Seasonality of the Top 3 Indexes

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Description

- I chose to explore three datasets that I pulled from the Yahoo Finance covering the past 20 years of history of the Dow Jones Industrial Average (DJI), S&P 500 (GSPC), and NASDAQ Composite (IXIC) Indices
- My intention was to identify monthly as well as seasonal trend outliers

Motivation

- There are many common phrases that are used on Wall Street to describe stock market beliefs
  - Ex. “The January Effect,” “Sell in May and go away,” “The Halloween Strategy,” “Santa Claus Rally”
- The “Efficient Market Hypothesis” suggests:
  - Stock prices always always trade at their fair market value and all information to be known is reflected in the price. One cannot time the market.
- My goal is to show if these seasonal effects are real or just fallacies

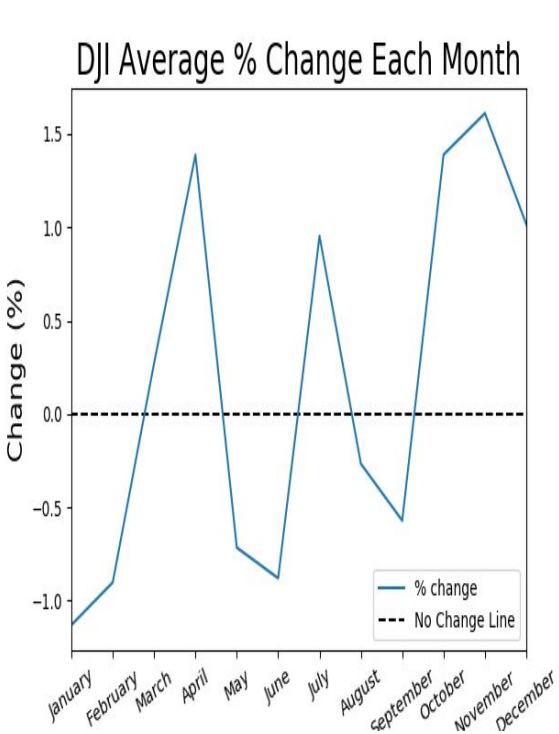
Background

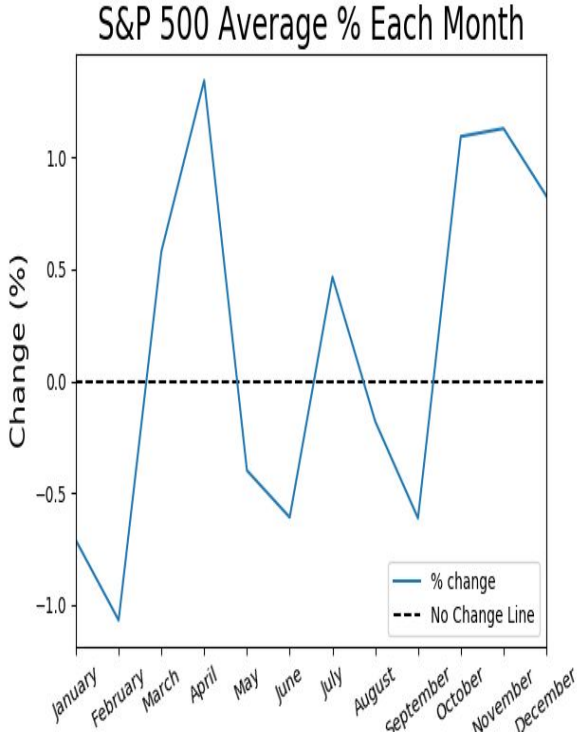
- The DJI, S&P 500, and NASDAQ Composite are the three most-followed indices in the US stock market
- DJI : 30 Large cap stocks
- S&P 500: 500 Large cap stocks
- NASDAQ Composite: 3000 Stocks (Mostly IT companies)

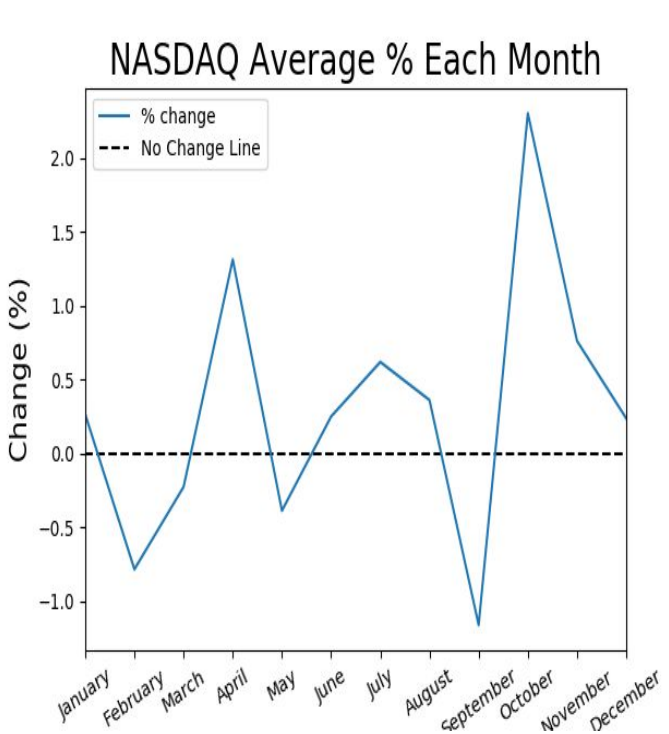
EDA and Pipeline

- Each dataset formatted the same way:
  - Columns: Date, Open, High, Low, Close, Adj Close, Volume
  - 5096 rows (business days between Jan 1, 2020 and April 3, 2020)
- Columns Added:
  - Datetime, year, month, inter-day price change, label (up or down)
- Resample method used to organize stock data (identifies business days and months)
- Recorded observed frequencies of increase or decrease for each month

Trend Graphs







Hypothesis Test #1

Do the stock market indexes show a monthly seasonality trend or are they generally uniformly distributed?

Null Hypothesis: Month should not matter, should be uniformly distributed

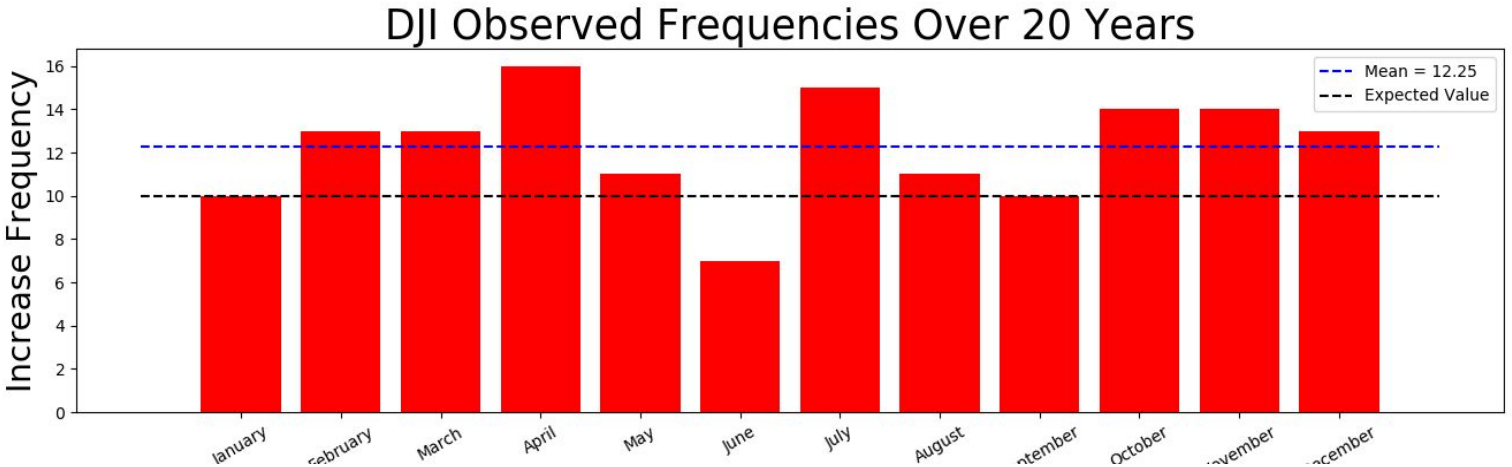
Alternate Hypothesis: Month has an effect on price

Approach:

Evaluate each month to an increase or decrease in closing price to create a discrete variable.

Run a Chi-Squared Test to see if monthly prices follow a uniform distribution

Results



P-values from Chi-Squared Results

- DJI: 0.287
- S&P 500: 0.539
- NASDAQ: 0.916

Hypothesis Test #2

Is there a seasonality difference in index price changes between the Summer and Winter months?

Null Hypothesis: Season should not have a significant effect on stock market

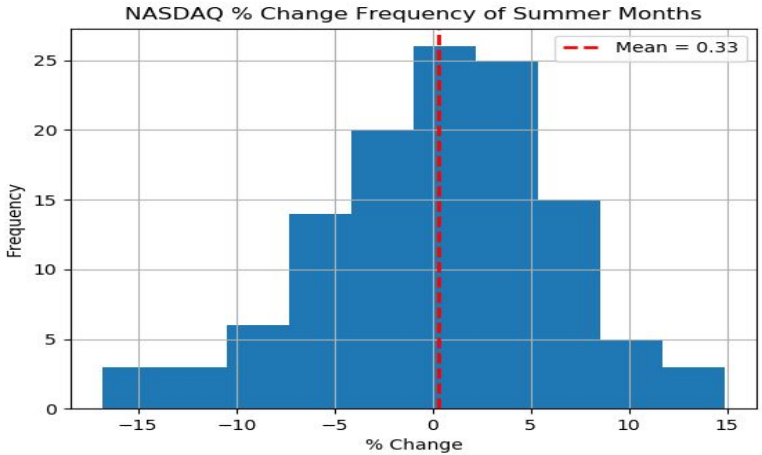
Alternate Hypothesis: There is a seasonal difference in stock trends between the Winter and Summer months

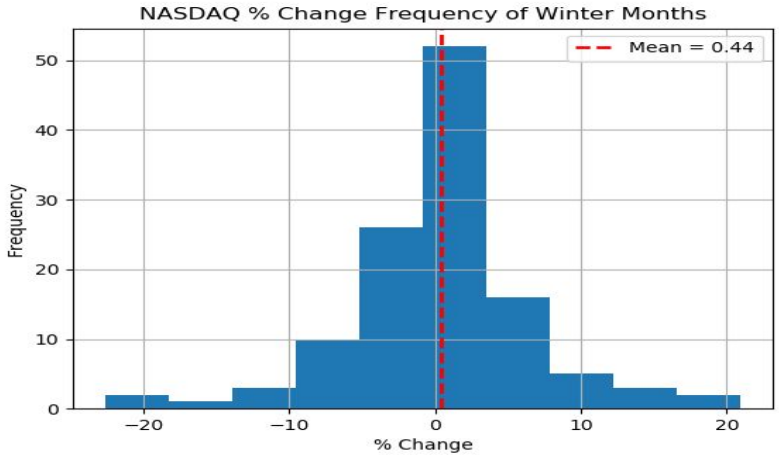
Approach:

Check for distribution of percent change frequencies for Winter and Summer

Perform a 2-tailed t-test to compare the similarity of the sample means

Results





Welch Test Statistic:

- DJI: 1.24
- S&P 500 1.13
- NASDAQ: 0.14

Degrees of Freedom:

- DJI: 237.89
- S&P 500: 237.96
- NASDAQ: 236.35

P-values:

- DJI: 0.22
- S&P 500: 0.26
- NASDAQ: 0.89

Conclusion

First glance looks like there is obvious trend differences among months. However...

For both hypothesis tests **I failed to reject the null hypothesis that seasonality is not a factor in stock price**. The p-values are much higher than .05 so the data generated is more likely to be consistent with a uniform distribution.

I am not willing to bet my money on it!

Future Direction

- Testing seasonality can be very valuable to a variety of topics.
  - Ex. Virus activity during summer or winter
- This topic was very interesting to me and I learned a lot about managing time-dependent data and hypothesis testing in general.
- I would highly consider continuing this project in the future to test for other factors influencing trends.