

**This document is downloaded from Outstanding Academic Papers by
Students**

(OAPS), Run Run Shaw Library, City University of Hong Kong.

Title	Can advanced turtle trading still be applied to the current trading market with algorithmic trading?
Author(s)	Chan, Tsz Lok (陳子樂)
Citation	Chan, T. L. (2021). Can advanced turtle trading still be applied to the current trading market with algorithmic trading? (Outstanding Academic Papers by Students (OAPS), City University of Hong Kong).
Issue Date	2021
URL	http://dspace.cityu.edu.hk/handle/2031/9543
Rights	This work is protected by copyright. Reproduction or distribution of the work in any format is prohibited without written permission of the copyright owner. Access is unrestricted.

Can Advanced Turtle Trading still be applied to the current trading market with Algorithmic Trading?

CHAN Tsz Lok

Bachelor of Science in Computational Finance, College of Business,
City University of Hong Kong
CB4001 - Honor Thesis

Supervisor: Dr. WONG Chak Sham Michael

Table of Contents

1. Abstract	2
2. Introduction	2-3
3. Related work and background	3-4
4. Problems of original turtle trading	4
5. Automated trading strategy development	4-8
5.1 Trend signal capture	5-6
5.2 The basic unit of a position	6-7
5.3 Opening a position	7
5.4 Adding a position	7
5.5 Stop loss	7
5.6 Take profit	7
5.7 The difference between the new version and the original Turtle Trading Rules	8
6. Data and implementation	8
7. System performance measures	9
8. Results and discussion	9-11
9. Conclusion	11-12
10. References	13
11. Appendix	14-37

Can Advanced Turtle Trading still be applied to the current trading market with Algorithmic Trading?

1. Abstract

The purpose of this report is to test the applicability of the modified Turtle Trading System to different markets through algorithmic trading. The trading rules used in the report are the Turtle Trading System invented by Richard Dennis in the 1970s (Faith & Foster, 2008). The program trading tool is known as Multicharts. The methodology used in the information is to modify and adapt the Turtle trading through backtesting and validation to develop a customized trading strategy for each market. The report concluded that each market, including indexes, Forex, cryptocurrencies, and commodities, can achieve consistent profits by trading a portfolio composed of new versions of the Turtle trading strategy with the appropriate parameters. The conclusion is that even though the Turtle trading strategy has been in place for decades, it can still work in various markets through improvements and adjustments with the help of program trading.

Keywords—Turtle trading strategy; algorithmic trading; Multicharts; indexes; Forex; cryptocurrencies; and commodities

2. Introduction

Technology develops rapidly, and program trading is no longer an unfamiliar tool among retail investors. In the past, retail investors only traded stocks and analyzed market trends through technical analysis and fundamental analysis. However, manual operations often reveal the undisciplined and emotion-driven trading strategies of the average retail trader in the market, which is why the research indicates that 90% of retail traders lose money (Gillham, 2021). In this report, one of the most well-known trading strategies, the Turtle Trading Strategy, is used as a trading strategy. Using Multicharts, the most popular program trading tool, retail traders can use an easy-to-use program code to have a stable trading strategy and solve human emotion problems in the market.

It has been several decades since Richard Dennis announced the turtle trade. However, the financial markets have become more and more complex and unpredictable. The most crucial point is that Richard Dennis said that even if he had announced the strategy, not many people would use it because the turtle trading strategy is a test of the trader's discipline. However, discipline is all about confidence and a deep understanding of trading. It is natural to understand that the inventor of a trading strategy is not afraid of 10 small losses because he experiences that he will win once if he loses ten times. However, the trader who does not know about the trade operation thinks he wrongly trades but is correct and not disciplined. Now that there are more oscillating markets, the turtle trading strategy for trend strategies is suffering more losses. As the trade side becomes more uncertain, the strategy's win rate is significantly reduced, causing the system to hold and endure diminishing profits. As stop losses continue to occur, the risk of trading increases, which causes the strategy to suffer from various disadvantages, such as a more significant maximum drawdown (MDD). To improve the original turtle trading rules, the system will retain the turtle trading strategy while improving the win rate and MDD. The system will narrow the channel to enhance the original Donchian channel, making the entry and exit positions more reactive. To avoid stopping losses caused by entry and exit in oscillating markets, the CMI indicator was added to determine the market trend before entering the market.

At the same time, we will raise the position conditions for adding positions to avoid losses in the rebound and oscillating markets. The strategy will have three parameters, namely Range, CMI_Val, and Risk, for optimizing the system. The Range is the parameter corresponding to the ATR and new Donchian channel. CMI_Val is 0-100, and the CMI indicator is more significant than a certain amount to call the market is a trending market. Risk is the risk taken when the strategy is stopped out (e.g., when the price of a long position falls Risk*N by price, the system will stop it out). A valuable aspect of the Turtle Trading Rule is the use of ATR to identify market volatility and determine the number of entries and price positions. This improved version of the Turtle Trading Rule retains this valuable aspect and thus keeps the spirit of the original trading rule.

3. Related work and background

(Anderson & Faff, 2004) created the optimal F. The optimal F represents the fraction of the total funds invested in the market by the strategy and is used to test the impact that money management would have on profits and percentage returns over the test period. According to reports, betting on the amount of each contract to the maximum observed loss will result in the loss of all trading capital. However, the percentage return will vary greatly when a different capitalization rate is applied to each contract. From this, the influence of capital management on the strategy can be seen.

(Xu & Zheng, 2018) explains some problems in the turtle trading system using experimental data and proposes some improvement methods based on the issues. There are two ways to change, and one is to add moving averages to filter some oscillating markets. The other is to optimize the trading parameters. After testing, the improved turtle trading strategy has better performance. Among other things, the returns are better, and the design is more adaptable, making it a better long-term investment. In the improved process, the equity position created is only 1/8 of the capital, which is lower and less risky than the original one. In the investment market, the management of money determines the survival rate of the strategy. The new version of the Turtle Trading Strategy is based on the Average True Range (ATR) and 0.3% of total capital. When the market goes to extremes, the reality is that contrary to our expectations, the loss is only less than 0.5% of the natural wealth. Therefore, modified turtle trading is effective for long-term investment in various markets. In addition, when the money reaches a certain amount, it is necessary to build a portfolio that can diversify the risk, to reduce the volume of transactions that the market cannot accommodate.

Through research, (Vezeris et al., 2019) concluded that automated trading systems based on turtle strategies could benefit from introducing exclusion barriers in their stop-loss strategies with a value of stop-loss multiplier X less than 5. Therefore, the Adaptive Turtle Trading System or AdTurtle was developed. On the contrary, the classical Turtle system becomes more profitable when using unique values of X (greater than or equal to 5).

In addition, the modified version of the Turtle trading strategy created by (Fang et al., 2020) started from the time frame aspect. The revised system changes the time frame from one day to four hours, making the strategy more flexible. Of course, the original parameters will not apply because the triggering time will be more frequent. Therefore, they must adjust all parameters from scratch. T-24 and T-48 serve as the best short- and long-term breakout points from the backtest. In addition, to determine the market trend, the exponential moving average is added to the modified strategy. It is a moving average of prices over a period, with the most recent price weighting. The 30 EMA, 60 EMA, and 100 EMA each suggest a fast, slow, and long-term trend. Finally, the Cut-loss condition is removed because the system period is shorter, and the strategy will not lose for a long time.

The most crucial point of the Turtle Trading Rule is using the Average True Range (ATR) to establish buy positions and position adding criteria. Therefore, we will retain this crucial part in this improved report version. This research report will make four improvements to the original turtle trading strategy. First, since the turtle trading strategy is a trend strategy, the system can use the CMI indicator to determine the type of stock price movement and thus the kind of trading strategy to implement. For example, in the Thermostat Trading Strategy (Pruitt et al., 2012), the CMI differentiates between market movement types. In addition, financial markets have become more complex and unpredictable than ever before. Therefore, the original parameters are no longer applicable to the current market.

Moreover, the original trading strategy uses the breakout point as a buy and sell point when the current price exceeds the highest or lowest price of the previous n days (i.e., the T -nth day). In the modified strategy, the new Donchian Channel entry point will be used to reduce the occurrence of extreme situations by using the average of the opening and closing prices to buy and sell positions. Finally, we will change the width of the add-on positions to prevent a false breakout in the market.

4. Problems of original turtle trading

The first problem with the Turtle Trading Rule is that the winning percentage is too low. As a trend strategy, the Turtle Trading Rule is a strategy of going long or selling in the presence of a rare one-sided trend in the market. The only way to achieve a great return on a trade is to keep increasing the position during a significant movement. However, the market tends to have more oscillations than trends. As a result, the turtle trading strategy requires constant entry to catch the rare one-sided trends in the market. Therefore, the Turtle Trading Strategy encounters many false breakouts during oscillating markets. With regular stops, withdrawals, and reduced capital, traders are often under tremendous pressure, making it more difficult to execute trades with discipline. In the book (Schwager & Recorded Books, Inc, 2016), Richard Dennis also states that 95% of his turtle trading profits are made on 5% of his trades, which shows the low win rate.

The second problem with the Turtle Trading Rule is that the strategy's maximum drawdown (MDD) is enormous. Turtle trading tends to trade multiple markets to capture the occurrence of rare one-sided trends in the market. When the strategy calls or sells, the losses incurred can be enormous as the system encounters multiple markets with oscillating markets and can then be held for many weeks or months. At the same time, the issue of profit-taking back should not be overlooked. As a result of the Turtle Trading Rule, the profit will be immediately retracted when there is a false breakout in the market. It is not uncommon for a turtle trading strategy to take all positions on an uptrend breakout, only to have the market back a few days later and close the positions at a stop loss. Richard Dennis is often on the wrong side of a \$10 million loss in one day, which is an excellent reflection of the severe MDD of this strategy.

5. Automated trading strategy development

The Turtle Trading Strategy, as described by (Faith & Foster, 2008), is a complete and mechanical trading strategy that can be presented in a systematic way using a programming method. It includes a series of trading strategies, for example, what to buy and sell, the size of the position when to buy and sell or exit. The most important aspect of the turtle trading strategy is to capture the long-term trends and maximize returns in the market formed by the movement. We can see this is a trend trading strategy. The following is a modification of the turtle trading as referenced by (Faith & Foster, 2008):

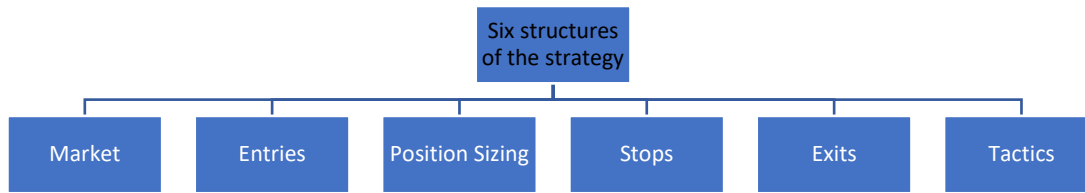


Figure 1. The six structures of the Turtle Trading Strategy

5.1 Trend signal capture

The new Donchian Channels

The Turtle Trading Rule uses a significant technical indicator - the Donchian channel. This channel is very similar to the Bollinger Bands, but it is calculated differently. The Donchian channel indicator was invented by Richard Donchian and consisted of two different colored curves. The indicator uses the highest and lowest prices within the period (usually 50, which can be modified) to show the market price volatility.

When the price breaks through the upper rail of the channel, it is a possible buy signal; conversely, when it breaks through the lower rail, it is a potential sell signal.

The new Donchian channel has a difference in the setup on the original Donchian channel. The original channel consists of the past 50-day high and low and forms a box-shaped channel. In the new version of the channel, the high and low points are changed to the average of the sum of the opening and closing prices. As seen in Figure 2, the new channel is narrower and more price-sensitive when a breakout occurs. The calculation of the indicators for the new Donchian channel is

$$\text{Upper rail} = \text{highest} \left(\frac{\text{open} + \text{close}}{2}, \text{Range} \right)$$

$$\text{Lower rail} = \text{lowest} \left(\frac{\text{open} + \text{close}}{2}, \text{Range} \right)$$



Figure 2. The new Donchian Channels with the past 50-days

The Choppy Market Index

Referring to the trend pattern of the Thermostat strategy, the new Turtle Trading Rule adds the CMI indicator to determine if the market is in a trend pattern. The Choppy Market Index (CMI) is a technical analysis indicator used to determine the type of market movement. It determines whether a stock is currently trending or consolidating by calculating the ratio of the difference between the current closing price and the previous closing price over a certain period to the Range of price movements during that period.

Choppy Market Index CMI calculation formula:

$$CMI = \left(\frac{AbsValue(Close - Close[Range - 1])}{Highest(High, Range) - Lowest(Low, Range)} * 100 \right);$$

Where AbsValue is the absolute value. The Range is the number of periods, e.g., 50. the value of the Range will be the same as the period of ATR.

The use of the Choppy Market Index CMI:

The critical use of this indicator is to differentiate the current stock price trend type: consolidation or trend. When the CMI indicator is below CMI_Val, e.g., 20, the market consolidates. On the other hand, when the CMI is greater than CMI_Val, e.g., 20, the market trend, the new strategy will select the most suitable CMI_Val by backtesting.

The CMI can also be used to predict changes in stock price trends. The stock will likely change from consolidation to a trend when the CMI is near 0 for a long period. When the CMI is around 100 for a long period, the direction will likely weaken, forming a consolidation.

5.2 The basic unit of a position

The Turtle Rule principle of position addition defines a small unit so that the expected change in the value of the position corresponds to 1% of the total net worth. In other words, if this one small unit is bought, the position's market value will not change by more than 1% of the total net worth on that day.

Therefore, how is this small unit defined? And how do you predict the value change of this small unit? First, to estimate the value change of this small unit (the value change is called N), the Turtle Strategy uses a statistical approach to historical price movements. The specific formula is as follows.

$$TrueRange = Maximum(Highest\ price - Lowest\ price, Highest\ price - PreClose, PreClose - Lowest\ price)$$

If Range is 50,

$$N = (the\ sum\ of\ the\ N\ values\ of\ the\ previous\ 49\ days + TrueRange\ at\ that\ time) / 50$$

Where Highest price means the highest price of the day, Lowest price means the lowest price of the day, and PreClose means the previous day's closing price.

Otherwise, $N = AvgTrueRange(Range);$

We can see from the definition that the N value is an appropriate expression of the recent volatility of the asset in terms of price.

Thus, a Unit should be calculated as follows.

$$Unit = (1\% * Total_net) / N$$

where total_net is the total net asset value.

The price volatility of a Unit's asset = 1% of total net assets.

5.3 Opening a position

Opening a position comes from the generation of a trend breakout signal. For example, suppose the current price breaks through the upper rail of the new Donchian channel (see Figure 2.), and the CMI shows a trend signal. In that case, a buy position opening call is generated. On the other hand, if the current price falls below the lower rail and the CMI shows a trend signal, a short-selling position opening signal is generated. The size of the initial open position is 1 Unit.

5.4 Adding a position

If the opened bottom position is a long position and the latest market price has increased by **1N** from the last opened position (or added position), another long position of 1 Unit is added.

If the open position is a short position and the latest price of the market has fallen by **1N** from the last position opened (or added), add another Unit short position.

The maximum number of entries is 4, including opening a position.

As we can see, the Turtle strategy is catching up and catching down.

5.5 Stop loss

If the open position is long and the latest price of the market has fallen by **Risk*N** (e.g., risk = 2) from the last position opened (or added), sell the entire position and close it with a stop loss.

If the open position is a short position and the latest price of the market has increased by **Risk*N** (e.g., risk = 2) from the last position opened (or added), buy the entire position and close it with a stop loss.

5.6 Take profit

If the open position is long and the latest price of the market falls below the lower rail of the new **Range*0.5**-Donchian channel, close all positions and end the strategy.

If the open position is a short position and the latest price of the market rises above the upper rail of the new **Range*0.5**-Donchian channel, close all positions to end the strategy.

5.7 The difference between the new version and the original Turtle Trading Rules

	Original	New
CMI indicator	Not have	Have (Parameter: CMI_Val)
The period of ATR and Donchian Channels	20	Depends on market (Parameter: Range)
Opening a position	highest(high,Range) lowest(low,Range)	highest((open+close)/2,Range) lowest((open+close)/2,Range)
Adding positions	Increased/decreased by 0.5N from the last opened position (or added position), another long/short position of 1 Unit is added.	Increased/decreased by 1N from the last opened position (or added position), another long/short position of 1 Unit is added.
Take Profit	highest(high,Range*0.5) lowest(low,Range*0.5)	highest((open+close)/2,Range*0.5) lowest((open+close)/2,Range*0.5)
Stop Loss	2*N	Depends on market (Parameter: Risk)

6. Data and implementation

We will download the data for testing the new Turtle trading strategy from stooq.com. The selected markets will include the index ETF, Forex, cryptocurrency, and commodity markets. The index ETF will be QQQ, SPY, and DIA, the Forex will be JPY/USD, EUR/USD, and AUD/USD, the cryptocurrency market will be BTC/USDT and ETH/USDT, and finally, the commodity market will be USO and XAU/USD. The testing period is daily and will last from October 1, 2001, to October 1, 2021 (except for cryptocurrency and commodity market), a testing period of up to 20 years. The selected market symbols are mostly the main symbols mentioned in the original Turtle Trading Rules (Faith & Foster, 2008). Because the selected market symbols include an index, Forex, cryptocurrency, and commodity markets, it is possible to effectively test the effectiveness of the strategies in these markets and diversify the risk in the portfolio.

Multicharts, the most popular program trading software, is used in this report and is available in English and Chinese for the Chinese community in Asia. It offers a full range of functions, including quantitative analysis, trade retesting, data processing, and portfolio trading, for programmers and manual traders. The charting window provides market trends, entry and exit levels, and signal alerts, making it easy to see immediately. Traders can set up their charting screens via Multicharts' API connection. Use the indicators provided or edit your own to watch the market signals and verify your win rate with the quick backtest function. After completing a trade, the trader can review the system's functionality through historical data retrieval and post-trade review. The highlight for professional programmers is Multicharts' PowerLanguage. The trader can program this relatively simple system to produce indicators and signals in just a few lines, allowing traders to focus on trading logic and design without programming language worries. In this way, it is possible to create the code in Multicharts and use it for fully automated computer execution, avoiding human influences and maintaining consistency in trading.

7. System performance measures

1. Return on account (%)
2. Percent Profitable (%)
3. Max Strategy Drawdown (%)
4. Profit factor
5. Sharpe ratio
6. Ratio Average Win / Average Loss
7. Total number of trades

8. Results and discussion

Range: 100 CMI_Val: 60 Risk: 4							
Symbol	Return on account (%)	Percent Profitable (%)	Max Strategy Drawdown (%)	Profit factor	Sharpe ratio	Ratio Average Win / Average Loss	Total number of trades
QQQ	368.25%	42.98%	42.52%	2.27	0.09	3.02	121
SPY	440.01%	44.35%	32.73%	1.93	0.08	2.42	115
DIA	278.24%	39.17%	52.68%	1.62	0.06	2.51	120

In the index market, the new version of the Turtle trade is back-tested using the parameters (100,60,4). QQQ, SPY, and DIA all have a win rate of about 40%, and a return is higher than 200% over the 20-year back-test from October 1, 2001, to October 1, 2021. On the other hand, DIA is one of the worst-performing index market ETFs. In terms of return, the win rate and MDD are relatively poor.

Range: 60 CMI_Val: 40 Risk: 2							
Symbol	Return on account (%)	Percent Profitable (%)	Max Strategy Drawdown (%)	Profit factor	Sharpe ratio	Ratio Average Win / Average Loss	Total number of trades
JPY/USD	462.61%	33.88%	32%	1.97	0.09	3.84	242
EUR/USD	657.65%	42.99%	19.18%	2.49	0.13	3.28	221
AUD/USD	171.56%	34.8%	34.12%	1.66	0.08	3.11	250

In the Forex market, the parameters used are (60,40,2). JPY/USD, EUR/USD, and AUD/USD have a wide range of returns (100% to 600%) and a 30% or more-win rate in the 20-year backtest from October 1, 2001, to October 1, 2021. On the other hand, MDD has stayed around 30% and below. EUR/USD is the best performer among them compared with other symbols. In terms of return, the winning rate and MDD are all outstanding.

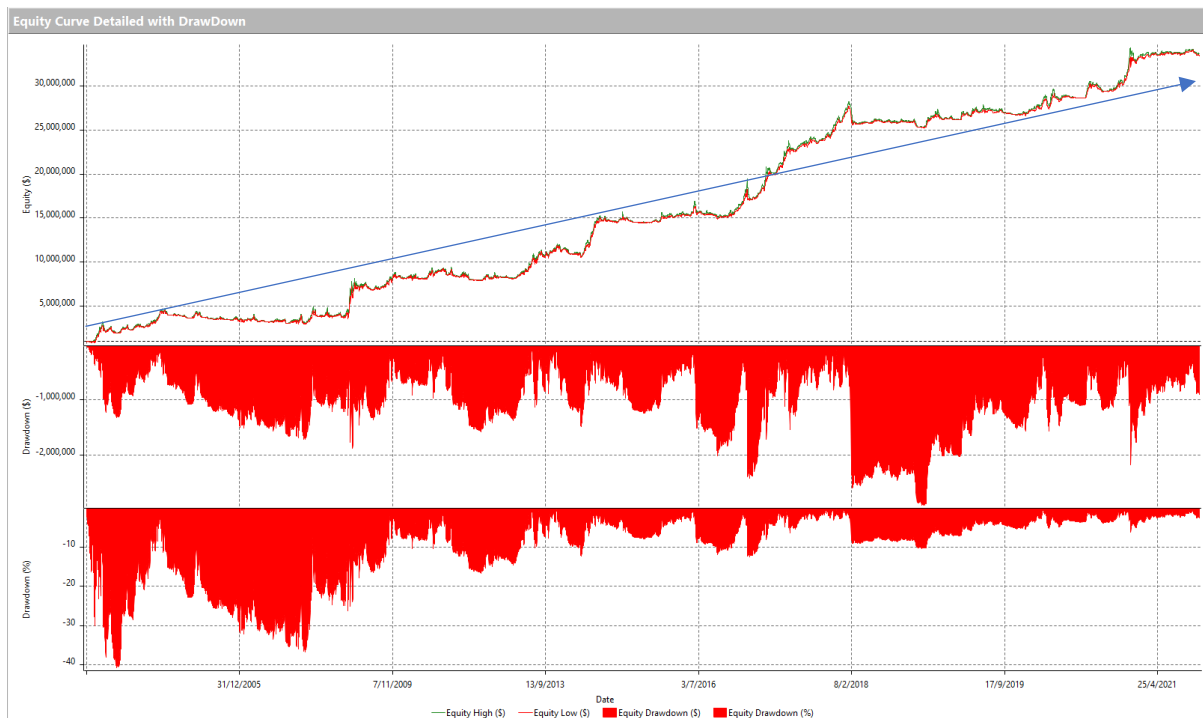
Range: 20 CMI_Val: 20 Risk: 3							
Symbol	Return on account (%)	Percent Profitable (%)	Max Strategy Drawdown (%)	Profit factor	Sharpe ratio	Ratio Average Win / Average Loss	Total number of trades
BTC/USDT	4799.99%	54.6%	46.49%	9.7	0.3	8.06	163
ETH/USDT	2959.03%	52.21%	39.2%	5.08	0.19	4.65	272

In the cryptocurrency market, the parameters used are (20,20,3). As a result, BTC/USDT and ETH/USDT have excellent returns in the 6-year backtest from October 1, 2015, to October 1, 2021, with a win rate of over 50%. Moreover, MDD has stayed around 40%. Therefore, BTC/USDT has a better return and win rate than ETH/USDT.

Range: 45 CMI_Val: 35 Risk: 2							
Symbol	Return on account (%)	Percent Profitable (%)	Max Strategy Drawdown (%)	Profit factor	Sharpe ratio	Ratio Average Win / Average Loss	Total number of trades
USO	394.59%	35.69%	44.09%	2.17	0.13	3.92	255
XAU/USD	781.84%	43.23%	36.55%	2.22	0.12	2.91	229

In the commodity market, the parameters used are (45,35,2). USO and XAU/USD return about 400% or more in the 15-year backtest from October 1, 2006, to October 1, 2021. In addition, XAU/USD outperformed USO in return, win rate, and MDD.

	Return on account (%)	Percent Profitable (%)	Max Strategy Drawdown (%)	Profit factor	Sharpe ratio	Ratio Average Win / Average Loss	Total number of trades
Portfolio	679.73%	42.08%	40.78%	2.67	0.21	3.68	1963



Combining ten symbols from different markets (index, Forex, cryptocurrency, and commodities) into one portfolio, the return is up to about 700% in the backtest from Oct 1, 2001, to Oct 1, 2021. The winning rate is maintained at about 40% as a swing trend trading, which is a qualified trading system. MDD has been dramatically improved compared to the original turtle trading strategy, maintained at 40%.

Turtle Trading Rules are mainly to capture market trends to make the most profit as a trend strategy. However, there is often less time for a direction to appear in a single market than in an oscillating market. As a result, the portfolio's Sharpe ratio is 0.21, which is relatively high compared to other market portfolios. A higher Sharpe ratio means a smoother equity curve. The equity curve of the portfolio is also relatively soft, which means that the new version of the Turtle Trading Portfolio is efficient in providing stable returns when trading the portfolio.

9. Conclusion

The report's logic and content of the new version of the Turtle Trading Method analyzed include market, position size, market-entry, stop loss, exit, and strategy. The past research has been in the direction of these six significant structures from the literature review. To perfect the Turtle Trading Rule, parameters are changed, stops are improved, filters are added, and so on. The core of this research is to improve win rates and reduce risk through multi-commodity and multi-strategy combinations and to achieve the objective of "not putting all eggs in one basket." Therefore, the report will start with the markets as the starting point and customize each market with its strategy. By combining ten symbols from 4 markets into one portfolio under the new version of Turtle Trading, we can test and adjust our strategy with the backtesting of historical performance and optimization of parameters provided by Multicharts. The portfolio has been proven to provide investors with a stable and consistent return on investment under the new version of Turtle Trading. The essence of trading is a game of probability. The success or failure of a trade depends on the success rate of your trading

system for capital risk control and the execution of the trading process. Although the turtle trading rules have been published for decades, the trader can still optimize them to achieve stable profits with algorithmic trading tools.

Looking back at the previous literature, they have analyzed the symbols on a case-by-case basis to determine their win rates, MDD, returns, etc. Often, the researcher uses a modified turtle trading rule to verify the performance of the selected product but does not analyze how multiple symbols would perform together in a portfolio. The essence of the turtle trading rule is to reduce market risk and losses by using various strategies and markets. However, evaluating a turtle trading strategy based on the results of a single symbol may be biased. This report looks at the portfolio performance in four markets over 20 years, using the new version of the Turtle Trading Rule. Improved turtle trading can effectively make up for losses in other markets with all markets traded simultaneously. As a result, it is possible to comprehensively find that the MDD under portfolio drops to 40%, which has not been presented in the previous literature. From another point of view, this also validates that the critical issue of the Turtle Rule is position size control so that when a trend appears in one market, there is enough capital to enter the market to capture the trend and cover losses in another market.

There are some possible limitations to this report. First, the backtest does not consider transaction costs, for example, trading commissions, slippage losses, and short interest. The exchange will have different trading fees, the slippage is challenging to define, and the short interest rate will increase depending on the length of time. As a result, all the above are difficult to measure, and the return on the backtest is different, affecting the performance of the results. Second, over-fitting may occur in backtesting. For example, if the program parameters are over-optimized and so on. Linear simulation is used for backtesting because it saves more time and helps to get the results faster. Due to this lack of accurate market operation and adjustments, other possible scenarios are often ignored, resulting in inconsistencies between past and future performance. Third, the data used does not simulate the actual situation. It is well known that fundamental markets are traded instantly. Sometimes, they are not traded due to lack of liquidity, such as the highest and lowest prices, and sometimes due to the market volatility being too fast. Therefore, when backtesting the transaction price is low liquidity position, backtesting cannot consider the occurrence of this extreme situation, which will also lead to bias in the results.

Finally, the reader can try some directions for future research. First, we should try to make the "best parameters" of in-sample data have the same high probability of "performance" of out-of-sample data. The historical data are divided into in-sample IS and out-of-sample OOS, optimized in IS and verified by OOS. According to the author of the probability of backtest overfitting (Bailey et al., 2015), we can cut the performance period into S parts after running the whole backtest and choose any $S/2$ details as IS and the rest OOS, which can generate more than one combination. Then we will make the result into a normal distribution to determine the probability that the parameter is profitable. In this way, we can see whether making money is real. Second, the use of backtesting data is more accurate. Backtesting can be purchased in ticks or seconds of data, with the help of the volume of transactions, can be backtesting in-depth during the backtest. In this way, it is possible to simulate and analyze more accurate results in depth. Third, testers can also set their transaction costs according to their trading broker to refine their backtest results.

The Turtle Trading Rules have been around for decades, some still believe in them, and others have given up on them. Those who still believe in it are brave enough to take the first step and try to optimize and improve it with action, proving its merits and making it their own. This is life. Only by trying and failing can you get what you accept, even with "All in or Nothing" determination.

10. References

- Anderson, J. A., & Faff, R. W. (October 15, 2004). Maximizing futures returns using fixed fraction asset allocation. *Applied Financial Economics*, 14, 15, 1067-1073.
- Bailey, D. H., Borwein, J., Lopez, P. M., & Zhu, Q. J. (2015). *The Probability of Backtest Overfitting*.
- Covel, M. (2009). *The complete turtletrader: The legend, the lessons, the results*.
- Chen, L. (2011). *MultiCharts kuai yi tong*. Taipei shi: Huan yu.
- Fang, F., Ventre, C., Basios, M., Kong, H., Kanthan, L., Martinez-Rego, D., Wu, F., ... Li, L. (March 25, 2020). Cryptocurrency trading: A comprehensive survey. *Arxiv*.
- Faith, C. M., & Foster, M. (2008). *Way of the turtle: [the secret methods that turned ordinary people into legendary traders]*. Burlington, N.C: McGraw-Hill Audio.
- Gillham, D. (2021, February 10). *Trading the Stock Market – Why Most Traders Fail*. Retrieved April 7, 2022, from <https://www.wealthwithin.com.au/learning-centre/share-trading-tips/trading-the-stock-market>
- maxhamax. (2015). *Order repeat for adding positions*. Retrieved November 30, 2021, from <http://www.coco-in.net/archiver/tid-42178.html>.
- Pruitt, G., Hill, J. R., & ProQuest (Firm). (2012). *Building winning trading systems with TradeStation*. Hoboken, N.J: John Wiley & Sons.
- Schwager, J. D., & Recorded Books, Inc. (2016). *Market wizards: Interviews with top traders*. Hoboken, N.J: Wiley.
- Tennis, S. K. (1999). *Ask Mr. EasyLanguage*. Greenville, SC: Traders Press.
- Vezeris, D., Karkanis, I., & Kyrgos, T. (June 08, 2019). AdTurtle: An Advanced Turtle Trading System. *Journal of Risk and Financial Management*, 12, 2, 96.
- Xu, J., & Zheng, J. (2018, August). Improved Turtle Trading Strategy and Empirical Analysis. In *2018 2nd International Conference on Education Science and Economic Management (ICESEM 2018)* (pp. 1194-1197). Atlantis Press.

11. Appendix A:

The modified code for the advanced turtle trading referenced in (maxhamax, 2015):

```

inputs:Range(20),CMI_Val(20),Risk(2); // Parameters
vars: N(0),StopLoss(1),DV(0),AccountBalance(0),DollarRisk(0),LIT(0),
      CMI(0),PercentRisk(0.01),InitialBalance(1000000); // Variables

/// New Turtle Trading //////////////////////////////////////

if marketposition = 0 then begin

//The basic unit of a position
//The position(LIT) corresponds to 1% of the total net worth
N = AvgTrueRange(Range);
DV = N * BigPointValue;
AccountBalance = InitialBalance ;
DollarRisk = AccountBalance * PercentRisk;
LIT = IntPortion(DollarRisk/DV);

//The CMI indicator is used to determine whether market is currently trending or consolidating
CMI = (AbsValue(Close - Close[Range-1]) / (Highest(High,Range) -Lowest(Low,Range)) *100);
//If CMI indicator is large than a CMI_value, market is in trend
If CMI > CMI_Val then begin
//Beginning to open the position
//Base on new Donchian Channel
buy("b1") LIT shares next bar highest((open+close)/2,Range) or higher;
sellshort("s1") LIT shares next bar lowest((open+close)/2,Range) or lower;

end;

end;

//For Long Position
//Adding positions
//The maximum number of entries is 4.
if marketposition = 1 then begin

//Long 1 position on the strategy before.
if currentshares = LIT then begin
buy("b2-1") LIT shares next bar entryprice[0] + (1.0*N) or higher;
buy("b2-2") LIT shares next bar entryprice[0] + (2.0*N) or higher;
buy("b2-3") LIT shares next bar entryprice[0] + (3.0*N) or higher;
end;

//Long 2 positions on the strategy before.
if currentshares = LIT * 2 then begin
buy("b3-1") LIT shares next bar entryprice[0] + (2.0*N) or higher;
buy("b3-2") LIT shares next bar entryprice[0] + (3.0*N) or higher;
end;

//Long is 3 positions on the strategy before.
if currentshares = LIT * 3 then
buy("b4-1") LIT shares next bar entryprice[0] + (3.0*N) or higher;
end;

//Take Profit
//All the units in the positions would be exited if the price breakout the new Donchian Channel.
sell ("out-S")all contracts next bar lowest((open+close)/2,Range*0.5) or lower;

//For Short Position
//Adding positions
//The maximum number of entries is 4.
if marketposition = -1 then begin

//Short 1 position on the strategy before.
if currentshares = LIT then begin
sellshort("s2-1") LIT shares next bar entryprice[0] - (1.0*N) or lower;
sellshort("s2-2") LIT shares next bar entryprice[0] - (2.0*N) or lower;
sellshort("s2-3") LIT shares next bar entryprice[0] - (3.0*N) or lower;
end;

//Short 2 positions on the strategy before.
if currentshares = LIT * 2 then begin
sellshort("s3-1") LIT shares next bar entryprice[0] - (2.0*N) or lower;
sellshort("s3-2") LIT shares next bar entryprice[0] - (3.0*N) or lower;
end;

// Short 3 positions on the strategy before.
if currentshares = LIT * 3 then
sellshort("s4-1") LIT shares next bar entryprice[0] - (3.0*N) or lower;
end;

//Take Profit
//All the units in the positions would be exited if the price breakout the new Donchian Channel.
buytocover ("out-B")all contracts next bar highest((open+close)/2,Range*0.5) or higher;

//Stop Loss
//The Turtles placed their stops loss based on position risk and no trade could incur more than risk.
StopLoss = Risk * DV * LIT;
if currentcontracts = (2 * LIT) then StopLoss = DV * Risk* 1.75 * LIT;
if currentcontracts = (3 * LIT) then StopLoss = DV * Risk* 2.25 * LIT;
if currentcontracts = (4 * LIT) then StopLoss = DV * Risk* 2.5 * LIT;
setstoploss (StopLoss);

```

CMI indicator is not occur for original Turtle Trading.

Original Turtle Trading:
next bar highest(high,Range) or higher;
next bar lowest(low,Range) or higher;

Original Turtle Trading:
+ (0.5*N) or higher;
+ (1.0*N) or higher;
+ (1.5*N) or higher;

+ (1.0*N) or higher;
+ (1.5*N) or higher;

+ (1.5*N) or higher;

Original Turtle Trading:
lowest(low,Range*0.5) or lower;

Original Turtle Trading:
- (0.5*N) or lower;
- (1.0*N) or lower;
- (1.5*N) or lower;

- (1.0*N) or lower;
- (1.5*N) or lower;

- (1.5*N) or lower;

Original Turtle Trading:
highest(high,Range*0.5) or higher;

The setting of strategy properties for Multicharts:

Strategy Properties ✕

Properties **Auto Trading** Backtesting Alerts

Costs/Capitalization

Commission Rule: No Commission Manage Rules...

Slippage: \$ per Trade
 per Share/Contract

Init Capital: \$ Interest Rate: %

Maximum number of bars study will reference:

Base Currency: USD

Position limits

Allow up to entry orders in the same direction as the currently held position:

- when the order is generated by a different entry order
- regardless of the entry that generated the order

Maximum shares/contracts per position:

Trade size (if not specified by signal)

Fixed Shares/Contracts:

Cash per Trade: \$

Trade size rounding

Round down to nearest shares/contracts

Minimum number shares/contracts:

Use as Default

OK Cancel

Appendix B:

QQQ:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$2,020,620.69	\$1,962,716.53	\$57,904.16
Gross Profit	\$3,606,160.75	\$3,088,891.39	\$517,269.36
Gross Loss	(\$1,585,540.06)	(\$1,126,174.86)	(\$459,365.20)
Adjusted Net Profit	\$1,329,659.58	\$1,328,394.22	(\$213,944.19)
Adjusted Gross Profit	\$3,106,076.23	\$2,612,265.10	\$353,694.43
Adjusted Gross Loss	(\$1,776,416.65)	(\$1,283,870.88)	(\$567,638.62)
Select Net Profit	\$818,589.22	\$523,891.86	\$294,697.36
Select Gross Profit	\$1,731,787.80	\$1,214,518.44	\$517,269.36
Select Gross Loss	(\$913,198.58)	(\$690,626.58)	(\$322,572.00)
Account Size Required	\$548,701.70	\$448,640.35	\$233,549.71
Return on Account	368.25%	437.48%	24.79%
Return on Initial Capital	202.06%	196.27%	5.79%
Max Strategy Drawdown	(\$1,226,096.72)	(\$1,126,035.37)	(\$491,019.08)
Max Strategy Drawdown (%)	(44.52%)	(32.31%)	(35.73%)
Max Close To Close Drawdown	(\$548,701.70)	(\$448,640.35)	(\$233,549.71)
Max Close To Close Drawdown (%)	(34.52%)	(21.57%)	(19.92%)
Return on Max Strategy Drawdown	1.65	1.74	0.12
Profit Factor	2.27	2.74	1.13
Adjusted Profit Factor	1.75	2.03	(0.62)
Select Profit Factor	1.9	1.76	2.32
Max # Contracts Held	65000	65000	65000
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	n/a	n/a	n/a
Annual Rate of Return	10.31%	10.02%	0.3%
Monthly Rate of Return	0.86%	0.83%	0.02%
Buy Hold Return	\$9,743,097.24	\$11,635,368.87	\$9,743,097.24
Avg Monthly Return	\$8,598.39		
Monthly Return StdDev	\$93,345.50		
Total # of Trades	121	93	28
Percent Profitable	42.98%	45.16%	35.71%

Figure 3. The Strategy Performance Summary of QQQ with parameter (100,60,4)

Performance Ratios	
Upside Potential Ratio	19.29
Sharpe Ratio	0.09
Annualized Sharpe Ratio	0.31
Sortino Ratio	0.13
Fouse Ratio	0
Calmar Ratio	0.02
Sterling Ratio	0
RINA Index	79.99
Net Profit as % of Largest loss	4989.59%
Net Profit as % of Max Trade Drawdown	4989.59%
Net Profit as % of Max Strategy Drawdown	164.8%
Select Net Profit as % of Largest loss	2021.37%
Select Net Profit as % of Max Trade Drawdown	2021.37%
Select Net Profit as % of Max Strategy Drawdown	66.76%
Adj Net Profit as % of Largest loss	3283.37%
Adj Net Profit as % of Max Trade Drawdown	3283.37%
Adj Net Profit as % of Max Strategy Drawdown	108.45%

Figure 4. The Performance Ratio of QQQ with parameter (100,60,4)

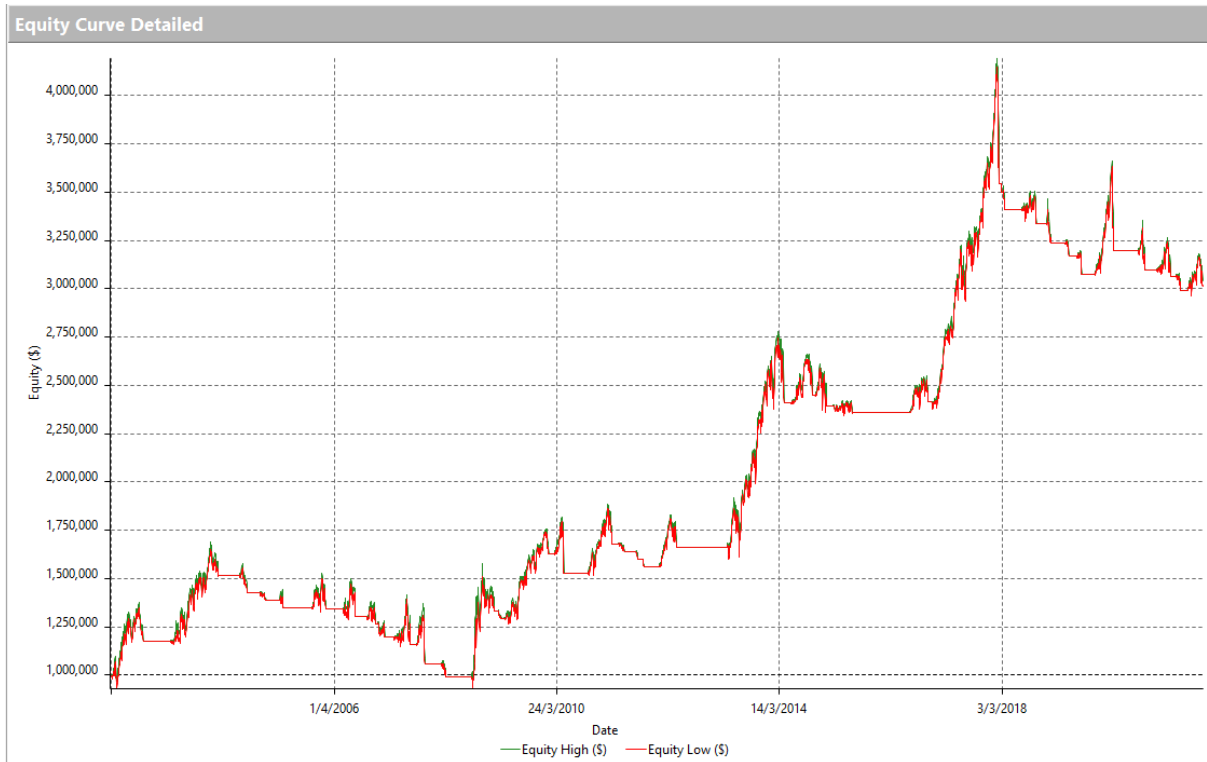


Figure 5. The Equity Curve Detailed of QQQ with parameter (100,60,4)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	121	93	28
Total # of Open Trades	0	0	0
Number Winning Trades	52	42	10
Number Losing Trades	69	51	18
Percent Profitable	42.98%	45.16%	35.71%
Avg Trade (win loss)	\$16,699.34	\$21,104.48	\$2,068.01
Average Winning Trade	\$69,349.25	\$73,545.03	\$51,726.94
Average Losing Trade	(\$22,978.84)	(\$22,081.86)	(\$25,520.29)
Ratio Avg Win / Avg Loss	3.02	3.33	2.03
Largest Winning Trade	\$297,047.80	\$297,047.80	\$99,790.67
Largest Losing Trade	(\$40,496.75)	(\$40,496.75)	(\$40,090.05)
Avg # Bars in Trades	73.6	81	49.2
Avg # Bars in Winning Trades	128.5	135.4	99.3
Avg # Bars in Losing Trades	32.3	36.1	21.3
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-31.6	-15.5	404.3
Avg # Bars Between Losing Trades	40.7	62.6	258.4

Figure 6. The Total Trade Analysis of QQQ with parameter (100,60,4)

SPY:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$1,681,611.74	\$1,675,550.45	\$6,061.29
Gross Profit	\$3,499,137.38	\$2,798,669.74	\$700,467.64
Gross Loss	(\$1,817,525.64)	(\$1,123,119.29)	(\$694,406.35)
Adjusted Net Profit	\$964,443.80	\$1,079,440.71	(\$396,865.40)
Adjusted Gross Profit	\$3,009,160.14	\$2,371,876.61	\$452,814.93
Adjusted Gross Loss	(\$2,044,716.35)	(\$1,292,435.89)	(\$849,680.33)
Select Net Profit	\$335,799.31	\$237,252.62	\$98,546.69
Select Gross Profit	\$1,967,581.54	\$1,267,113.90	\$700,467.64
Select Gross Loss	(\$1,631,782.23)	(\$1,029,861.28)	(\$601,920.95)
Account Size Required	\$382,174.55	\$302,167.07	\$421,815.78
Return on Account	440.01%	554.51%	1.44%
Return on Initial Capital	168.16%	167.56%	0.61%
Max Strategy Drawdown	(\$974,457.87)	(\$834,369.99)	(\$735,673.42)
Max Strategy Drawdown (%)	(32.73%)	(29.77%)	(42.24%)
Max Close To Close Drawdown	(\$382,174.55)	(\$302,167.07)	(\$421,815.78)
Max Close To Close Drawdown (%)	(21.78%)	(17.01%)	(29.54%)
Return on Max Strategy Drawdown	1.73	2.01	0.01
Profit Factor	1.93	2.49	1.01
Adjusted Profit Factor	1.47	1.84	(0.53)
Select Profit Factor	1.21	1.23	1.16
Max # Contracts Held	34096	34096	23240
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	n/a	n/a	n/a
Annual Rate of Return	8.58%	8.55%	0.03%
Monthly Rate of Return	0.72%	0.71%	0%
Buy Hold Return	\$2,655,366.27	\$2,655,366.27	\$3,009,904.69
Avg Monthly Return	\$7,125.47	\$7,125.47	
Monthly Return StdDev	\$80,047.09		
Total # of Trades	115	87	28
Percent Profitable	44.35%	49.43%	28.57%

Figure 7. The Strategy Performance Summary of SPY with parameter (100,60,4)

Performance Ratios	
Upside Potential Ratio	21.59
Sharpe Ratio	0.08
Annualized Sharpe Ratio	0.27
Sortino Ratio	0.13
Fouse Ratio	0
Calmar Ratio	0.02
Sterling Ratio	0
RINA Index	28.87
Net Profit as % of Largest loss	3280.85%
Net Profit as % of Max Trade Drawdown	3280.85%
Net Profit as % of Max Strategy Drawdown	172.57%
Select Net Profit as % of Largest loss	655.15%
Select Net Profit as % of Max Trade Drawdown	655.15%
Select Net Profit as % of Max Strategy Drawdown	34.46%
Adj Net Profit as % of Largest loss	1881.64%
Adj Net Profit as % of Max Trade Drawdown	1881.64%
Adj Net Profit as % of Max Strategy Drawdown	98.97%

Figure 8. The Performance Ratio of SPY with parameter (100,60,4)

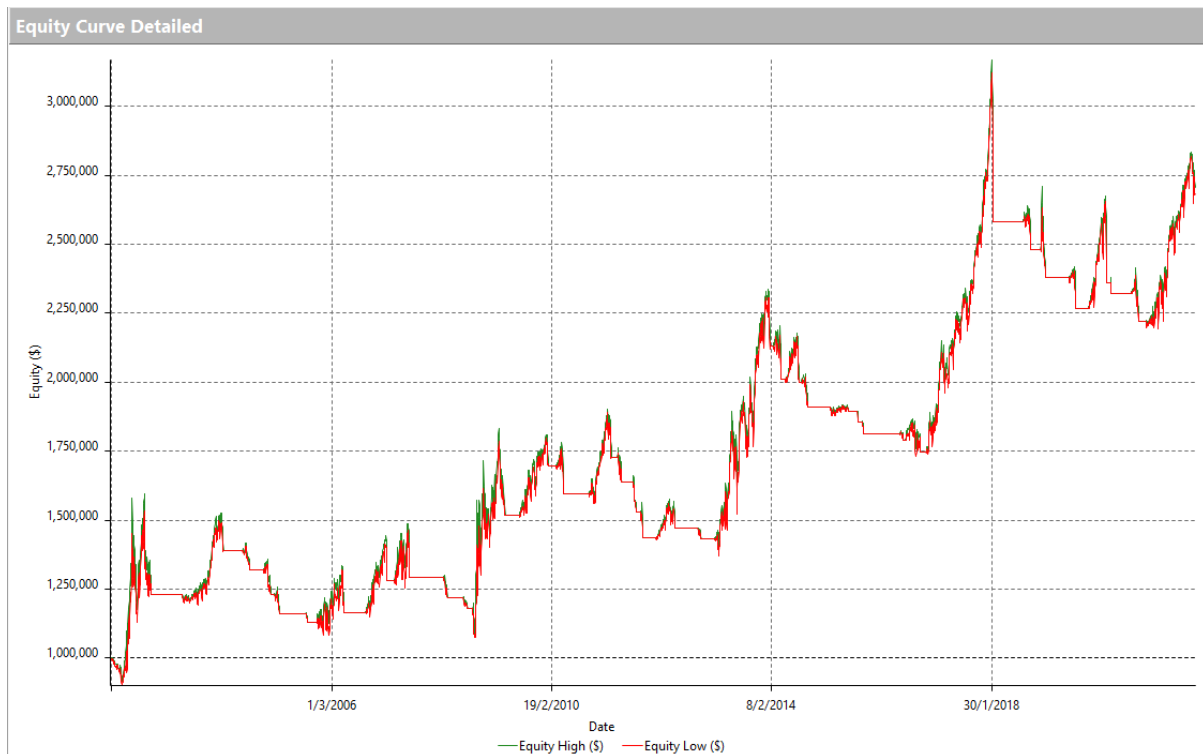


Figure 9. The Equity Curve Detailed of SPY with parameter (100,60,4)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	115	87	28
Total # of Open Trades	0	0	0
Number Winning Trades	51	43	8
Number Losing Trades	64	44	20
Percent Profitable	44.35%	49.43%	28.57%
Avg Trade (win loss)	\$14,622.71	\$19,259.20	\$216.47
Average Winning Trade	\$68,610.54	\$65,085.34	\$87,558.46
Average Losing Trade	(\$28,398.84)	(\$25,525.44)	(\$34,720.32)
Ratio Avg Win / Avg Loss	2.42	2.55	2.52
Largest Winning Trade	\$223,419.60	\$223,419.60	\$122,401.33
Largest Losing Trade	(\$51,255.40)	(\$48,427.70)	(\$51,255.40)
Avg # Bars in Trades	74.9	83.9	47
Avg # Bars in Winning Trades	136.5	136.9	134.4
Avg # Bars in Losing Trades	25.8	32.1	12.1
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-37.7	-19.7	495.1
Avg # Bars Between Losing Trades	52.8	82.4	239.7

Figure 10. The Total Trade Analysis of SPY with parameter (100,60,4)

DIA:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$1,213,605.31	\$1,303,235.87	(\$89,630.56)
Gross Profit	\$3,177,835.59	\$2,491,255.24	\$686,580.35
Gross Loss	(\$1,964,230.28)	(\$1,188,019.37)	(\$776,210.91)
Adjusted Net Profit	\$520,174.58	\$750,032.57	(\$503,148.22)
Adjusted Gross Profit	\$2,714,300.63	\$2,111,342.38	\$343,290.18
Adjusted Gross Loss	(\$2,194,126.05)	(\$1,361,309.81)	(\$928,438.39)
Select Net Profit	\$192,289.64	\$558,485.27	(\$366,195.63)
Select Gross Profit	\$1,340,953.36	\$1,340,953.36	\$0.00
Select Gross Loss	(\$1,148,663.72)	(\$782,468.09)	(\$366,195.63)
Account Size Required	\$436,169.15	\$331,774.61	\$435,848.79
Return on Account	278.24%	392.81%	(20.56%)
Return on Initial Capital	121.36%	130.32%	(8.96%)
Max Strategy Drawdown	(\$1,185,006.72)	(\$985,551.49)	(\$774,422.39)
Max Strategy Drawdown (%)	(52.68%)	(35.22%)	(50.46%)
Max Close To Close Drawdown	(\$436,169.15)	(\$331,774.61)	(\$435,848.79)
Max Close To Close Drawdown (%)	(39.38%)	(21.54%)	(34.04%)
Return on Max Strategy Drawdown	1.02	1.32	(0.12)
Profit Factor	1.62	2.1	(0.88)
Adjusted Profit Factor	1.24	1.55	(0.37)
Select Profit Factor	1.17	1.71	-0
Max # Contracts Held	41484	41484	22584
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	n/a	n/a	n/a
Annual Rate of Return	6.19%	6.65%	(0.46%)
Monthly Rate of Return	0.52%	0.55%	(0.04%)
Buy Hold Return	\$2,297,494.88	\$2,297,494.88	\$2,914,940.40
Avg Monthly Return	\$5,142.40		
Monthly Return StdDev	\$88,782.92		
Total # of Trades	120	90	30
Percent Profitable	39.17%	47.78%	13.33%

Figure 11. The Strategy Performance Summary of DIA with parameter (100,60,4)

Performance Ratios	
Upside Potential Ratio	14.04
Sharpe Ratio	0.06
Annualized Sharpe Ratio	0.2
Sortino Ratio	0.09
Fouse Ratio	0
Calmar Ratio	0.02
Sterling Ratio	0
RINA Index	16.59
Net Profit as % of Largest loss	2618.14%
Net Profit as % of Max Trade Drawdown	2618.14%
Net Profit as % of Max Strategy Drawdown	102.41%
Select Net Profit as % of Largest loss	414.83%
Select Net Profit as % of Max Trade Drawdown	414.83%
Select Net Profit as % of Max Strategy Drawdown	16.23%
Adj Net Profit as % of Largest loss	1122.19%
Adj Net Profit as % of Max Trade Drawdown	1122.19%
Adj Net Profit as % of Max Strategy Drawdown	43.9%

Figure 12. The Performance Ratio of DIA with parameter (100,60,4)

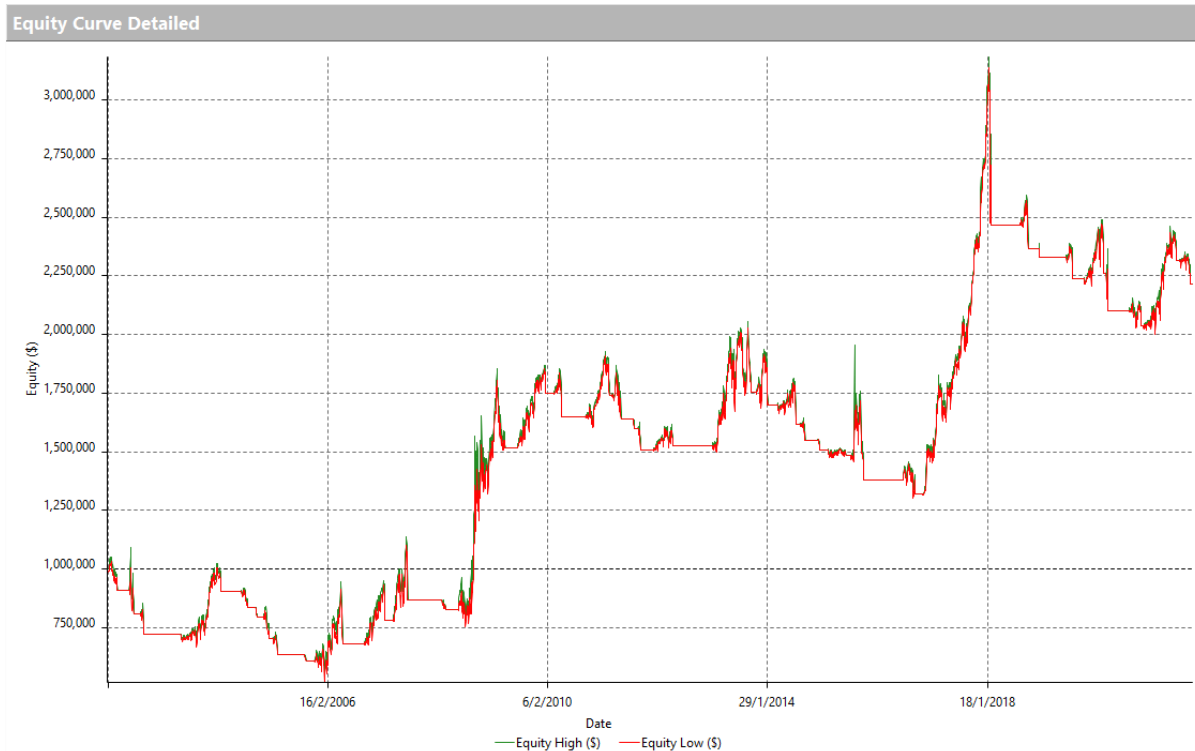


Figure 13. The Equity Curve Detailed of DIA with parameter (100,60,4)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	120	90	30
Total # of Open Trades	0	0	0
Number Winning Trades	47	43	4
Number Losing Trades	73	47	26
Percent Profitable	39.17%	47.78%	13.33%
Avg Trade (win loss)	\$10,113.38	\$14,480.40	(\$2,987.69)
Average Winning Trade	\$67,613.52	\$57,936.17	\$171,645.09
Average Losing Trade	(\$26,907.26)	(\$25,277.01)	(\$29,854.27)
Ratio Avg Win / Avg Loss	2.51	2.29	5.75
Largest Winning Trade	\$302,582.67	\$302,582.67	\$186,674.39
Largest Losing Trade	(\$46,353.66)	(\$44,686.17)	(\$46,353.66)
Avg # Bars in Trades	70	79.1	42.8
Avg # Bars in Winning Trades	132.3	124.9	211.3
Avg # Bars in Losing Trades	30	37.2	16.9
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-25.1	-7.8	1047.8
Avg # Bars Between Losing Trades	39	69.9	176.8

Figure 14. The Total Trade Analysis of DIA with parameter (100,60,4)

JPY/USD:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$2,425,930.00	\$709,230.00	\$1,716,700.00
Gross Profit	\$4,935,400.00	\$2,063,550.00	\$2,871,850.00
Gross Loss	(\$2,509,470.00)	(\$1,354,320.00)	(\$1,155,150.00)
Adjusted Net Profit	\$1,682,515.22	\$271,359.88	\$1,074,740.39
Adjusted Gross Profit	\$4,390,376.25	\$1,771,719.96	\$2,364,173.85
Adjusted Gross Loss	(\$2,707,861.02)	(\$1,500,360.08)	(\$1,289,433.46)
Select Net Profit	\$812,390.00	\$1,053,270.00	(\$240,880.00)
Select Gross Profit	\$2,710,190.00	\$2,063,550.00	\$646,640.00
Select Gross Loss	(\$1,897,800.00)	(\$1,010,280.00)	(\$887,520.00)
Account Size Required	\$524,400.00	\$439,030.00	\$511,840.00
Return on Account	462.61%	161.54%	335.4%
Return on Initial Capital	242.59%	70.92%	171.67%
Max Strategy Drawdown	(\$507,810.00)	(\$693,930.00)	(\$612,260.00)
Max Strategy Drawdown (%)	(32%)	(32.17%)	(51.97%)
Max Close To Close Drawdown	(\$524,400.00)	(\$439,030.00)	(\$511,840.00)
Max Close To Close Drawdown (%)	(21.61%)	(22.94%)	(51.18%)
Return on Max Strategy Drawdown	3	1.02	2.8
Profit Factor	1.97	1.52	2.49
Adjusted Profit Factor	1.62	1.18	1.83
Select Profit Factor	1.43	2.04	(0.73)
Max # Contracts Held	104	88	104
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	(\$11,880.00)	n/a	(\$11,880.00)
Annual Rate of Return	12.37%	3.62%	8.75%
Monthly Rate of Return	1.03%	0.3%	0.73%
Buy Hold Return	\$210,264.01	\$150,742.83	\$210,264.01
Avg Monthly Return	\$10,185.86		
Monthly Return StdDev	\$101,231.45		
Total # of Trades	242	136	106
Percent Profitable	33.88%	36.76%	30.19%

Figure 15. The Strategy Performance Summary of JPY/USD with parameter (60,40,2)

Performance Ratios	
Upside Potential Ratio	28.55
Sharpe Ratio	0.09
Annualized Sharpe Ratio	0.32
Sortino Ratio	0.21
Fouse Ratio	0
Calmar Ratio	0.03
Sterling Ratio	0
RINA Index	126.93
Net Profit as % of Largest loss	9045.23%
Net Profit as % of Max Trade Drawdown	9045.23%
Net Profit as % of Max Strategy Drawdown	300.31%
Select Net Profit as % of Largest loss	3029.05%
Select Net Profit as % of Max Trade Drawdown	3029.05%
Select Net Profit as % of Max Strategy Drawdown	100.57%
Adj Net Profit as % of Largest loss	6273.36%
Adj Net Profit as % of Max Trade Drawdown	6273.36%
Adj Net Profit as % of Max Strategy Drawdown	208.28%

Figure 16. The Performance Ratio of JPY/USD with parameter (60,40,2)

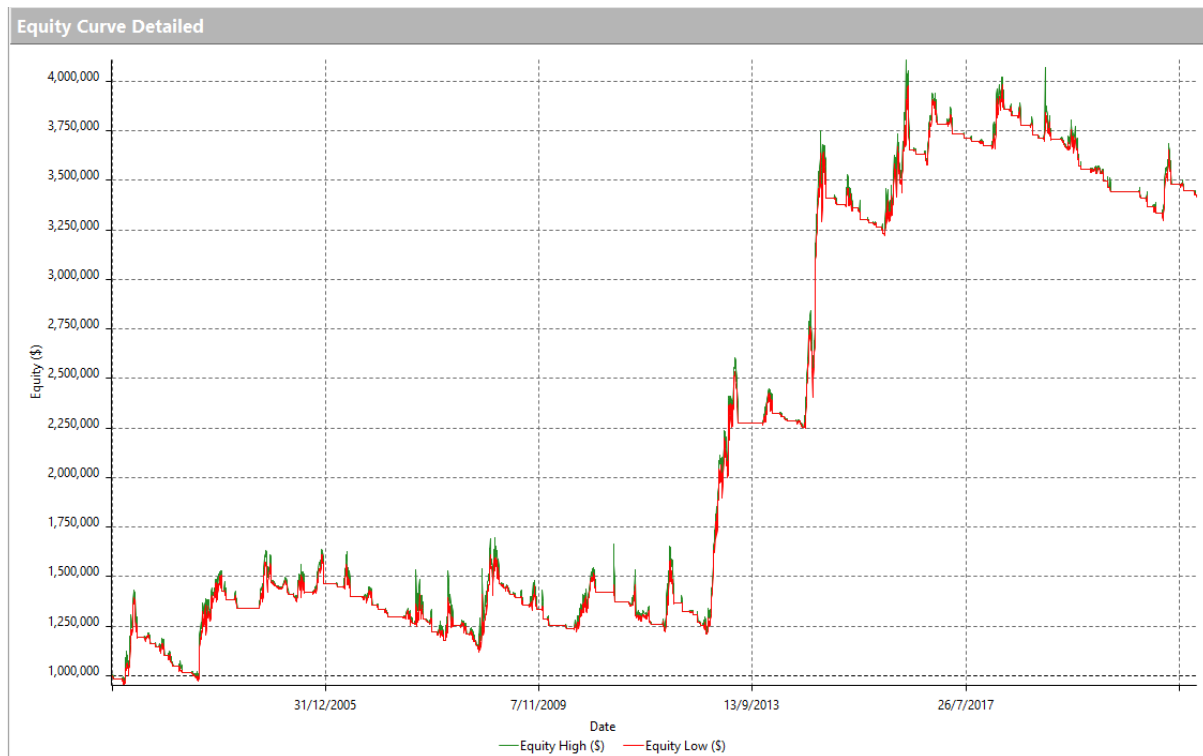


Figure 17. The Equity Curve Detailed of JPY/USD with parameter (60,40,2)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	242	136	106
Total # of Open Trades	1	0	1
Number Winning Trades	82	50	32
Number Losing Trades	160	86	74
Percent Profitable	33.88%	36.76%	30.19%
Avg Trade (win loss)	\$10,024.50	\$5,214.93	\$16,195.28
Average Winning Trade	\$60,187.80	\$41,271.00	\$89,745.31
Average Losing Trade	(\$15,684.19)	(\$15,747.91)	(\$15,610.14)
Ratio Avg Win / Avg Loss	3.84	2.62	5.75
Largest Winning Trade	\$307,060.00	\$122,550.00	\$307,060.00
Largest Losing Trade	(\$26,820.00)	(\$26,730.00)	(\$26,820.00)
Avg # Bars in Trades	30	30.3	29.6
Avg # Bars in Winning Trades	60.8	60.8	60.9
Avg # Bars in Losing Trades	14.1	12.5	16
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	2.4	42.9	101.2
Avg # Bars Between Losing Trades	18.3	47.8	54

Figure 18. The Total Trade Analysis of JPY/USD with parameter (60,40,2)

EUR/USD:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$2,913,390.00	\$1,499,190.00	\$1,414,200.00
Gross Profit	\$4,869,690.00	\$2,472,150.00	\$2,397,540.00
Gross Loss	(\$1,956,300.00)	(\$972,960.00)	(\$983,340.00)
Adjusted Net Profit	\$2,238,793.56	\$1,055,723.48	\$888,706.21
Adjusted Gross Profit	\$4,370,070.35	\$2,150,303.48	\$1,997,950.00
Adjusted Gross Loss	(\$2,131,276.79)	(\$1,094,580.00)	(\$1,109,243.79)
Select Net Profit	\$714,040.00	\$997,300.00	(\$283,260.00)
Select Gross Profit	\$2,245,790.00	\$1,774,550.00	\$471,240.00
Select Gross Loss	(\$1,531,750.00)	(\$777,250.00)	(\$754,500.00)
Account Size Required	\$443,000.00	\$452,390.00	\$497,000.00
Return on Account	657.65%	331.39%	284.55%
Return on Initial Capital	291.34%	149.92%	141.42%
Max Strategy Drawdown	(\$596,470.00)	(\$698,930.00)	(\$689,480.00)
Max Strategy Drawdown (%)	(19.18%)	(25.98%)	(23.19%)
Max Close To Close Drawdown	(\$443,000.00)	(\$452,390.00)	(\$497,000.00)
Max Close To Close Drawdown (%)	(10.2%)	(18.28%)	(17.07%)
Return on Max Strategy Drawdown	4.88	2.14	2.05
Profit Factor	2.49	2.54	2.44
Adjusted Profit Factor	2.05	1.96	1.8
Select Profit Factor	1.47	2.28	(0.62)
Max # Contracts Held	88	64	88
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	\$32,110.00	n/a	\$32,110.00
Annual Rate of Return	14.86%	7.65%	7.21%
Monthly Rate of Return	1.24%	0.64%	0.6%
Buy Hold Return	\$300,325.59	\$300,325.59	\$34,384.21
Avg Monthly Return	\$12,534.04		
Monthly Return StdDev	\$82,905.65		
Total # of Trades	221	123	98
Percent Profitable	42.99%	47.97%	36.73%

Figure 19. The Strategy Performance Summary of EUR/USD with parameter (60,40,2)

Performance Ratios	
Upside Potential Ratio	55.06
Sharpe Ratio	0.13
Annualized Sharpe Ratio	0.44
Sortino Ratio	0.34
Fouse Ratio	0.01
Calmar Ratio	0.06
Sterling Ratio	0
RINA Index	123.61
Net Profit as % of Largest loss	10472.29%
Net Profit as % of Max Trade Drawdown	10472.29%
Net Profit as % of Max Strategy Drawdown	488.44%
Select Net Profit as % of Largest loss	2566.64%
Select Net Profit as % of Max Trade Drawdown	2566.64%
Select Net Profit as % of Max Strategy Drawdown	119.71%
Adj Net Profit as % of Largest loss	8047.42%
Adj Net Profit as % of Max Trade Drawdown	8047.42%
Adj Net Profit as % of Max Strategy Drawdown	375.34%

Figure 20. The Performance Ratio of EUR/USD with parameter (60,40,2)

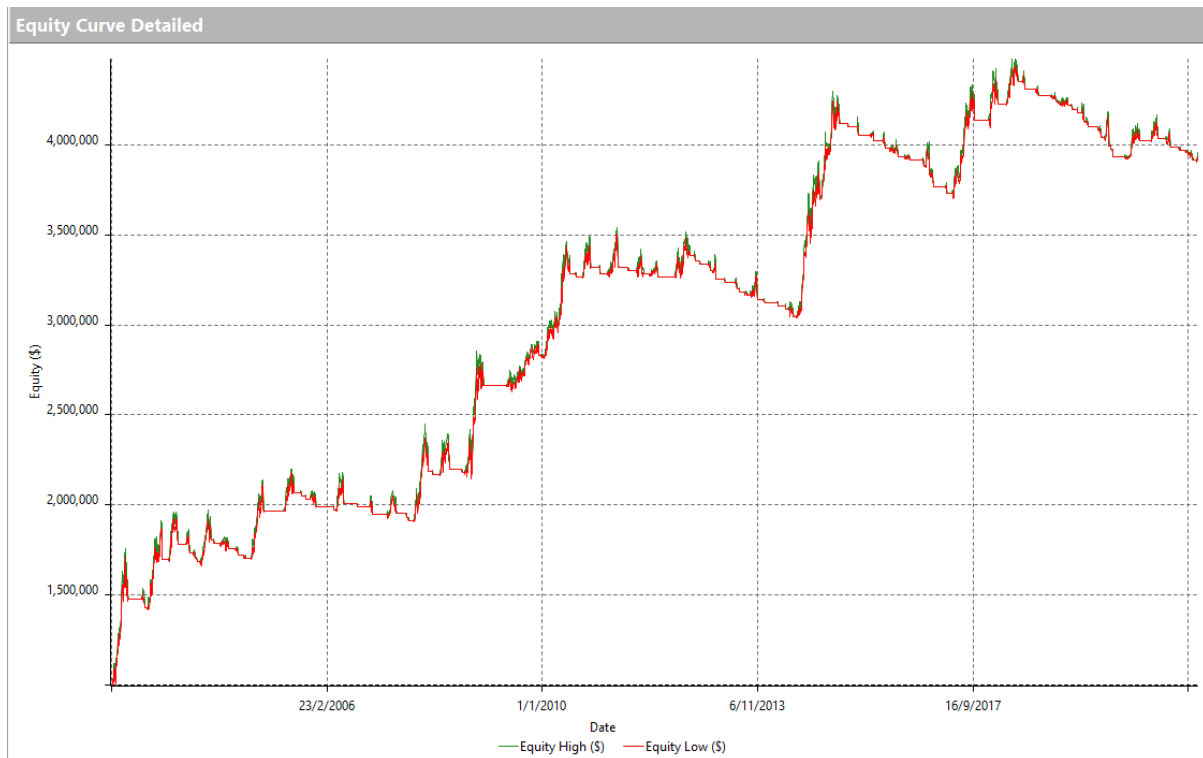


Figure 21. The Equity Curve Detailed of EUR/USD with parameter (60,40,2)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	221	123	98
Total # of Open Trades	3	0	3
Number Winning Trades	95	59	36
Number Losing Trades	125	64	61
Percent Profitable	42.99%	47.97%	36.73%
Avg Trade (win loss)	\$13,182.76	\$12,188.54	\$14,430.61
Average Winning Trade	\$51,259.89	\$41,900.85	\$66,598.33
Average Losing Trade	(\$15,650.40)	(\$15,202.50)	(\$16,120.33)
Ratio Avg Win / Avg Loss	3.28	2.76	4.13
Largest Winning Trade	\$179,100.00	\$133,600.00	\$179,100.00
Largest Losing Trade	(\$27,820.00)	(\$27,820.00)	(\$27,060.00)
Avg # Bars in Trades	34.7	34.8	34.6
Avg # Bars in Winning Trades	62.1	58.7	67.7
Avg # Bars in Losing Trades	13.9	12.7	15.2
Avg # Bars Between Trades	31	n/a	31
Avg # Bars Between Winning Trades	-7.5	29.2	76.4
Avg # Bars Between Losing Trades	27.6	68.3	69.8

Figure 22. The Total Trade Analysis of EUR/USD with parameter (60,40,2)

AUD/USD:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$1,671,790.00	\$445,680.00	\$1,226,110.00
Gross Profit	\$4,212,430.00	\$1,665,000.00	\$2,547,430.00
Gross Loss	(\$2,540,640.00)	(\$1,219,320.00)	(\$1,321,320.00)
Adjusted Net Profit	\$1,021,171.82	\$75,349.15	\$657,370.50
Adjusted Gross Profit	\$3,760,810.10	\$1,431,853.37	\$2,122,858.33
Adjusted Gross Loss	(\$2,739,638.28)	(\$1,356,504.22)	(\$1,465,487.83)
Select Net Profit	\$527,790.00	\$663,580.00	(\$135,790.00)
Select Gross Profit	\$2,408,570.00	\$1,665,000.00	\$743,570.00
Select Gross Loss	(\$1,880,780.00)	(\$1,001,420.00)	(\$879,360.00)
Account Size Required	\$974,460.00	\$709,410.00	\$590,720.00
Return on Account	171.56%	62.82%	207.56%
Return on Initial Capital	167.18%	44.57%	122.61%
Max Strategy Drawdown	(\$1,227,360.00)	(\$926,430.00)	(\$945,350.00)
Max Strategy Drawdown (%)	(34.12%)	(40.06%)	(38.38%)
Max Close To Close Drawdown	(\$974,460.00)	(\$709,410.00)	(\$590,720.00)
Max Close To Close Drawdown (%)	(28.79%)	(33.39%)	(30.81%)
Return on Max Strategy Drawdown	1.36	0.48	1.3
Profit Factor	1.66	1.37	1.93
Adjusted Profit Factor	1.37	1.06	1.45
Select Profit Factor	1.28	1.66	(0.85)
Max # Contracts Held	104	104	100
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	n/a	n/a	n/a
Annual Rate of Return	8.53%	2.27%	6.25%
Monthly Rate of Return	0.71%	0.19%	0.52%
Buy Hold Return	\$378,337.15	\$378,337.15	\$122,534.56
Avg Monthly Return	\$7,114.00		
Monthly Return StdDev	\$86,094.54		
Total # of Trades	250	130	120
Percent Profitable	34.8%	39.23%	30%

Figure 23. The Strategy Performance Summary of AUD/USD with parameter (60,40,2)

Performance Ratios	
Upside Potential Ratio	37.09
Sharpe Ratio	0.08
Annualized Sharpe Ratio	0.27
Sortino Ratio	0.19
Fouse Ratio	0
Calmar Ratio	0.02
Sterling Ratio	0
RINA Index	78.01
Net Profit as % of Largest loss	6110.34%
Net Profit as % of Max Trade Drawdown	6110.34%
Net Profit as % of Max Strategy Drawdown	136.21%
Select Net Profit as % of Largest loss	1929.06%
Select Net Profit as % of Max Trade Drawdown	1929.06%
Select Net Profit as % of Max Strategy Drawdown	43%
Adj Net Profit as % of Largest loss	3732.35%
Adj Net Profit as % of Max Trade Drawdown	3732.35%
Adj Net Profit as % of Max Strategy Drawdown	83.2%

Figure 24. The Performance Ratio of AUD/USD with parameter (60,40,2)

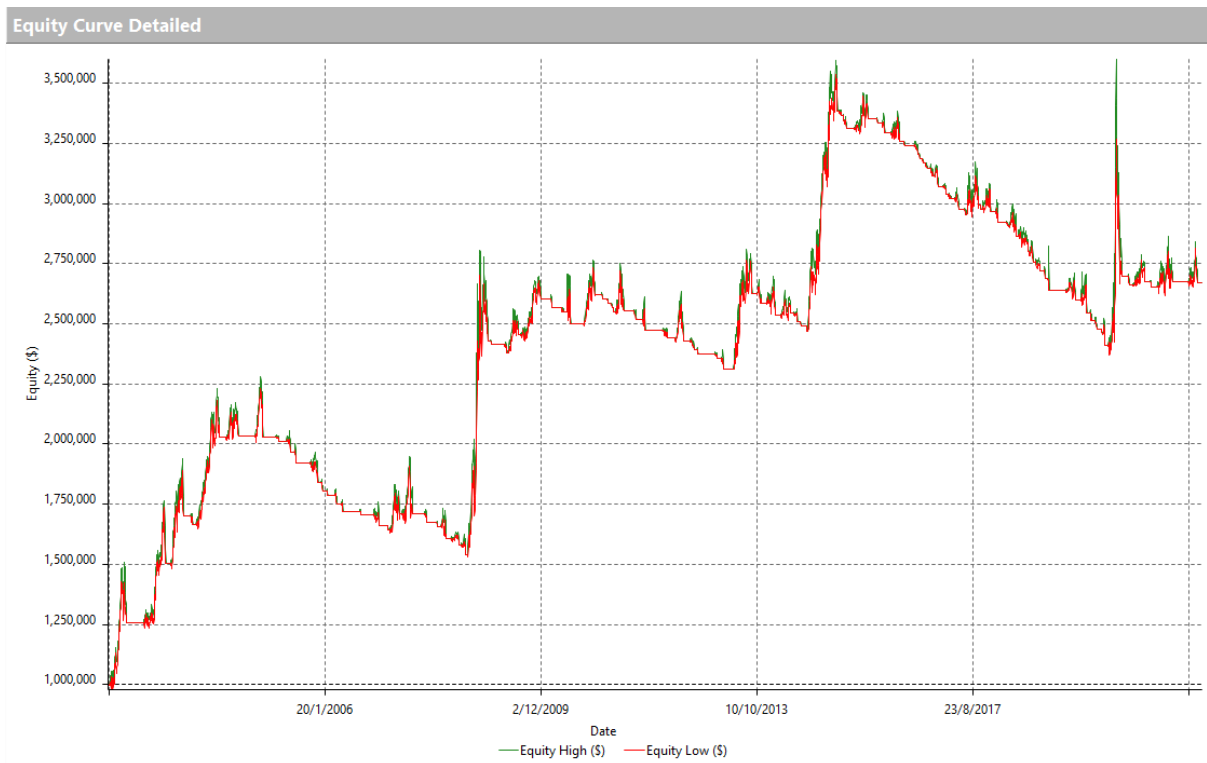


Figure 25. The Equity Curve Detailed of AUD/USD with parameter (60,40,2)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	250	130	120
Total # of Open Trades	0	0	0
Number Winning Trades	87	51	36
Number Losing Trades	163	79	84
Percent Profitable	34.8%	39.23%	30%
Avg Trade (win loss)	\$6,687.16	\$3,428.31	\$10,217.58
Average Winning Trade	\$48,418.74	\$32,647.06	\$70,761.94
Average Losing Trade	(\$15,586.75)	(\$15,434.43)	(\$15,730.00)
Ratio Avg Win / Avg Loss	3.11	2.12	4.5
Largest Winning Trade	\$243,180.00	\$105,820.00	\$243,180.00
Largest Losing Trade	(\$27,360.00)	(\$26,680.00)	(\$27,360.00)
Avg # Bars in Trades	31.2	32.5	29.7
Avg # Bars in Winning Trades	60.4	59.1	62.2
Avg # Bars in Losing Trades	15.6	15.4	15.8
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-0.8	42.5	81.7
Avg # Bars Between Losing Trades	16.2	50.2	45.9

Figure 26. The Total Trade Analysis of AUD/USD with parameter (60,40,2)

BTC/USDT:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$7,893,313.48	\$7,673,496.28	\$219,817.20
Gross Profit	\$8,800,998.57	\$8,022,925.08	\$778,073.49
Gross Loss	(\$907,685.09)	(\$349,428.81)	(\$558,256.29)
Adjusted Net Profit	\$6,854,893.25	\$6,605,743.34	(\$19,017.43)
Adjusted Gross Profit	\$7,868,094.59	\$7,020,059.45	\$622,458.79
Adjusted Gross Loss	(\$1,013,201.34)	(\$414,316.11)	(\$641,476.22)
Select Net Profit	\$3,604,778.81	\$3,255,355.13	\$349,423.68
Select Gross Profit	\$4,239,627.26	\$3,461,553.77	\$778,073.49
Select Gross Loss	(\$634,848.45)	(\$206,198.64)	(\$428,649.81)
Account Size Required	\$164,444.54	\$159,298.40	\$198,643.47
Return on Account	4799.99%	4817.06%	110.66%
Return on Initial Capital	789.33%	767.35%	21.98%
Max Strategy Drawdown	(\$1,968,921.02)	(\$1,968,921.02)	(\$443,997.61)
Max Strategy Drawdown (%)	(46.49%)	(46.68%)	(35.94%)
Max Close To Close Drawdown	(\$164,444.54)	(\$159,298.40)	(\$198,643.47)
Max Close To Close Drawdown (%)	(4.64%)	(3.35%)	(19.86%)
Return on Max Strategy Drawdown	4.01	3.9	0.5
Profit Factor	9.7	22.96	1.39
Adjusted Profit Factor	7.77	16.94	(0.97)
Select Profit Factor	6.68	16.79	1.82
Max # Contracts Held	6888	6888	2280
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	(\$11,650.80)	n/a	(\$11,650.80)
Annual Rate of Return	140.84%	136.92%	3.92%
Monthly Rate of Return	11.74%	11.41%	0.33%
Buy Hold Return	\$98,808,945.89	\$98,808,945.89	\$105,453,072.76
Avg Monthly Return	\$114,227.00		
Monthly Return StdDev	\$312,695.93		
Total # of Trades	163	93	70
Percent Profitable	54.6%	68.82%	35.71%

Figure 27. The Strategy Performance Summary of BTC/USDT with parameter (20,20,3)

Performance Ratios	
Upside Potential Ratio	68.13
Sharpe Ratio	0.3
Annualized Sharpe Ratio	1.02
Sortino Ratio	1.15
Fouse Ratio	0.03
Calmar Ratio	0.04
Sterling Ratio	0
RINA Index	604.4
Net Profit as % of Largest loss	20921.86%
Net Profit as % of Max Trade Drawdown	20921.86%
Net Profit as % of Max Strategy Drawdown	400.9%
Select Net Profit as % of Largest loss	9554.76%
Select Net Profit as % of Max Trade Drawdown	9554.76%
Select Net Profit as % of Max Strategy Drawdown	183.08%
Adj Net Profit as % of Largest loss	18169.44%
Adj Net Profit as % of Max Trade Drawdown	18169.44%
Adj Net Profit as % of Max Strategy Drawdown	348.15%

Figure 28. The Performance Ratio of BTC/USDT with parameter (20,20,3)

Equity Curve Detailed

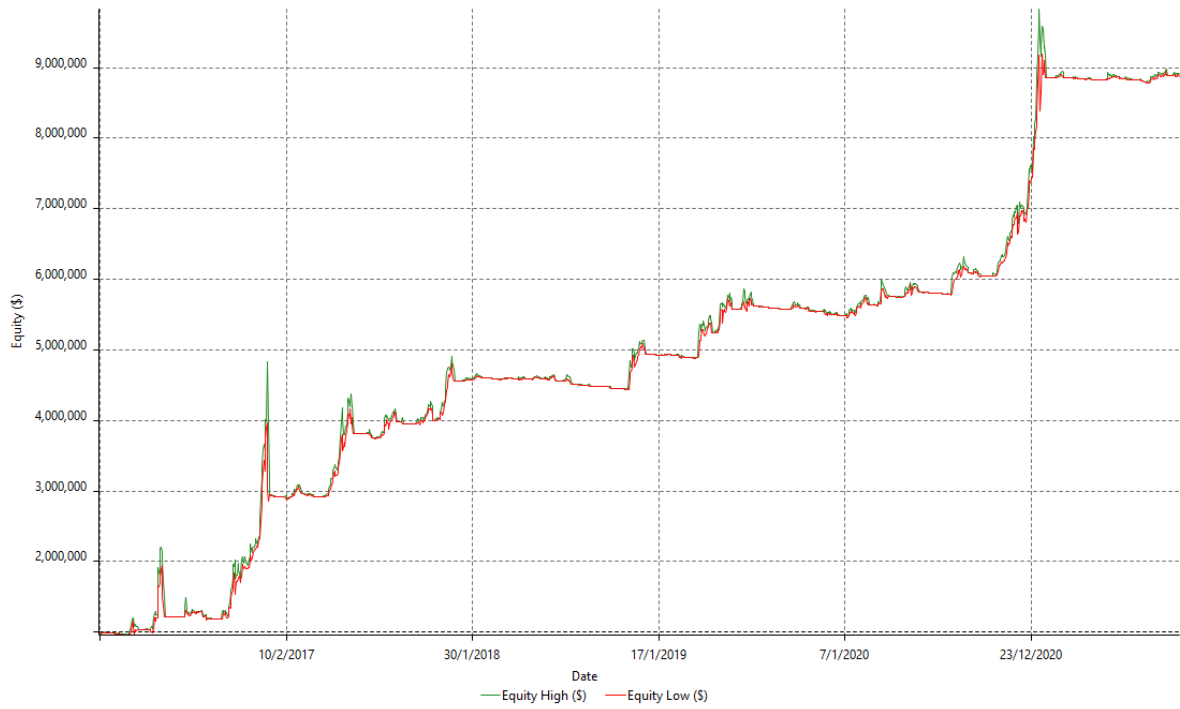


Figure 29. The Equity Curve Detailed of BTC/USDT with parameter (20,20,3)

Total Trade Analysis

	All Trades	Long Trades	Short Trades
Total # of Trades	163	93	70
Total # of Open Trades	3	0	3
Number Winning Trades	89	64	25
Number Losing Trades	74	29	45
Percent Profitable	54.6%	68.82%	35.71%
Avg Trade (win loss)	\$48,425.24	\$82,510.71	\$3,140.25
Average Winning Trade	\$98,887.62	\$125,358.20	\$31,122.94
Average Losing Trade	(\$12,266.01)	(\$12,049.27)	(\$12,405.70)
Ratio Avg Win / Avg Loss	8.06	10.4	2.51
Largest Winning Trade	\$715,666.00	\$715,666.00	\$139,050.67
Largest Losing Trade	(\$37,727.59)	(\$28,907.49)	(\$37,727.59)
Avg # Bars in Trades	17.6	22.1	11.7
Avg # Bars in Winning Trades	25	27.9	17.7
Avg # Bars in Losing Trades	8.7	9.2	8.4
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-7.6	-3.7	44.3
Avg # Bars Between Losing Trades	12.2	44.3	26

Figure 30. The Total Trade Analysis of BTC/USDT with parameter (20,20,3)

ETH/USDT:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$6,856,346.09	\$6,257,424.77	\$598,921.32
Gross Profit	\$8,537,822.01	\$7,189,786.67	\$1,348,035.35
Gross Loss	(\$1,681,475.92)	(\$932,361.90)	(\$749,114.02)
Adjusted Net Profit	\$5,992,392.79	\$5,409,888.32	\$303,926.67
Adjusted Gross Profit	\$7,821,343.91	\$6,452,130.12	\$1,151,404.18
Adjusted Gross Loss	(\$1,828,951.12)	(\$1,042,241.80)	(\$847,477.51)
Select Net Profit	\$4,105,417.53	\$3,313,220.32	\$792,197.22
Select Gross Profit	\$5,230,246.23	\$3,882,210.89	\$1,348,035.35
Select Gross Loss	(\$1,124,828.70)	(\$568,990.57)	(\$555,838.13)
Account Size Required	\$231,708.99	\$199,596.57	\$169,653.57
Return on Account	2959.03%	3135.04%	353.03%
Return on Initial Capital	685.63%	625.74%	59.89%
Max Strategy Drawdown	(\$1,576,250.00)	(\$1,576,250.00)	(\$398,264.02)
Max Strategy Drawdown (%)	(39.2%)	(38.78%)	(25.22%)
Max Close To Close Drawdown	(\$231,708.99)	(\$199,596.57)	(\$169,653.57)
Max Close To Close Drawdown (%)	(17.67%)	(7.5%)	(15.63%)
Return on Max Strategy Drawdown	4.35	3.97	2.01
Profit Factor	5.08	7.71	1.8
Adjusted Profit Factor	4.28	6.19	1.36
Select Profit Factor	4.65	6.62	2.42
Max # Contracts Held	65000	65000	65000
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	(\$6,349.05)	n/a	(\$6,349.05)
Annual Rate of Return	119.76%	109.3%	10.46%
Monthly Rate of Return	9.98%	9.11%	0.87%
Buy Hold Return	\$3,035,777,777.78	\$3,035,777,777.78	\$290,742,843.28
Avg Monthly Return	\$97,857.10		
Monthly Return StdDev	\$312,899.18		
Total # of Trades	272	167	105
Percent Profitable	52.21%	56.89%	44.76%

Figure 31. The Strategy Performance Summary of ETH/USDT with parameter (20,20,3)

Performance Ratios	
Upside Potential Ratio	153.17
Sharpe Ratio	0.19
Annualized Sharpe Ratio	0.67
Sortino Ratio	1.92
Fouse Ratio	0.04
Calmar Ratio	0.09
Sterling Ratio	0
RINA Index	596.71
Net Profit as % of Largest loss	20316.62%
Net Profit as % of Max Trade Drawdown	20316.62%
Net Profit as % of Max Strategy Drawdown	434.98%
Select Net Profit as % of Largest loss	12165.11%
Select Net Profit as % of Max Trade Drawdown	12165.11%
Select Net Profit as % of Max Strategy Drawdown	260.45%
Adj Net Profit as % of Largest loss	17756.57%
Adj Net Profit as % of Max Trade Drawdown	17756.57%
Adj Net Profit as % of Max Strategy Drawdown	380.17%

Figure 32. The Performance Ratio of ETH/USDT with parameter (20,20,3)

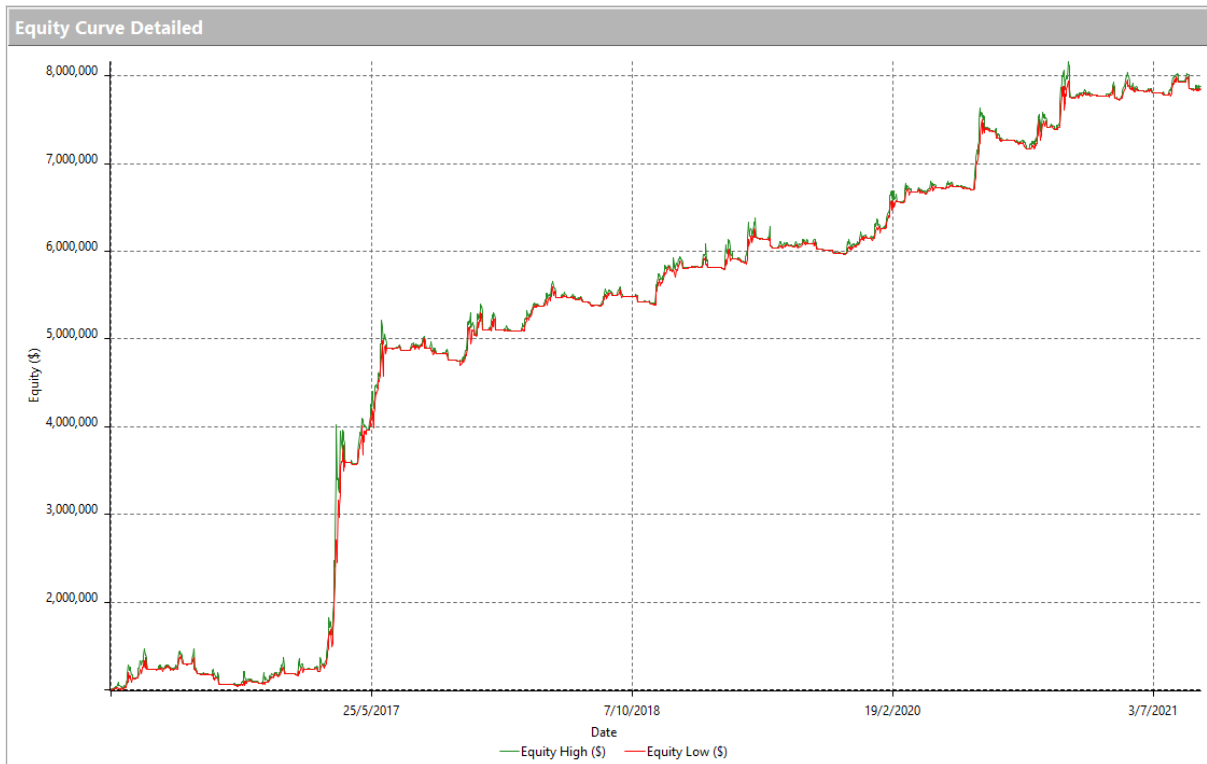


Figure 33. The Equity Curve Detailed of ETH/USDT with parameter (20,20,3)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	272	167	105
Total # of Open Trades	3	0	3
Number Winning Trades	142	95	47
Number Losing Trades	130	72	58
Percent Profitable	52.21%	56.89%	44.76%
Avg Trade (win loss)	\$25,207.15	\$37,469.61	\$5,704.01
Average Winning Trade	\$60,125.51	\$75,681.96	\$28,681.60
Average Losing Trade	(\$12,934.43)	(\$12,949.47)	(\$12,915.76)
Ratio Avg Win / Avg Loss	4.65	5.84	2.22
Largest Winning Trade	\$1,025,801.85	\$1,025,801.85	\$110,706.42
Largest Losing Trade	(\$33,747.47)	(\$33,723.13)	(\$33,747.47)
Avg # Bars in Trades	15.3	15.7	14.6
Avg # Bars in Winning Trades	21.8	21.5	22.6
Avg # Bars in Losing Trades	8.1	8.2	8
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-6.4	1.6	24
Avg # Bars Between Losing Trades	8.8	22.3	29.8

Figure 34. The Total Trade Analysis of ETH/USDT with parameter (20,20,3)

USO:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$3,220,697.53	\$279,074.22	\$2,941,623.31
Gross Profit	\$5,965,976.35	\$1,657,240.15	\$4,308,736.20
Gross Loss	(\$2,745,278.82)	(\$1,378,165.93)	(\$1,367,112.89)
Adjusted Net Profit	\$2,380,923.02	(\$106,342.83)	\$2,130,941.09
Adjusted Gross Profit	\$5,340,572.10	\$1,415,506.83	\$3,659,169.78
Adjusted Gross Loss	(\$2,959,649.08)	(\$1,521,849.66)	(\$1,538,228.69)
Select Net Profit	\$1,283,276.85	\$530,031.83	\$753,245.02
Select Gross Profit	\$3,373,359.15	\$1,657,240.15	\$1,716,119.00
Select Gross Loss	(\$2,090,082.30)	(\$1,127,208.32)	(\$962,873.98)
Account Size Required	\$816,220.02	\$782,672.37	\$384,860.58
Return on Account	394.59%	35.66%	764.33%
Return on Initial Capital	322.07%	27.91%	294.16%
Max Strategy Drawdown	(\$930,912.02)	(\$933,059.47)	(\$503,963.39)
Max Strategy Drawdown (%)	(44.09%)	(54.08%)	(31.78%)
Max Close To Close Drawdown	(\$816,220.02)	(\$782,672.37)	(\$384,860.58)
Max Close To Close Drawdown (%)	(40.72%)	(49.33%)	(26.21%)
Return on Max Strategy Drawdown	3.46	0.3	5.84
Profit Factor	2.17	1.2	3.15
Adjusted Profit Factor	1.8	(0.93)	2.39
Select Profit Factor	1.61	1.47	1.78
Max # Contracts Held	60060	43444	60060
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	\$18,630.00	\$18,630.00	n/a
Annual Rate of Return	22.07%	1.91%	20.16%
Monthly Rate of Return	1.84%	0.16%	1.68%
Buy Hold Return	(\$872,241.13)	(\$872,241.13)	(\$864,619.82)
Avg Monthly Return	\$18,405.27		
Monthly Return StdDev	\$120,644.74		
Total # of Trades	255	139	116
Percent Profitable	35.69%	33.81%	37.93%

Figure 35. The Strategy Performance Summary of USO with parameter (45,35,2)

Performance Ratios	
Upside Potential Ratio	37.82
Sharpe Ratio	0.13
Annualized Sharpe Ratio	0.46
Sortino Ratio	0.39
Fouse Ratio	0.01
Calmar Ratio	0.02
Sterling Ratio	0
RINA Index	161.93
Net Profit as % of Largest loss	6815.88%
Net Profit as % of Max Trade Drawdown	6815.88%
Net Profit as % of Max Strategy Drawdown	345.97%
Select Net Profit as % of Largest loss	2715.76%
Select Net Profit as % of Max Trade Drawdown	2715.76%
Select Net Profit as % of Max Strategy Drawdown	137.85%
Adj Net Profit as % of Largest loss	5038.68%
Adj Net Profit as % of Max Trade Drawdown	5038.68%
Adj Net Profit as % of Max Strategy Drawdown	255.76%

Figure 36. The Performance Ratio of USO with parameter (45,35,2)

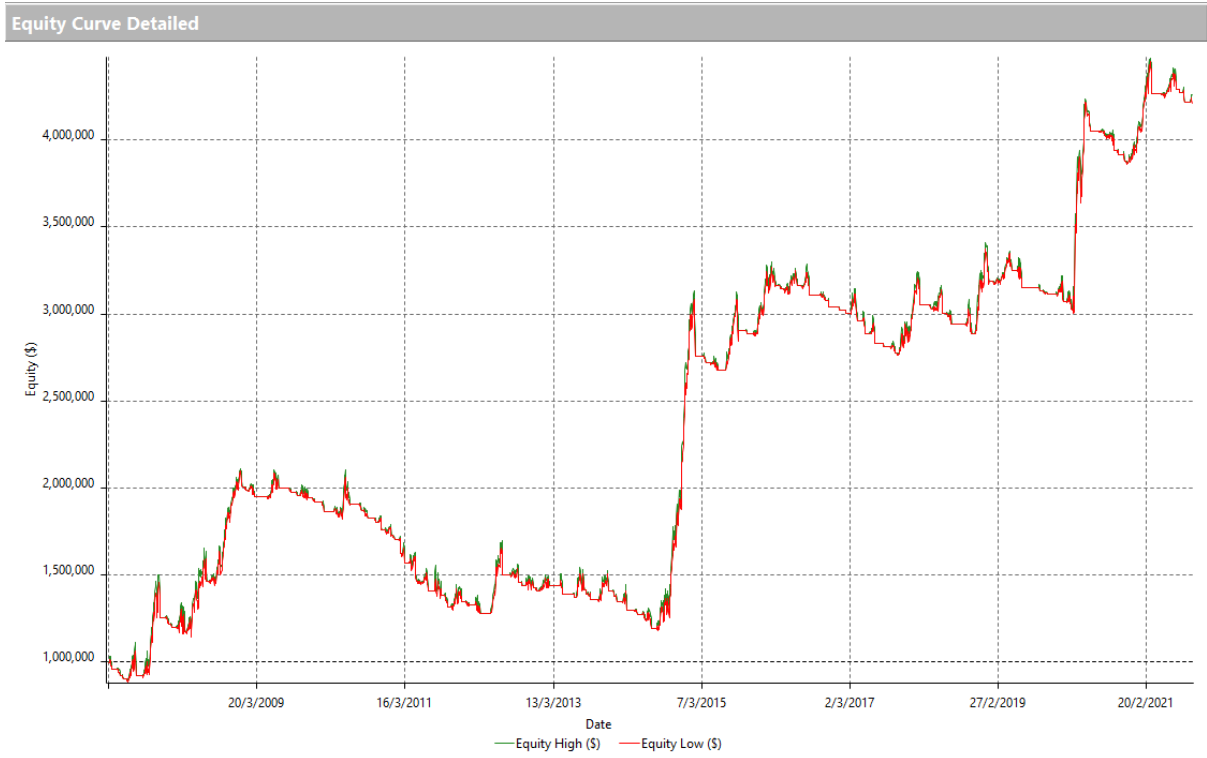


Figure 37. The Equity Curve Detailed of USO with parameter (45,35,2)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	255	139	116
Total # of Open Trades	3	3	0
Number Winning Trades	91	47	44
Number Losing Trades	164	92	72
Percent Profitable	35.69%	33.81%	37.93%
Avg Trade (win loss)	\$12,630.19	\$2,007.73	\$25,358.82
Average Winning Trade	\$65,560.18	\$35,260.43	\$97,925.82
Average Losing Trade	(\$16,739.50)	(\$14,980.06)	(\$18,987.68)
Ratio Avg Win / Avg Loss	3.92	2.35	5.16
Largest Winning Trade	\$406,870.00	\$111,542.47	\$406,870.00
Largest Losing Trade	(\$47,252.87)	(\$35,922.44)	(\$47,252.87)
Avg # Bars in Trades	25.4	24.3	26.7
Avg # Bars in Winning Trades	48.7	44.1	53.7
Avg # Bars in Losing Trades	12.4	14.2	10.2
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-7.2	36.2	32.1
Avg # Bars Between Losing Trades	10.6	26.8	42.3

Figure 38. The Total Trade Analysis of USO with parameter (45,35,2)

XAU/USD:

Strategy Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$2,497,692.95	\$2,475,375.15	\$22,317.80
Gross Profit	\$4,552,349.82	\$3,407,042.12	\$1,145,307.70
Gross Loss	(\$2,054,656.87)	(\$931,666.97)	(\$1,122,989.90)
Adjusted Net Profit	\$1,859,959.25	\$1,940,917.90	(\$316,659.82)
Adjusted Gross Profit	\$4,094,821.45	\$2,993,877.57	\$939,604.36
Adjusted Gross Loss	(\$2,234,862.20)	(\$1,052,959.68)	(\$1,256,264.28)
Select Net Profit	\$923,788.28	\$1,141,228.63	(\$217,440.35)
Select Gross Profit	\$2,482,135.88	\$1,837,447.13	\$644,688.85
Select Gross Loss	(\$1,558,347.70)	(\$696,218.50)	(\$862,129.20)
Account Size Required	\$319,461.88	\$334,503.39	\$501,885.16
Return on Account	781.84%	740.01%	4.45%
Return on Initial Capital	249.77%	247.54%	2.23%
Max Strategy Drawdown	(\$637,592.04)	(\$534,672.43)	(\$544,741.56)
Max Strategy Drawdown (%)	(36.55%)	(26.65%)	(53.14%)
Max Close To Close Drawdown	(\$319,461.88)	(\$334,503.39)	(\$501,885.16)
Max Close To Close Drawdown (%)	(21.79%)	(12.5%)	(50.19%)
Return on Max Strategy Drawdown	3.92	4.63	0.04
Profit Factor	2.22	3.66	1.02
Adjusted Profit Factor	1.83	2.84	(0.75)
Select Profit Factor	1.59	2.64	(0.75)
Max # Contracts Held	4948	4948	3764
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	(\$11,886.40)	n/a	(\$11,886.40)
Annual Rate of Return	17.1%	16.95%	0.15%
Monthly Rate of Return	1.42%	1.41%	0.01%
Buy Hold Return	\$1,593,976.08	\$1,593,976.08	\$1,685,570.16
Avg Monthly Return	\$14,044.10		
Monthly Return StdDev	\$97,608.59		
Total # of Trades	229	127	102
Percent Profitable	43.23%	53.54%	30.39%

Figure 39. The Strategy Performance Summary of XAU/USD with parameter (45,35,2)

Performance Ratios	
Upside Potential Ratio	40.29
Sharpe Ratio	0.12
Annualized Sharpe Ratio	0.43
Sortino Ratio	0.35
Fouse Ratio	0.01
Calmar Ratio	0.04
Sterling Ratio	0
RINA Index	128.19
Net Profit as % of Largest loss	9080.48%
Net Profit as % of Max Trade Drawdown	9080.48%
Net Profit as % of Max Strategy Drawdown	391.74%
Select Net Profit as % of Largest loss	3358.48%
Select Net Profit as % of Max Trade Drawdown	3358.48%
Select Net Profit as % of Max Strategy Drawdown	144.89%
Adj Net Profit as % of Largest loss	6761.97%
Adj Net Profit as % of Max Trade Drawdown	6761.97%
Adj Net Profit as % of Max Strategy Drawdown	291.72%

Figure 40. The Performance Ratio of XAU/USD with parameter (45,35,2)

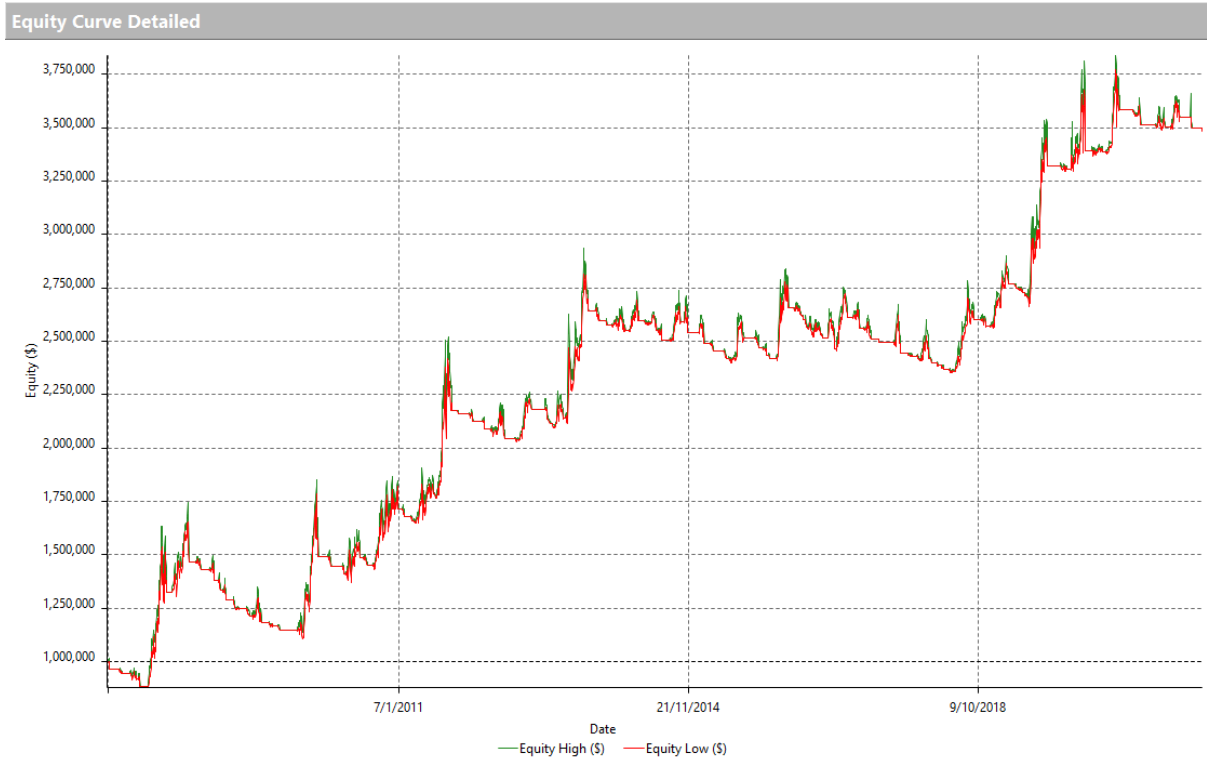


Figure 41. The Equity Curve Detailed of XAU/USD with parameter (45,35,2)

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	229	127	102
Total # of Open Trades	1	0	1
Number Winning Trades	99	68	31
Number Losing Trades	130	59	71
Percent Profitable	43.23%	53.54%	30.39%
Avg Trade (win loss)	\$10,906.96	\$19,491.14	\$218.80
Average Winning Trade	\$45,983.33	\$50,103.56	\$36,945.41
Average Losing Trade	(\$15,805.05)	(\$15,790.97)	(\$15,816.76)
Ratio Avg Win / Avg Loss	2.91	3.17	2.34
Largest Winning Trade	\$168,607.45	\$168,607.45	\$140,137.44
Largest Losing Trade	(\$27,506.18)	(\$27,506.18)	(\$27,500.98)
Avg # Bars in Trades	27.7	32.4	21.7
Avg # Bars in Winning Trades	46.3	48.8	41
Avg # Bars in Losing Trades	13.5	13.6	13.3
Avg # Bars Between Trades	n/a	n/a	n/a
Avg # Bars Between Winning Trades	-7.2	8.2	83.9
Avg # Bars Between Losing Trades	16.3	52	41.2

Figure 42. The Total Trade Analysis of XAU/USD with parameter (45,35,2)

Portfolio:

Performance Summary			
	All Trades	Long Trades	Short Trades
Net Profit	\$32,464,430.86	\$24,317,655.75	\$8,146,775.12
Gross Profit	\$51,872,252.87	\$34,796,704.81	\$17,075,548.06
Gross Loss	(\$19,407,822.00)	(\$10,479,049.06)	(\$8,928,772.94)
Account Size Required	\$4,776,088.63	\$4,119,499.16	\$3,948,111.52
Return on Account	679.73%	590.31%	206.35%
Return on Initial Capital	3246.44%	2431.77%	814.68%
Profit Factor	2.67	3.32	1.91
Slippage Paid	\$0.00	\$0.00	\$0.00
Commission Paid	\$0.00	\$0.00	\$0.00
Open Position P/L	\$8,973.75	\$18,630.00	(\$9,656.25)
Select Net Profit	\$15,888,759.77		
Adjusted Net Profit	\$30,083,743.17		
Max Portfolio Drawdown	(\$2,920,758.22)		
Max Portfolio Drawdown (%)	(40.76%)		
Max Portfolio Close To Close Drawdown	(\$1,169,529.89)		
Max Portfolio Close To Close Drawdown (%)	(29.4%)		
Return on Max Portfolio Drawdown	11.12		
Annual Rate of Return	165.56%		

Figure 43. The Performance Summary of Portfolio

Performance Ratios	
Upside Potential Ratio	39.5
Sharpe Ratio	0.21
Annualized Sharpe Ratio	0.73
Sortino Ratio	0.53
Fouse Ratio	0.01
Calmar Ratio	0.01
Sterling Ratio	0
RINA Index	1232.43
Portfolio Net Profit as % of Largest loss	63338.56%
Portfolio Net Profit as % of Max Trade Drawdown	63338.56%
Portfolio Net Profit as % of Max Portfolio Drawdown	11111.51%
Select Net Profit as % of Largest loss	30999.19%
Select Net Profit as % of Max Trade Drawdown	30999.19%
Select Net Profit as % of Max Strategy Drawdown	543.99%
Adj Net Profit as % of Largest loss	58693.8%
Adj Net Profit as % of Max Trade Drawdown	58693.8%
Adj Net Profit as % of Max Strategy Drawdown	1030%

Figure 44. The Performance Ratio of Portfolio

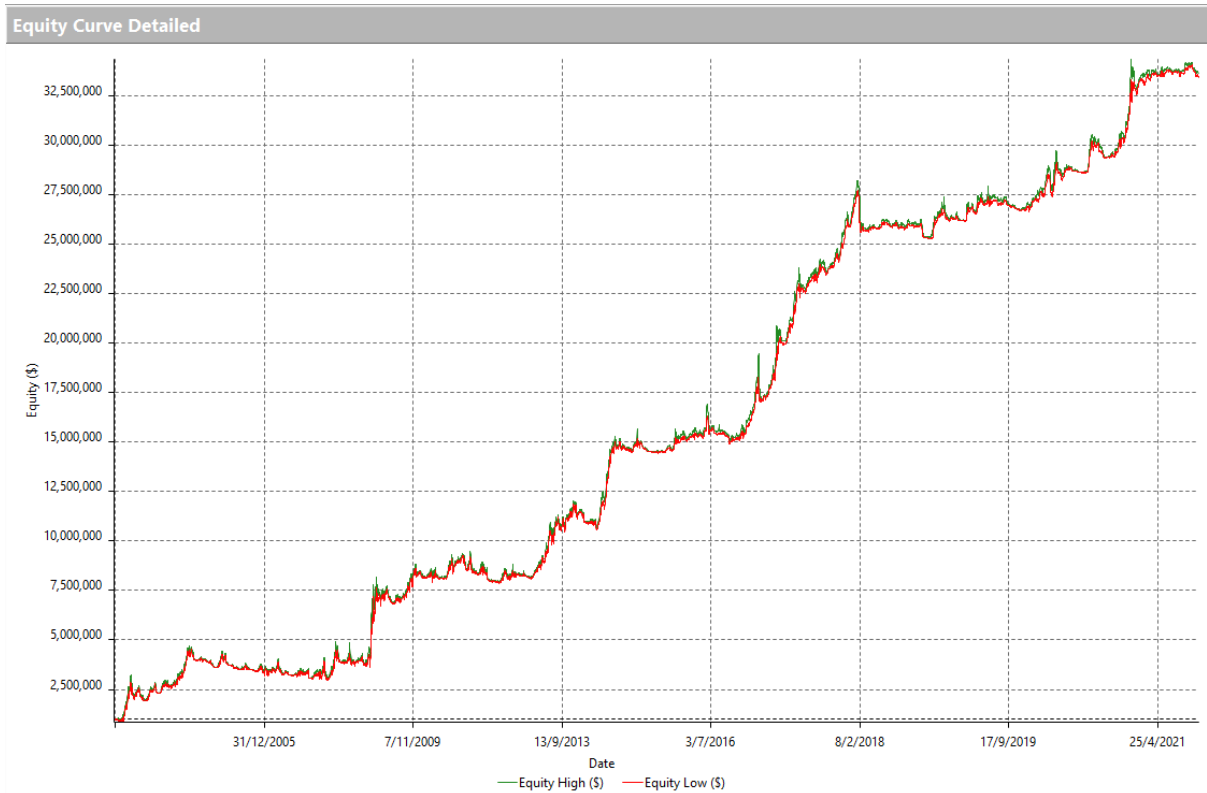


Figure 45. The Equity Curve Detailed of Portfolio

Total Trade Analysis			
	All Trades	Long Trades	Short Trades
Total # of Trades	1963	1175	788
Total # of Open Trades	14	3	11
Number Winning Trades	826	557	269
Number Losing Trades	1136	618	518
Percent Profitable	42.08%	47.4%	34.14%
Avg Trade (win loss)	\$16,538.17	\$20,695.88	\$10,338.55
Average Winning Trade	\$62,799.34	\$62,471.64	\$63,477.87
Average Losing Trade	(\$17,084.35)	(\$16,956.39)	(\$17,237.01)
Ratio Avg Win / Avg Loss	3.68	3.68	3.68

Figure 46. The Total Trade Analysis of Portfolio