Options trading research

April 25, 2024

1 Executive summary

A trading strategy has been developed that in the backtest has a higher-risk adjusted return than 'buy-and-hold' of the underlying asset. However, the excess return is marginal. Also, many years are required before the prediction of expected returns becomes meaningful. Certain improvements could be made to have a better-performing options trading strategy.

2 Introduction

2.1 Aim

A backtest engine is produced in python in order to do research into automated options trading strategies. The following research questions are asked:

1. Is it possible to predict the expected return of an options trade?
2. Is it possible to use the prediction in 1 to find optimal trades, thereby producing an excess risk-adjusted return compared to 'buy-and-hold' of the underlying asset?

2.2 Outline of analyses

The analysis is done in the following order:

1. The distribution of daily returns is modelled using historical data (before the start of the options data).
2. A backtest is run without optimization
3. A backtest is run with optimization.

Freely available daily historical data of SPY from OptionsDX is used.

2.3 Details of backtest engine

1. Credit spread trades are performed.
2. The volatility is predicted using a Garch(1,1) model.
3. The backtest is started at the first date in the options data, and ended at the last date in the options data.
4. Trades are performed back-to-back. On the day that the one trade closes, the next trade opens. Trades are performed sequentially.
5. The expected return is computed based on the predicted standard deviation and a Student's t distribution (probabilistic expected value calculation).
6. The actual return is computed based on the price of the underlying asset at expiration.

7. Slippage is estimated by expecting a certain decrease in short prices and increase in long prices. The maximum of either a percentage change or absolute change (USD value) is used for each options price.
8. For the sake of simplicity, no exit strategy is used, such as profit-taking or stop-loss.
9. For the sake of simplicity, the only parameter varied during optimization is the number of days to expiration.

2.4 Inputs

Parameter	Value
Desired probability of maximum loss	10 %
Distance between long and short trade	1 strike price row
Minimum expected return required	0 %
Capital allocated to trade	10 %
Days to expiration desired	7 days
Range of days to expiration during optimization	1 - 22 days
Relative slippage	0.5 %
Absolute slippage	0.01 USD

3 Analysis

3.1 Step 1: Distribution

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[**********100%%**********]  1 of 1 completed
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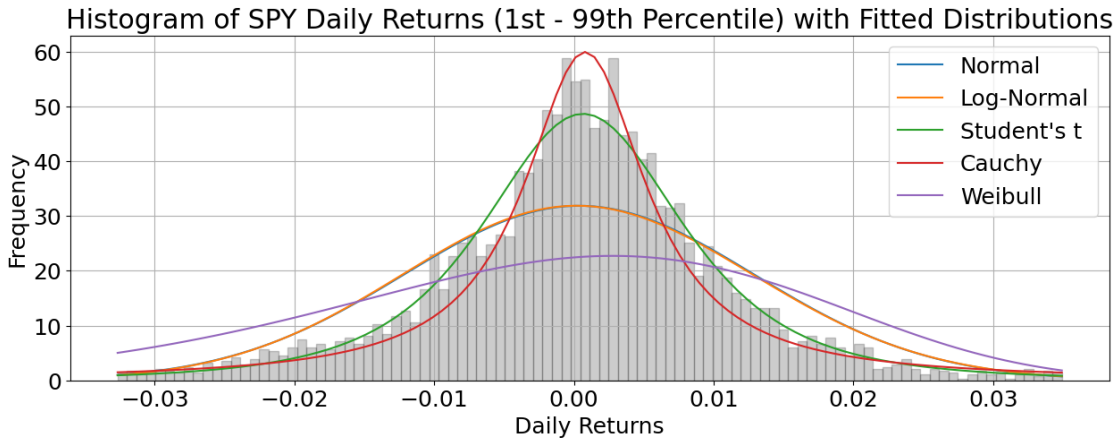


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Student's t degrees of freedom: 2.82
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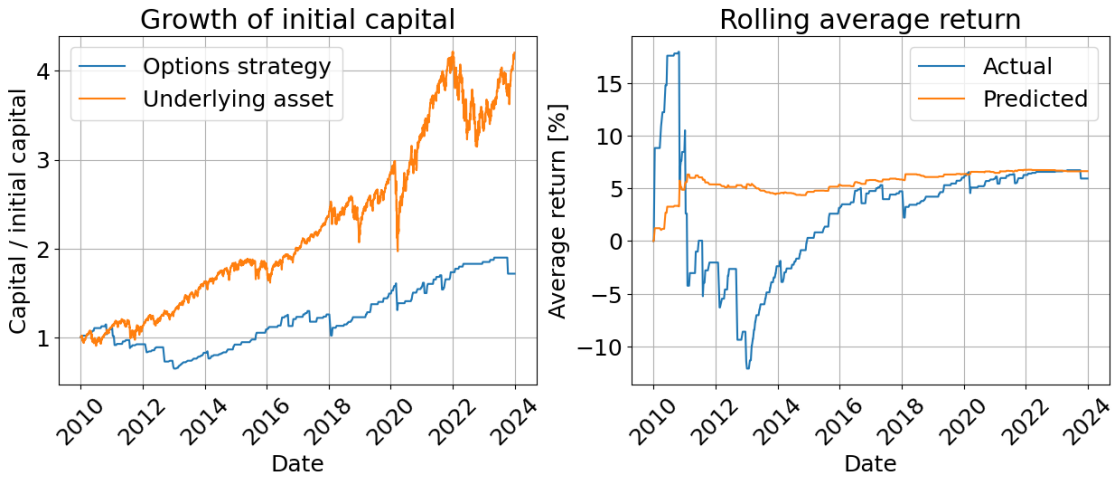
Discussion:

The Student's t distribution is used, as it fits the histogram across the different regions the best. This is to be expected, as equity returns typically have 'fatter tails' than that given by a normal distribution.

3.2 Step 2: Backtest without optimization

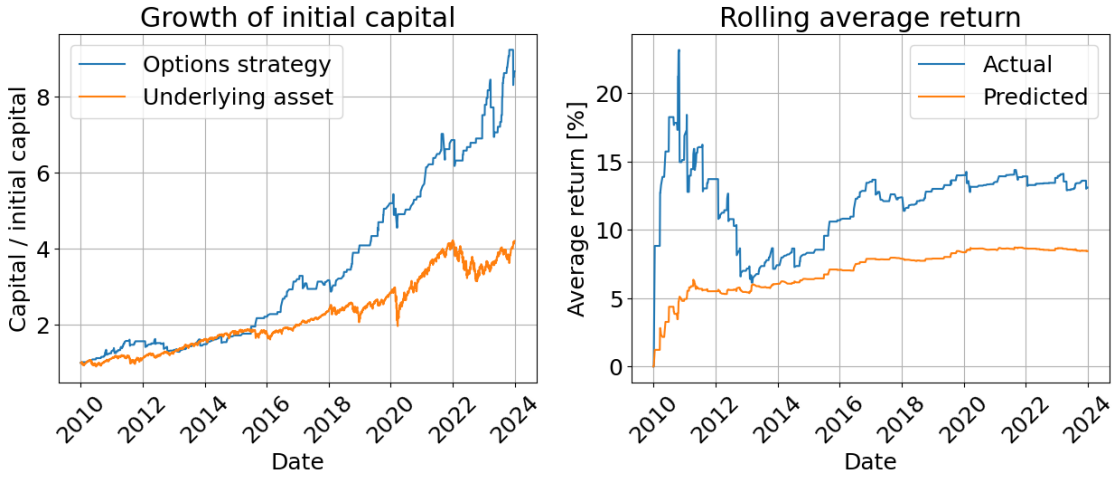



```
Sharpe Ratio of underlying asset: 0.54
Sharpe Ratio of options strategy: 0.3
```

Discussion:

1. The risk-adjusted return of the fixed arbitrary options trading strategy is lower than that of 'buy-and-hold' of the underlying asset.
2. Towards the end of the test period, the expected and actual returns converge. This is to be expected, as the predicted return is probabilistic in nature, and is only meaningful after a large number of trades.

3.3 Step 3: Backtest with optimization

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Sharpe Ratio of underlying asset: 0.54
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Sharpe Ratio of options strategy: 0.78
```

Discussion:

1. The risk-adjusted return of the optimizing options trading strategy is higher than that of 'buy-and-hold' of the underlying asset.
2. Towards the end of the test period, the expected and actual returns have a constant difference. This error could be because the volatility prediction used becomes less accurate with longer trade lengths (number of days to expiration).

4 Concluding remarks

4.1 Conclusion

A trading strategy has been developed that in the backtest has a higher-risk adjusted return than 'buy-and-hold' of the underlying asset. However, the excess return is marginal. Also, many years are required before the prediction of expected returns becomes meaningful. Certain improvements could be made to have a better-performing options trading strategy.

4.2 Recommendations

Such a trading strategy, where trades are performed back-to-back, should not be employed. Instead, more frequent trading should be performed, with a significant number of trades performed simultaneously, in order to have greater trust in the expected return prediction.

4.3 Future work

The following areas can be improved:

1. A volatility prediction model suitable for longer timeframes should be used.
2. Research should be done into optimization of exit parameters, such as profit-taking and stop-loss. This could make a significant difference to the strategy's performance if options are priced assuming they are held to expiration (such as Black-Scholes being based on European options).
3. Backtests should be performed on other equity ETF's as well (out-of-sample tests).