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 JEPI 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 Micrsoft. 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 volitlites for out-of-the money calls using this the contract's moneyness, time to maturity, and at-the-money volatility.

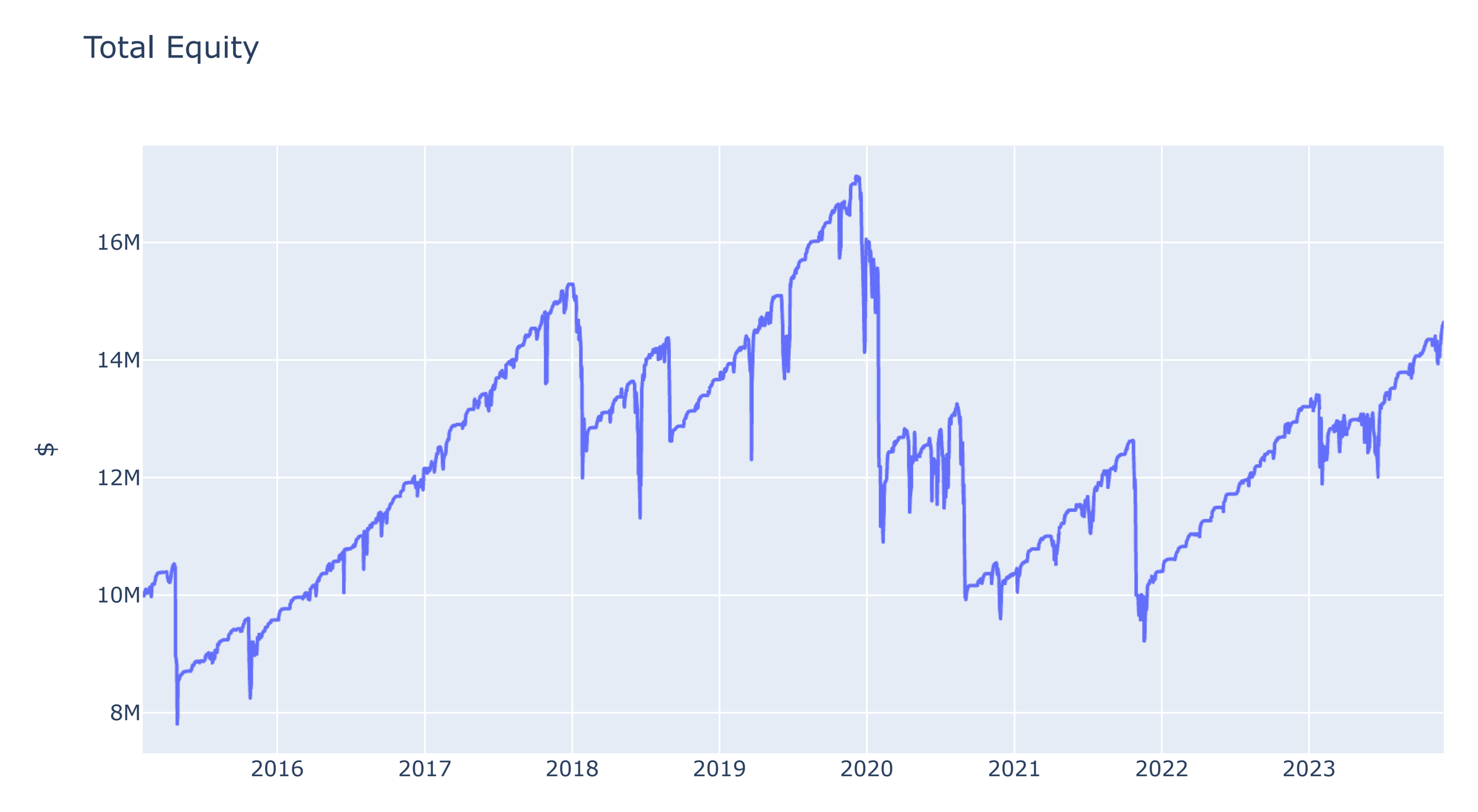
The option contract's **moneyness** is defined as $\frac{K}{S_0}$, which in this example is $\frac{284.5}{263.13} = 1.07712$.

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

- 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.



- 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 sky rocketed 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 prices 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 Telsa 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

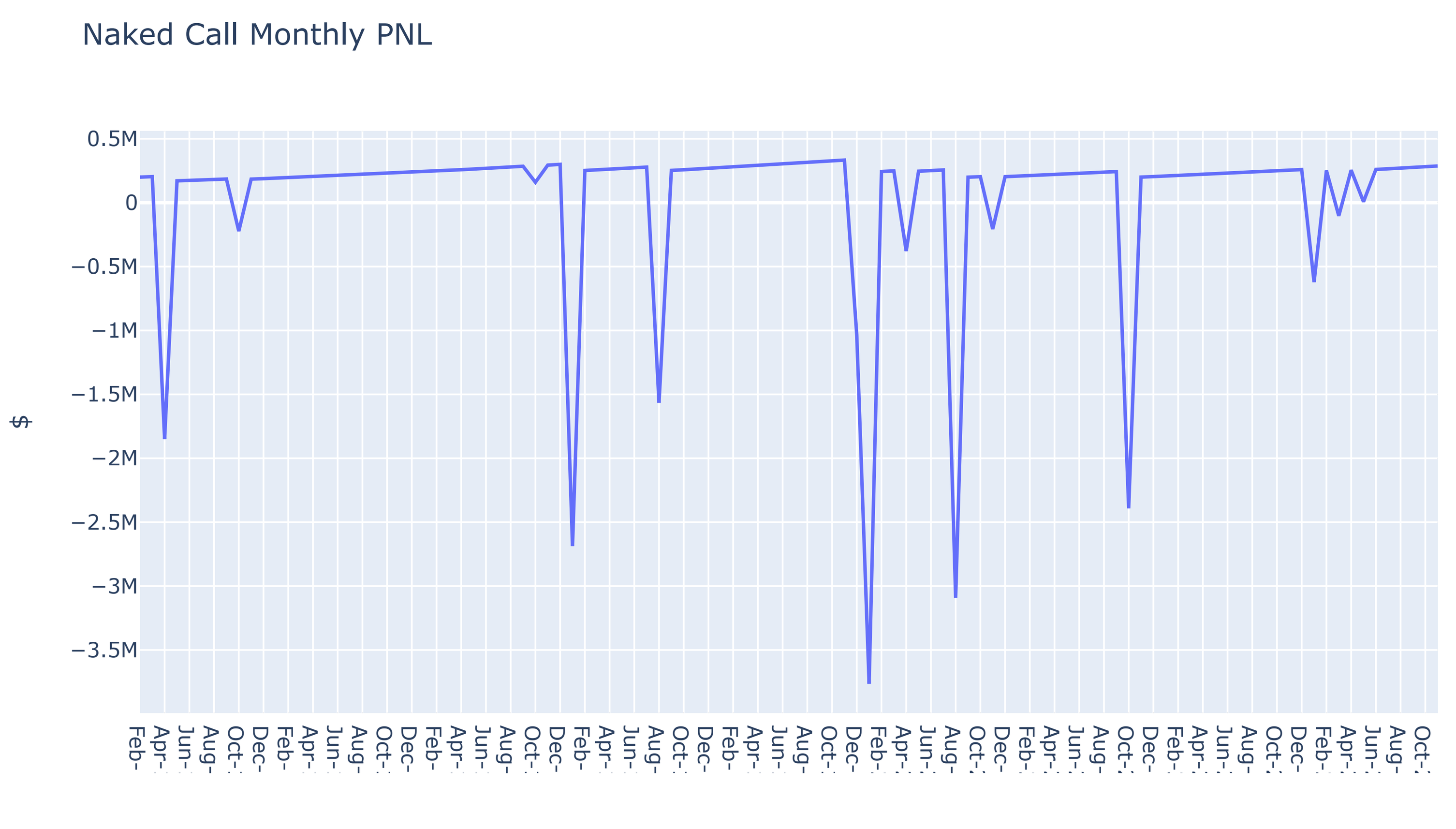
- Below shows the tesla 'profit' schedule of my $\$4,084,033$ loss. All option prices are scaled by 100.

	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
2020-01-21 00:00:00	$3.11	$0.08	$1.80	$132.20	$4.81	$-925,011.69	$-354,333.99	$-62.090%	$-605,672.36
2020-01-22 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
2020-01-23 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
2020-01-24 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
2020-01-27 00:00:00	$0.01	$0.00	$0.01	$107.88	$0.01	$-719,869.23	$384,594.91	$34.822%	$-400,529.90
2020-01-28 00:00:00	$0.00	$0.00	$0.01	$122.70	$0.01	$-818,770.23	$-98,901.00	$-13.739%	$-499,430.90
2020-01-29 00:00:00	$0.00	$0.00	$0.00	$173.28	$0.00	$-1,156,100.79	$-337,330.55	$-41.200%	$-836,761.45
2020-01-30 00:00:00	$0.00	$0.00	$0.00	$547.23	$0.00	$-3,651,009.31	$-2,494,908.53	$-215.804%	$-3,331,669.98
2020-01-31 00:00:00	$0.00	$0.00	$0.00	$612.13	$0.00	$-4,084,033.15	$-433,023.84	$-11.860%	$-3,764,693.82

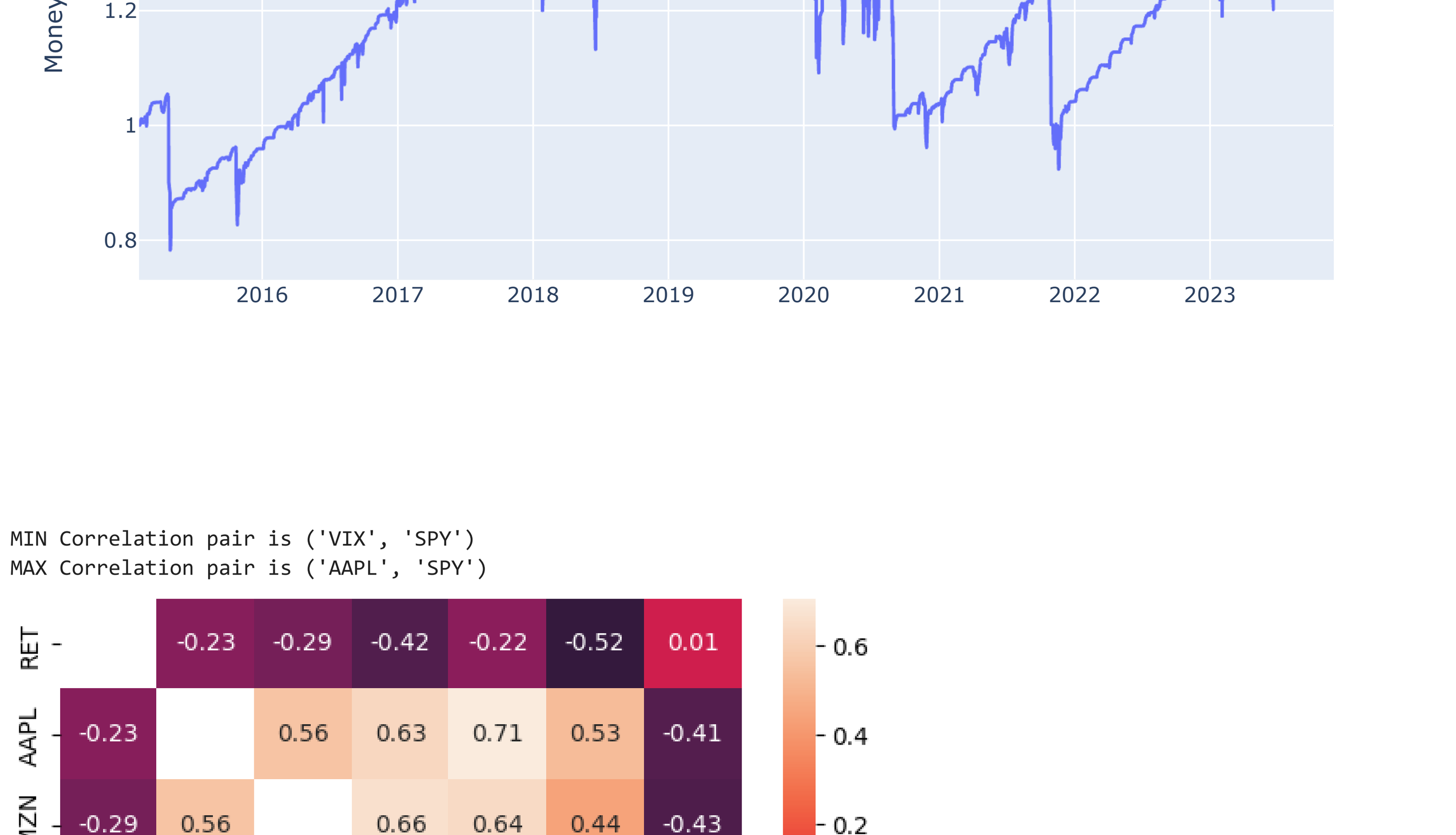
Normal Profit Schedule

- 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	$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
2019-07-05 00:00:00	$17.24	$11.18	$7.64	$5.39	$13.30	$-270,884.73	$38,386.76	$12.412%	$37,111.67
2019-07-08 00:00:00	$10.40	$9.70	$4.13	$2.71	$8.91	$-172,412.37	$98,472.37	$36.352%	$135,584.04
2019-07-09 00:00:00	$10.32	$17.19	$4.30	$1.93	$7.34	$-195,565.19	$-23,152.82	$-13.429%	$112,431.22
2019-07-10 00:00:00	$7.94	$22.84	$3.71	$3.14	$8.51	$-222,858.04	$-27,292.85	$-13.956%	$85,138.37
2019-07-11 00:00:00	$7.74	$9.79	$2.18	$1.88	$8.56	$-139,197.42	$83,660.62	$37.540%	$168,798.99
2019-07-12 00:00:00	$7.36	$14.14	$2.01	$2.52	$7.55	$-156,908.95	$-17,711.52	$-12.724%	$151,087.46
2019-07-15 00:00:00	$4.70	$10.02	$1.66	$3.01	$5.17	$-120,169.18	$36,739.77	$23.415%	$187,827.23
2019-07-16 00:00:00	$2.79	$6.34	$1.04	$2.33	$2.49	$-75,239.47	$44,929.71	$37.389%	$232,756.94
2019-07-17 00:00:00	$1.93	$3.42	$0.62	$2.21	$1.66	$-50,911.86	$24,327.61	$32.334%	$257,084.55
2019-07-18 00:00:00	$1.59	$2.19	$0.78	$1.62	$1.36	$-39,929.22	$10,982.64	$21.572%	$268,067.19
2019-07-19 00:00:00	$1.00	$1.15	$0.24	$1.75	$0.06	$-23,909.08	$16,020.13	$40.121%	$284,087.33
2019-07-22 00:00:00	$0.13	$0.59	$0.36	$0.50	$0.02	$-10,182.56	$13,726.53	$57.411%	$297,813.85
2019-07-23 00:00:00	$0.09	$0.39	$0.35	$0.49	$0.01	$-8,964.25	$1,218.31	$11.965%	$299,032.16
2019-07-24 00:00:00	$0.05	$0.17	$0.16	$0.71	$0.01	$-7,757.37	$1,206.88	$13.463%	$300,239.04
2019-07-25 00:00:00	$0.01	$0.02	$0.04	$0.00	$0.00	$-463.71	$7,293.66	$94.022%	$307,532.70
2019-07-26 00:00:00	$0.01	$0.00	$0.01	$0.00	$0.00	$-103.77	$359.93	$77.621%	$307,892.64
2019-07-29 00:00:00	$0.00	$0.00	$0.00	$0.00	$0.00	$-0.09	$103.68	$99.912%	$307,996.32
2019-07-30 00:00:00	$0.00	$0.00	$0.00	$0.00	$0.00	$-0.00	$0.09	$100.000%	$307,996.41
2019-07-31 00:00:00	$0.00	$0.00	$0.00	$0.00	$0.00	$-0.00	$0.00	$100.000%	$307,996.41



- PNL month to month is relatively constant, however, there are times when the strategy imploads.

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MIN Correlation pair is ('VIX', 'SPY')
MAX Correlation pair is ('AAPL', 'SPY')
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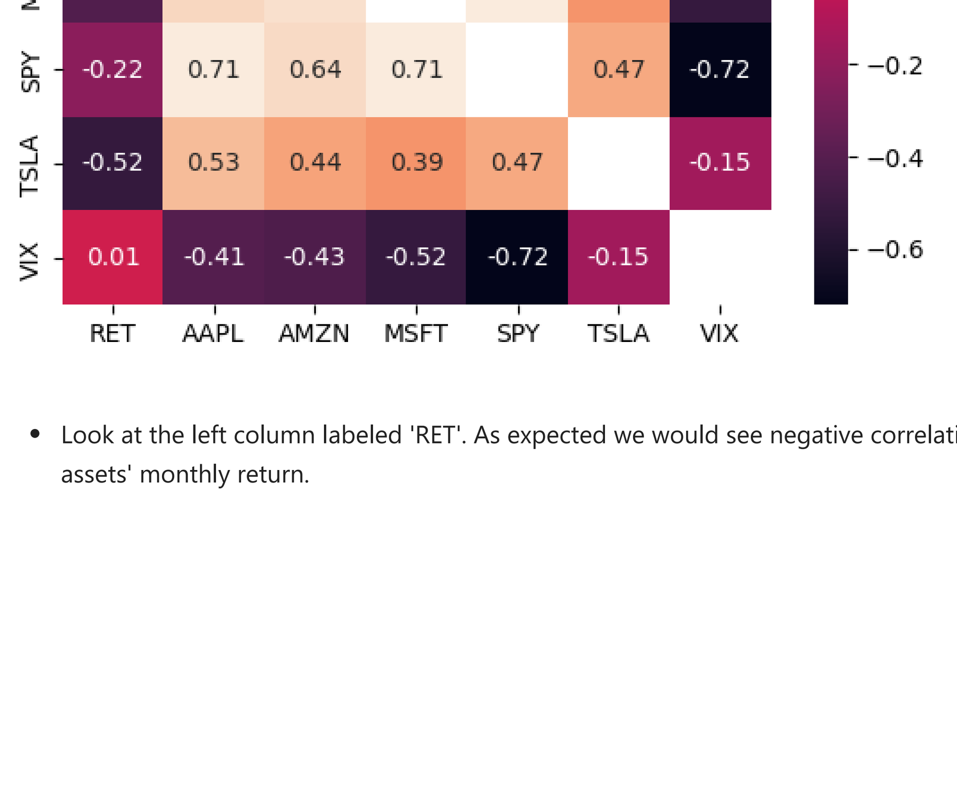

- Look at the left column labeled 'RET'. As expected we would see negative correlations between the strategy's monthly return and assets' monthly return.

Monthly Strategy Return Statistics

- starting date: '2015-02'
- end date: '2023-11-30'

	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