VoEx Spike Trading Algorithm

<u>DISCLAIMER</u>

Deep Dive Stocks is not an investment advisor. The information contained in this primer is intended only for educational purposes to highlight the applicability of VoEx in a variety of hypothetical portfolio styles. No information here is intended to be offered or construed as individual investment advice, targeted investment advice, or any investment advice aimed at any one person or persons, portfolio or portfolios, objective or objectives. It is important to remember that past performance does not beget future performance and there is always risk in investing in the market.

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<u>Summary</u>

Deep Dive Stocks' mission is to provide market data aimed at making trading as transparent, effortless, and profitable as possible. A major component of this goal is reducing the overhead associated with the time-consuming process of being constantly up to date on a highly dynamic market.

In adherence to this principal, the first ever back test for VoEx has been performed in a quantitative and algorithmically driven way. The VoEx Spike Trading Algorithm (VS-Tag) was tested using a comprehensive yet simple and conservative trading algorithm to verify how VoEx can simplify trading without compromising growth.

Forty-eight back tests in total were performed, with each mimicking a particular trading style to assess efficacy and profitability. These diverse trading styles were tested with four distinct start-dates to represent different time-horizons and entry points into the market.

Of the 48 tests performed, 89.59% experienced positive growth with 31.25% experiencing growth that exceeded the S&P 500's growth. In comparing growth, VS-Tag was able to reach above 90% greater-than-market value. In extraction of these values into reality, trends are observed that serve as guidance if choosing which trading style is most preferential while maintaining confidence.

Overall, VS-Tag has demonstrated itself to be a powerful contender in trading algorithms and has a promising future.

<u>Construction</u>

The market scan gives daily information regarding any stocks that have experienced a drastic change in VoEx, and while this information was quantitatively verified post-hoc, the prospective profitability had yet to be established. In an effort to do so, a simple trading algorithm was devised and tested to ensure the post-hoc could translate to pre-hoc.

There were several key components that were required for the algorithm. VS-Tag must:

1) Be relatively straight forward,
2) Have a variable amount of interactive-ness required from the trader,
3) Create growth,
4) Be conservative, and most importantly:
5) Beat the market

The algorithm designed is straightforward:
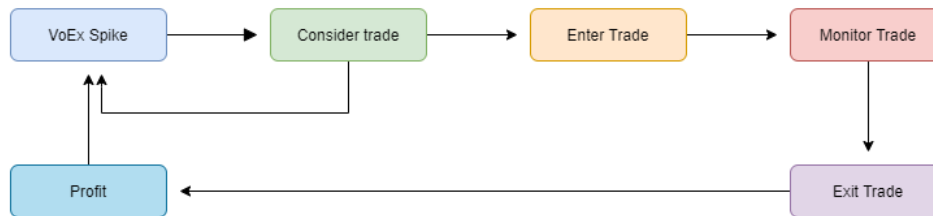
Starting with the daily market scan results, the process starts with:

1) If there is a stock with a VoEx Spike,
2) And can afford to enter into a 100-share position,
3) Determine predicted price-direction,
4) Enter either long or short position

Once the trade was entered depending on style of trading it was intending to mimic, there are two main choices for the algorithm. The algorithm could either:

1) Hold the stock for 5 days, regardless of price movement, then exit.

 Or,

2) Check the movement every day and compare it to the predicted movement. If the actual price-action is counter to the predicted price-action, exit at the earliest moment.

For option 2, when considering an exit, the earliest moment means the opening price of the next trading day.

For some traders, there may be an associated risk tolerance when considering exiting a trade. Thus, option 2 is further expanded:

2.1)   If the actual price movement and the predicted price movement are not in-line, AND the percent difference is less than the risk tolerance, do nothing.

Or,

2.2)   If the actual price movement and the predicted price movement are not in-line, AND the percent difference is greater than the risk tolerance, close with market open.

The risk thresholds tested were 0%, 5%, and 10%. The 0% threshold indicated that the trade would be checked every day, including the day the trade was entered, with no threshold for deviation.

Lastly, Deep Dive Stocks wanted to investigate if choosing one prediction over another would have benefit. This would determine the breadth of trading opportunities available to prospective traders.

To best replicate the dynamic nature of entering and exiting positions, Deep Dive Stocks utilized the following prices to be replicate trading behavior:

Reason or Action	Price Utilized
Entering a trade	Market Open day after VoEx Spike
Exit a trade because of holding-period	Closing rice on the 5th day
Exit a trade because of risk threshold	Opening price day after determination
Comparing price-action with predicted price-action	Closing price on current day versus the closing price on the day of the VoEx Spike
Determining PnL	Entering price versus the Closing Price

All trades were entered on the opening price following the day of their appearance on the market scan, if applicable. The positions that were closed because of their holding period were closed at the closing price on the specified day. Trades that were closed because they breeched the risk-threshold were closed on the opening price following the day of determination. When determining the actual profits or losses, the price the trade was entered at was compared to the price the trade was closed at.

Additionally, no trades were entered 5 days prior to the last date in the data. This was to ensure that all trades could be closed. Since the back test had an established end-date of 2021-11-05, this means the last trade was entered on 2021-10-29.

Each back test combination had a starting balance of $10,000.

<u>Assumptions</u>

The back-test has several implicit assumptions built in, the first three are:

1) The Full-balance assumption: the full value of the balance is always available for trading, and

2) The Equality Assumption: all potential trades are considered equal, the only importance is how they appear on the market list, and
3) The Equal Quantity Assumption: same quantity of shares were utilized for every trade, regardless of direction.

This means that the trades are entered as a first-come-first-can-afford basis as they appear on the market scan. The subsequent growth was re-invested back into the available balance for future trading.

Additionally, all trades were entered with 100 shares. This was chosen to mimic the purchasing of either a call (for long position) or put (for short position) as close as possible where the profits or losses were determined based solely on the retrospective understanding that if the prediction was negative, the entered position was short, and if the prediction was positive, the position entered was long.

Other assumptions within the algorithm are those that are related to determining if a given stock can be traded. For a position to be considered, it must meet the following criteria:

1) Date Condition: all dates (from spike day to Spike date + 5) must be present in the stock's data (i.e.: all of those dates had to be trading dates), and
2) Single-Use Condition: a particular stock does not have a trade already on the books.

The date condition was enacted in to ensure that if a stock required exiting, the data would be there to allow that to occur. Although rare, stocks do occasionally stop trading, and this is an inherent risk to any position.

The single-use condition is to prevent "double dipping" of trade securities. Occasionally a stock may experience volatile VoEx movements whereby it is present on two sequential days with opposite predictions: these decisions are best saved for after a full review and analysis of that particular stock's report. The single-use condition ensures that initial trade already on the books was kept until the normal exiting signals were given.

<u>Limitations</u>

There are several limitations that must be kept in mind when working through the results.

The first is that there is no consideration given the difference in closing price and opening price of any security if any action is based on the prior for the latter. That is, for instance, if a stock is determined to have exceeded the risk threshold because of Day 3's closing price, yet Day 4's opening price is within tolerance, the position is still closed; all previous decisions are final.

The second limitation is that no consideration is given to the dynamic nature of options pricing. Thus, this trading algorithm could not mimic options-based plays due to how their values may change based off additional and sundry forces. It may be that a share-trade profitable but an option-based play with similar intent and design may not be. If utilizing options to mimic this trading pattern, it will be important to understand which options most accurately mimic a share-only trade or have sufficient understanding of option's pricing, and to adjust one's position appropriately.

The third limitation: because of the equality assumption (first-in-first-can-afford) there is no selective force present when choosing a trade other than the ability to afford the trade. This may have significant downstream effects on growth whereby there is in inherent selection pressure towards low-cap stocks that may have differing performance profiles than larger-cap stocks that is hitherto uninvestigated with regards to VoEx.

Lastly, there is no "profit-taking" aspect to this trading algorithm. There are only two times that a position is closed: on the opening price if the stock has exceeded the risk threshold, or on the closing price if the position is on its 5th day. There currently have been no tests performed to determine the viability of any profit-taking strategies.

<u>Benefits</u>

Although it may seem that the limits and assumptions may severely alter VS-Tag's real-world viability, the limitations and assumptions were baked into serve a vital function: conservatism.

Most back tests are designed to optimize profits – by tweaking the conditions just right on the particular data sets used so that the outcome looks marvelous. Deep Dive Stock wants the opposite: no-profit taking; no exiting a trade due to external factors; no deciding to enter or exit a trade based on the pre-market or post-market price

conditions or news; not selectively choosing start-dates that best match highest growth. Instead, Deep Dive Stocks wanted to deliver a algorithmic bot that would only perform the trades in the strictest of senses.

Even without these strict requirements in place, the results are quite promising.

Let's have a look!

In total, 48 back tests were performed as outlined below (one category from each column per back test):

Prediction Cohort	Risk Tolerance	Start Date
None	Not Applicable (Held for full 5 days)	2020-19-01
Positive Predictions Only	0%	2020-01-01
Negative Predictions Only	5%	2021-01-01
	10%	2021-04-01

One pick from each category for each back test

Of the 48 back tests, the crude numbers are presented below.

Type of Growth	Amount	Total	Percentage
Positive Growth	43	48	89.58
Negative Growth	5	48	10.42
Beat the Market	15	48	31.25

Additionally, it was worth looking at if the time of starting the trade was a determining factor in what kind of gains the algorithm would produce:

Date of Start	Positive Growth (%)	Negative Growth (%)	Beat the Market (%)
2019-01-01	12 (100)	0 (0)	0 (0)
2020-01-01	10 (83.33)	2 (16.67)	5 (41.67)
2021-01-01	11 (91.67)	1 (8.33)	7 (58.3)
2021-04-01	10 (83.33)	2 (16.67)	3 (33)

In looking at those that produced negative growth:

Date of Start	Prediction Cohort	Risk Tolerance (%)	Percent Growth (Loss)	$SPY Return
2020-01-01	+	0	(12.20)	46.06
2020-01-01	-	NA	(1.70)	46.04
2021-01-01	+	0	(2.65)	23.53
2021-04-01	NA	5	(18.90)	16.08
2021-04-01	+	0	(2.60)	16.08

By consigning oneself to only trade with positive predictions throughout, there is a trend of accruing less growth. This may have to do with the unequal distribution of predictions between positive and negative.

Although not shown in complete (too many!), the summary statistics for those that produced positive gains are presented:

Date Start	Mean Growth (%)	Median Growth (%)	Max	Least Growth (%)	$SPY Growth (%)	%Change from $SPY using Mean
2019-01-01	41.53	43.37	64.50	8.71	92.38	(75.94)
2020-01-01	34.06	23.15	65.78	0.03	46.04	(15.39)
2021-01-01	35.27	32.60	62.14	2.18	23.53	39.90
2021-04-01	13.22	8.72	28.04	3.75	16.08	(19.54)

The trading styles that beat the market:

Date Start	Prediction Cohort	Risk Tolerance (%)	% Growth (Loss)	$SPY Growth (%)	% Increase from $SPY
2020-01-01	NA	NA	55.89	46.04	19.32
2020-01-01	NA	0	53.64	46.04	15.24
2020-01-01	NA	5	64.52	46.04	33.43
2020-01-01	NA	10	65.78	46.04	35.31
2020-01-01	-	0	53.63	46.04	15.23
2021-01-01	NA	NA	61.22	23.53	88.94
2021-01-01	NA	0	32.60	23.53	32.32
2021-01-01	NA	5	62.14	23.53	90.14
2021-01-01	NA	10	53.06	23.53	77.11
2021-01-01	+	10	26.39	23.53	11.46
2021-01-01	-	0	60.06	23.53	87.40
2021-01-01	-	5	44.49	23.53	61.63
2021-04-01	NA	NA	27.86	16.08	53.62
2021-04-01	NA	10	24.67	16.08	42.16
2021-04-01	-	0	28.04	16.08	54.22

The no-prediction-preference cohort dominates the screen with an astounding 11 out of 17 (64.07%) of the back tests having beaten the market. Although there are almost equal 5% to 10% risk tolerance in the group (3 versus 4, respectively), the gains were not equal, with the 5% risk cohort demonstrating an average of 57.05% and the 10% risk cohort an average growth of 42.48%.

The summary statistics:

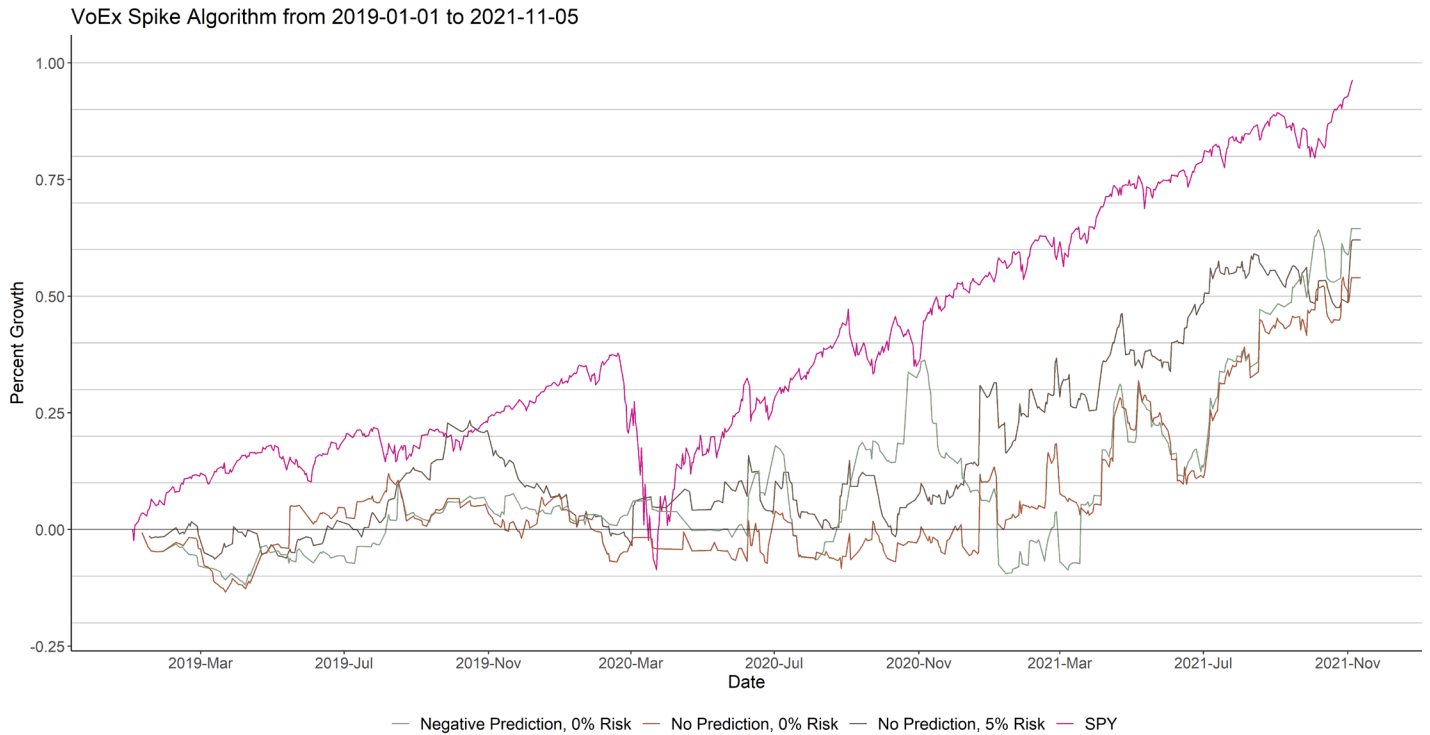| Mean Growth (%)	Median Growth (%)	Max | Least Growth (%)	Average % Dif. from $SPY	Median % Dif. from $SPY
47.60	53.63	65.78 | 24.67	31.10	42.63

Let's turn towards the growth graphs. Each graph shows the running profits from the respective trading strategy as indicated by the color. The starting balance for all strategies was $10,000.

A quick note about the legends for the graphs: 0% Risk and No Risk are not the same: "No Risk" means the position was held for 5-days and not checked daily for movement against the predicted price-action. 0% Risk means the position was checked every day for risk with a 0% risk threshold.

In addition to the graphs, the following statistics are provided:

Statistic	Purpose
Gross Profits	The gross profits show the total amount of money that was received for all of the transactions over the whole trading period. It does not include any losses taken out of it.
Gross Loss	The gross loss metric shows the total amount of money that was lost in the trade or trading period. It does not include any profits.
Net Profits	The net profits are the gross profits with the losses removed. A positive net profits indicates that the trade made more money than lost.
Profit Factor	The profit factor shows what the gross amount of money that was received per dollar spent.
Percent Profitable	The percent profitable metric indicates the percentage of trades that ended with a net profit.
Net Profit Factor	The net profit factor is the net profits per trade. Any positive net profit factor indicates that on average, the trade(s) profited the amount indicated per trade.

Starting Date: 2019-01-01

VoEx Spike Algorithm from 2019-01-01 to 2021-11-05

Negative Prediction, 0% Risk — No Prediction, 0% Risk — No Prediction, 5% Risk — SPY

Metrics: Negative Prediction Preference, 0% Risk	Value or Amount ($)
Gross Profits	33, 907
Gross Losses	(27,457)
Net Profits	6,425
Profit Factor	1.23
Percent Profitable	42.38
Net Profit Factor	11.43

Metrics: No Prediction Preference, 5% Risk	Value or Amount ($)
Gross Profits	37,080
Gross Losses	(30,874)
Net Profits	6,206
Profit Factor	1.20
Percent Profitable	47.74
Net Profit Factor	9.68

Metrics: No Prediction Preference, 0% Risk	Value or Amount ($)
Gross Profits	38,762
Gross Losses	(33,367)
Net Profits	5,395
Profit Factor	1.16
Percent Profitable	38.87
Net Profit Factor	7.06

Looking at how these gainers compare to the market:

Trading	Growth (%)	% Dif. from $SPY (-)
$SPY	92.38	-
Negative Prediction Preference, 0% Risk	64.50	(35.54)
No Prediction Preference, 5% Risk	62.06	(39.26)
No Prediction Preference, 0% Risk	53.95	(52.52)

And then, for all the trading styles shown in the graph, the averages are:

Metrics: All for 2019-01-01 (Shown)	Value or Amount ($)
Gross Profits	36,583
Gross Losses	(30,566)
Net Profits	6,017
Profit Factor	1.20
Percent Profitable	43.00
Net Profit Factor	9.39

VoEx Spike Algorithm from 2020-01-01 to 2021-11-05

— No Prediction, 10% Risk   — No Prediction, 5% Risk   — SPY
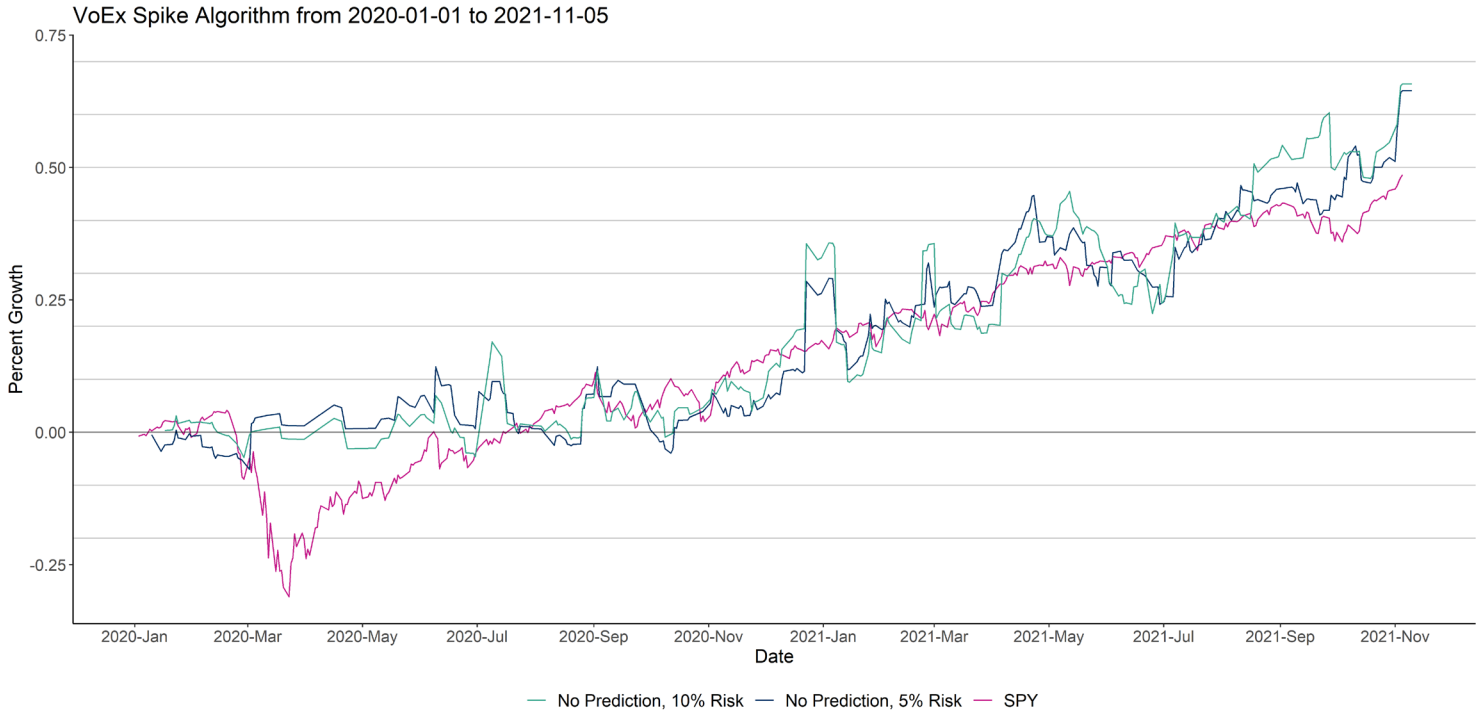
The growth of the no-prediction-preference with 10% risk tolerance and no-prediction-preference with 5% risk tolerance were the highest gainers in this time-group. The growth seems to be relatively stable with SPY except for 1) during the crash of 2020, during which the trading algorithm saw no decrease in price, and 2) in recent times where the algorithm has been able to pick up profits more than SPY.

Metrics: No Prediction Preference, 5% Risk	Value or Amount ($)
Gross Profits	30,181
Gross Losses	(23,729)
Net Profits	6,452
Profit Factor	1.27
Percent Profitable	48.63
Net Profit Factor	13.58

Metrics: No Prediction Preference, 10% Risk	Value or Amount ($)
Gross Profits	32,235
Gross Losses	(25,657)
Net Profits	6,578
Profit Factor	1.26
Percent Profitable	49.45
Net Profit Factor	14.58

In comparing these growths to the market:

| Trading	Growth (%)	% Dif. from $SPY (-)
$SPY	46.06	-
No Prediction Preference, 10% Risk	65.78	35.31
No Prediction Preference, 5% Risk	64.52	33.43

And then looking at the averages for all of those shown:

Metrics: All for 2020-01-01 (Shown)	Value or Amount ($)
Gross Profits	31,208
Gross Loss	(24,693)
Net Profits	6,017
Profit Factor	1.23
Percent Profitable	49.04
Net Profit Factor	14.09

Starting Date: 2021-01-01

VoEx Spike Algorithm from 2021-01-01 to 2021-11-05
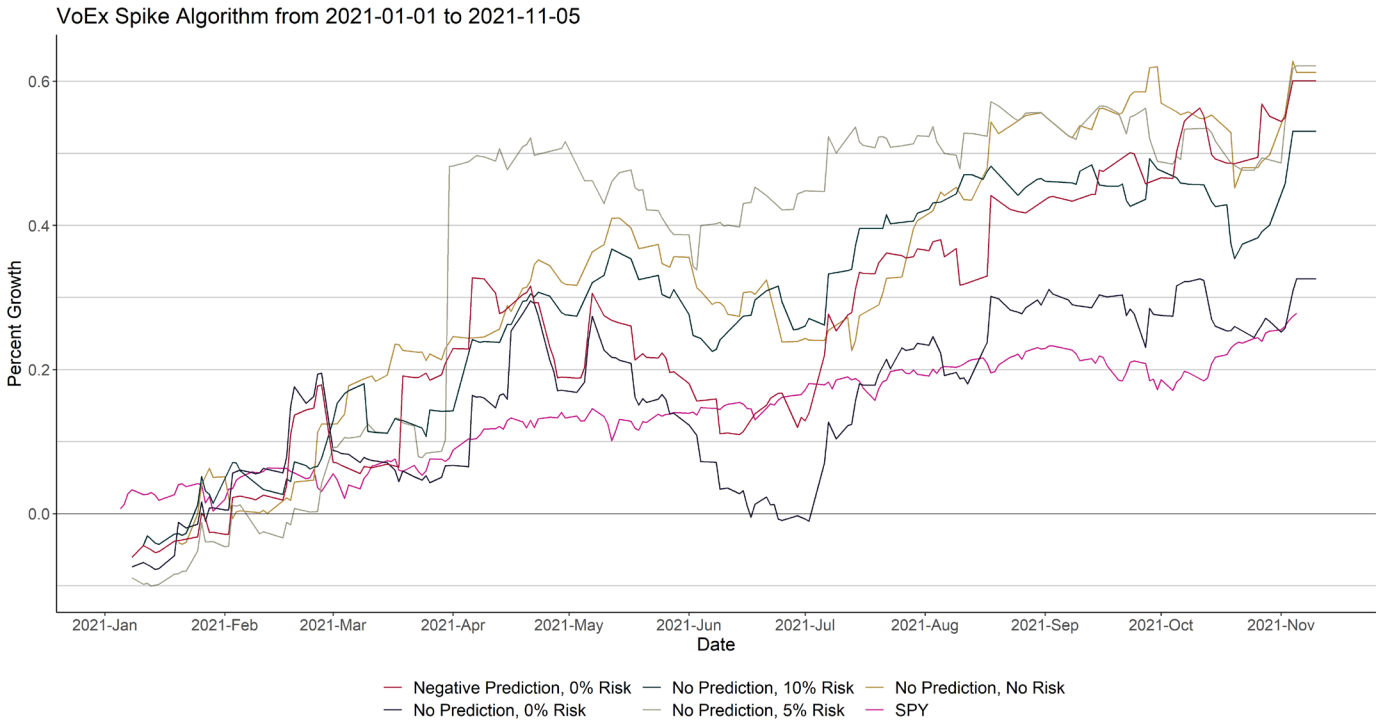
Metrics: No Prediction Preference, 5% Risk	Value or Amount ($)
Gross Profits	18,759
Gross Losses	(12,581)
Net Profits	6,214
Profit Factor	1.49
Percent Profitable	48.46
Net Profit Factor	23.90

Metrics: No Prediction Preference, No Risk Consideration	Value or Amount ($)
Gross Profits	16,895
Gross Losses	(10,773)
Net Profits	6,122
Profit Factor	1.57
Percent Profitable	55.51
Net Profit Factor	24.99

Metrics: Negative Prediction Preference, 0% Risk	Value or Amount ($)
Gross Profits	17,498
Gross Losses	(11,492)
Net Profits	6,006
Profit Factor	1.52
Percent Profitable	46.64
Net Profit Factor	23.74

Comparing the performance of these trading styles with the market:

Trading	Growth (%)	% Dif. from $SPY (-)
$SPY	23.53	-
No Prediction Preference, 5% Risk Tolerance	62.14	90.14
No Prediction Preference, No Risk Considerations	61.22	88.94
Negative Prediction Preference, 5% Risk Tolerance	60.06	87.40

And then looking at the averages for all of those shown:

Metrics: All for 2021-01-01 (Shown)	Value or Amount ($)
Gross Profits	17,717
Q	(11,615)
Net Profits	6,114
Profit Factor	1.53
Percent Profitable	48.46
Net Profit Factor	24.21

Starting Date: 2021-04-01

VoEx Spike Algorithm from 2021-04-01 to 2021-11-05
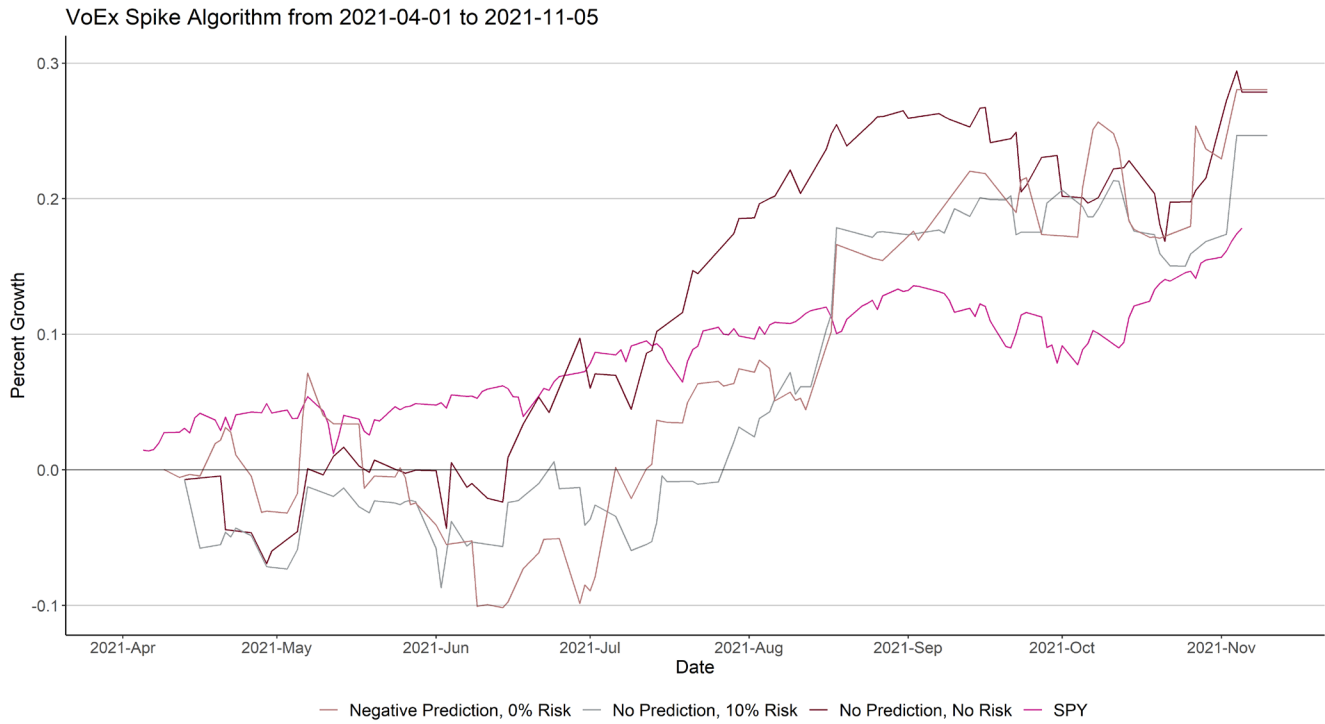
Metrics: Negative Prediction Preference, 0% Risk Tolerance	Value or Amount ($)
Gross Profits	9,472
Gross Losses	(6,668)
Net Profits	2,804
Profit Factor	1.42
Percent Profitable	41.67
Net Profit Factor	17.97

Metrics: No Prediction Preference, No Risk Consideration	Value or Amount ($)
Gross Profits	8,463
Gross Losses	(5,677)
Net Profits	2,786
Profit Factor	1.49
Percent Profitable	57.67
Net Profit Factor	20.34

Metrics: No Prediction Preference, 10% Tolerance	Value or Amount ($)
Gross Profits	8,409
Gross Losses	(5,492)
Net Profits	2,467
Profit Factor	1.42
Percent Profitable	52.23
Net Profit Factor	17.75

In comparing these trading styles to the market:

Trading	Growth (%)	% Dif. from $SPY (-)
$SPY	16.08	-
Negative Prediction Preference, 0% Risk Tolerance	28.04	54.22
No Prediction Preference, No Risk Consideration	27.86	53.62
No Prediction Preference, 10% Risk Tolerance	24.67	41.16

And then looking at the averages for all of those shown:

Metrics: All for 2021-04-01 (Shown)	Value or Amount ($)
Gross Profits	8,781
Gross Losses	(5,495)
Net Profits	2,585
Profit Factor	1.44
Percent Profitable	50.86
Net Profit Factor	18.69

Finally, the averages for all trading styles shown from all dates:

Metrics: All	Value or Amount ($)
Profit Factor	1.37
Percent Profitable	48.20
Net Profit Factor	16.82

<u>Discussion</u>

Testing the VoEx Spike Trading Algorithm (VS-Tag) was performed with a a straightforward and conservative trading algorithm. This algorithm entered trades as presented by the Daily Market Scan on a first-come-first-can-afford basis depending on two distinct factors: if the trade could be afforded, and if it met the prediction criteria (if chosen).

From there, the trades were either kept blindly until the 5-day holding period was over or checked daily for movement against the predicted price movement. The algorithm was rigorously conservative to ensure that any posterior hyper-optimizations were absent that would artificially skew the results.

There are several important points to mention in the construction of VS-Tag.

First, the decision to hold the trade for 5 days represented the extremis limit of the statistical power for VoEx Spike. Although still statistically significant at day 5, the power is slightly diminished for various reasons outlined in the Market Scan Primer. This reinforced the conservatism of the trading algorithm and allowed for additional verification of the statistical work presented in the Market Scan Primer.

Secondly, due to the first-in-first-afford nature of the trades, there were no consideration regarding the relative "profitability" of each respective trade option. This is either a hinderance, or benefit, to the system, depending on a particular trading style. A trader may be more prone to only enter into trades with certain thresholds of VoEx Spike values or on stocks that they perceive as having a greater chance at a successful play.

Associated with the entering-nature of the algorithm, there were no considerations for the potential for "profit switching" (switching trades for a perceived greater chance at profits), a trader may be inclined to do so with varying levels of success. Due to the dynamic nature this trading style could employ, it was categorically left out of the algorithm.

Lastly, there were no profit-taking considerations within the algorithm. At times, it may be that a security's price movement extends well beyond the boundaries as predicted by the 5-day VoEx Spike graph with subsequent reversion (price appreciation) the following days. This "VoEx transcendence" phenomena is well known by those who utilize VoEx and may be an indication for withdrawing from the position and realizing gains prior to the

reversion in price. However, in adhering to severe conservatism, this consideration was not implemented. Trades were only exited under two conditions: the position had been held for 5 days or the positions price-movement was counter to the allotted risk thresholds.

To investigate how a portfolio would change with time, four dates were chosen as the start-dates for VS-Tag: 2019-01-01, 2020-01-01, 2021-01-01, and 2021-04-01. These dates were chosen to include the maximum trading periods possible with current market data (2019-01-03) until the most recent trading periods at the time of writing.

In all cohorts, except for the trades starting in 2019, there were trading styles that beat the market (as measured against $SPY). Even though starting the VS-Tag in 2019 did not beat the market, significant positive returns upwards of 60% were still obtained.

There are two particularly interesting findings to take note from the time-cohorts. The first is that in the 2019 and 2020 VS-Tag start-date cohorts, during the early 2020 market downturn, VS-Tag did not sustain any significant portfolio regression. This is curious as it suggests that the VS-Tag is paradoxically stabilizing in unstable markets, and is most prominent in the 2020-start-group back tests.

This apparent protection offered by VS-Tag is witnessed again in the most recent downturn in SPY. In almost all time-groups and trading styles there was either a slight growth or only a stagnation in profits but rarely a portfolio depreciation. Although this market dip was not as severe as early 2020, it suggests that this protective feature of VS-Tag may not be an isolated event.

In looking specifically at the 2020-time group, where the performance of VS-Tag almost mirrors that of the market, this added protection at little-to-no cost (certainly less cost than the depreciation in asset value during the dip), may be quite compelling.

The second finding is that there appears that there is a recent increased efficacy to VS-Tag starting in mid-2020. In all start-date cohorts that passed through mid-2020, there is an observable increase in the profitability. This may have to do with the emerging market forces that are growing in influence that VoEx monitors that would allow for greater accuracy and granularity in VoEx-spikes. It also may be a telling of a time-dependent price-appreciation associated with greater exposure to VoEx. As we will see, this is supported below where the presence of VoEx spikes is not equally distributed throughout the years, and it may be that the greater the

number of opportunities from VoEx spikes, the greater the opportunity for growth.

Next - of all the cohorts shown graphically (those that beat the market, or in 2019's case, have the highest growth), almost no cohort has sustained negative growth except for when starting out. Starting VS-Tag seems to be associated with a "calibration period" where the accumulation of growth starts out slowly and begins to readily pick up. Combined with the results below between the negative and positive cohorts, it suggests that the availability of profits from VS-Tag may have a significant dependence on the availability of trades. In looking at the number of VoEx spikes available for trading throughout the year: 2019 had 401, 2020 had 494, 2021 with 828 and the last six months (2021-01) with 600 alone.

It would seem that the underlying factors associated with VoEx are readily increasing in the current market – something that VoEx intended to capture from its instantiation. This increase in the factors that VoEx measures seem to have an increase in the rate of VoEx Spikes, and consequently, the rate of growth.

An important aspect of the analysis the back tests is ensuring that there are trends that persist throughout the various trading styles and time-cohorts which would increase the confidence of future success. To do that, it is worthwhile to investigate the top three and bottom three growers for each type of trading to see if any trends emerge.

Below is a table of the top and bottom three growers for each date-group. An (*) indicates that style beat the market:

Date Start: 2019-10-01	Rank	Growth (%)	Prediction Cohort	Risk Cohort (%)
2019-01-01	1	62.06	NA	5
2019-01-01	2	64.50	-	0
2019-01-01	3	53.95	NA	0
2019-01-01	10	35.35	-	NA/10
2019-01-01	11	12.57	+	10
2019-01-01	12	8.71	+	0
Date Start: 2020-01-01				
2020-01-01	1*	65.78	NA	0
2020-01-01	2*	64.52	NA	5
2020-01-01	3*	55.89	NA	NA
2020-01-01	10	8.0	+	0
Date Start: 2020-01-01				
2020-01-01	11	(1.7)	-	NA
2020-01-01	12	(12.20)	+	0
Date Start: 2021-01-01				
2021-01-01	1*	62.14	NA	5
2021-01-01	2*	61.22	NA	NA
2021-01-01	3*	60.06	-	0
2021-01-01	10	7.90	-	10
2021-01-01	11	2.8	-	NA
2021-01-01	12	(2.65)	+	0

Date Start: 2020-04-01	Rank	Growth (%)	Prediction Cohort	Risk Cohort (%)
2021-04-01	1*	28.04	-	0
2021-04-01	2*	27.86	NA	NA
2021-04-01	3*	24.67	NA	10
2021-04-01	10	3.75	-	NA
2021-04-01	11	(2.60)	+	0
2021-04-01	12	(18.90)	NA	5

* Indicates that that trading
  style beat the market.

Out of the four time-groups, three have the no-prediction-preference (NA) and 5% risk threshold trading style included in the highest earners, two of which have that trading style as the highest earner.

The only time the positive prediction cohort appears on the table is in the bottom-growers cohort. This is slightly disheartening as it suggests that there is a limitation with using positive-only predictions within VS-Tag, the consequence of which may hinder or limit trading styles. For instance, the reliance on only positive predictions would avoid the requirement for short-selling and options plays. Although in the long-term it seems although using the positive-prediction only cohorts bring growth, it is still drastically reduced compared to the counter-options[1].

As mentioned before, there this may be due to the unequal distribution between the positive and negative predictions. Whereas 1026 (65.60%) of the predictions were negative only 538 (34.40%) were positive. This may limit the ability to recuperate any losses. Interestingly, the converse doesn't seem to be true: strictly limiting a trading style to negative predictions seems to place the results in the top three only 4 times (33%). This suggests that the full exclusion of positive predictions is not wholly beneficial. This line of evidence further helps explain the behavior of VS-Tag

[1] From the 2019-start-group, all positive-prediction-only trading groups experienced positive growth: +/NA-risk (48.60%), +/0% (8.71%), +/5%(12.57%), +/10% (48.60%).

throughout the years: the more opportunities for growth, the greater the profits.

What is reassuring about VS-Tag, in general, is the high presence of the NA for the risk cohort present in the top three groups. In all date-groups that beat the market, they all have a no-risk cohort threshold trading style (the trades were held for the complete 5-day period). This adds evidence that the statistical work in understanding VoEx spikes was grounded in reality.

When a risk tolerance was chosen, there is an apparent goldilocks situation. At too sensitive of a risk tolerance (0%) trades may be exited too soon, leaving potential profits behind. An additional observation to the 0% risk tolerance is that in all the graphed groups above, after the calibration period, only the 0% risk tolerance group experiences additional dips into negative growth. This is a logical consequence to exiting too many trades too early with compounding losses.

Yet, at the 10% the risk tolerance may be too course and trades are held longer than they should prior to exiting when there may have been earlier indications that the trade was not going as predicted before the 10% threshold was reached. The increased exposure to sustained down-side versus the limited growth potential of the 10% risk is an important consideration between those two risk-cohorts[2].

VS-Tag has shown that it can fulfill many roles in a trader's arsenal. With the evidence that in recent years the number of VoEx spikes has been increasing resulting in prima facie increase in growth, VS-Tag demonstrates itself to be an excellent growth-producer that achieves values greater than the market. Additionally, there is evidence that VS-Tag provides portfolio-protection during market-downturns while still allowing a trader to capture slight growth. There is also a prospect of VS-Tag helping a trader identify trends and movements in underlying stock that they may be able to extend elsewhere in the management of their portfolio.

Looking at just the growth, VS-Tag has performed exceptionally given its low complexity and low barrier to entry. There may be times where the respective earnings from the market versus the utilization of VS-Tag may benefit the low-capital trader: there are greater opportunities for growth presented via VS-Tag than there are from investing in a single ETF (i.e.: 1 share purchased per VS-

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[2] This is also evidenced by the respective decrease in percent profitable in the 0%-risk cohort versus the 10%-risk cohort: the percent profitability is lower in the 0% because a greater number of trades are performed as compared to the 10%-risk cohort.

Tag may produce greater growth at a lower cost-basis than purchasing 1-share of SPY).

In turning towards the future, further work will be aimed at implementing additional trading styles, holding periods, and profit-taking into the algorithm. These will reduce the conservatism of the algorithm in an effort to make it more dynamic to market conditions. Yet, since these implementations are not currently in place, there is risk involved with the use of additional trading techniques in situ.

There may be some development of a market-ready, real-world trading algorithm designed after these results and trading style that would automatically trade in accordance to the VS-Tag by utilizing API calls to one's broker to automatically perform transactions. This could create a completely hands-free but reliant system of growth.
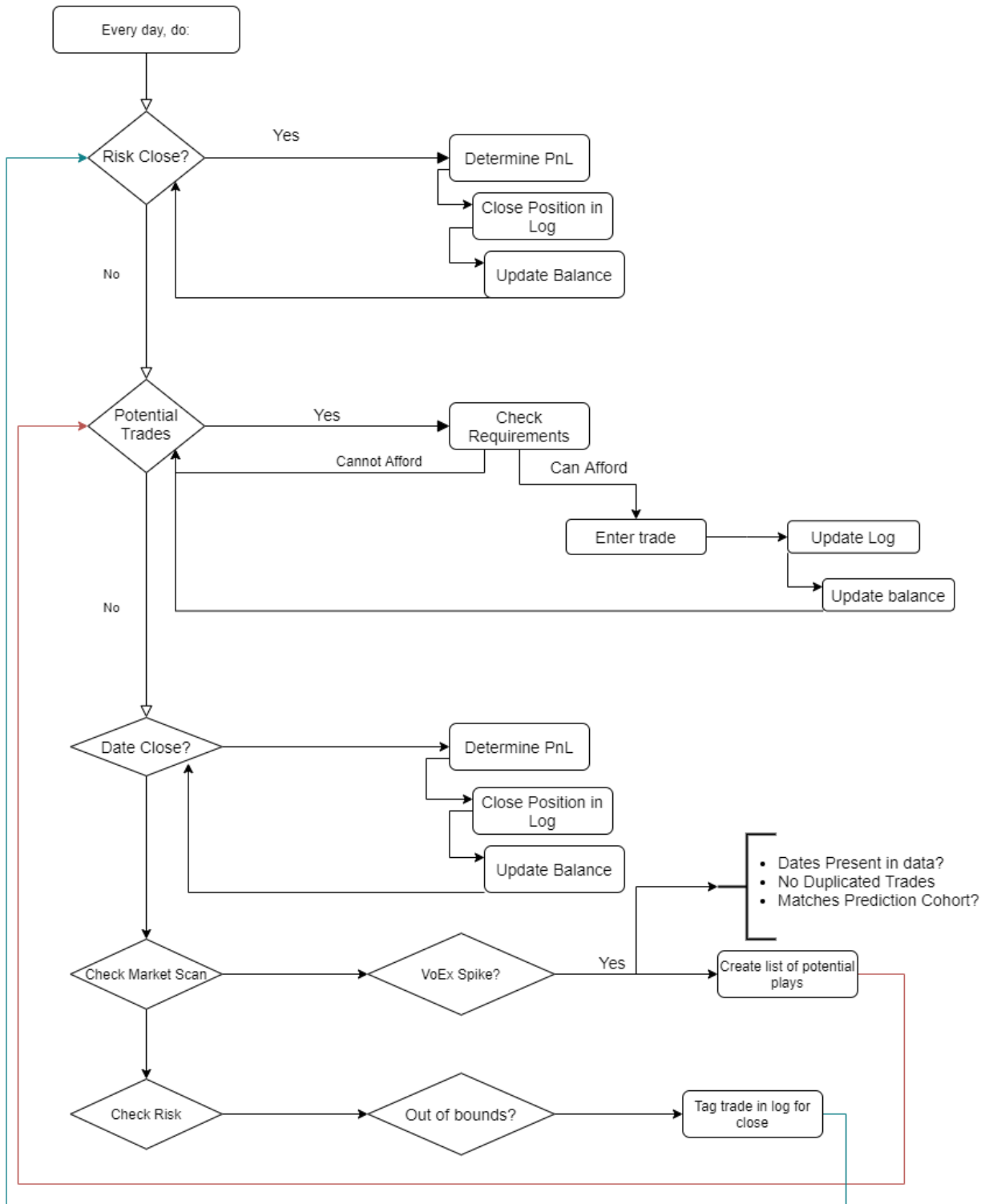
Overall, the back testing of VS-Tag has demonstrated a successful, highly viable and adaptable trading algorithm that is grounded in VoEx that provides consist of returns and in recent times, beats the market for growth.

As always, happy trading!

- Justin

Appendix: Program Algorithm


```
Every day, do:
```

Risk Close?
— Yes → Determine PnL → Close Position in Log → Update Balance
— No ↓

Potential Trades
— Yes → Check Requirements
  — Cannot Afford
  — Can Afford → Enter trade → Update Log → Update balance
— No ↓

Date Close?
— Determine PnL → Close Position in Log → Update Balance

- Dates Present in data?
- No Duplicated Trades
- Matches Prediction Cohort?

Check Market Scan → **VoEx Spike?** — Yes → Create list of potential plays

Check Risk → **Out of bounds?** → Tag trade in log for close

Appendix: Trading Algorithm
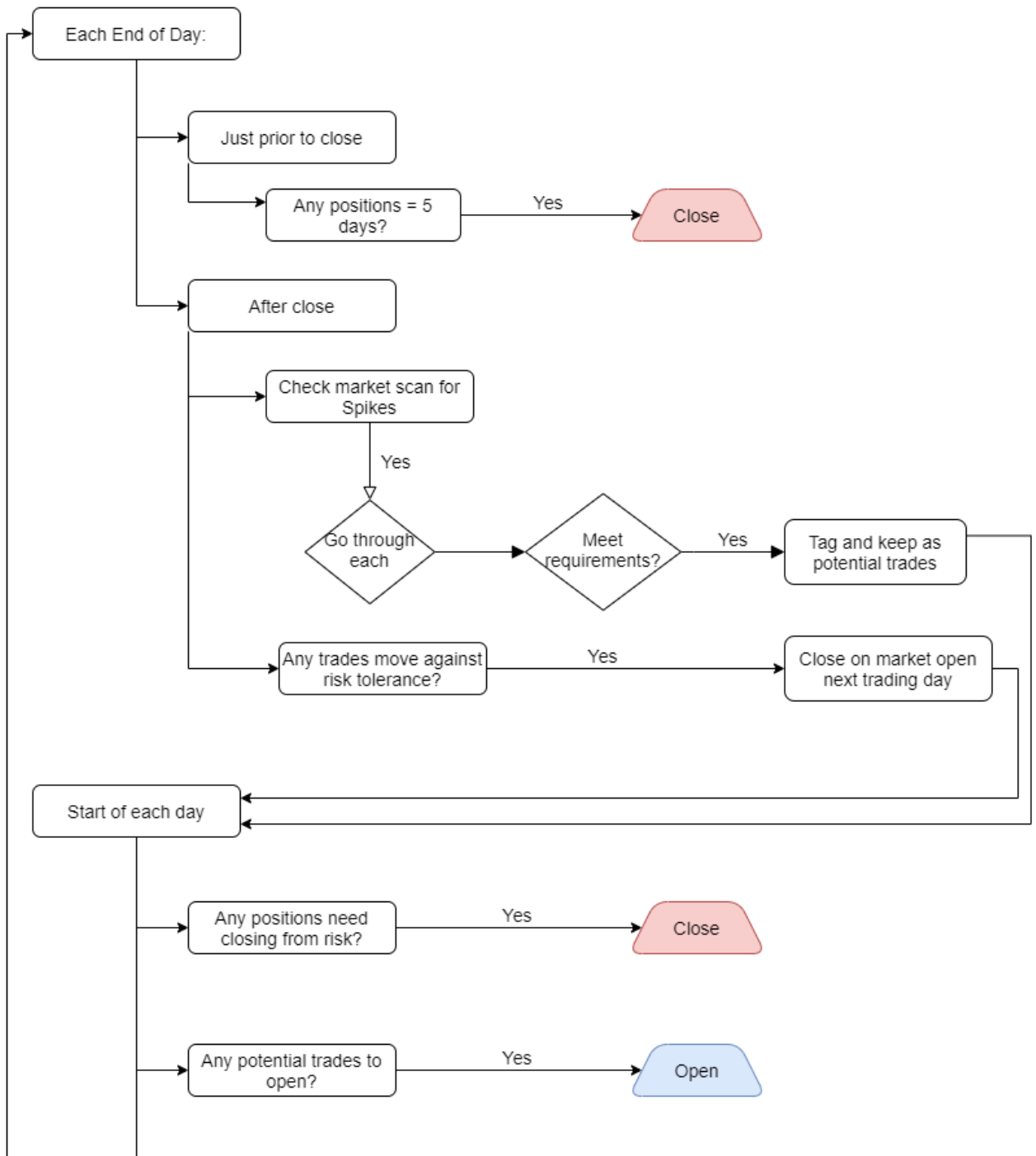
Appendix: Prediction Algorithm

VoEx Spike > 0 or VoEx Spike < 0

Branch 1: Previous VoEx > 0 -or- Previous VoEx < 0

- (< 0) → Spike Amount >= 250 or Spike Amount < 250
  - (>= 250) → Negative Prediction
  - (< 250) → Positive Prediction
- (< 0) → IF
  - Spike Amount <= 300 -or- Spike Amount >= 500 → Positive Prediction
  - Spike Amount > 300 -AND- Spike Amount < 500 → Negative Prediction

Branch 2: Previous VoEx > 0 -or- Previous VoEx < 0

- (< 0) → IF
  - Spike Amount >= -350 -or- Spike Amount <= -550 → Negative Prediction
  - Spike Amount < -350 -AND- Spike Amount > -440 → Positive Prediction
- (< 0) → Spike Amount <= -400 -or- Spike Amount > -400
  - (<= -400) → Positive Prediction
  - (> -400) → Negative Prediction

<u>Disclaimer</u>

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