Dynamic Iron Condor Spread on SPX Strategy Analysis

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Abstract

This paper analyzes profitable Iron Condor and Butterfly option strategies for the S&P 500. By looking at different option spreads and trading rules, it is possible to find profitable strategies over eighty percent of the time. However, this paper doesn't discuss how to minimize risk for each strategy. Instead, it compares the overall risks and downfalls of each strategy. Such strategies include different times to expiration, implied volatility trading rules, and volume trading rules.

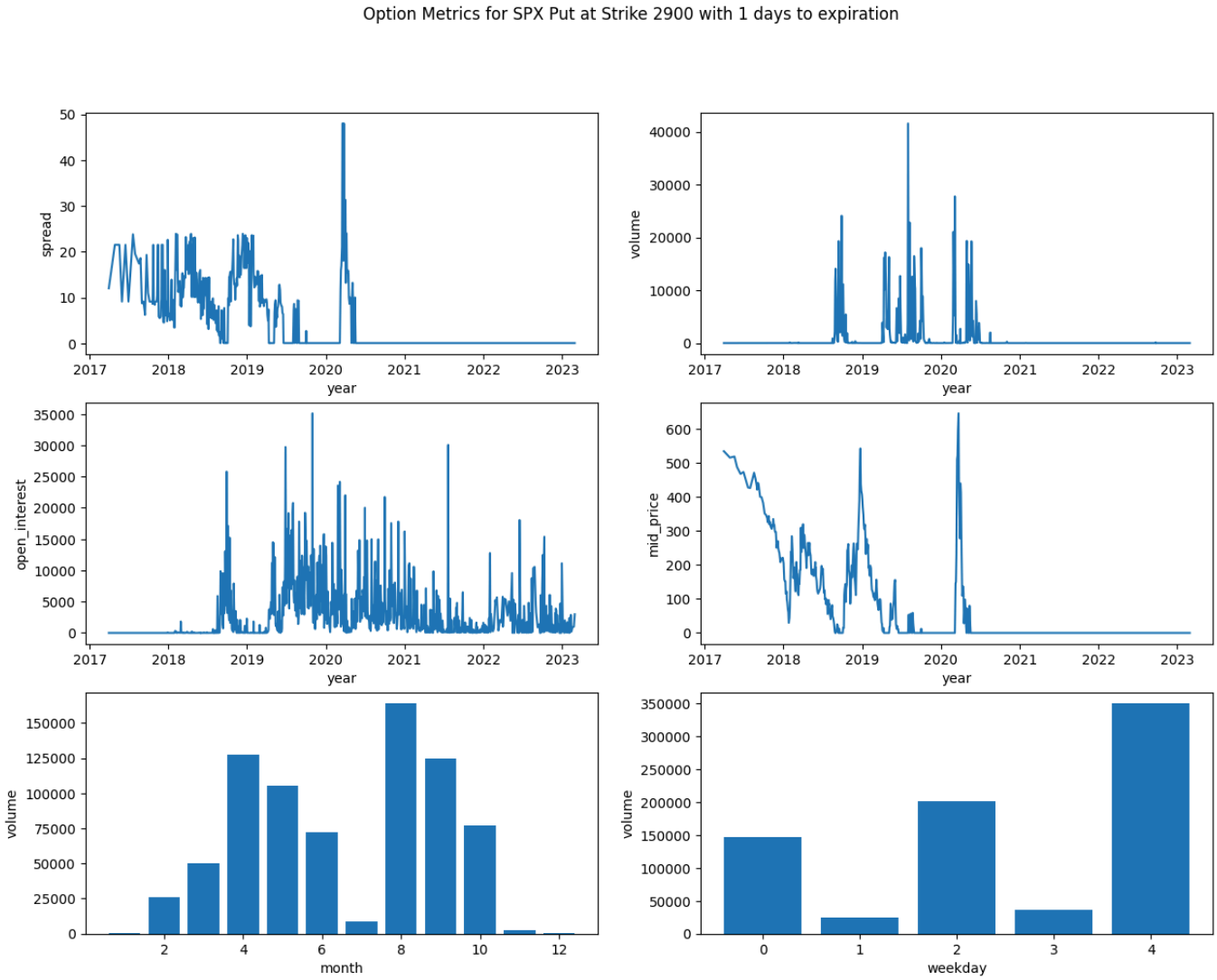
Introduction

This project focuses on SPX options traded on the Chicago Board of Exchange from 2010 to 2023. This data was provided by OptionMetrics, giving data on option volume, open interest, days to expiration, best bid, and best offer. These options are European options that are settled on the closing price at expiration. There is also a dataset on the SPX intraday movement. However, this project only focuses on the close price for modeling purposes.

In addition, this project uses Yahoo Finance data to get ten-year treasury note yields, which helps to calculate the implied volatility for the trading strategies. No other data is used, but some values are calculated based on the datasets mentioned above.

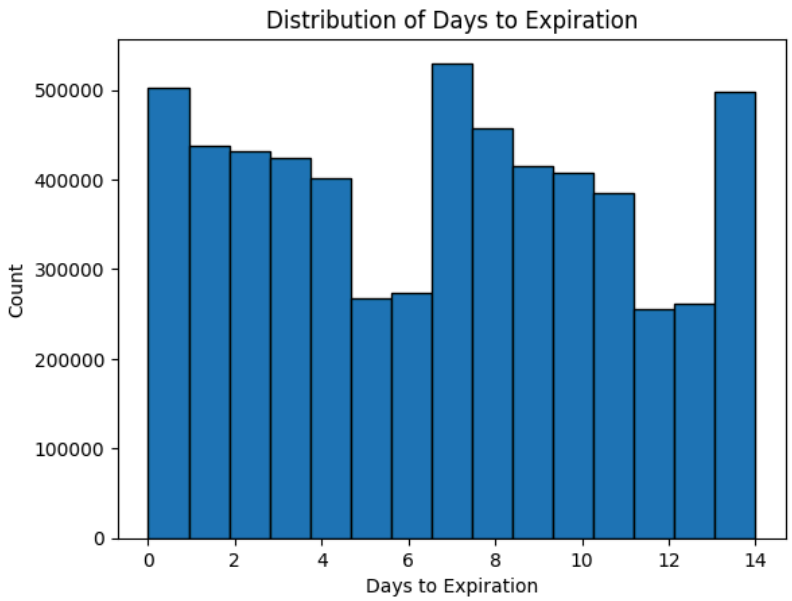
The strategy used is an iron condor spread, which consists of a long put, short put, short call, and long call in that order from smallest to lowest strike. For an iron condor to work, the difference between the call strikes should be equal to the difference in strikes of the calls. Then, the strikes of the short call should be some amount greater than the strike of the short put. Otherwise, if the strikes were the same, it would be a butterfly spread strategy. Inherently, this option spread has either zero or negative profit. However, the options are bought at a net credit. Thus they generate profit when SPX is between the two short option strikes, with a break-even between the put and call spreads. This profit can also be reversed by switching which options are long and which ones are short.

Before executing any strategies, looking at the stock movement compared to other metrics is essential. The graph below shows different possibly crucial metrics for our option strategy. It looks at the spread between the best bid and best offer, volume, open interest, and mid-price of the option.



After looking at the graphs, it's apparent that volume was most correlated with the option's price. In this case, volume is a lagging indicator for the mid-price, which will be useful when using volume as a predictor for the model's cost and net profit.

When picking what days to expiration to use, the below histogram shows that the most common days to expiration are zero, seven, and fourteen. However, it is hard to do any calculations with zero days to expiration. Thus, this project uses one day to expiration instead. The reason that the most common expirations are chosen is because they give more data to work with when formulating a strategy. These different expirations are then compared to form an optimal strategy.



Methods

When calculating what strikes to use for the iron condor strategies on a given day, the range of strikes for that day is collected and sorted in ascending order. This makes it easier to select strikes dynamically, as strike increments can change over time. Thus, using the index of the strike for the options allows the model to easily select options with correct spacing to create an iron condor. In this case, spacing means the difference between the put strikes and the difference between the call strikes should be equal.

Ideally, these strike spacings of the options would stay relatively the same over time. However, given the nature of the data, there aren't many days when this spacing is possible. It is not easy to find days where the difference between the put strikes and the difference between the call strikes is actually equal and similar to previous days. Most days, there are different iron condors based on this strategy. Some days the spacing is only five dollars, and some can be up to 25 dollars. The optimal strikes were found through simple experimentation. It was found that using strikes indexed five away from the at-the-money strike for the long options and three away from the at-the-money strike for the short options was optimal. Regardless of this fact, changing the spread had minor effects on the profit. Making sure the put and call spread were at least two indexes apart was necessary as in some cases it would lead the put and call spread to be zero. This would mean we wouldn't have an iron condor.

Additionally, the difference between these calls and puts varies greatly. For example, the puts and calls can be 10 dollars apart or even 100 dollars apart from day to day. What stays constant is where the iron condor is centered. It is centered around the value of the close of the SPX of the day the options are bought. Profit is then made if the value of the SPX stays within the break-even points of our iron condor. While this varying strategy could be better, it becomes lucrative when putting in buy and sell rules.

The trading rules used for this model are implied volatility and volume limits. The implied volatility should be constant across options. The short call on each day was randomly selected as our option to calculate the volatility. An optimal volatility was then chosen that lead to the

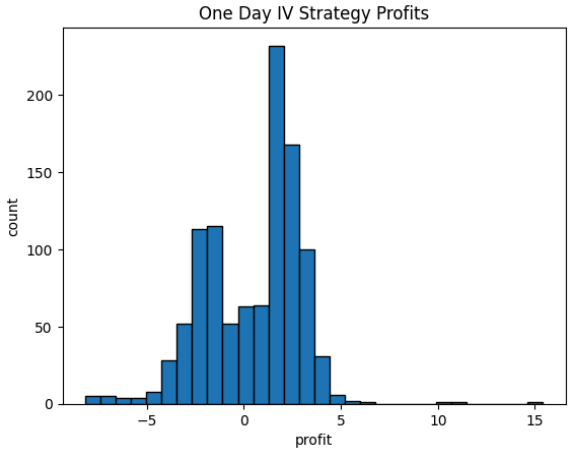
highest mean daily profit. The volume rule consists of calculating the difference in volume between the long options and the short options to see if market intuitions are correct. By market intuitions, it is implied that if there is more activity at the options with strikes further from the SPX value, the market sees the SPX as quite volatile in the future. Both trading rules capture similar ideas of volatility as this affects iron condors the most. For iron condors, it is best if the market stays relatively neutral for it to be a profitable strategy. Thus, introducing trading rules for when the market is volatile would improve the odds of making a profit.

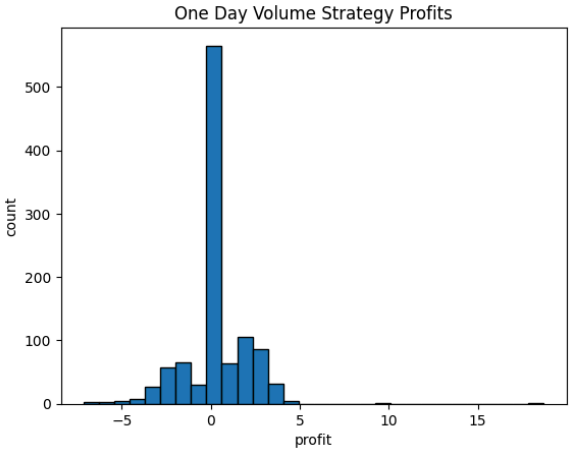
Results

To clarify certain points in the results section, the “without rules” strategy means buying an iron condor daily as our strategy. In each table, implied volatility is shortened to IV for readability purposes. Additionally, if one wants to compare the tables to the code notebook provided, please note that the profits here are multiplied by 100 to account for the fact that the contract size for the options is 100.

One Day to Expiration Strategy Comparison

	Without Rules	**With IV Rule**	**With Volume Rule**
Mean	**-49.54**	**46.70**	**22.92**
Median	**-130.00**	**130.00**	**0.00**
Standard Deviation	**252.04**	**244.51**	**175.84**





For the one day to expiration iron condor spread, there are 1056 viable days from 2010 to 2023 for which we can execute the strategy. Within those days, the mean and median profit were -49.55 and -130 dollars, respectively. This is not a great result, but trading rules still need to be implemented. After implementing a rule only to buy an iron condor if the implied volatility is below 0.19 and sell if it is above 0.2, we have a mean of 46.71 and a median of 130 dollars. Comparing this to the volume rule strategy, the implied volatility strategy has a greater mean and median, but with greater standard deviation. Both are still better options than the strategy without rules due to having higher mean and lower variation. However, if one were only to sell the iron condor, the without rules strategy would have positive returns greater than either

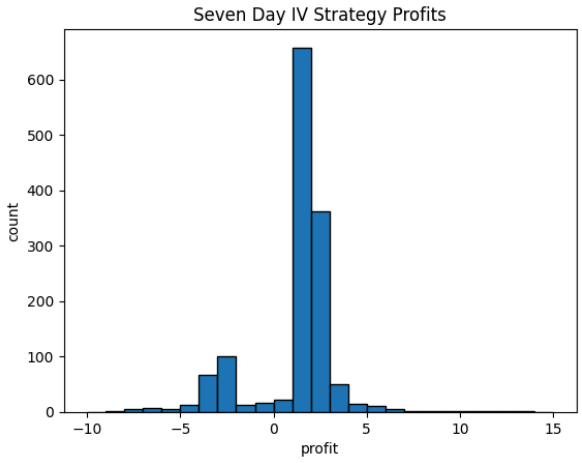
strategy with greater variance. Interestingly, this follows the efficient market hypothesis, where increased volatility leads to decreased expected returns.

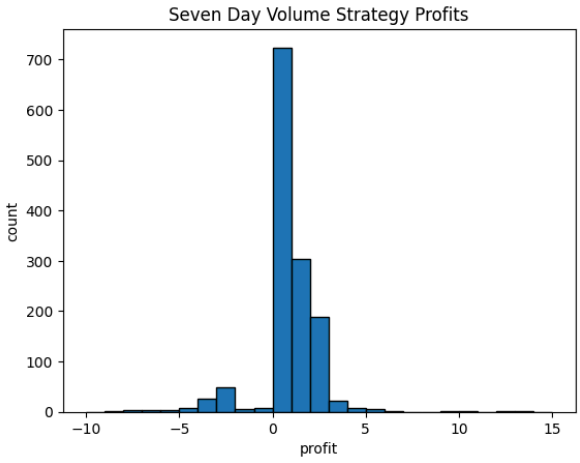
Depending on one's risk tolerance, one could use the volume rule strategy to reduce profit variation. However, this comes at the cost of expected returns. One reason the volume rule has a lower variance and lower mean is that during the 1056 days, we can't exercise our strategy on a large portion of the days. In actuality, there are no opportunities to buy the iron condor and only opportunities to sell the spread using the volume rule. This leaves us with only 506 days to really work with. The implied volatility strategy also removes days, but less than 50 are removed.

From the distributions above, one can see that the implied volatility strategy has greater variance in returns. There is also a concentration of days with profit around -1 to -3 and 1 to 3. The volume strategy, however has a large concentration of days around 0 profit. The implied volatility model follows a bimodal distribution, while the volume strategy follows a unimodal distribution.

Seven Days to Expiration Strategy Comparison

	Without Rules	**With IV Rule**	**With Volume Rule**
Mean	**-116.28**	**116.28**	**52.94**
Median	**-160.00**	**160.00**	**0.00**
Standard Deviation	**318.02**	**318.02**	**259.86**

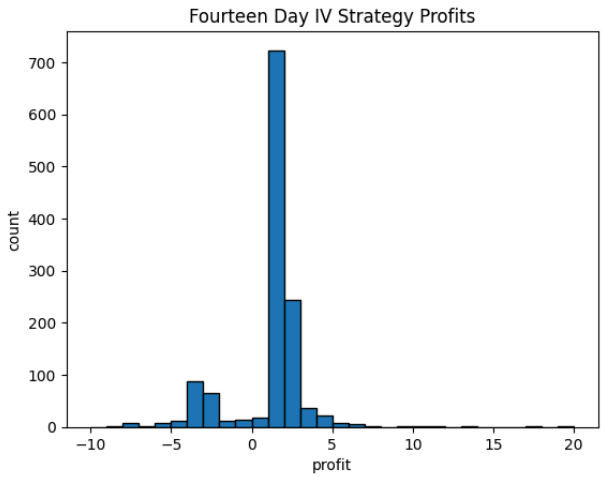


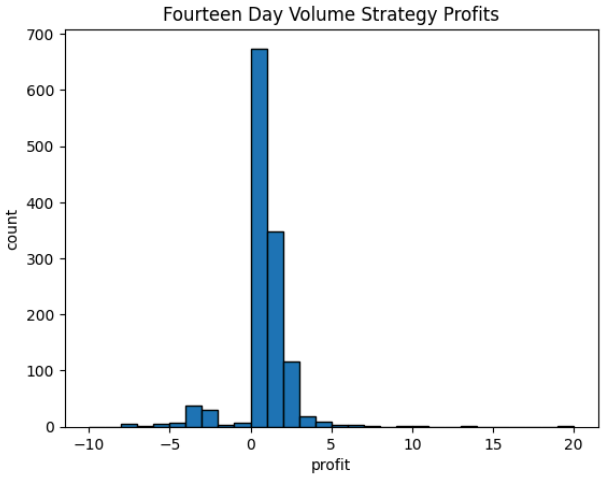


When comparing the seven day to expiration strategy to the one day to expiration, one can see that the seven day strategy has a greater variance, but also greater returns. What changes about the implied volatility rule is that the SPX volatility becomes too great over seven days, and it becomes infeasible to buy any iron condor. Thus, the implied volatility rule only sells iron condors. The volume strategy stays the same, but has a greater mean and standard deviation. Even here, the Efficient Market Hypothesis still holds. The distributions above show that the implied volatility strategy has a high concentration of profits, around 1 to 2, while the concentration ranges from 0 to 2 for the volume strategy. Both have very similar distributions despite this difference.

Fourteen Days to Expiration Strategy Comparison

	Without Rules	With IV Rule	With Volume Rule
Mean	**-119.66**	**119.66**	**62.54**
Median	**-150.00**	**150.00**	**0.00**
Standard Deviation	**440.92**	**440.92**	**412.19**





Nothing changes from the seven-day strategy to the fourteen-day strategy, as implied volatility is now even greater with greater time to expiration. Evidently, this means that our average returns are now greater than the seven-day strategy. One can also see how these distributions are similar to the seven-day strategy.

Discussion

Based on the results, there was no definitive way to increase the expected return of the iron condor strategy due to a trading rule. The trading rules however, did decrease the variance of the profit. Being able to reduce the variance of such a volatile strategy is necessary for creating consistent profits. It is important to note how the trading rules have less effect on the variance of the profit as the time to expiration increases. Additionally, the profits become much more centered around zero with larger outliers. These outliers can't be seen in the histograms above since they were too large that they had to be removed for readability purposes.

A limitation of this strategy is the inconsistency of the strikes in the spread. If there were a more concise way of finding a spread with smaller differences day to day, it could lead to less variance in the profits. Additionally, the trading rules had little effect on the profit as the time to expiration increased. This is most likely due to the stock becoming more unpredictable over time.

When comparing all the possible strategies, the best strategy would be the one day to expiration strategy with the implied volatility rule. This is because of the low variance and relatively high return. With almost half the volatility of the fourteen day to expiration strategy and

less volatility than the no-rule one-day strategy, it is ideal for consistent returns above zero for a majority of days.

For future variations of this model, it might be interesting to try to model the possible movement of the stock from the purchase of the spread to expiration. This could lead to more opportunities to buy the iron condor, rather than just selling it for most days. Finding more opportunities to buy the strategy might lead to less profit variance as one is able to find a consistent way to always have positive profit. While, the proposed strategy is highly volatile with little expected return, there may be other variations with better trading rules that allow for a higher expected return.

References

Plessis, Kirk Du, et al. “Iron Condor Options Strategy [Setup, Adjustments, Exit].” *Option Alpha*, 28 Dec. 2020, https://optionalpha.com/strategies/iron-condor#:~:text=Implied%20volatility%20impact%20on%20an,is%20at%20exit%20or%20expiration.