

Naked Call Strategy

- The strategy shows promise with active risk management. Cumulative returns indicate very large fat tails, with the majority of my losses coming from one stock: TESLA.
- I learned of this strategy at JP Morgan. There is an ETF called JEP1 ran by two PMs named Hamilton Reiner and Raffaele Zingone. They generate a really nice dividend yield writing call options on low volatility stocks. In hindsight, I probably should have never included TESLA in the backtest.

Strategy

- In this strategy, I simply write calls against the spy 500 etf and 4 tech stocks: Amazon, Apple, Tesla, and Microsoft. Initially, we start with \$10,000,000 in capital and sell \$200,000 notional equally weighted across the 5 assets.

Data

- All 'spot prices' are adjusted prices and are pulled from Quandl and the one-month treasury yield was pulled from the Federal Reserve's website.
- All call options are priced using Black-Scholes and their time to maturity is always less than or equal to $t = \frac{1}{12}$. I used historical 30-day implied volatilities for at-the-money options from Interactive Brokers to price these options. Pricing out-of-the-money options, I conservatively estimated the implied volatility for that specific strike through linear interpolation.

Example:

On September 9, 2018, the adjusted price of the S&P 500 ETF was \$264.13. The VIX index on that date indicated the 30-day at-the-money volatility was $\sigma_0 = 13.16\%$. Dividing by the square root of 12, we calculate volatility of stock price in one month, in this case we get 3.92%.

- Next I want to calculate the strike price such that the probability the call option finishes in the money is 2.5%. This corresponds to a 1.96 sigma move in the particular month. In this example, this equates to a return 7.69%.

The strike price equals:

$$K = 264.13 * (1.0769) = \$284.50.$$

- The biggest assumption made was the volatility skew. I made a conservative estimate of pricing the volitites for out-of-the-money calls using this the contract's moneyness, time to maturity, and at-the-money volatility.

The option contract's **moneyness** is defined as $\frac{K}{S_0}$, which in this example is $\frac{284.5}{264.13} = 1.07712$.

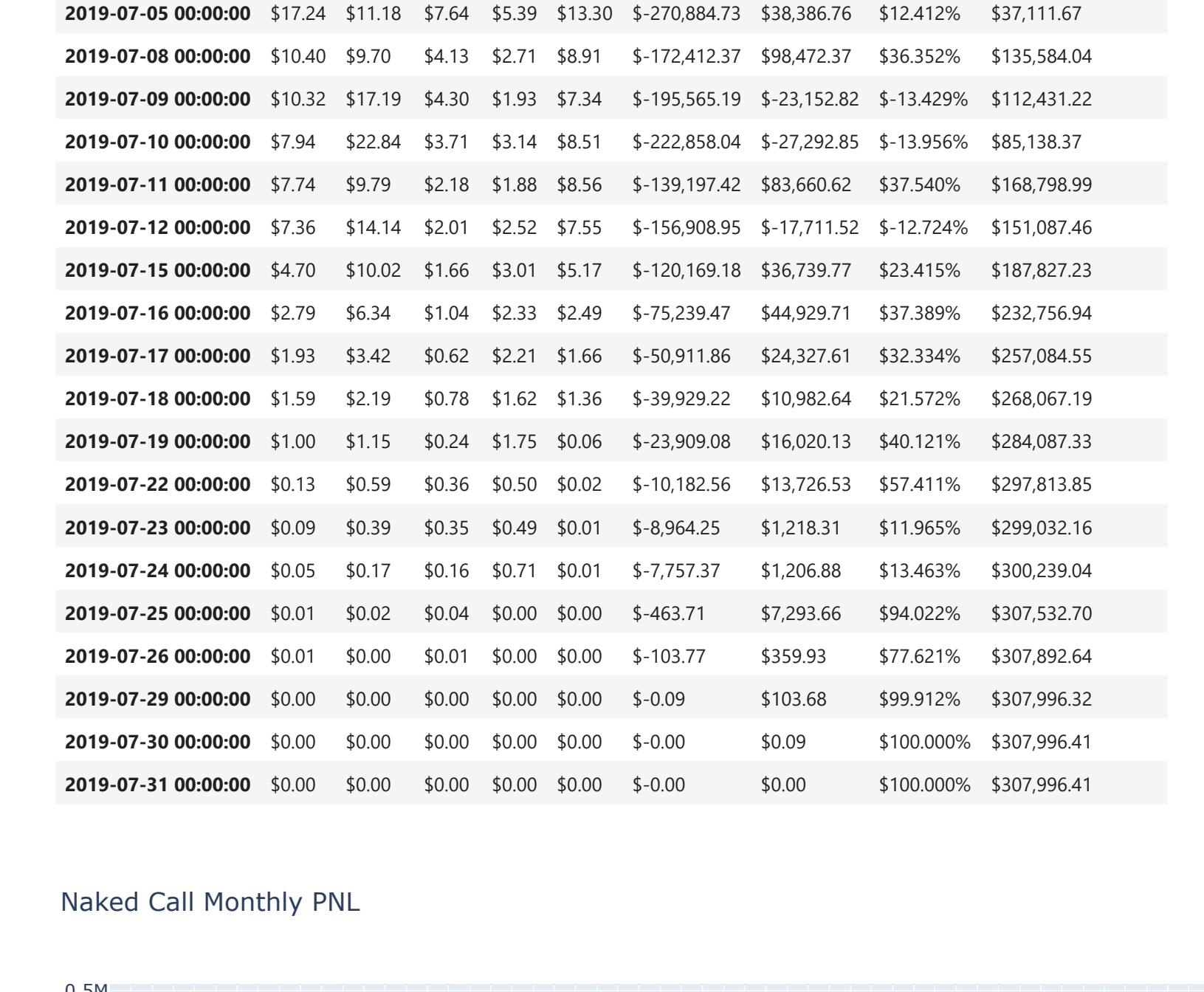
$$\begin{aligned}\sigma(M, T) &= \sigma_0 + \alpha t + \beta(M - 1)^2 \\ \sigma(M, T) &= 0.136 + 0.1 \cdot \frac{1}{12} + 0.1 \cdot (1.07712 - 1)^2 = 0.1449 = 14.49\%\end{aligned}$$

- At this particular time period, the one-month treasury yield was 2%, so now we can reasonably price this option using black-scholes:

	Price	Delta	Gamma	Vega	Theta
CALL(K = 284.5)	0.191679	0.0431429	0.00829266	6.98581	-0.0172535

- At the beginning of each month I write 2.00% worth of the total equity in my portfolio in call options using the example described above. I mark-to- market this portfolio until expiration at the end of the each month and hopefully they all expire worthless.

Total Equity



- Plot of the total equity in the portfolio. Initially, we started at \$10,000,000 which grew to \$14,500,000 in nearly 9 years. The strategy is subject to major fat tails that could wipe out a years' worth of returns in a day.
- Active risk management and bottom-up research on the particular equities can definitely boost returns. For example, in January 2020 TESLA's share price skyrocketed by 51%. I sold 6671 call options on TESLA with a strike price of \$37.2 when its current price was \$28.684. Each call option's price was \$0.0957 or \$9.57 notionally. There were a few factors driving its price higher: (1) TESLA's announcement to enter China, (2) better than expected quarter 4 delivery numbers, and (3) the first stimulus checks were being re-invested into tech popular companies like TESLA.
- At the end of the month the option expired \$6.12 in the money. In total, I lost \$4,084,033 on one single trade.
- A similar situation occurred October 25, 2021 when Tesla announced that Hertz agreed to buy 100,000 electric vehicles driving the share price 12% higher in one day. The call option finished \$38.000 in the money suffering a \$2.6M loss.

TESLA TRADE

- Below shows the tesla 'profit' schedule of my \$4,084,033 loss. All option prices are scaled by 100.

	SPY	AMZN	AAPL	TSLA	MSFT	MV	PNL	RET	CUMULATIVE_PNL
2020-01-02 00:00:00	\$17.14	\$12.12	\$10.77	\$9.57	\$15.12	\$-319,339.33	\$0.00	\$0.000%	\$0.00
2020-01-03 00:00:00	\$17.39	\$7.54	\$6.97	\$13.29	\$9.01	\$-272,577.01	\$46,762.32	\$14.643%	\$46,762.32
2020-01-06 00:00:00	\$14.47	\$9.20	\$5.75	\$16.08	\$7.68	\$-276,183.49	\$-3,606.47	\$-1.323%	\$43,155.84
2020-01-07 00:00:00	\$10.11	\$8.75	\$3.85	\$31.60	\$4.09	\$-334,643.11	\$-58,459.62	\$-21.167%	\$-15,303.78
2020-01-08 00:00:00	\$11.07	\$4.88	\$5.25	\$71.57	\$6.43	\$-602,806.25	\$-268,163.14	\$-80.134%	\$-283,466.92
2020-01-09 00:00:00	\$10.73	\$4.78	\$12.29	\$37.00	\$8.92	\$-422,519.41	\$180,286.84	\$29.908%	\$-103,180.08
2020-01-10 00:00:00	\$7.23	\$2.66	\$14.01	\$43.74	\$7.58	\$-447,890.36	\$-25,370.95	\$-6.005%	\$-128,551.03
2020-01-13 00:00:00	\$6.80	\$1.50	\$18.60	\$117.18	\$7.75	\$-958,000.18	\$-510,109.82	\$-113.892%	\$-638,660.85
2020-01-14 00:00:00	\$4.91	\$0.69	\$11.27	\$164.97	\$4.82	\$-1,209,754.47	\$-251,754.29	\$-26.279%	\$-890,415.14
2020-01-15 00:00:00	\$4.99	\$0.44	\$9.09	\$105.66	\$5.05	\$-801,069.19	\$408,685.29	\$33.782%	\$-481,729.86
2020-01-16 00:00:00	\$8.80	\$0.39	\$8.41	\$82.88	\$12.03	\$-688,525.13	\$112,544.06	\$14.049%	\$-369,185.80
2020-01-17 00:00:00	\$8.76	\$0.15	\$7.83	\$64.50	\$14.32	\$-570,677.70	\$117,847.43	\$17.116%	\$-251,338.37
2020-01-18 00:00:00	\$3.11	\$0.08	\$1.80	\$132.20	\$4.81	\$-925,111.69	\$-354,333.99	\$-62.090%	\$-605,672.36
2020-01-19 00:00:00	\$2.14	\$0.03	\$1.52	\$216.28	\$2.29	\$-1,469,782.99	\$-544,771.30	\$-58.893%	\$-1,150,443.66
2020-01-20 00:00:00	\$1.61	\$0.01	\$1.33	\$203.33	\$2.57	\$-1,381,374.29	\$88,408.70	\$6.015%	\$-1,062,034.96
2020-01-21 00:00:00	\$0.58	\$0.00	\$1.42	\$163.43	\$0.83	\$-1,104,464.14	\$276,910.15	\$20.046%	\$-785,124.81
2020-01-22 00:00:00	\$0.01	\$0.00	\$0.01	\$107.88	\$0.01	\$-719,869.23	\$384,594.91	\$34.822%	\$-400,529.90
2020-01-23 00:00:00	\$10.32	\$17.19	\$4.30	\$1.93	\$7.34	\$-195,565.19	\$-23,152.82	\$-13.429%	\$112,431.22
2020-01-24 00:00:00	\$7.94	\$22.84	\$3.71	\$3.14	\$8.51	\$-222,858.04	\$-27,292.85	\$-13.956%	\$85,138.37
2020-01-25 00:00:00	\$7.74	\$9.79	\$2.18	\$1.88	\$8.56	\$-139,197.42	\$83,660.62	\$37.540%	\$168,798.99
2020-01-26 00:00:00	\$7.36	\$14.14	\$2.01	\$2.52	\$7.55	\$-156,908.95	\$-17,711.52	\$-12.724%	\$151,087.46
2020-01-27 00:00:00	\$4.70	\$10.02	\$1.66	\$3.01	\$5.17	\$-120,169.18	\$36,739.77	\$23.415%	\$187,827.23
2020-01-28 00:00:00	\$2.79	\$6.34	\$1.04	\$2.33	\$2.49	\$-75,239.47	\$44,929.71	\$37.389%	\$232,756.94
2020-01-29 00:00:00	\$1.93	\$3.42	\$0.62	\$2.21	\$1.66	\$-50,911.86	\$24,327.61	\$32.334%	\$257,084.55
2020-01-30 00:00:00	\$0.05	\$0.17	\$0.16	\$0.71	\$0.01	\$-7,757.37	\$1,206.88	\$13.463%	\$300,239.04
2020-01-31 00:00:00	\$0.01	\$0.02	\$0.04	\$0.00	\$0.00	\$-4,084,033.15	\$-433,023.84	\$-11.860%	\$-3,764,693.82

- Below is what a typical month would look like. In this example I sold \$307,000 of options - all of which expired worthless - where I realized a gain of \$307,000 at the end of the month. All option prices are scaled by 100.

	SPY	AMZN	AAPL	TSLA	MSFT	MV	PNL	RET	CUMULATIVE_PNL
2019-07-01 00:00:00	\$19.81	\$13.40	\$6.81	\$8.24	\$14.51	\$-307,996.41	\$0.00	\$0.000%	\$0.00
2019-07-02 00:00:00	\$13.50	\$12.98	\$7.73	\$6.52	\$13.90	\$-279,377.58	\$28,618.83	\$9.292%	\$28,618.83
2019-07-03 00:00:00	\$17.69	\$11.21	\$9.25	\$6.59	\$16.42	\$-309,271.49	\$-29,893.91	\$-10.700%	\$-1,275.08
2019-07-04 00:00:00	\$17.24	\$11.18	\$7.64	\$5.39	\$13.30	\$-270,884.73	\$38,386.76	\$12.412%	\$37,111.67

- Normal Profit Schedule
- Below is what a typical month would look like. In this example I sold \$307,000 of options - all of which expired worthless - where I realized a gain of \$307,000 at the end of the month. All option prices are scaled by 100.

	SPY	AMZN	AAPL	TSLA	MSFT	MV	PNL	RET	CUMULATIVE_PNL
2019-07-01 00:00:00	\$19.81	\$13.40	\$6.81	\$8.24	\$14.51	\$-307,996.41	\$0.00	\$0.000%	\$0.00
2019-07-02 00:00:00	\$13.50</								

Monthly Strategy Return Statistics

- starting date: '2015-02'
- end date: '2023-11-30'
- Returns are *annualized*

	Mean	Vol	Sharpe	Min	Max
RET	6.85%	18.12%	0.378	-25.154%	3.661%

Tail Metrics

	Skewness	Kurtosis	VaR (0.05)	CVaR (0.05)	Max Drawdown	Peak	Bottom	Recover	Duration (to Recover)
RET	-3.879671	14.610340	-9.80%	-19.60%	-42.02%	2019-11-30 00:00:00	2021-10-31 00:00:00	None	None