Market-Data-Team Final Report

By:

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Motivation

We see the daily up and downs of the market and imagine there must be patterns, through this project we wanted to collect data from the markets and analyze a myriad of different dates/times and examine the current prices, and based on the data collected/analyzed to forecast the future prices of selected stocks (Microsoft, Tesla, Johnson & Johnson, Nvidia, Facebook).
Based on our predictions, we use our paper trading account to buy/sell our stocks at a price which we deem will give us the best results. Through this experiment, we will be able to analyze our predictions by evaluating our short term trades to see how effective technical analysis is.

Background

Technical analysis is one of the most widely used trading tools on Wall Street, but it is also one of the most controversial. Technical traders swear by it, while fundamental traders often look down on it as ineffective. Technical analysis attempts to capture market psychology and sentiment by analyzing price trends and chart patterns for possible trading opportunities. Contrary to fundamental analysis, technical analysts do not necessarily care much about the companies behind the stocks they trade or their profitability.
Technical analysis can be split into 3 distinct categories:

        I.   Chart Patterns and Visualizations (head and shoulders, ascending triangle, etc)

II.	Support/Resistance zones

III.	Technical Indicators (EMA, MACD, RSI etc)

In a nutshell, technical analysis argues that you can identify the right time to buy and sell a stock using technical indicators that are based on the stock's historical price and volume movements. On the other hand, fundamental analysis argues that you can measure the actual intrinsic value of a stock based on the fundamental information found in a company's financial statements.

Dataset and Representation

In order to visualize our data, one of the categories in technical Analysis; we needed to collect the most up to date stock information for our companies (Microsoft, Tesla, Johnson & Johnson, Nvidia, Facebook). In order to do this, we collected our data via Yahoo Finance by using the pandas datareader, which assisted us in data storage and analysis. Once the data was grabbed, we were able to specify the time periods we wanted to analyze at first, so we took the past 5 years worth of stock data from our companies.

```python
MSFT = dr.data.get_data_yahoo('msft',start='2015-01-01', end='2020-12-11')
TSLA = dr.data.get_data_yahoo('tsla',start='2015-01-01', end='2020-12-11')
JNJ  = dr.data.get_data_yahoo('jnj',start='2015-01-01', end='2020-12-11')
FB   = dr.data.get_data_yahoo('fb',start='2015-01-01', end='2020-12-11')
NVDA = dr.data.get_data_yahoo('nvda',start='2015-01-01', end='2020-12-11')
```

```python
# specify our start and end date using datetime
start = datetime(2015, 1 , 1)
end = datetime(2020, 12, 11)
```

```python
#Import Stocks Data from Yahoo Finance
FB   = web.DataReader("FB",   'yahoo', start, end)
NVDA = web.DataReader("NVDA", 'yahoo', start, end)
MSFT = web.DataReader("MSFT", 'yahoo', start, end)
JNJ  = web.DataReader("JNJ",  'yahoo', start, end)
TSLA = web.DataReader("TSLA", 'yahoo', start, end)
```

Once the data was collected, we now have access to a bunch of features in our dataset that allow us to extract and visualize different aspects of our dataset.

The Features in our dataset include:

Date	High	Low	Open	Close	Volume	Adj Close
2020-11-16	120.989998	118.150002	118.919998	120.300003	91183000.0	120.300003
2020-11-17	120.669998	118.959999	119.550003	119.389999	74271000.0	119.389999
2020-11-18	119.820000	118.000000	118.610001	118.029999	76322100.0	118.029999
2020-11-19	119.059998	116.809998	117.589996	118.639999	74113000.0	118.639999
2020-11-20	118.769997	117.290001	118.639999	117.339996	73391400.0	117.339996

High price:

The peak in price of a stock during that specific date

Low price:

The trough in price of a stock during a specific date

Open price:

The price presented when the market opens on a specific date

Volume:

Is the amount of an asset or security that changes hands on a specific date

Close price:

The price of a stock when the market closed on a specific date

Adjusted close price:

The closing price of a stock after accounting for any corporate actions

(The two most important one is adjusted close price and volume)

	FB	NVDA	MSFT	JNJ	TSLA
Date					
2020-12-07	285.579987	544.270020	214.289993	148.970001	641.760010
2020-12-08	283.399994	534.000000	216.009995	151.550003	649.880005
2020-12-09	277.920013	517.229980	211.800003	153.100006	604.479980
2020-12-10	277.119995	518.890015	210.520004	152.250000	627.070007
2020-12-11	273.549988	520.530029	213.259995	152.949997	609.989990

Visualizations that allowed us to analyze the charts and patterns:

Adjusted Closing Price of each stock:
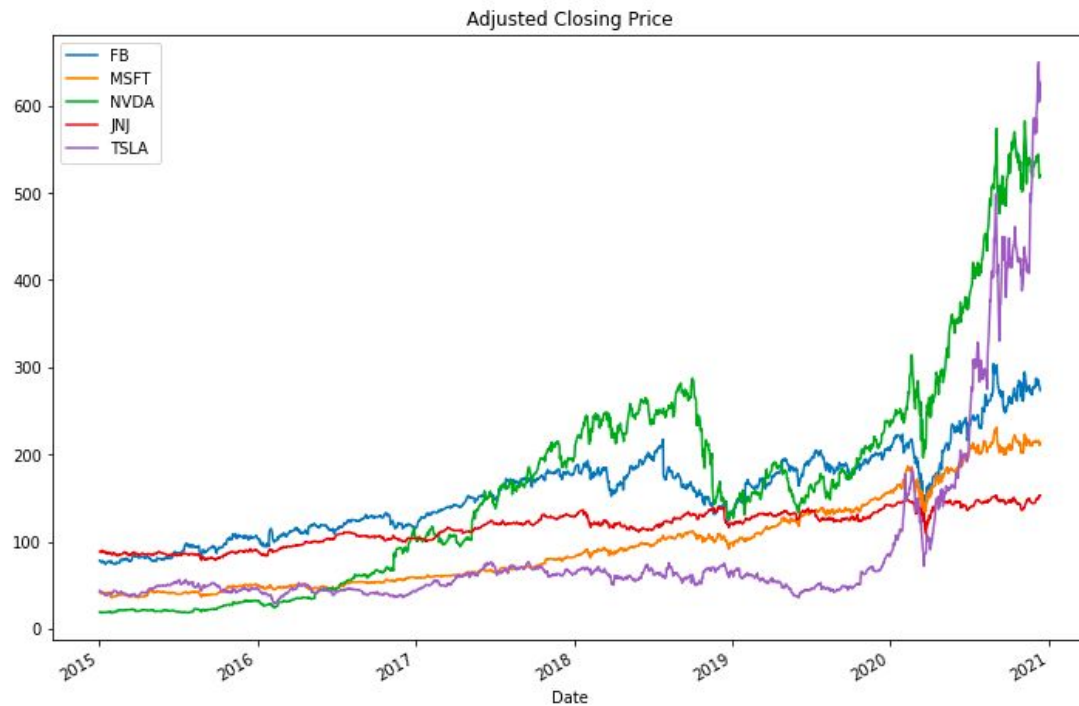
Volume traded for each stock:

```
#plot stocks and their volume traded during start and end dates
FB['Volume'].plot(label='FB',figsize=(12,8), title = 'Volume')
MSFT['Volume'].plot(label='MSFT')
NVDA['Volume'].plot(label='NVDA')
JNJ['Volume'].plot(label='JNJ')
TSLA['Volume'].plot(label = 'TSLA')
plt.legend()
```
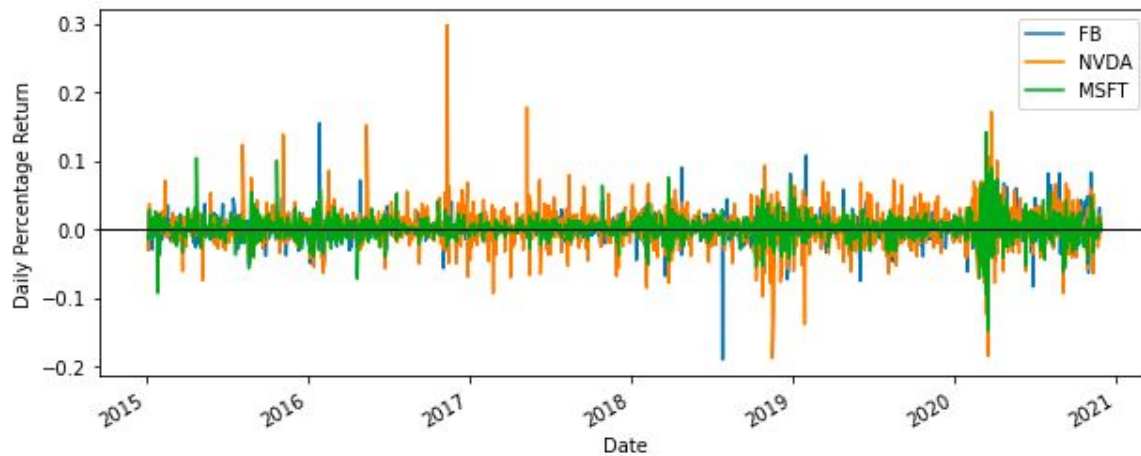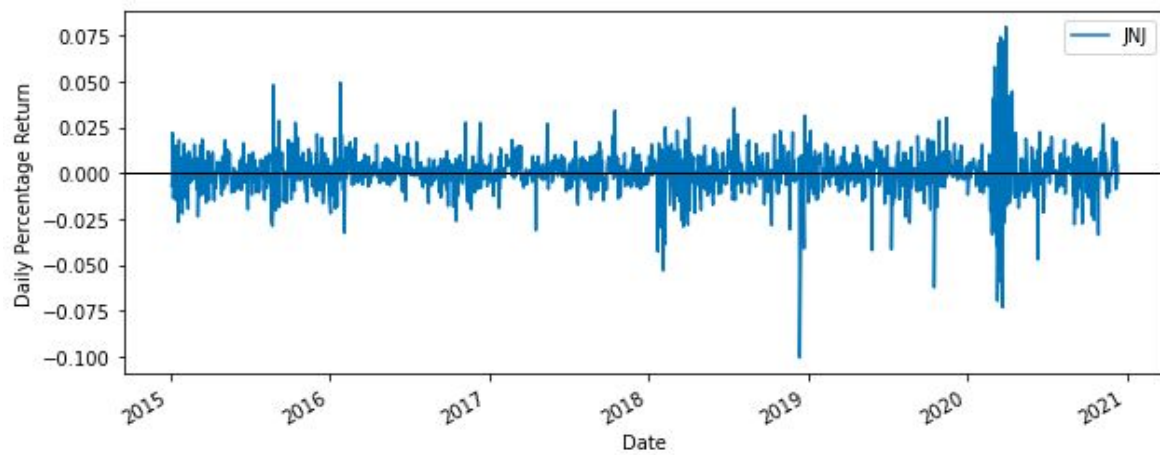
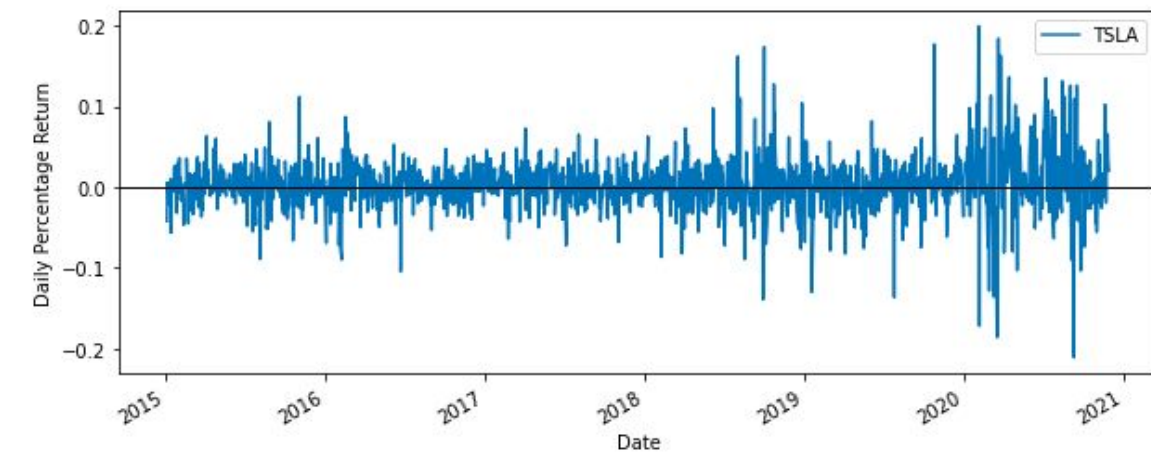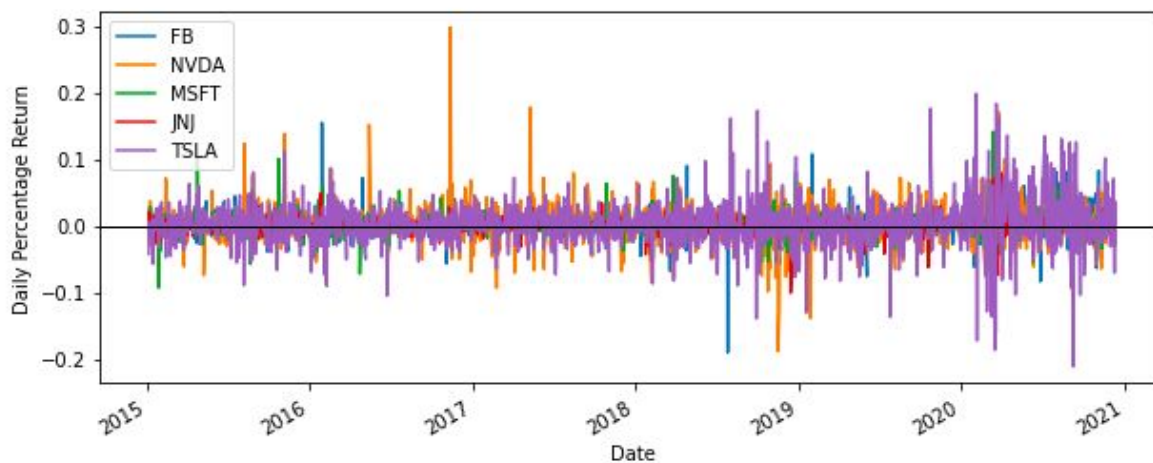<matplotlib.legend.Legend at 0x1264d3e90>
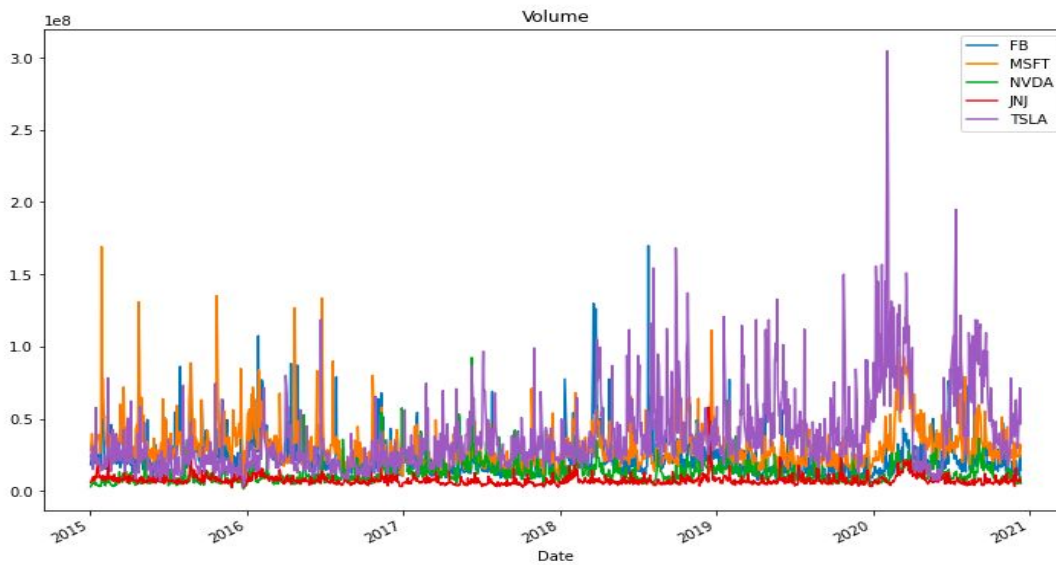
Normalization of the stocks to identify best return from start price:
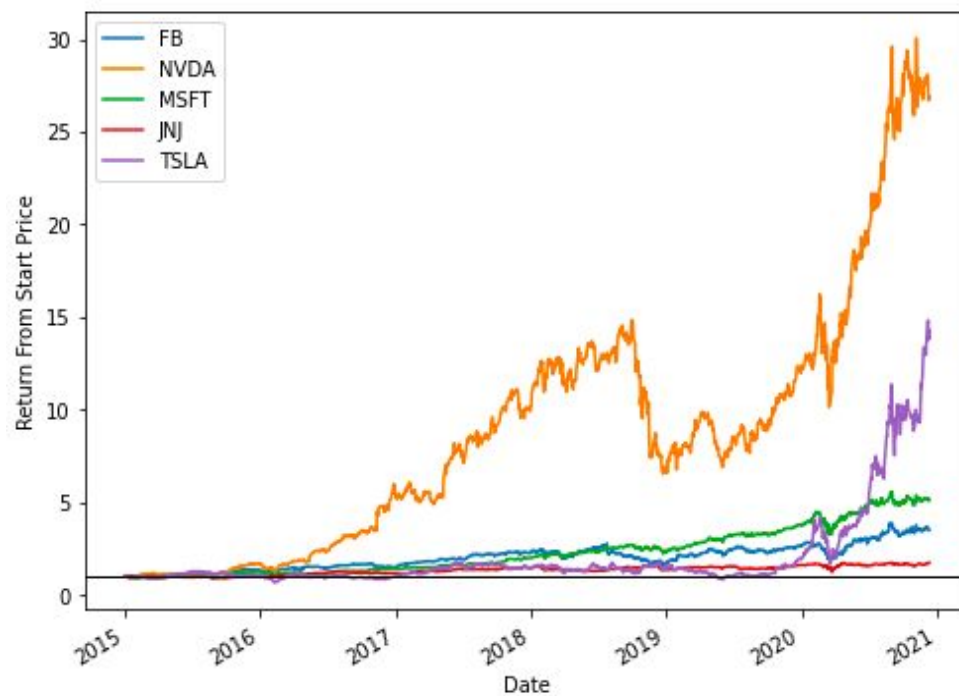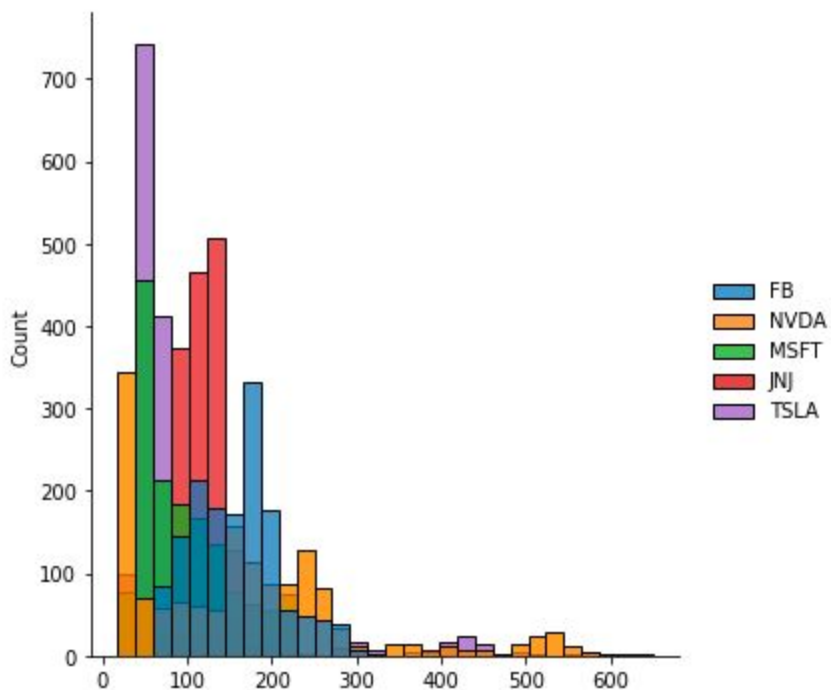
Daily percent change for each stock:

Histogram to identify the spread and distribution type:

In addition to analyzing the chart patterns with our visualizations, we used technical indicators though the TA-Libary (TA-lib) available to us in python which includes 150 + indicators to help us predict stock direction.

The indicators we used to help us make predictions were Simple Moving Averages, Exponential Moving Averages, Moving Average Convergence Divergence, Relative Strength Index, and Volume traded.

Each one of these indicators on their own can help predict stock direction but they each do it in their own unique way. Furthermore, to guarantee that we are making the most appropriate move, we need to look at multiple indicators before making any decision as indicators by themselves have their strengths and weaknesses.

Moving Averages:

Moving averages is a simple technical analysis tool that smooths out price data by creating a constantly updated average price. Furthermore, moving averages are usually calculated to identify the trend direction of a stock or to determine its support and resistance levels. It is a lagging indicator because it is based on past prices over a specific time period, i.e, the past 10 days, 10 months, or 10 years etc. When a short-term moving average crosses below a longer-term moving average it indicates a sell/bearish crossover, and when a short-term moving average crosses above a longer-term moving average it indicates a buy/bullish crossover. For this project we utilize two different moving average tools: Simple Moving Average and Exponential Moving Average. The first method we used is the simple moving average. The SMA is simply calculated by summing the daily closing prices and divided by the specific time periods. With each average connected to the next, it creates singular flow lines. For SMA we simply assign equal weight to all values, which differs from EMA. The specific time periods we used were 10,30, 50 days for SMA.

Moving Averages of each stock:
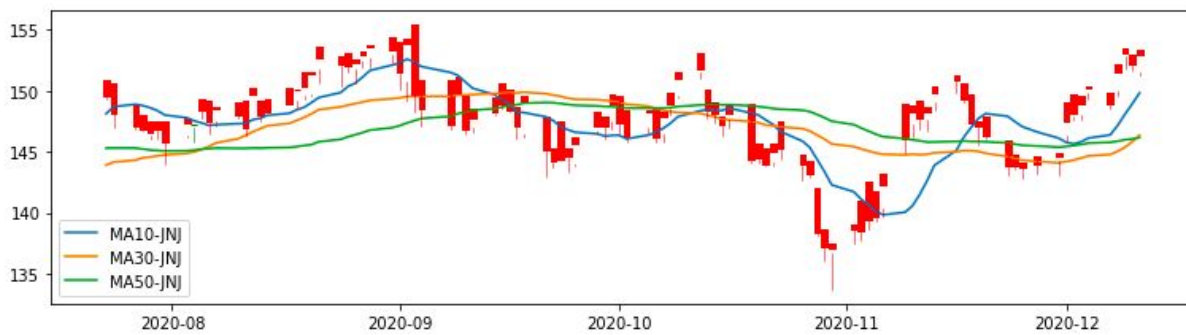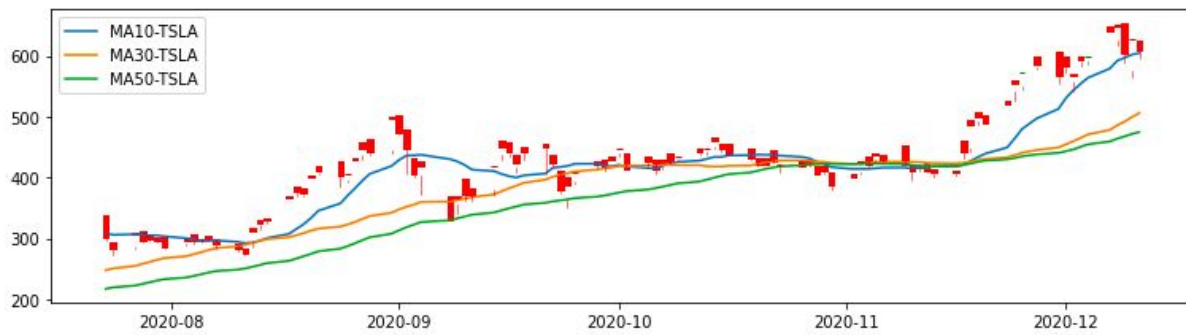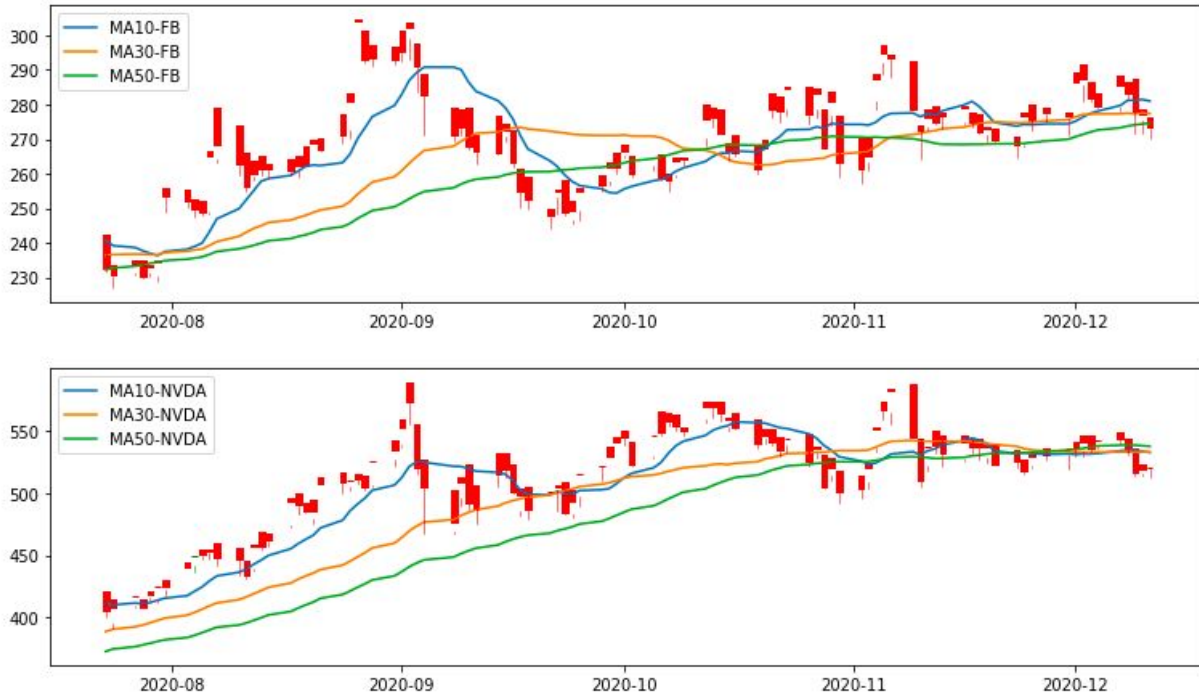
Exponential Moving Averages is a type of moving average that places a greater significance on the most recent data points/recent prices. Exponential moving averages follow more closely than the simple moving average above, we also interpret EMA similar to SMA in terms of crossover indication. We used 10, 50, and 200 days as our specific time periods for EMA. EMA of each stock:

MSFT

TSLA

JNJ

FB

NVDA
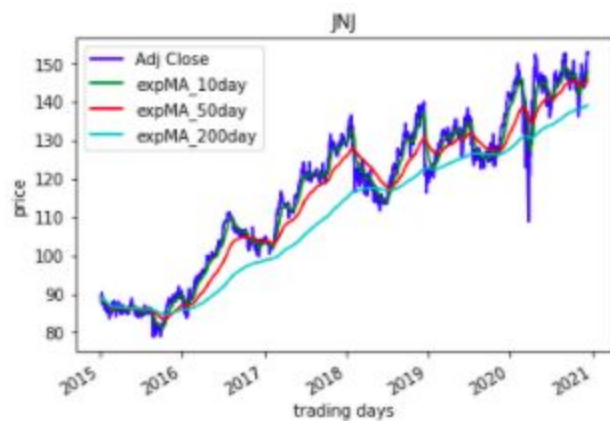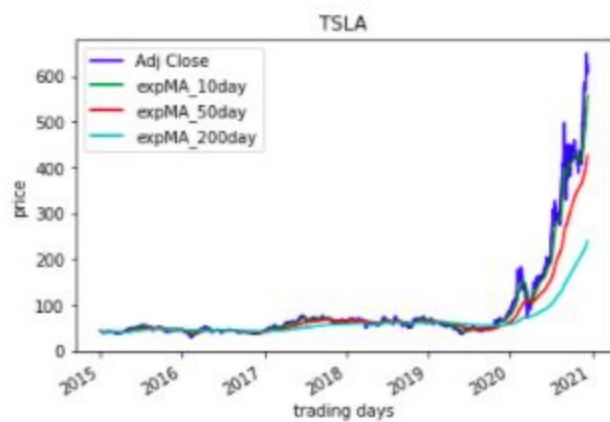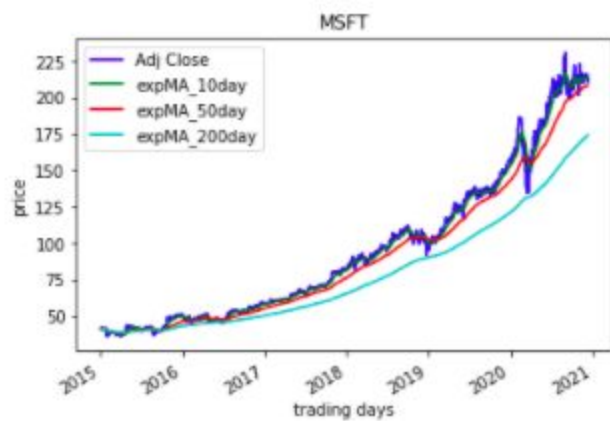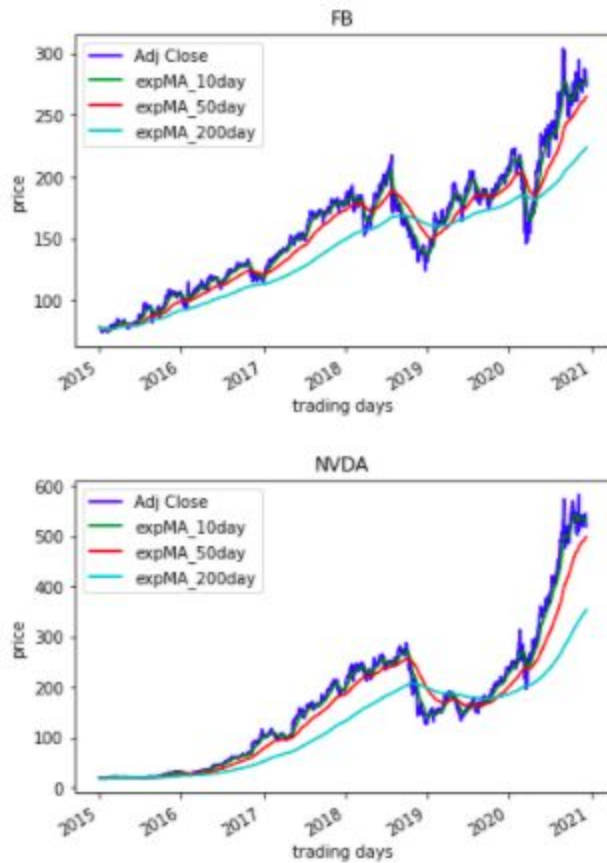
Given that moving averages are more based on historical data, it does not give us a good prediction of the future state of a stock, which means results gathered from simple moving averages can be random. In some cases, when price action becomes choppy, the price may swing back and forth, generating multiple trade signals that are potentially false alarms. On the other hand, if the price action follows more of a trend, then moving averages are a good indicator to see when to buy/sell a particular stock. In general, just by looking at moving averages won't guarantee success, we also need to utilize other tools in order to maximize our ability to buy/sell stocks at the right time.

Moving Average Convergence Divergence (MACD):

In addition to simply looking at moving averages on the surface, we decided to look more in depth into the subject. Moving Average Convergence Divergence is a momentum indicator that charts two lines that provide trade signals when crossover occurs similar to moving averages. When the MACD line crosses from below to above the signal line, this indicates a bullish signal (buy). When the MACD line crosses from above to below the signal line, this indicates a bearish signal (sell). MACD can be calculated by subtracting the value of a 26 period EMA from a 12 period EMA.

MACD of each stock:
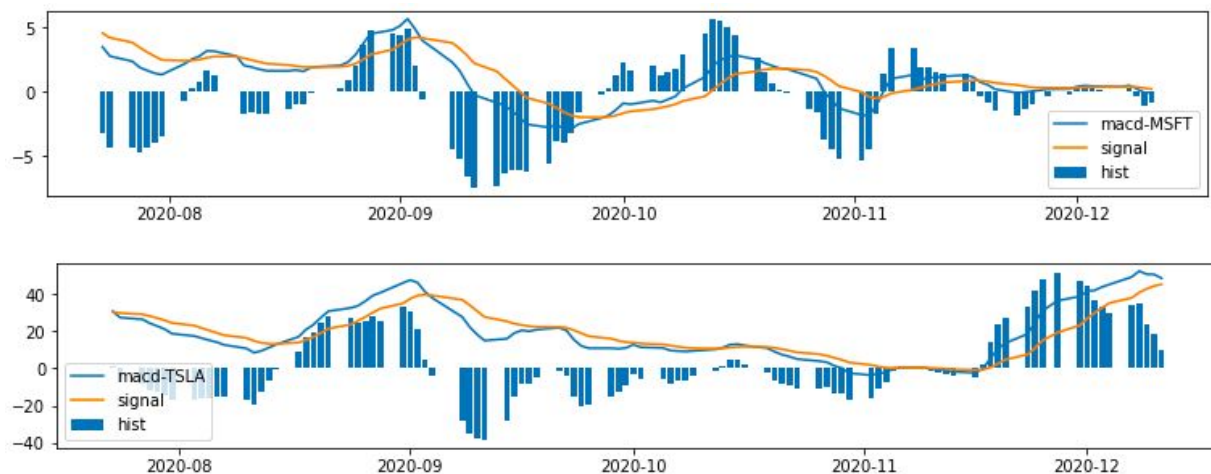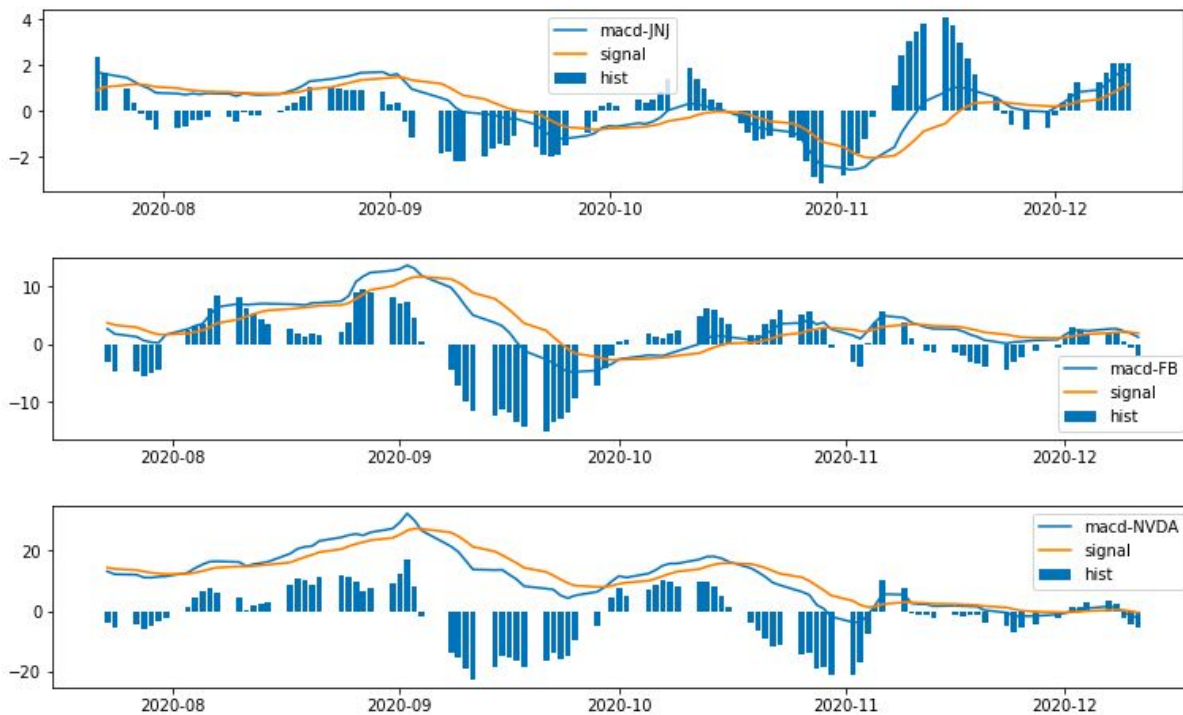
As we progressed through our research, we realized that just simply looking at moving average convergence divergence was not enough, as MACD is often used in conjunction with another tool, Relative Strength Index.

Relative Strength Index(RSI):

Relative Strength Index is an indicator that helps measure whether a stock is overbought or oversold, by measuring the magnitude of recent price changes. It assists in determining whether a selloff will occur or a rally to a higher stock price. The RSI oscillates between zero and 100, when the RSI is above 70 it is considered overbought and when it is below 30 it is considered oversold. The formula for RSI:

RSI = 100 – [100 / (1 + (Average of Upward Price Δ / Average of Downward Price Δ))]

RSI for each stock:
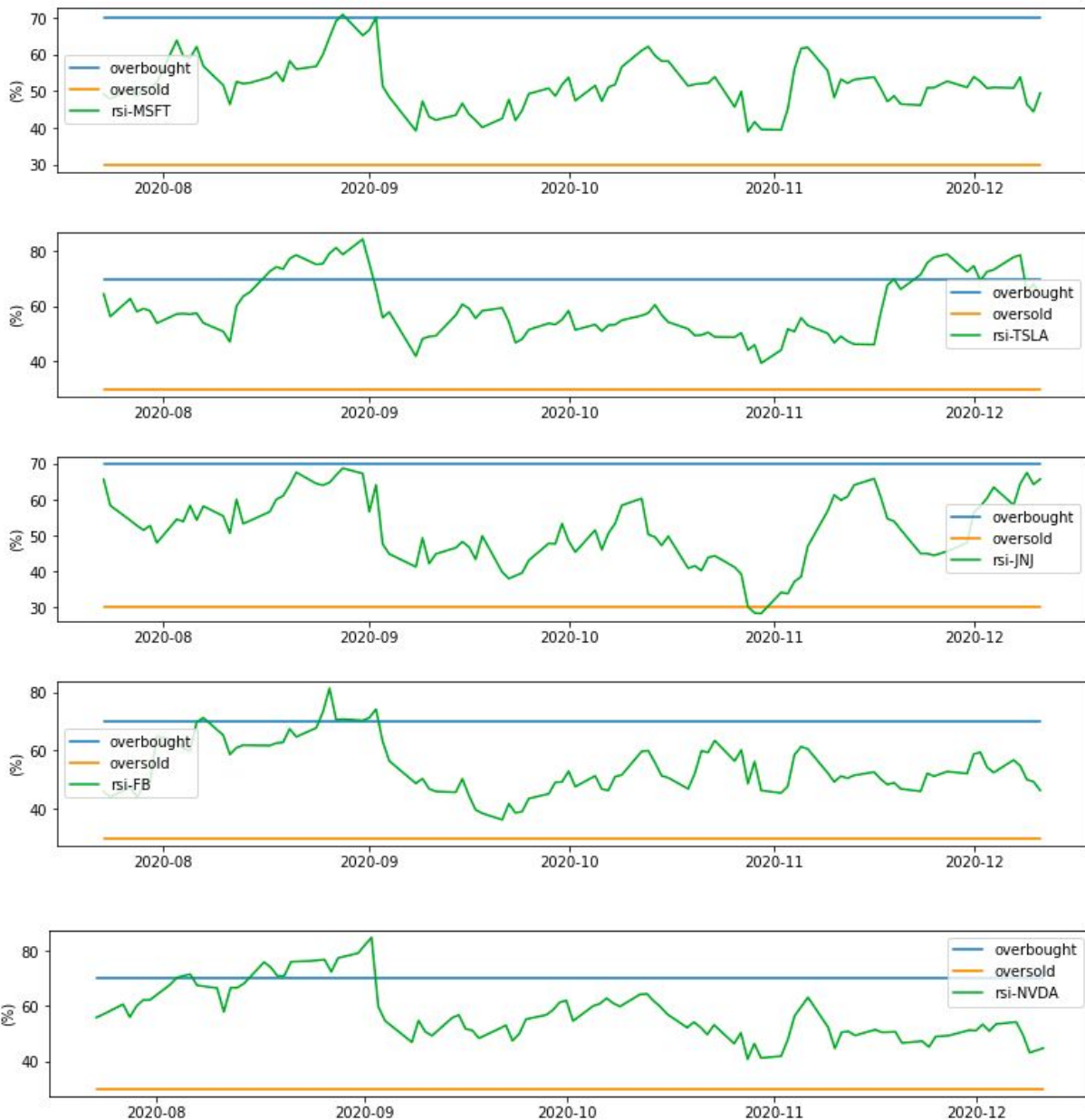
Overall, while both indicators measure momentum in the market, the MACD measures the relationship between two EMAs, while the RSI measures price change in relation to recent price highs and lows. As for the reason why these two indicators work well in conjunction is that the two indicators act as a fail safe for each other as they might give contrary indications. For

example, the RSI might indicate that right now would not be the best time to sell a specific stock while the MACD on the other hand might suggest otherwise. This is good to any potential investor as it will prompt such investors to not rush his/her decision on selling the stock by mistake if the decision was solely based on one of the aforementioned indicators.

Volume:

Volume is an important metric and feature to track because it reflects the overall activity of the market, indicating the sheer amount of buying and selling of a specific stock. It represents the total amount of shares traded during a certain period of time. When there is more volume in a stock the demand is high and the opposite when the volume is low compared to other days.

Volume of each stock:
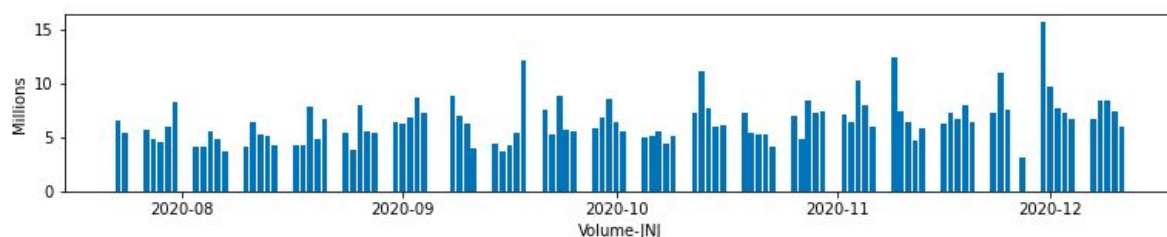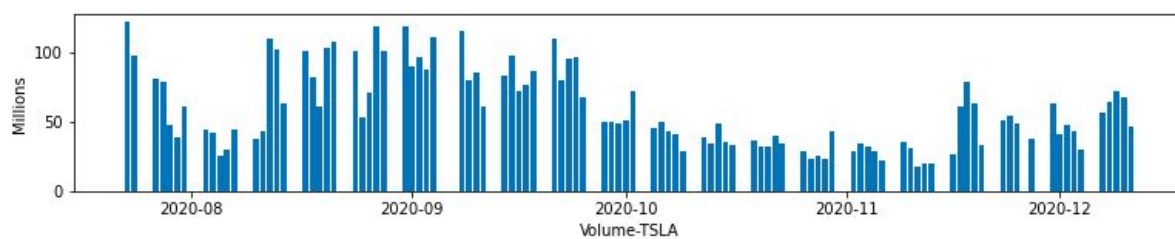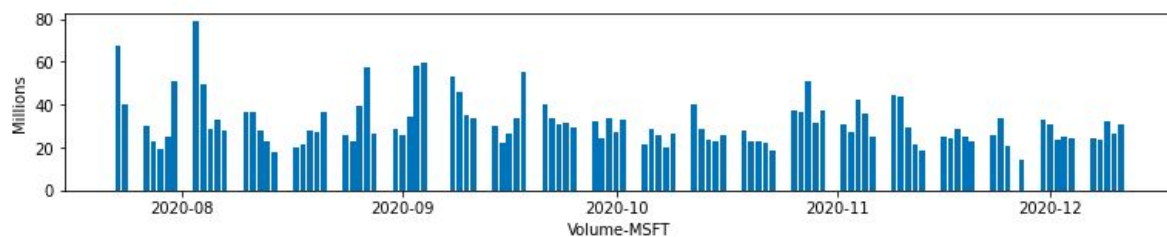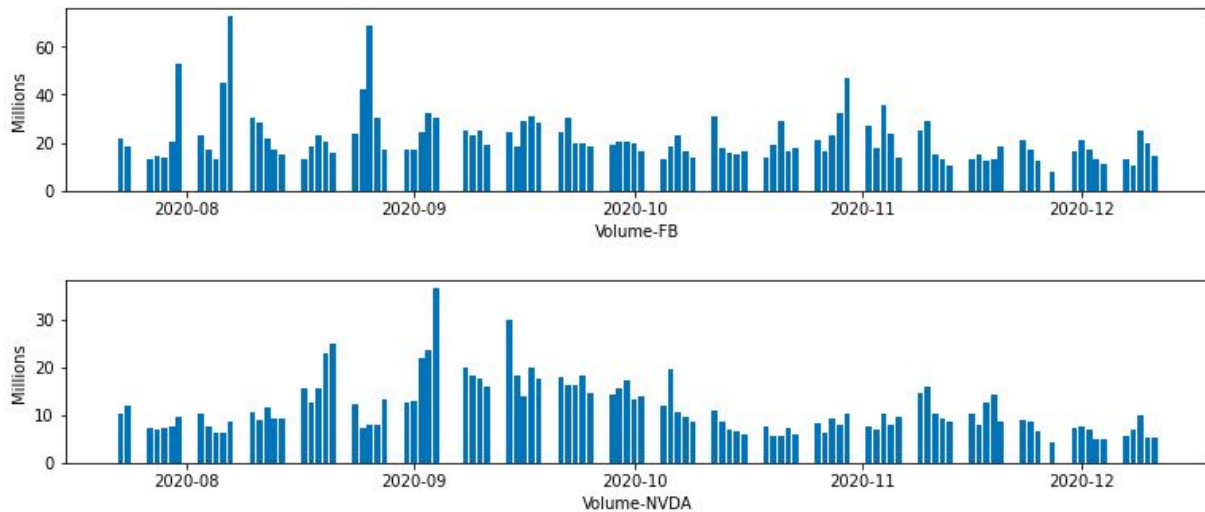
Analysis:

With the help of the open source Technical-Analysis library (TA-lib), we had access to over 150+ technical indicators to assist in our prediction making. Although we chose 5 indicators to use in this project, in future work we hope to incorporate more indicators to get a different perspective. The indicators we chose were popular indicators used by experts to help them inform their decisions. The indicators we chose worked together to help us be more comfortable in our trading strategies. For example, by looking at just a simple indicator may not be the best solution as shown with exponential moving averages that the signals to buy/sell occurred seldomly compared to other indicators. However, by looking at all 5, it gave us a good indication of when to buy or sell or stocks. In addition to using technical indicators to make predictions, we used chartings of different features in our dataset to assist us in deducing any trends. For example, if we analyzed this chart of Facebook's adjusted closing prices, we can identify a cup and handle pattern which is a bullish continuation pattern that represents a teacup on the chart. The cup part of the pattern is where the price changes from a bearish to bullish trend, while the handle signifies a slight pullback before the prices soars to higher highs (in theory once you

identify the handle is the best time to buy). Although there can be many interpretations based on just looking at the chart, in best practice once we identify a trend by charting we try to substantiate that claim with indicators that follow that same sentiment. In conclusion using both charting patterns and technical indicators helped us become more comfortable in the decisions we made as we believed it increased our odds of higher returns or increased our possibility nonetheless.
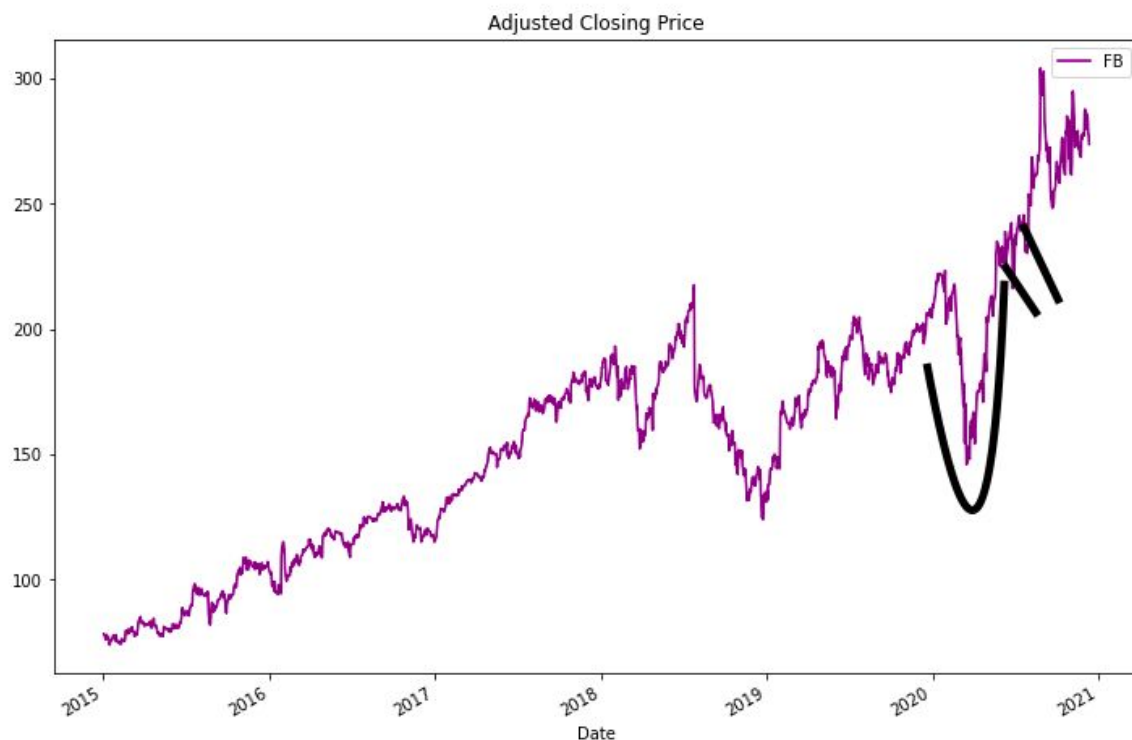
Questions

1. <u>Is the process of Technical Analysis beneficial in determining future stock price/performance?</u>

Yes, technical analysis is beneficial in determining future stock price/performance. By analyzing and reading charts to identify trends in the market we were successfully able to have a positive return of close to $7000 (3.5%) on our paper trading account at the end of our one month of trading. Although technical analysis doesn't always work 100% of the time, this is evident because we used similar strategies and our account based on our indicators and charting patterns and week to week we had different results. But in the end we netted a positive P/L ratio.

Positions

Position ▲	⚙	Qty	P/L Day $	P/L Open $	P/L YTD $	Cost	Net Liq
FB +200 277.60 +2.01 +0.73%		+200	$402.00	$1,193.00	$1,193.00	$54,327.00	$55,520.00
JNJ +150 144.00 +0.32 +0.22%		+150	$48.00	$149.50	$149.50	$21,450.50	$21,600.00
MSFT +300 215.23 +1.36 +0.64%		+300	$408.00	$1,414.00	$1,414.00	$63,155.00	$64,569.00
NVDA +250 530.45 +1.06 +0.20%		+250	$265.00	($2,505.00)	($2,505.00)	$135,117.50	$132,612.50
TSLA +5 586.80 +12.80 +2.23%		+5	$64.00	$775.00	$775.00	$2,159.00	$2,934.00
Cash		—	—	—	—	($72,573.74)	($72,573.74)
Totals:		—	$1,187.00	$1,026.50	$1,026.50	$203,635.26	$204,661.76

Positions

Position ▲	⚙	Qty	P/L Day $	P/L Open $	P/L YTD $	Cost	Net Liq
FB +200 281.85 -5.67 -1.97%		+200	($1,134.00)	$2,043.00	$2,043.00	$54,327.00	$56,370.00
JNJ +150 148.99 +0.85 +0.57%		+150	$127.50	$898.00	$898.00	$21,450.50	$22,348.50
MSFT +300 214.40 -0.97 -0.45%		+300	($291.00)	$1,165.00	$1,165.00	$63,155.00	$64,320.00
NVDA +250 536.80 -4.98 -0.92%		+250	($1,245.00)	($917.50)	($917.50)	$135,117.50	$134,200.00
TSLA +5 594.30 +25.48 +4.48%		+5	$127.40	$812.50	$812.50	$2,159.00	$2,971.50
Cash		—	—	—	—	($72,573.74)	($72,573.74)
Totals:		—	($2,415.10)	$4,001.00	$4,001.00	$203,635.26	$207,636.26

Positions

Position ▲	⚙	Qty	P/L Day $	P/L Open $	P/L YTD $	Cost	Net Liq
FB +200 286.3749 +9.4049 +3.40%		+200	$1,880.98	$2,947.98	$2,947.98	$54,327.00	$57,274.98
JNJ +150 148.49 +3.81 +2.63%		+150	$571.50	$823.00	$823.00	$21,450.50	$22,273.50
MSFT +300 214.19 +0.12 +0.06%		+300	$36.00	$1,102.00	$1,102.00	$63,155.00	$64,257.00
NVDA +250 535.185 -0.875 -0.16%		+250	($218.75)	($1,321.25)	($1,321.25)	$135,117.50	$133,796.25
TSLA +5 582.3138 +14.7138 +2.59%		+5	$73.57	$752.57	$752.57	$2,159.00	$2,911.57
Cash		—	—	—	—	($72,573.74)	($72,573.74)
Totals:		—	$2,343.30	$4,304.30	$4,304.30	$203,635.26	$207,939.56

Positions

Position ▲	⚙	Qty	P/L Day $	P/L Open $	P/L YTD $	Cost	Net Liq
FB +200 286.51 +6.81 +2.43%		+200	$1,362.00	$2,975.00	$2,975.00	$54,327.00	$57,302.00
JNJ +150 149.8973 -0.3727 -0.25%		+150	($55.90)	$1,034.10	$1,034.10	$21,450.50	$22,484.60
MSFT +300 214.07 -0.29 -0.14%		+300	($87.00)	$1,066.00	$1,066.00	$63,155.00	$64,221.00
NVDA +250 543.29 +0.96 +0.18%		+250	$240.00	$705.00	$705.00	$135,117.50	$135,822.50
TSLA +5 626.5316 +27.4916 +4.59%		+5	$137.46	$973.66	$973.66	$2,159.00	$3,132.66
Cash		–	–	–	–	($72,573.74)	($72,573.74)
Totals:		–	$1,596.56	$6,753.76	$6,753.76	$203,635.26	$210,389.02

2. <u>Does it boil down to fundamental analysis or mixture of the two?</u>

Performing well in the market requires a mixture of both fundamental analysis and technical analysis. As fundamental analysis focuses on a lot of the real-life events that may not be recognized from a chart. Some of these include economic data, monetary policies, management quality, and annual reports.

Technical analysis, which focuses mainly on the price trends of a stock, fundamental analysis seeks to determine the fair market value of that security and where it should be trading.

Some fundamental analysis indicators include: Book Value per Share, Cash and Cash Equivalents per Share, Debt-to-Equity Ratio, Free Cash Flow, Earnings Report. There is no right or wrong system in the markets, which is evident since there are so many different factors that determine a stock's direction on any given day. But one thing for certain is that a combination of both is needed to well equip one's self in having a proper risk tolerance and increasing probabilities, given the subjective nature of both technical and fundamental analysis. In addition, most successful traders take into consideration a wide range of technical and fundamental factors before making the decision to buy or sell a stock.

3. How effective is technical analysis?

Technical analysis is very effective depending on the person who is using it. As it is very subjective in nature, TA allows for multiple interpretations to be deduced based on the same data represented. Two people can look at a chart visualizing the adjusted closing prices for a stock and both individuals can walk away from the chart with two different predictions and analysis on what they think the stock would look like next. Technical analysis is very probabilistic, and to deem it effective requires one to associate their findings to the successes of technical analysis. A mixture of both fundamental and technical analysis is needed to best prepare oneself for proper risk and allocation management. Based on our results on just using technical analysis for our dataset, we deem it to be effective, but we believe if we mixed in fundamental analysis our predictions would be more accurate with our findings, because at times there were price movements that we did not anticipate based on historical price data; but if we used fundamental analysis we would've been able to associate those movements with news articles that came out for that stock, or our current environment with recent covid vaccines news which was a catalyst for the market. As you can see, technical analysis is effective to an extent in which you need more economic data to justify price changes.

4. Is the history of stock prices an indicator for future stock prices/movement?

Absolutely, the history of stock prices is an indicator for future price movements as it is one of the main features used in technical analysis. By analyzing the past stock prices one can use different indicators to help quantify future price movements and justify claims. Although you can use it to anticipate the direction of a stock, it doesn't necessarily provide an accurate representation of the movement because the market can act irrationally at times disregarding the past stock prices. So the history of stock prices is definitely an indicator for future stock price

movements, but to an extent; even the Security and Exchange Commission warns that past performance isn't an indicator of future performance.

Conclusion

Through this project, we had a lot of fun exploring the stock market and keeping up with financial news especially given the time period. This project exposed us to how there is a lot of data science used in the market in many different ways. From incorporating methods from class to researching relevant techniques used on market data, this project opened our eyes to how finance and technology go hand in hand in a lot of ways. We had some hiccups in the beginning, like being unable to incorporate data obtained through Quandl since their database is not up to date or which indicators should we choose to get a decent/positive result, but with time we were able to solve our problems. We hope to continue to maintain this project and enhance it to our specifications while we explore more ways to incorporate our own trading style into these programs. Being able to work on a new individual project was worthwhile to us this semester as we took on the challenge and found it to be an exciting journey throughout the semester.