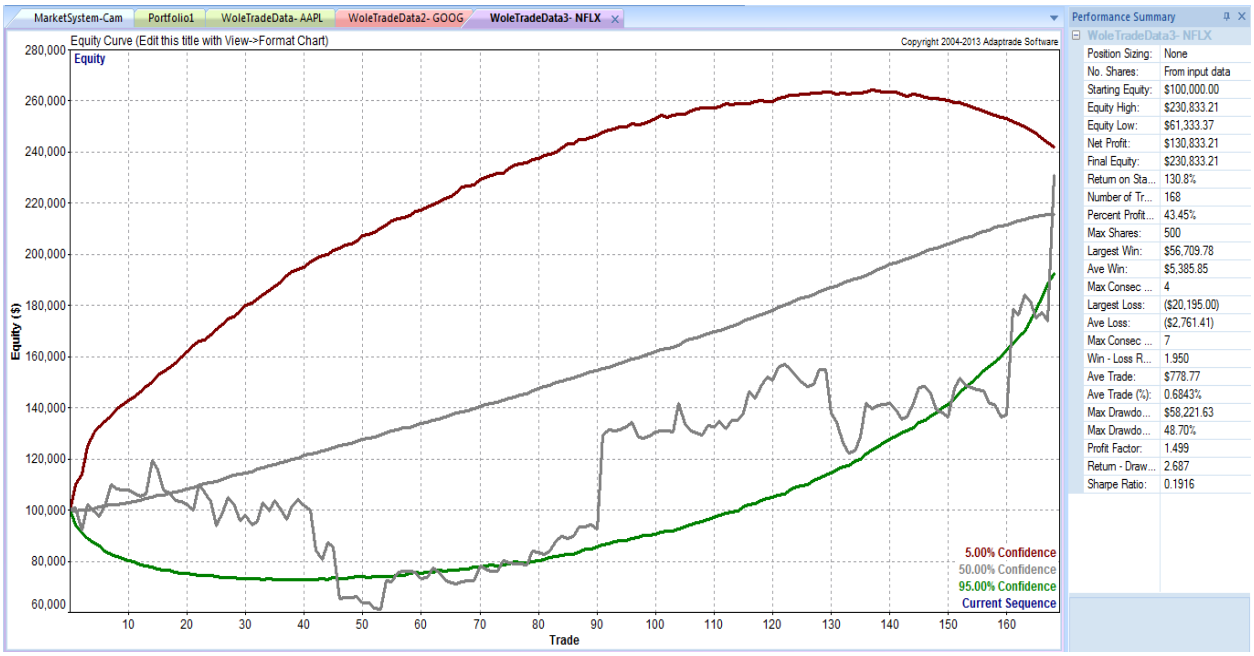


Figure 138: Monte Carlo Performance (NFLX)

Market System: WoleTradeData3- NFLX

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	115.8	30.41	3.791	0.1110
60	112.1	32.66	3.490	0.1086
70	108.3	35.36	3.190	0.1058
80	103.7	38.79	2.851	0.1028
85	100.8	41.17	2.658	0.1010
90	97.65	44.16	2.433	0.09855
91	96.76	44.94	2.382	0.09797
92	95.86	45.76	2.327	0.09731
93	94.80	46.64	2.272	0.09661
94	93.65	47.77	2.210	0.09594
95	92.47	49.00	2.134	0.09518
96	91.07	50.28	2.060	0.09426
97	88.94	52.20	1.977	0.09308
98	87.00	54.30	1.855	0.09163
99	83.37	57.53	1.689	0.08930
100	66.31	70.10	1.077	0.07920

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $92,469.90
Final Account Equity: $192,469.90
Return on Starting Equity: 92.47%
Profit Factor: 1.352

Max Number of Shares: 500
Minimum Number of Shares: 135
Average Number of Shares: 408

Largest Winning Trade: $36,910.00
Largest Winning Trade (%): 32.46%
Average Winning Trade: $4,559.45
Average Winning Trade (%): 3.248%

Largest Losing Trade: ($23,560.00)
Largest Losing Trade (%): -22.59%
Average Losing Trade: ($3,092.56)
Average Losing Trade (%): -2.310%

Average Trade: $550.42
Average Trade (%): 0.5176%
Trade Standard Deviation: $8,355.08
Trade Standard Deviation (%): 6.223%

Win/Loss Ratio: 1.759
Win/Loss Ratio (%/%): 1.863
Max Consecutive Wins: 4
Max Consecutive Losses: 12

Worst Case Drawdown: ($86,647.48)
Worst Case Drawdown (%): 49.00%
Average Drawdown: ($18,662.68)
Average Drawdown (%): 11.84%

Return/Drawdown Ratio: 2.134
Modified Sharpe Ratio: 0.09518

Figure 139: Monte Carlo Data (NFLX)

After the Monte Carlo was completed for the back testing, we ran the Monte Carlo for a 30 day future trade. **Figure 140** shows the performances from the Monte Carlo that was ran for 30 trades in the future. The data result for this analysis is shown in **Figure 141.** When the system traded 30 days in the future, the net profit was $1,791.79 with a profit factor of 1.006. The system is expected to return -4.752% of the equity with a 48.70% max drawdown at 97%

confidence, -1.132% of the equity with a 48.70% drawdown at 96% confidence, and 1.1792% of the equity with a 47.90% drawdown at 95% confidence. Based on these numbers the strategy is predicted to lose money at higher confidence levels or return a small portion of the equity, which is visible in the very low net profit. The strategy doesn't seem to continue to be very profitable in the future.

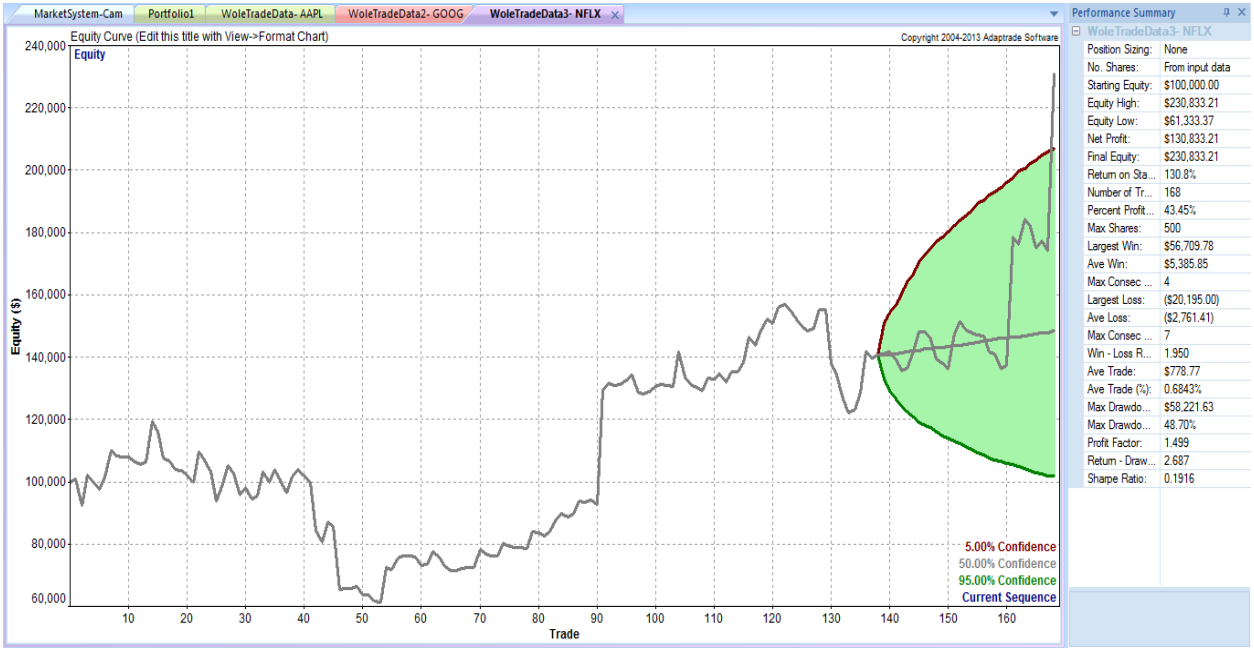


Figure 140: Monte Carlo Performance (30 Days In Future) (NFLX)

Market System: WoleTradeData3- NFLX

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	48.58	48.70	0.9975	0.06889
60	40.85	48.70	0.8387	0.06315
70	32.42	48.70	0.6657	0.05635
80	23.49	48.70	0.4824	0.04892
85	18.49	48.70	0.3798	0.04445
90	11.60	48.70	0.2380	0.03808
91	10.12	48.70	0.2078	0.03661
92	7.985	48.70	0.1637	0.03469
93	6.579	48.70	0.1351	0.03315
94	4.436	48.70	0.09109	0.03127
95	1.792	48.70	0.03679	0.02857
96	-1.132	48.70	0.000	0.02539
97	-4.752	48.70	0.000	0.02147
98	-9.031	48.70	0.000	0.01714
99	-15.41	48.87	0.000	0.009649
100	-46.99	67.77	0.000	-0.03266

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $1,791.79
Final Account Equity: $101,791.79
Return on Starting Equity: 1.792%
Profit Factor: 1.006

Max Number of Shares: 500
Minimum Number of Shares: 252
Average Number of Shares: 467

Largest Winning Trade: $36,910.00
Largest Winning Trade (%): 39.84%
Average Winning Trade: $3,926.16
Average Winning Trade (%): 3.827%

Largest Losing Trade: ($20,195.00)
Largest Losing Trade (%): -23.54%
Average Losing Trade: ($3,035.83)
Average Losing Trade (%): -2.707%

Average Trade: $10.67
Average Trade (%): 0.1591%
Trade Standard Deviation: $6,407.35
Trade Standard Deviation (%): 5.929%

Win/Loss Ratio: 1.362
Win/Loss Ratio (%/%): 1.484
Max Consecutive Wins: 3
Max Consecutive Losses: 9

Worst Case Drawdown: ($62,257.48)
Worst Case Drawdown (%): 48.70%
Average Drawdown: ($16,377.79)
Average Drawdown (%): 12.29%

Return/Drawdown Ratio: 0.03679
Modified Sharpe Ratio: 0.02857

Figure 141: Monte Carlo Data (30 Days in Future) (NFLX)

After the Monte Carlo, a 2% of equity per trade was ran and is shown in **Figure 142**. When 2% of the total equity was allocated to each trade made, the net profit was predicted to be $97,155.95. The strategy doesn't produce a better net profit when 2% of the equity is being allocated.

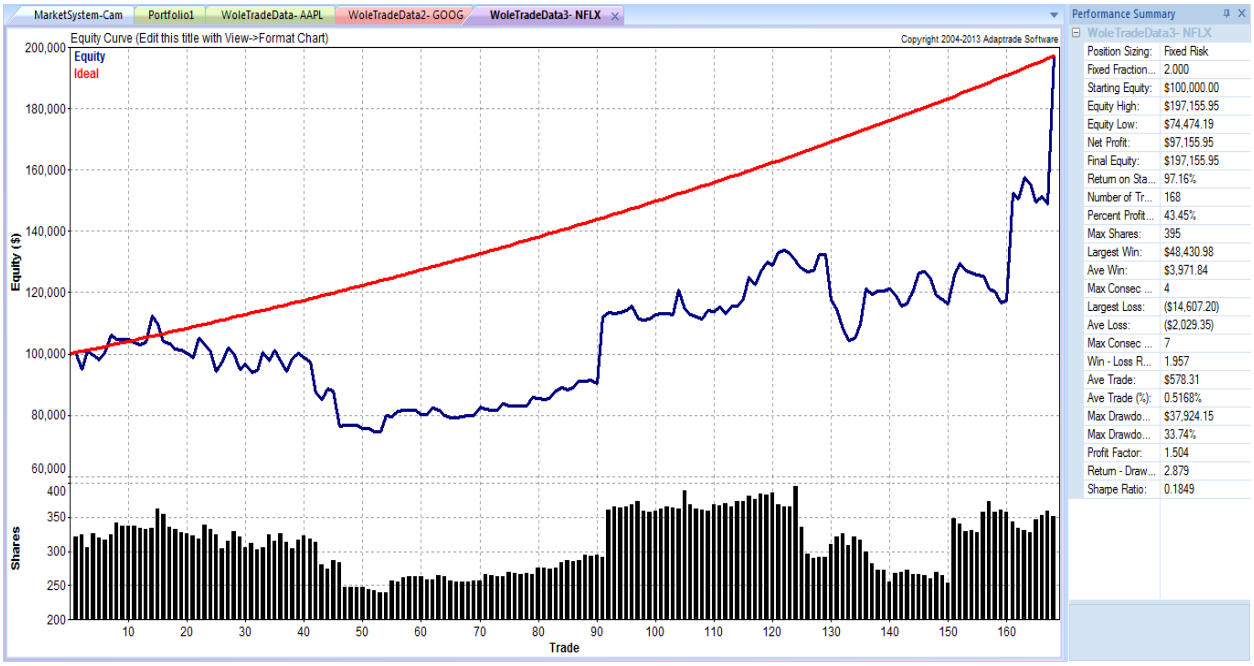


Figure 142: 2% of Equity Per Trade (NFLX)

The last analysis ran for this stock was the optimization for both the net profit and return rate. When optimized, the net profit was slightly increased to $273,049.32, shown in **Figure 143**, the return rate increased to 273.05%, shown in **Figure 144,** with a max drawdown was 58.73%. Although there was a significant increase in net profit and return rate, the max drawdown was still higher than desired. **Figure 145** shows the improvement in actual equity versus the ideal equity, bringing it a little closer to the ideal equity.

Market System: WoleTradeData3- NFLX

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 11.01
Net Profit at Optimum: 273049.32
Max Percent Drawdown at Optimum: 58.73%

Figure 143: Net Profit Optimization (NFLX)

Market System: WoleTradeData3- NFLX

POSITION SIZING METHOD: Fixed Risk
OPTIMIZED PARAMETER: Fixed Fraction

Optimal Results Over All Trades

ANALYSIS SETTINGS:
Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.00%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

RESULTS:
Optimal Fixed Fraction: 11.01
Rate of Return at Optimum: 273.05
Max Percent Drawdown at Optimum: 58.73%

Figure 144: Optimization for Return Rate (NFLX)

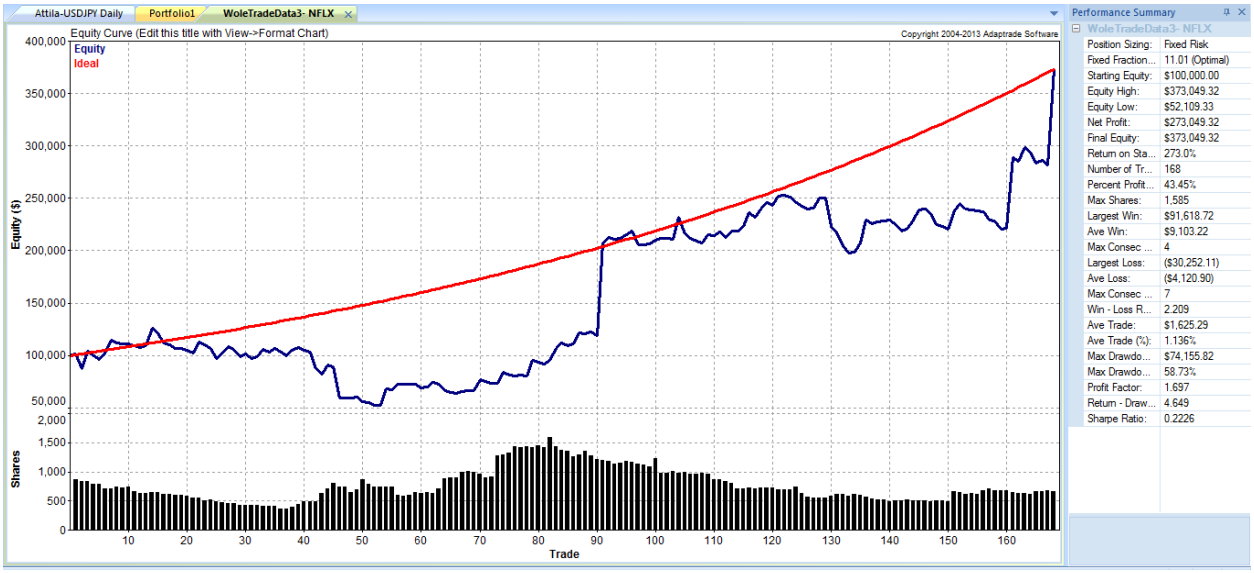


Figure 145: Optimization Performance (NFLX)

Portfolio

After the analysis was ran separately for each stock, the same analysis was completed for all of the stocks together as a portfolio. For the portfolio of stocks, the same starting equity, $100,000, and time period, April 27, 2010 to April 27, 2015, was used. **Figure 146** shows the performance of the portfolio over the 5 years. The net profit came out to be $166, 258.51, winning 45.88% of the 656 trades that were made with a profit factor of 1.565 and max drawdown of 29.40%. The actual equity didn't follow the ideal equity too well, as seen it spent the majority fluctuating below the model. When the Monte Carlo was ran for the portfolio, it spent most of the time near the 95% confidence, and managed to cross the 95% confidence a few times as shown in **Figure 147**. **Figure 148** shows the data from the Monte Carlo Analysis, the strategy is expected to have a total net profit of $74,721.11. Through the analysis, there is 97% confidence that there will be a return of 57.93% of equity with a max drawdown of 38.54%, 96% confidence that there will be a return of 66.88% of equity with a max drawdown of 37.02% and

95% confidence that there will be a return of 74.72% with a max drawdown of 35.85%. The strategy predicted a fairly high return rate, with a reasonable max drawdown.

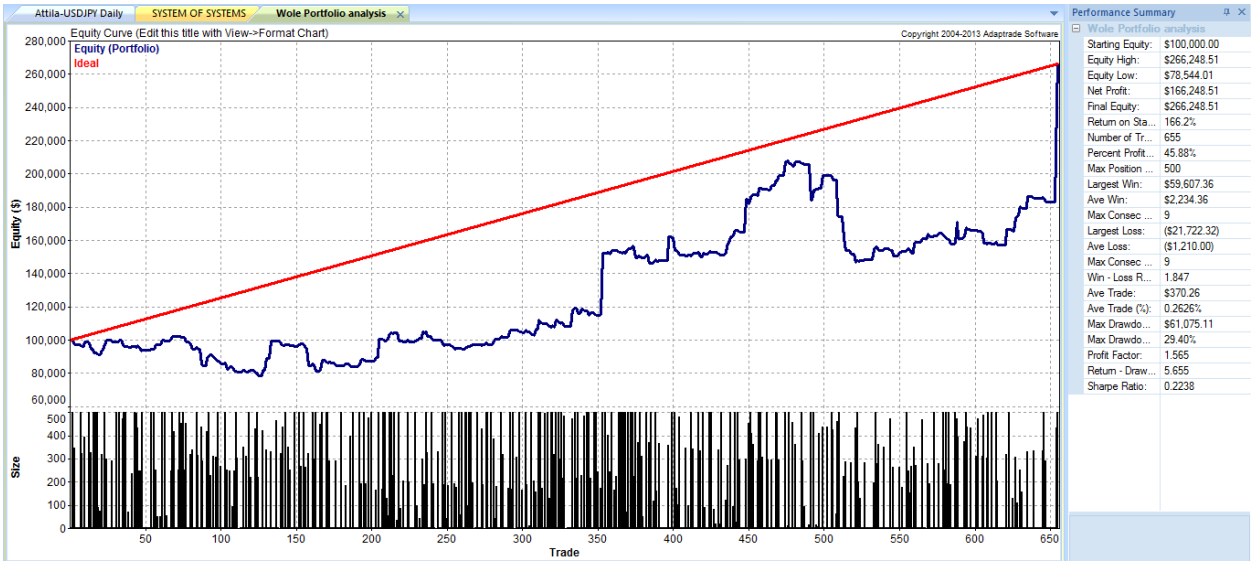


Figure 146: Back-Testing Performance (Portfolio)

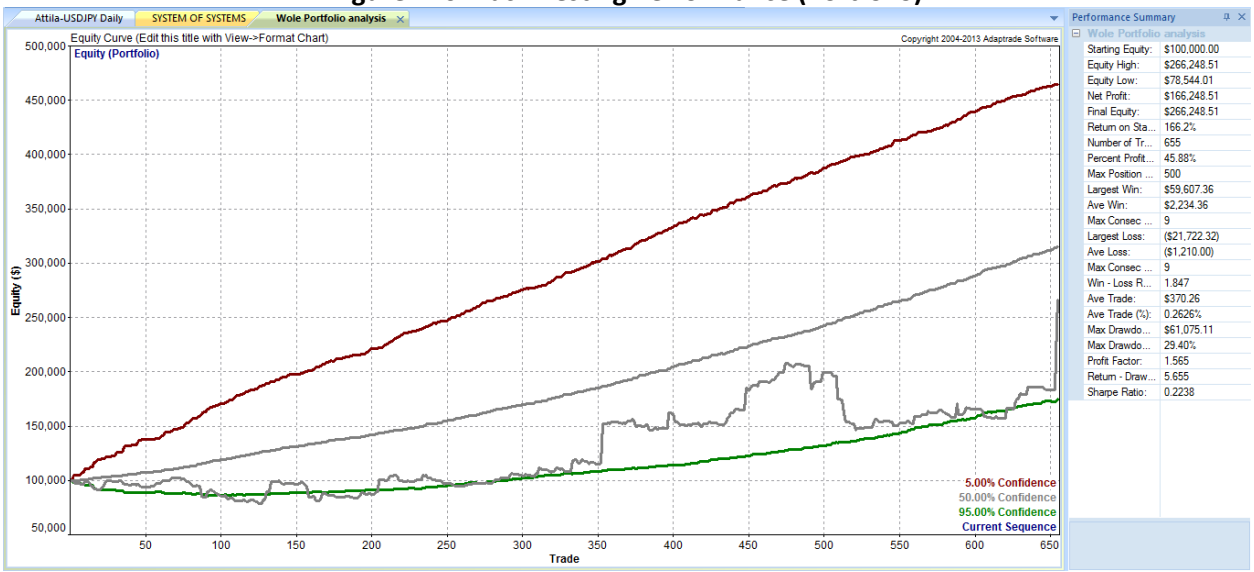


Figure 147: Monte Carlo Performance (Portfolio)

Portfolio: Wole Portfolio analysis

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	215.1	20.10	10.55	0.1115
60	192.1	21.95	8.878	0.1053
70	167.3	24.28	7.229	0.09817
80	138.5	27.07	5.524	0.08878
85	120.9	28.95	4.651	0.08226
90	99.82	31.61	3.620	0.07435
91	95.18	32.37	3.377	0.07236
92	90.44	33.05	3.127	0.07010
93	86.68	33.89	2.924	0.06799
94	80.92	34.88	2.698	0.06571
95	74.72	35.85	2.402	0.06247
96	66.88	37.02	2.119	0.05879
97	57.93	38.54	1.772	0.05407
98	46.63	40.53	1.401	0.04740
99	30.21	43.64	0.8276	0.03647
100	-34.04	65.62	0.000	-0.02928

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $74,721.11
Final Account Equity: $174,721.11
Return on Starting Equity: 74.72%
Profit Factor: 1.245

Maximum Position Size: 500
Minimum Position Size: 1
Average Position Size: 277

Largest Winning Trade: $17,809.44
Largest Winning Trade (%): 11.86%
Average Winning Trade: $1,732.91
Average Winning Trade (%): 1.235%

Largest Losing Trade: ($28,700.00)
Largest Losing Trade (%): -18.37%
Average Losing Trade: ($1,642.19)
Average Losing Trade (%): -0.9119%

Average Trade: $159.86
Average Trade (%): 0.1435%
Trade Standard Deviation: $5,215.92
Trade Standard Deviation (%): 2.728%

Win/Loss Ratio: 1.497
Win/Loss Ratio (%/%): 1.565
Max Consecutive Wins: 5
Max Consecutive Losses: 13

Worst Case Drawdown: ($74,271.51)
Worst Case Drawdown (%): 35.85%
Average Drawdown: ($8,482.71)
Average Drawdown (%): 5.220%

Return/Drawdown Ratio: 2.402
Modified Sharpe Ratio: 0.06247

Figure 148: Monte Carlo Results (Portfolio)

After the Monte Carlo was completed for the back testing, we ran the Monte Carlo for a 60 day future trade. Since the portfolio made around 600 trades, the analysis was ran for 60 days in the future to gather more accurate data. **Figure 149** shows the performances from the Monte Carlo that was ran for 60 trades in the future. The data result for this analysis is shown in **Figure**

150. When the system traded 60 days in the future, the net profit was $44,190.73 with a profit factor of 1.137. The system is expected to return 39.49% of the equity with a 34.93% max drawdown at 97% confidence, 42.38% of the equity with a 33.90% drawdown at 96% confidence, and 44.19% of the equity with a 33.09% drawdown at 95% confidence. Based on these numbers portfolio isn't predicted to do too well in the future. Even though it produces a good net profit, the return rate and max drawdown are very close to each other which isn't good for comfort.

Figure 149: Monte Carlo Performance (60 Days In Future) (Portfolio)

Portfolio: Wole Portfolio analysis

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	79.10	29.40	2.687	0.05986
60	73.28	29.40	2.487	0.05726
70	67.24	29.40	2.281	0.05440
80	60.60	29.40	2.046	0.05111
85	56.69	29.40	1.907	0.04911
90	51.74	30.45	1.714	0.04649
91	50.57	30.89	1.664	0.04585
92	49.32	31.27	1.609	0.04518
93	47.84	31.82	1.542	0.04436
94	46.13	32.45	1.466	0.04339
95	44.19	33.09	1.384	0.04242
96	42.38	33.90	1.267	0.04119
97	39.49	34.93	1.162	0.03967
98	35.87	36.48	1.001	0.03742
99	29.61	38.59	0.7714	0.03377
100	9.324	52.35	0.1968	0.02010

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $44,190.73
Final Account Equity: $144,190.73
Return on Starting Equity: 44.19%
Profit Factor: 1.137

Maximum Position Size: 500
Minimum Position Size: 1
Average Position Size: 285

Largest Winning Trade: $36,910.00
Largest Winning Trade (%): 31.96%
Average Winning Trade: $1,733.22
Average Winning Trade (%): 1.412%

Largest Losing Trade: ($21,722.32)
Largest Losing Trade (%): -11.06%
Average Losing Trade: ($1,316.99)
Average Losing Trade (%): -1.003%

Average Trade: $96.46
Average Trade (%): 0.1135%
Trade Standard Deviation: $3,816.72
Trade Standard Deviation (%): 2.798%

Win/Loss Ratio: 1.358
Win/Loss Ratio (%/%): 1.442
Max Consecutive Wins: 9
Max Consecutive Losses: 9

Worst Case Drawdown: ($68,759.98)
Worst Case Drawdown (%): 33.09%
Average Drawdown: ($7,127.96)
Average Drawdown (%): 4.953%

Return/Drawdown Ratio: 1.384
Modified Sharpe Ratio: 0.04242

Figure 150: Monte Carlo Data (60 Days in Future) (Portfolio)

The last analysis ran for this stock was the optimization for both the net profit and return rate. When optimized, the net profit was slightly increased to $834,913.7, shown in **Figure 151**, the return rate increased to 834.91%, shown in **Figure 152,** with a max drawdown was 36.43%. When the net profit was optimize, Amazon (AMZN) got 20.01% of the equity, Netflix (NFLX) got 11.01% of the equity, Apple (APPL) got 10% of the equity and Google (GOOG) got 0% of the equity. This shows that Amazon (AMZN) performed the best in the portfolio, while Apple (AAPL) and Netflix (NFLX) were fairly equal. Unfortunately, Google (GOOG) did the worst out of the four stocks and didn't receive any percent of the equity. When the return rate was optimized, Netflix (NFLX) got 21.01% of the equity, Apple (AAPL) got 20% of the equity, Amazon (AMZN) got 10.01% of the equity and Google (GOOG) got 0% of the equity. This shows that Apple (AAPL) and Netflix (NFLX) performed the best, both receive fairly equal amount of the equity. Amazon (AMZN) didn't do as well when the return rate was optimized, but still received a decent percent of the equity. Unfortunately, Google (GOOG) was the weakest stock and failed to receive any portion of the equity. **Figure 153** shows the improvement in actual equity versus the ideal equity, bringing it a little tighter to the ideal equity.

Portfolio: Wole Portfolio analysis

Analysis Settings

Initial Account Equity: $100,000.00
Refer to market systems for margins, costs, and fees

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

Optimization Results

Net Profit at Optimum: 834913.77
Max Percent Drawdown at Optimum: 36.43%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	Fixed Risk	ff = 10.00%
2	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	Fixed Risk	ff = 0.000%
3	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	Fixed Risk	ff = 11.01%
4	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	Fixed Risk	ff = 20.01%

Figure 151: Net Profit Optimization (Portfolio)

Portfolio: Wole Portfolio analysis

Analysis Settings

Initial Account Equity: $100,000.00
Refer to market systems for margins, costs, and fees

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

Optimization Results

Rate of Return at Optimum: 834.91
Max Percent Drawdown at Optimum: 36.43%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	Fixed Risk	ff = 20.00%
2	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	Fixed Risk	ff = 0.000%
3	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	Fixed Risk	ff = 21.01%
4	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	Fixed Risk	ff = 10.01%

Figure 152: Optimization for Return Rate (Portfolio)

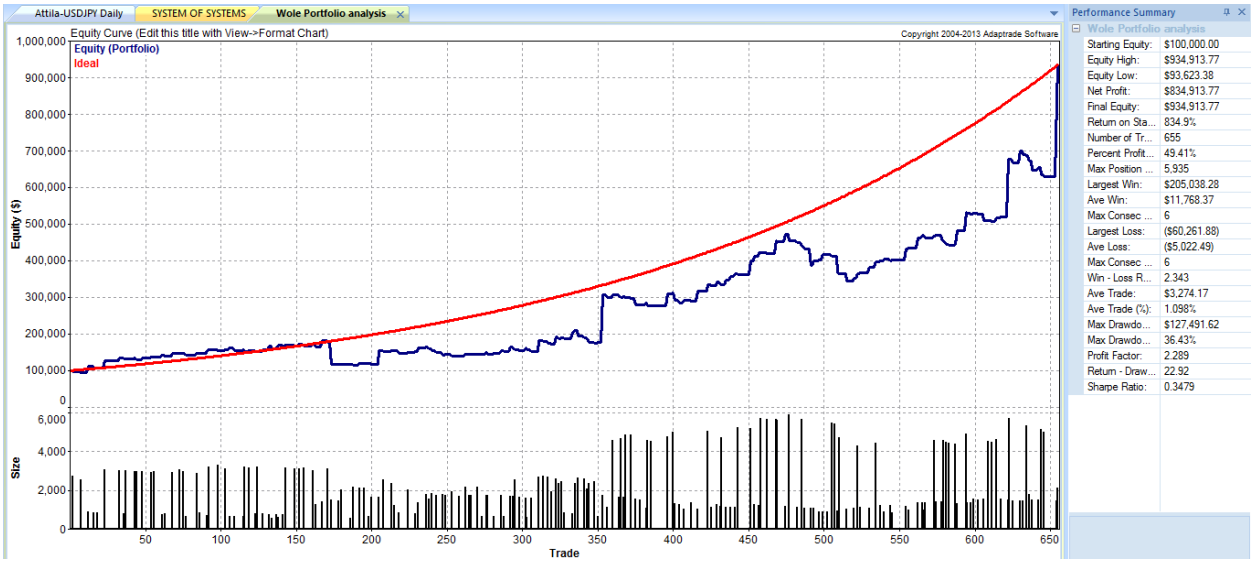


Figure 153: Optimization Performance (Portfolio)

Volatility System

The analysis for the Volatility Strategy implemented on the GBPCAD currency pair used a starting account size of $100,000, and a maximum trade size limit of 1,000,000 units, or 10 standard lots. The trades plotted in relation to how much account equity is available at that trade can be seen in **Figure 154**.

Figure 154-Equity Curve of GBPCAD

This graph shows the ideal equity curve in red, and the trades made as the blue line. When applied to the GBPCAD currency pair, the Volatility Strategy made a net profit of $19,765.15 over the course of 5 years, with 480 trades made. The system was 73.33% profitable, with an average winning trade of $186.69, and an average losing trade of $0.84. The largest losing trade for the whole 5 years was $5,463.93, which does cause concern. The max drawdown of the system was $7,775.85 and the profit factor of this system was 1.424.

Once the Monte Carlo analysis has been run on the system, a more confident prediction of probability can be made on the system. Statistically speaking, the Monte Carlo analysis aims to show how valid a system can be by randomizing all of the trades, and showing a confidence range of where the trades could possibly lie. The Monte Carlo analysis for the GBPCAD currency pair can be seen in **Figure 155**, and the corresponding performance report of the analysis in **Figure 156** and **Figure 157**.

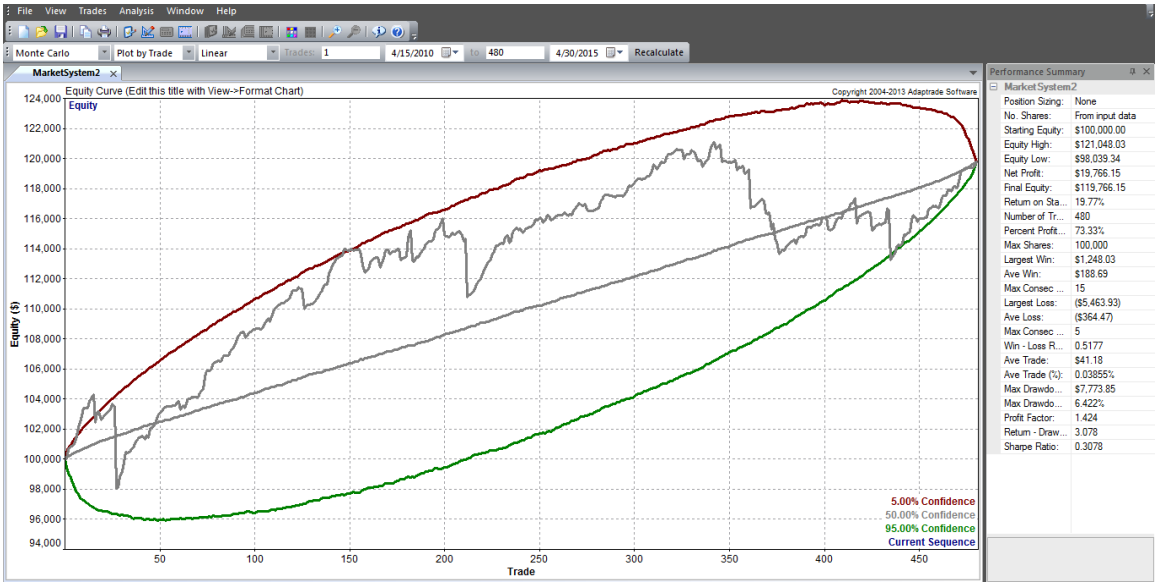


Figure 155-Monte Carlo Analysis of GBPCAD

File Edit Help

Market System: MarketSystem2

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	19.77	6.819	2.899	0.08820
60	19.77	7.314	2.702	0.08725
70	19.77	7.863	2.514	0.08628
80	19.77	8.581	2.303	0.08513
85	19.77	9.057	2.182	0.08445
90	19.77	9.656	2.047	0.08368
91	19.77	9.813	2.014	0.08350
92	19.77	9.996	1.977	0.08328
93	19.77	10.22	1.935	0.08308
94	19.77	10.39	1.903	0.08281
95	19.77	10.65	1.856	0.08255
96	19.77	10.98	1.800	0.08224
97	19.77	11.32	1.746	0.08176
98	19.77	11.75	1.682	0.08119
99	19.77	12.60	1.568	0.08038
100	19.77	18.72	1.056	0.07727

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $19,766.15 — Max Number of Shares: 100,000
Final Account Equity: $119,766.15 — Minimum Number of Shares: 100,000

Figure 156-Monte Carlo Analysis Report GBPCAD Part 1

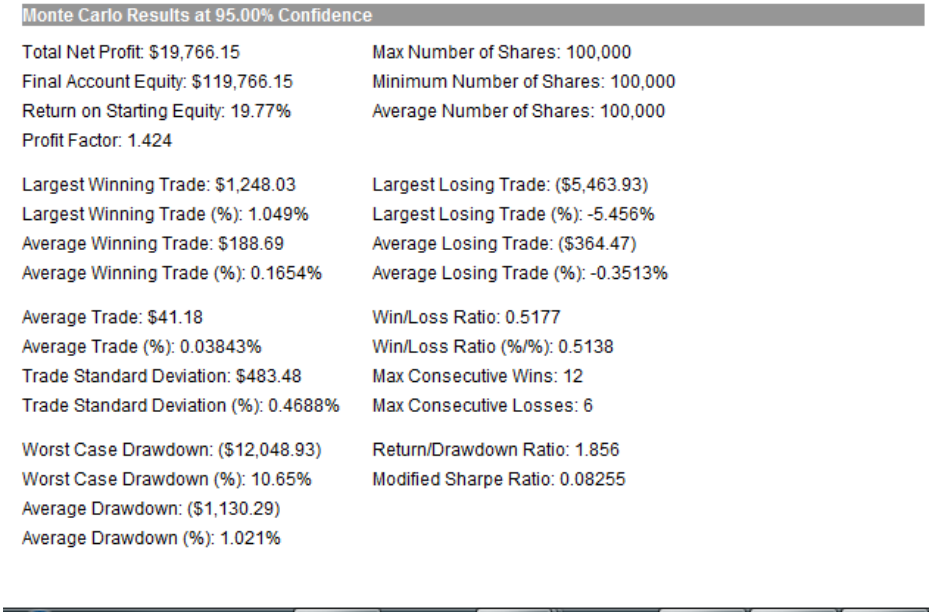


Figure 157-Monte Carlo Analysis Report GBPCAD Part 2

The graph of the 10,000 run Monte Carlo analysis shows that after randomly scrambling the trades 10,000 times, the system has the potential to trade anywhere within the shaded area. For this particular Monte Carlo analysis of this currency, the bands seem to be a decent width apart. There is confidence that the potential trades in the future will stay close to the already plotted trades. The original trades do break through the top of these two spans, indicating a potential outlier. When the results of the Monte Carlo analysis are observed, across all confidence intervals, the analysis is confident that the system will make a return of 19.77%.

A way to see if the strategy will hold in the future is to project a prediction of 30 trades into the future, and run a Monte Carlo analysis on the predicted 30 trades. In **Figure 158**, it can be seen that the predicted 30 trades into the future do not necessarily agree with the confidence bands of the Monte Carlo analysis. The future trades break through the top of the bands, indicating that the future trades may be more likely to stay within the range of the bands. This is positive considering that the bands aren't spread out that much, and project in an upward fashion. In **Figure 159** and **Figure 160**, the report of the Monte Carlo analysis of the predicted 30 trades

can be seen. Out of this report, we can see that from the analysis, there can be 97% confidence that the strategy have a 10.93% rate of return, 96% confidence of a 11.49% rate of return, and a 95% confidence of a 11.96% rate of return.

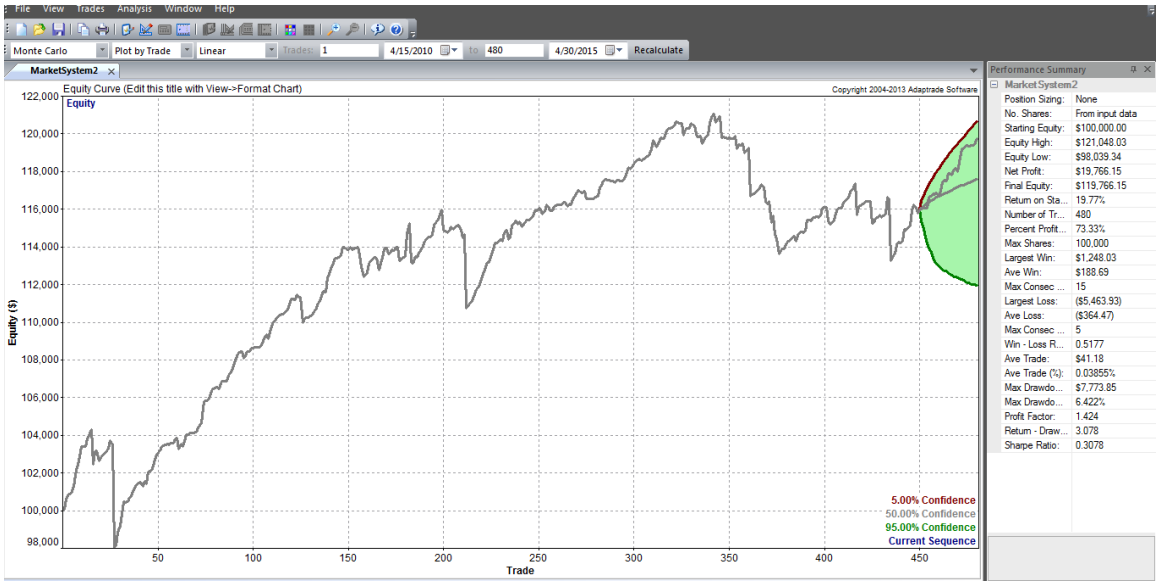


Figure 158- 30 Predicted Future Trades GBPCAD

File Edit Help

Market System: MarketSystem2

Trading Parameters

Initial Account Equity: $100,000.00
Trading Vehicle: Stocks
Minimum Margin Requirement: 100.0%
Slippage per side: $0.00 per trade
Commissions and fees per side: $0.00 per trade

Position Sizing Method: None
No. Shares: From input data
Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	17.60	6.422	2.740	0.07902
60	16.93	6.422	2.635	0.07599
70	16.12	6.422	2.505	0.07226
80	15.05	6.422	2.310	0.06683
85	14.34	6.632	2.158	0.06341
90	13.41	7.343	1.840	0.05864
91	13.21	7.520	1.770	0.05762
92	12.96	7.728	1.689	0.05641
93	12.63	7.965	1.612	0.05492
94	12.32	8.262	1.529	0.05333
95	11.95	8.530	1.413	0.05177
96	11.49	8.775	1.322	0.04932
97	10.93	9.137	1.195	0.04704
98	10.09	9.840	1.054	0.04332
99	8.753	10.91	0.8048	0.03723
100	-3.755	20.82	0.000	-0.01080

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $11,951.48
Final Account Equity: $111,951.48
Max Number of Shares: 100,000
Minimum Number of Shares: 100,000

Figure 159-30 Predicted future trade analysis report GBPCAD part 1

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $11,951.48
Final Account Equity: $111,951.48
Return on Starting Equity: 11.95%
Profit Factor: 1.223
Max Number of Shares: 100,000
Minimum Number of Shares: 100,000
Average Number of Shares: 100,000

Largest Winning Trade: $1,248.03
Largest Winning Trade (%): 1.100%
Average Winning Trade: $185.18
Average Winning Trade (%): 0.1666%
Largest Losing Trade: ($5,463.93)
Largest Losing Trade (%): -5.279%
Average Losing Trade: ($413.88)
Average Losing Trade (%): -0.3642%

Average Trade: $24.90
Average Trade (%): 0.02467%
Trade Standard Deviation: $545.07
Trade Standard Deviation (%): 0.4868%
Win/Loss Ratio: 0.4551
Win/Loss Ratio (%/%): 0.4657
Max Consecutive Wins: 15
Max Consecutive Losses: 5

Worst Case Drawdown: ($10,325.49)
Worst Case Drawdown (%): 8.530%
Average Drawdown: ($1,151.57)
Average Drawdown (%): 1.004%
Return/Drawdown Ratio: 1.413
Modified Sharpe Ratio: 0.05177

Figure 160- 30 Predicted future trade analysis report GBPCAD part 2

MSA has the feature to set a fixed rate position size percentage to the system being worked with. The position size can then be optimized to maximize certain specifications, such as net profit, profitability, or rate of return. A position size of 2% of the account equity per trade was set. This can be seen in **Figure 161**. The net profit for this optimization was 129,673.27. This is a much greater net profit than the original $19,765.15.

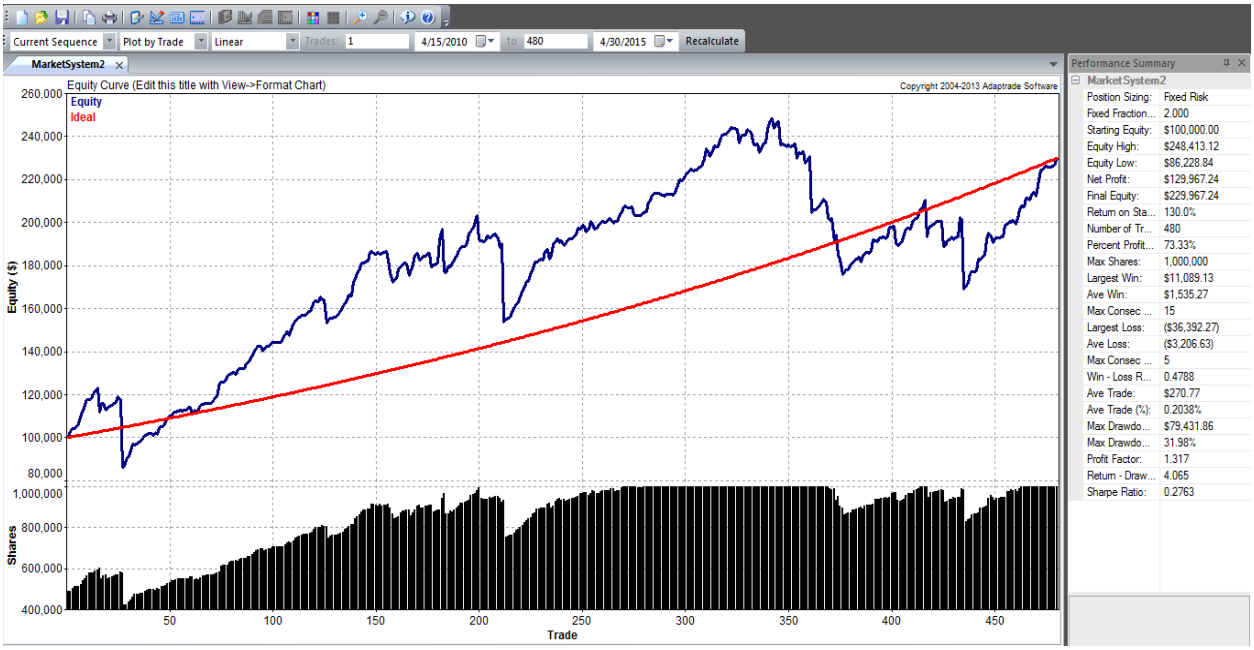


Figure 161- Using 2% of Equity per Trade of GBPCAD

System Of Systems Analysis

The analysis of the hedge fund as a whole, consisting of all four portfolios, used a starting account size of $100,000. The trades plotted in relation to how much account equity is available at that trade can be seen in **Figure 162**.

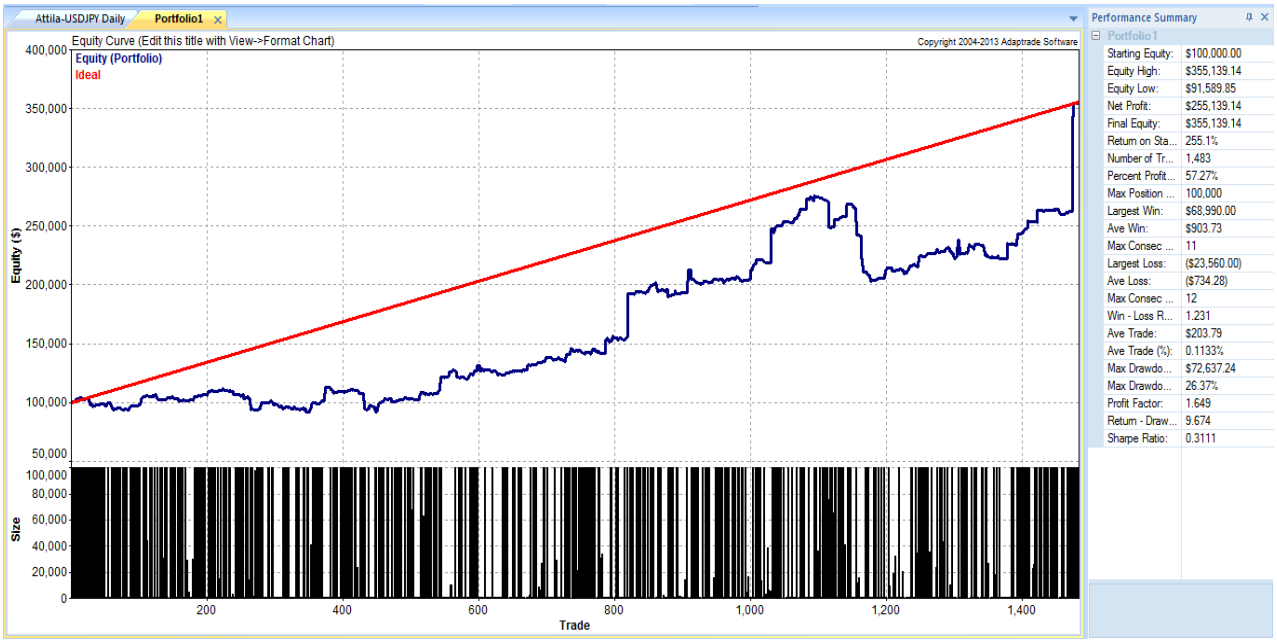


Figure 162- Hedge fund equity curve

This graph shows the ideal equity curve in red, and the trades made as the blue line. When applied to the entire portfolio of stocks and currency pairs, the hedge fund made a net profit of $255,139.14 over the course of 5 years, with 1,483 trades made. The system was 57.27% profitable, with an average winning trade of $903.73, and an average losing trade of $734.28. The largest losing trade for the whole 5 years was also $23,560. The max drawdown of the system was $72,637.24 and the profit factor of this system was 1.649.

Once the Monte Carlo analysis has been run on the entire portfolio, a more confident prediction of probability can be made on the portfolio. Statistically speaking, the Monte Carlo analysis aims to show how valid a system can be by randomizing all of the trades, and showing a confidence range of where the trades could possibly lie. The Monte Carlo analysis for the hedge fund can be seen in **Figure 163**, and the corresponding performance report of the analysis in **Figure 164** and **Figure 165**.

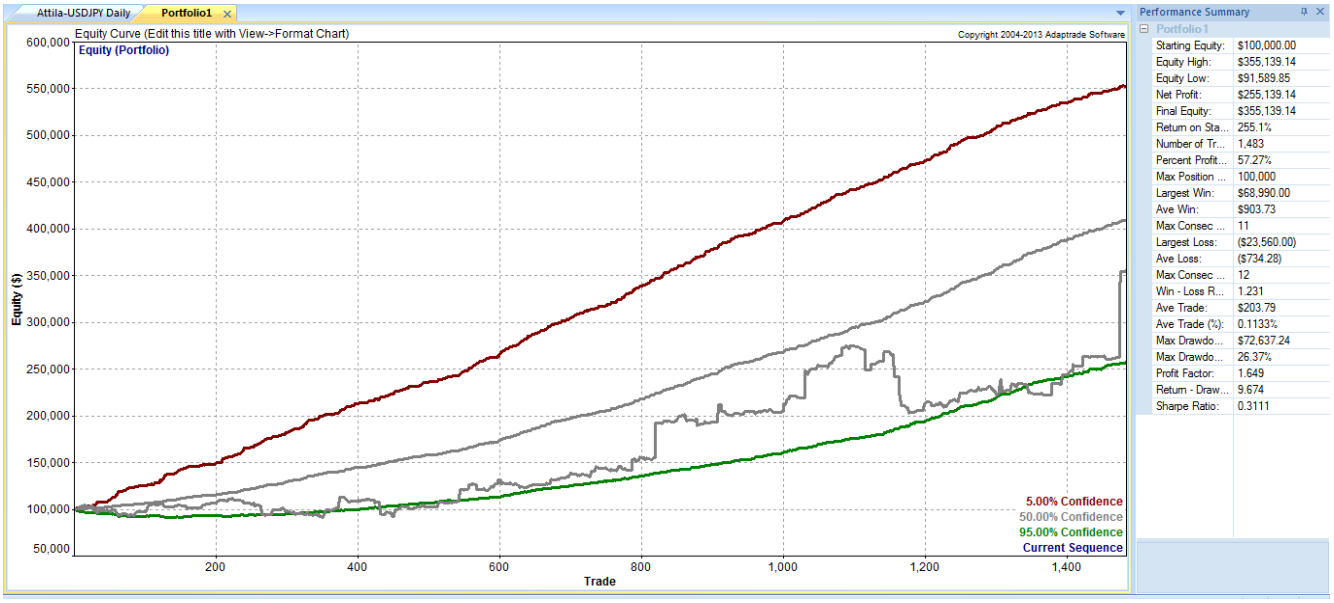


Figure 163- Monte Carlo analysis of hedge fund

Monte Carlo Results: Portfolio

File Edit Help

Portfolio: Portfolio1

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	None	NA
5	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	None	NA
6	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	None	NA
7	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	None	NA
8	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	None	NA
9	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	None	NA
10	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	None	NA
11	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	None	NA
12	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	None	NA
13	C:UsersOwnerDesktopISP IQPIQPanalysisCAMCamsTrades-GBPCAD.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	308.7	16.88	18.05	0.08845
60	284.5	18.33	15.67	0.08504
70	259.4	20.02	13.38	0.08105
80	228.6	22.14	11.20	0.07622
85	209.8	23.45	9.951	0.07264
90	189.7	25.53	8.384	0.06851
91	185.0	26.02	8.037	0.06752
92	179.6	26.62	7.679	0.06632
93	171.9	27.26	7.260	0.06517
94	164.2	27.87	6.820	0.06360

Figure 164- Monte Carlo analysis report part 1

95	157.0	28.84	6.415	0.06219
96	149.4	29.77	5.945	0.06030
97	140.6	31.08	5.347	0.05788
98	125.9	32.88	4.745	0.05491
99	105.4	36.00	3.585	0.04891
100	3.137	54.25	0.07430	0.009322

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $157,001.88	Maximum Position Size: 100,000
Final Account Equity: $257,001.88	Minimum Position Size: 1
Return on Starting Equity: 157.0%	Average Position Size: 44,804
Profit Factor: 1.377	
Largest Winning Trade: $19,950.00	Largest Losing Trade: ($28,700.00)
Largest Winning Trade (%): 11.22%	Largest Losing Trade (%): -16.18%
Average Winning Trade: $762.83	Average Losing Trade: ($1,021.84)
Average Winning Trade (%): 0.4526%	Average Losing Trade (%): -0.4770%
Average Trade: $124.22	Win/Loss Ratio: 1.029
Average Trade (%): 0.08280%	Win/Loss Ratio (%/%): 1.057
Trade Standard Deviation: $3,502.29	Max Consecutive Wins: 9
Trade Standard Deviation (%): 1.555%	Max Consecutive Losses: 11
Worst Case Drawdown: ($72,300.57)	Return/Drawdown Ratio: 6.415
Worst Case Drawdown (%): 28.84%	Modified Sharpe Ratio: 0.06219
Average Drawdown: ($4,665.78)	
Average Drawdown (%): 2.316%	

Figure 165- Monte Carlo analysis report part 2

The graph of the Monte Carlo analysis shows that after randomly scrambling the trades 10,000 times, the system has the potential to trade anywhere within the shaded area. For the Monte Carlo analysis of the entire portfolio, it can be seen that the bands are fairly spread apart, but the trades made lie within the 50% to 95% confidence range. This is fairly reassuring being that there is between 50-95% confidence that no matter when the trades are made, they will project in a slow, positive linear fashion. When the results of the Monte Carlo analysis are observed, there is 97% confidence for a rate of return of 140.5%, 96% confidence for 149.4% rate of return, and 95% confidence for 157% rate of return.

A way to see if the hedge fund portfolio will hold in the future is to project a prediction of 100 trades into the future, and run a Monte Carlo analysis on the predicted 100 trades. The trades predicted were increased from 30 to 100, due to how many more trades there are in the entire portfolio. In **Figure 5**, it can be seen that the predicted 100 trades into the future rides along the top 5% confidence band, and then continues to dramatically increase through the top band. This shows that the predicted 100 trades into the future may not be that accurate, but there

still is a 50% chance that the future trades ride fall in the middle of the shaded region. This analysis shows that further research and analysis must be done on the separate stocks or currencies within the entire portfolio in order to ensure future profit. In **Figure 166** and **Figure 167**, the report of the Monte Carlo analysis of the predicted 100 trades can be seen. Out of this report, we can see that from the analysis, there can be 97% confidence that the strategy have a 111.3% rate of return, 96% confidence of a 113.7% rate of return, and a 95% confidence of a 115.7% rate of return.

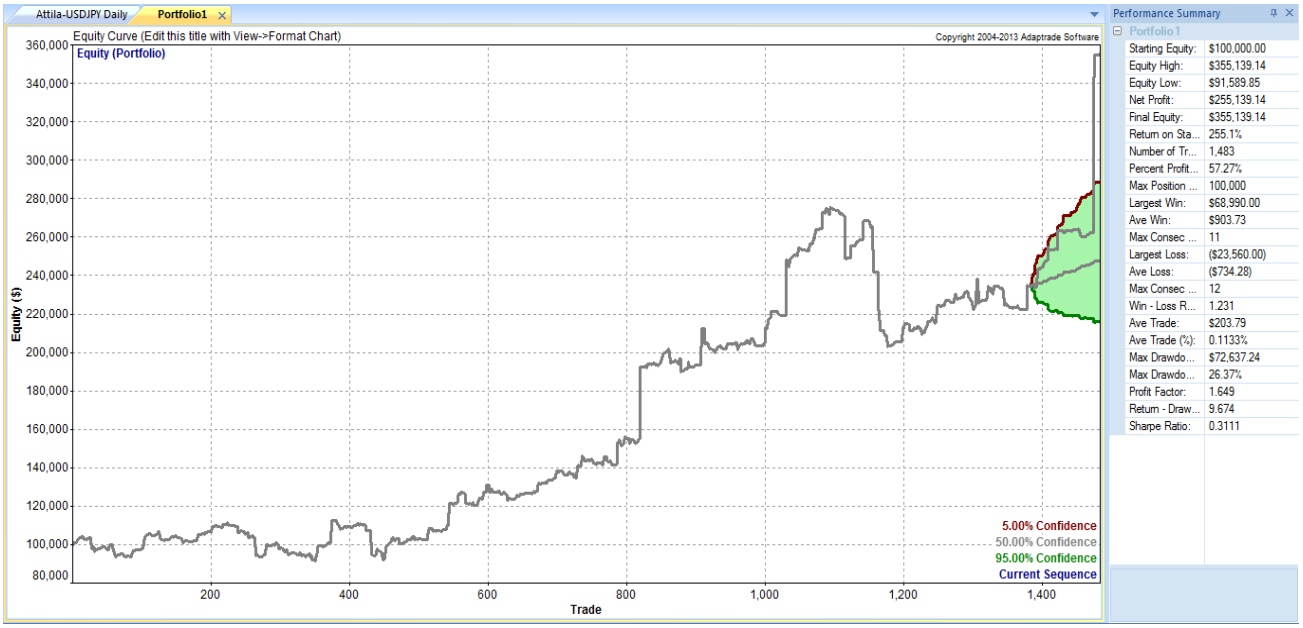
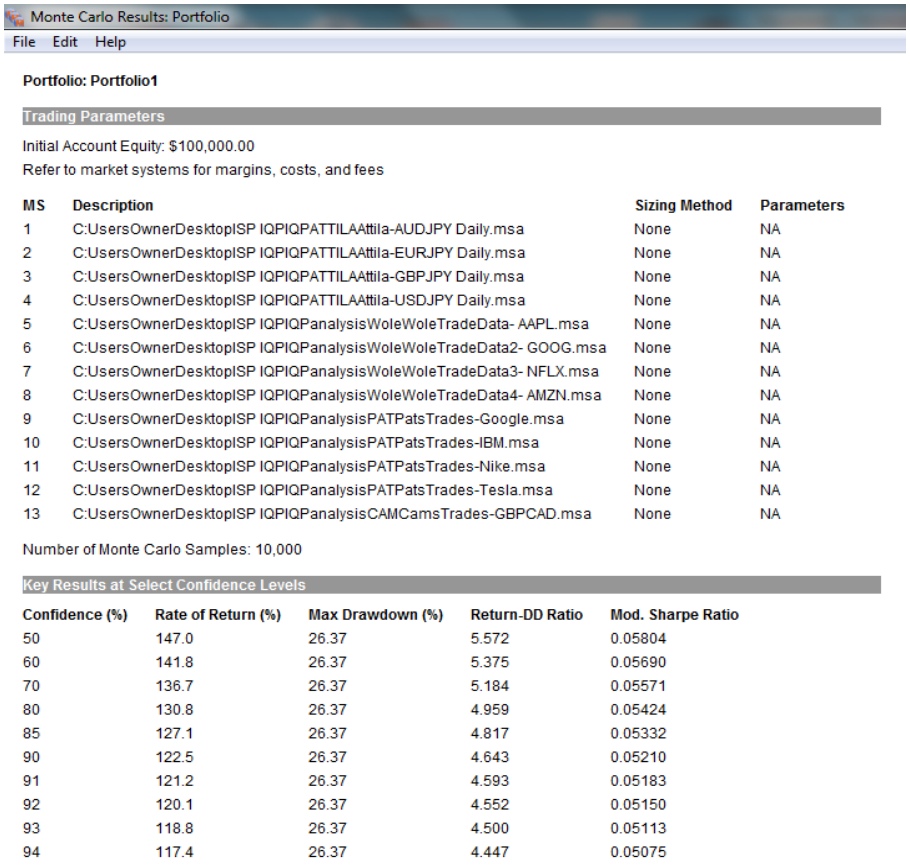


Figure 166- 100 Predicted future trades



Monte Carlo Results: Portfolio

File Edit Help

Portfolio: Portfolio1

Trading Parameters

Initial Account Equity: $100,000.00

Refer to market systems for margins, costs, and fees

MS	Description	Sizing Method	Parameters
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	None	NA
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	None	NA
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	None	NA
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	None	NA
5	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	None	NA
6	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	None	NA
7	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	None	NA
8	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	None	NA
9	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	None	NA
10	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	None	NA
11	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	None	NA
12	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	None	NA
13	C:UsersOwnerDesktopISP IQPIQPanalysisCAMCamsTrades-GBPCAD.msa	None	NA

Number of Monte Carlo Samples: 10,000

Key Results at Select Confidence Levels

Confidence (%)	Rate of Return (%)	Max Drawdown (%)	Return-DD Ratio	Mod. Sharpe Ratio
50	147.0	26.37	5.572	0.05804
60	141.8	26.37	5.375	0.05690
70	136.7	26.37	5.184	0.05571
80	130.8	26.37	4.959	0.05424
85	127.1	26.37	4.817	0.05332
90	122.5	26.37	4.643	0.05210
91	121.2	26.37	4.593	0.05183
92	120.1	26.37	4.552	0.05150
93	118.8	26.37	4.500	0.05113
94	117.4	26.37	4.447	0.05075

Figure 166- 100 Predicted future trade analysis report part 1

95	115.7	26.37	4.382	0.05029
96	113.7	26.37	4.301	0.04978
97	111.3	26.37	4.205	0.04910
98	108.1	26.37	4.076	0.04814
99	102.7	27.85	3.751	0.04663
100	67.67	39.36	1.719	0.03548

Monte Carlo Results at 95.00% Confidence

Total Net Profit: $115,691.78
Final Account Equity: $215,691.78
Return on Starting Equity: 115.7%
Profit Factor: 1.272

Maximum Position Size: 100,000
Minimum Position Size: 1
Average Position Size: 46,236

Largest Winning Trade: $36,910.00
Largest Winning Trade (%): 23.75%
Average Winning Trade: $753.27
Average Winning Trade (%): 0.4891%

Largest Losing Trade: ($23,560.00)
Largest Losing Trade (%): -11.47%
Average Losing Trade: ($797.71)
Average Losing Trade (%): -0.4896%

Average Trade: $92.48
Average Trade (%): 0.07100%
Trade Standard Deviation: $2,576.49
Trade Standard Deviation (%): 1.457%

Win/Loss Ratio: 0.9642
Win/Loss Ratio (%/%): 1.013
Max Consecutive Wins: 11
Max Consecutive Losses: 12

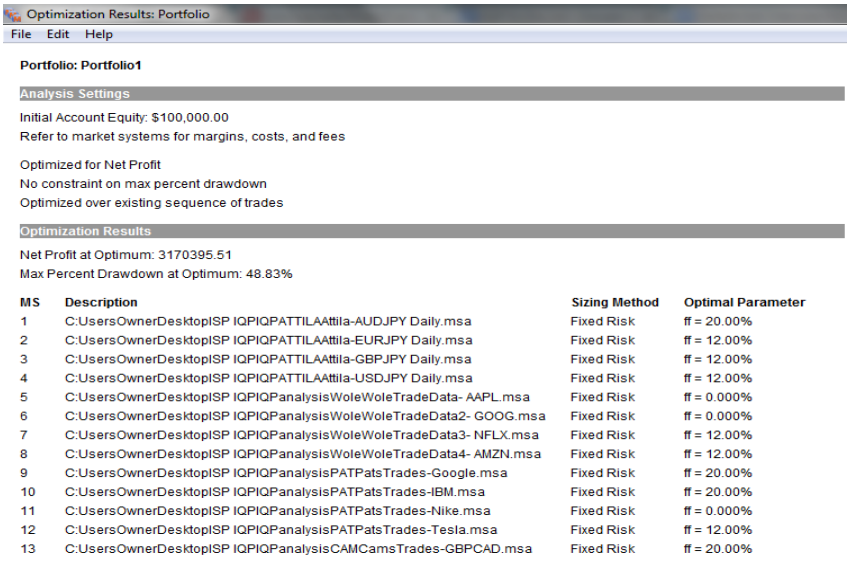
Worst Case Drawdown: ($72,637.24)
Worst Case Drawdown (%): 26.37%
Average Drawdown: ($4,132.28)
Average Drawdown (%): 2.472%

Return/Drawdown Ratio: 4.382
Modified Sharpe Ratio: 0.05029

Figure 167- 100 Predicted future trade analysis report part 2

MSA has the feature to set a fixed rate position size percentage to the system being worked with. The position size can then be optimized to maximize certain specifications, such as

net profit, profitability, or rate of return. A position size of 2% of the account equity per trade was set, and then optimized for both maximum net profit, and for maximum rate of return. The optimization done on the position size to maximize net profit can be seen in **Figure 168** and **Figure 169**. When the position size was optimized for maximum net profit, the net profit rose from $255,139.14 to $3,170,395.51 over the 5 year time period. The optimal position size percentages vary amongst the various assets. It can be seen that Apple, Google, and Nike all receive 0% of the account to trade. With this data, it could possibly be beneficial to remove these three and replace these with new currency pairs or stocks that would be beneficial to the entire portfolio.



Optimization Results: Portfolio

File Edit Help

Portfolio: Portfolio1

Analysis Settings

Initial Account Equity: $100,000.00
Refer to market systems for margins, costs, and fees

Optimized for Net Profit
No constraint on max percent drawdown
Optimized over existing sequence of trades

Optimization Results

Net Profit at Optimum: 3170395.51
Max Percent Drawdown at Optimum: 48.83%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	Fixed Risk	ff = 20.00%
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	Fixed Risk	ff = 12.00%
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	Fixed Risk	ff = 12.00%
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	Fixed Risk	ff = 12.00%
5	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	Fixed Risk	ff = 0.000%
6	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	Fixed Risk	ff = 0.000%
7	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	Fixed Risk	ff = 12.00%
8	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	Fixed Risk	ff = 12.00%
9	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	Fixed Risk	ff = 20.00%
10	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	Fixed Risk	ff = 20.00%
11	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	Fixed Risk	ff = 0.000%
12	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	Fixed Risk	ff = 12.00%
13	C:UsersOwnerDesktopISP IQPIQPanalysisCAMCamsTrades-GBPCAD.msa	Fixed Risk	ff = 20.00%

Figure 168- Position size optimization report for net profit

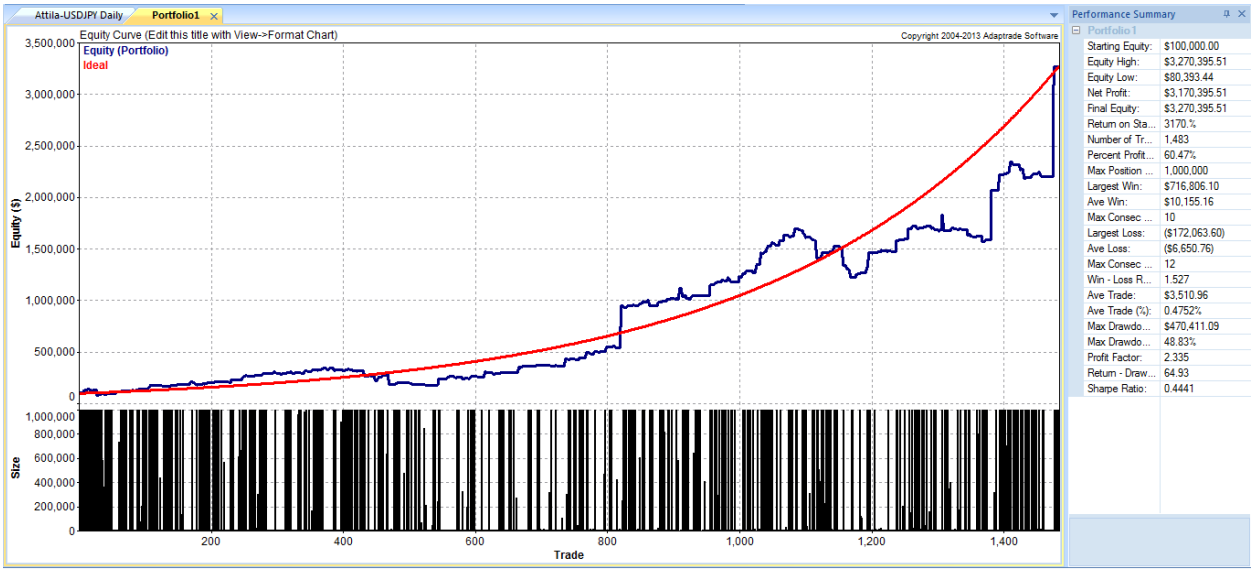
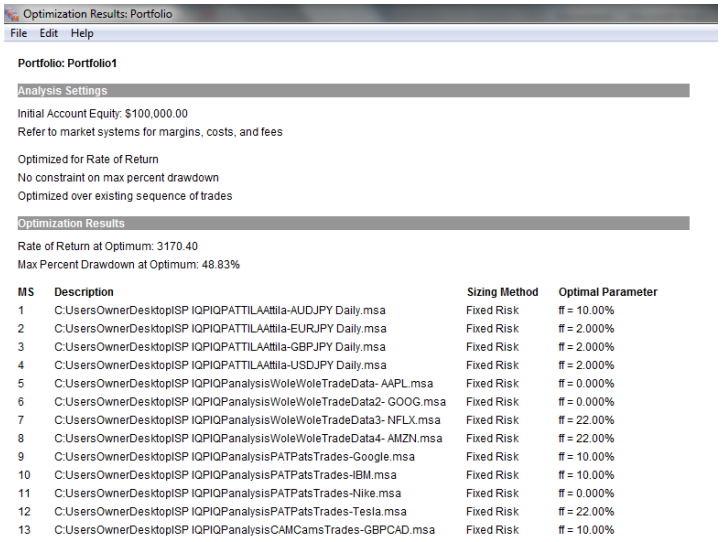


Figure 169- Position size optimization for net profit graph

Another optimization done to the position sizing was to maximize the rate of return. In **Figure 170,** the optimized position sizes vary amongst the various assets of the hedge fund. Same as the optimized position sizing for net profit, Apple, Google, and Nike received no money allocation to trade. The net profit is the same, with the same rate of return of 3170.40%. The graph of the optimized position size for maximum rate of return can be seen in **Figure 171**.



Optimization Results: Portfolio

File Edit Help

Portfolio: Portfolio1

Analysis Settings

Initial Account Equity: $100,000.00
Refer to market systems for margins, costs, and fees

Optimized for Rate of Return
No constraint on max percent drawdown
Optimized over existing sequence of trades

Optimization Results

Rate of Return at Optimum: 3170.40
Max Percent Drawdown at Optimum: 48.83%

MS	Description	Sizing Method	Optimal Parameter
1	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-AUDJPY Daily.msa	Fixed Risk	ff = 10.00%
2	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-EURJPY Daily.msa	Fixed Risk	ff = 2.000%
3	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-GBPJPY Daily.msa	Fixed Risk	ff = 2.000%
4	C:UsersOwnerDesktopISP IQPIQPATTILAAttila-USDJPY Daily.msa	Fixed Risk	ff = 2.000%
5	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData- AAPL.msa	Fixed Risk	ff = 0.000%
6	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData2- GOOG.msa	Fixed Risk	ff = 0.000%
7	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData3- NFLX.msa	Fixed Risk	ff = 22.00%
8	C:UsersOwnerDesktopISP IQPIQPanalysisWoleWoleTradeData4- AMZN.msa	Fixed Risk	ff = 22.00%
9	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Google.msa	Fixed Risk	ff = 10.00%
10	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-IBM.msa	Fixed Risk	ff = 10.00%
11	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Nike.msa	Fixed Risk	ff = 0.000%
12	C:UsersOwnerDesktopISP IQPIQPanalysisPATPatsTrades-Tesla.msa	Fixed Risk	ff = 22.00%
13	C:UsersOwnerDesktopISP IQPIQPanalysisCAMCamsTrades-GBPCAD.msa	Fixed Risk	ff = 10.00%

Figure 170- Position size optimization report for rate of return

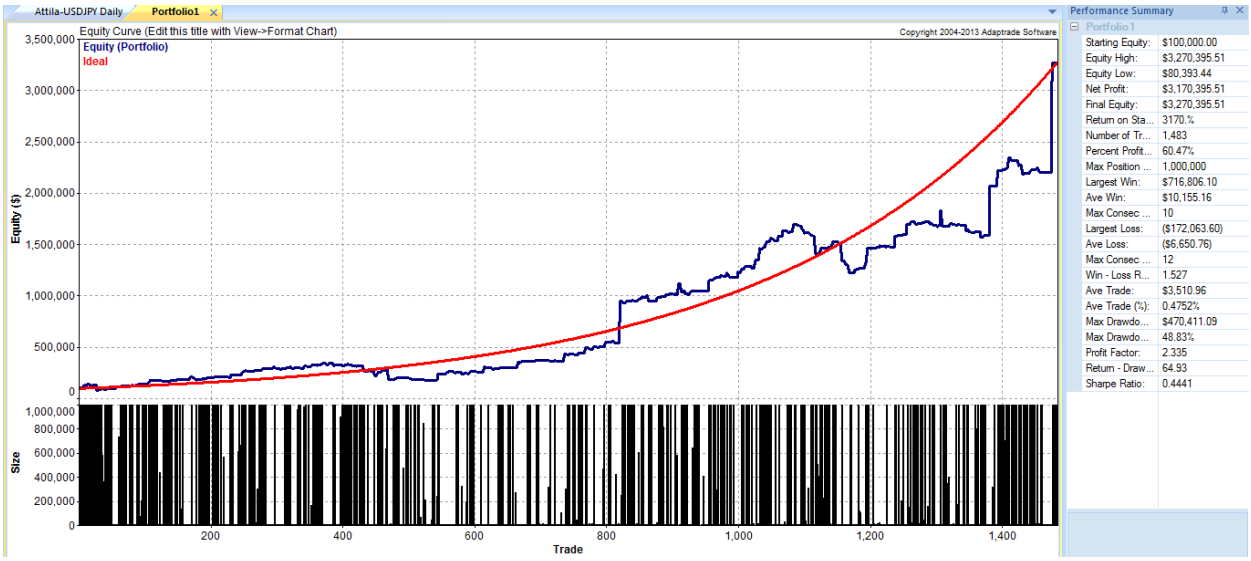


Figure 171- Position size optimization for rate of return graph

Conclusion

Adaptive Moving Average System

This automated system was profitable for each stock tested upon in back testing, yet with further future analysis it seems that the strategy worked much more efficiently for future use with select stocks. As my optimal portfolio suggested, the parameters set for Nike stock were indeed the most efficient. In order to trade real money, some small alterations would be made to the strategy, but this stock would be a top choice for the AMA strategy. Some parameters that could be changed are the span values of both moving average indicators as they were once optimized in Tradestation; they may have been over fit to historical data. Also, stop values and profit targets could be analyzed again and changed to increase the efficiency of the system. The daily charts are a great fit for this strategy, but the system could also be used on weekly bar charts where success has previously been recorded. The system is currently usable in the stock market yet more tests can be ran to make a more profitable and comfortable automated strategy.

Ichimoku Trading System

Considering the profit factor, and that the entire portfolio for the "Ichi" strategy was over 50% profitable, this strategy could potentially be ready to use in a live market. One "catch" to this strategy is that it is tailored for markets that are in an overall up-trend, so the market would have to be chosen accordingly. The risk is managed exceptionally well, with a max drawdown of $6.72, which can be very comforting to many people, especially considering that the starting account size for that drawdown is $100,000. One thing that could potentially be changed for the strategy is the size of the stop loss and the dollar trailing. Increasing these values can cause the time stayed in the market to increase, but could potentially increase the max drawdown and the

average loss of a trade. More analysis would need to be done to see if this concept would work better than the original.

Trend Following Turtle System

The modified trend following system that was developed for this hedge fund satisfied the objectives for the most part. The strategy made a lot of trades throughout the five years, which is typically unusually for a trend following system, but is what was desired for this specific strategy. The strategy won about 40% of the total trades that were made for each stock, which is good for a trend following system. The system was able to catch the big jumps in the market and did a fairly decent job of avoiding the noise, although the profit was still affected by it. One negative was the drawdown was higher than sought compared to the return rate for some of the stocks. Possible improvements that can be made would be implementing a stop loss to maximize the profit. The system won a large amount of money, but the net profit was much lower due to losing a large amount of money. With a stop loss implemented to minimize the largest lost and lost on trades, the system would continue to make as much money as prior to the stop loss, but wouldn't be losing as much on trades. An indicator can also be implemented to improve the filtering of noise. With these to improvements made, the strategy would be ready to begin trading with real money.

Volatility Trading System

The volatility automated trading system that was developed met most of the objectives, but could be developed further for more success. The volatility system traded over 400 times for the five-year plan and was still very profitable. When using 2% of equity per trade, the system is even more profitable. This system could be ready for trading with real money, but it would have to be monitored closely due to the big losers it sometimes encounters. Going forward with this system, it would be smart to try and configure a stop loss of some sort to limit big losing trades.

The only problem encountered with this system was configuring the time filter, but once the problem was solved no other problems were run into.

System Of Systems

When the numbers are examined on the profitability of the hedge fund, there shows sign of potentially being successful in the future. With a starting account size of $100,000, the entire fund was able to make about 255%, $255,139, in a five year time span. Before optimization, the average winning trade was $903.73, and the average loosing trade was $734.28. One aspect that could potentially be alarming to some people is the max drawdown of the fund, which was $72,637.24. In comparison to the amount made over the five years, this is a lot of money. Once the entire fund was optimized for net profit, with a starting account size of $100,000, the hedge fund made $3,170,395.51, with a profit factor of 2.335. The over all optimization ended up removing 3 particular systems, the turtle traded Apple and Google, and the moving average traded Nike. This shows that there is still some flaw to the hedge fund, and with more analysis, these three systems can be changed to markets that are profitable. Considering vastly huge difference between the beginning net profit and the optimized net profit, and taking into account the 3 systems that were removed from trading, the hedge fund has the potential to make a much larger profit. Aside from the small flaws, the entire system of systems that the hedge fund trades is very profitable, and could potentially be used someday to trade live and with actual money.

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Appendices

Adaptive Moving Average Code

```
inputs:
Price(close),
EffRatioLength(10),
FastAvgLength(4),
SlowAvgLength(25),
FastLength(2),
SlowLength(50);
variables:
MAA(0),
FastAvg(0),
SlowAvg(0),
LongConditionBar(0),
LongCondition(False),
CloseCondition(False);
MAA = AdaptiveMovAvg(Price, EffRatioLength, FastAvgLength, SlowAvgLength ) ;


FastAvg = AverageFC( Price, FastLength);
SlowAvg = AverageFC( Price, SlowLength);


LongCondition = FastAvg crosses above MAA;

If (LongCondition[3]) then begin
Buy ("LE") 500 shares next bar at market;
LongCondition = False;
end;

CloseCondition = FastAvg crosses below MAA;

If (CloseCondition[3]) then begin
Sell("close") 500 shares next bar at market;
CloseCondition = False;
end;

Begin
SetStopPosition;
SetDollarTrailing(450);
end;

Begin
SetStopPosition;
Setpercenttrailing(1500,15);
end;
```

```
Begin
Setstopposition;
Setstoploss(500);
end;
Begin
SetStopPosition;
SetProfitTarget(5000);
end;
```

Ichimoku Code

```
Input:
        Kinjun_Sen_Length(26);

Variables:
        Price1(high),
        Price2(low),
        Kinjun_Sen(0),
        BarsToWait(1),
        BarsToWaitClose(2),



Kinjun_Sen = 0.5 * ( Highest( High, Kinjun_Sen_Length ) + Lowest( Low,
Kinjun_Sen_Length ) ) ;



If low[BarsToWait] crosses above Kinjun_Sen[BarsToWait] then
        Buy ("LE_Kin") next bar at market;

If high[BarsToWaitClose] crosses below Kinjun_Sen[BarsToWaitClose] then
        sell ("Close_Kin") next bar at market;



{Setpercenttrailing(100, 30);}
Setdollartrailing(50);
SetStopLoss( 100 );
```

Turtle Trading Code

```
Variables:
        Move (0);

        If close > close [2] and close [2] < close [5] then Move = -1;

        If close < close [2] and close [2] > close [3] then Move = 1;

If Move = -1 Then
        Buy 500 Shares Next Bar at Market ;

If Move = 1 Then
        Sell 500 Shares Next Bar at Market ;
```

Volatility Code

```
inputs:
Length(200),
PctAbove (1),
PctBelow(1);
Variables:
            volfilter (false),
            timefilter (false),
            Lowerband (0),
            Upperband (0),
            Offset (0),
            ocRange (0),
            ocRangeAvg (0),
            PctBelowFactor(1-(PctBelow *.01)),
            PctAboveFactor(1+(PctAbove *.01));

LowerBand = AverageFC( Close, Length ) * PctBelowFactor ;
UpperBand = AverageFC( Close, Length ) * PctAboveFactor ;
If Time = SessionEndTime(1, 1) then
Begin
  // Compute the daily range and average
  ocRange = ( HighD(0) - lowD(0) ) * PriceScale;
 ocRangeAvg = Average( ocRange, 12 );
  If ocRangeAvg < 240 and ocRangeAvg >= 60 then
                        volFilter = True;
End;
if time >= 0100 and time < 0900 then
            timeFilter = True;
If timeFilter =True And volFilter =True Then
Begin
  If ( Close Crosses Below LowerBand ) Then
                        Buy("LE") next bar at market
  Else If ( Close Crosses Above UpperBand )  Then
                        Sellshort("SE") next bar at market;
End;
If ( Close > LowerBand ) Then
            sell next bar at market;
If ( Close < UpperBand ) Then
            buytocover next bar at market;
```