

Stock Market Analysis

CST2106 (Data Visualization)



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# Executive Summary

This project is an in-depth analysis that investigates the impact of news events on stock market movements, specifically the impact of the Covid-19 and **the Russian Invasion of Ukraine**. This analysis focuses on news sentiment data and major market indices such as the S&P500, the Dow Jones for the industrial sector, the NASDAQ for the technology sector, and the VIX for the market volatility. Using the data visualization and data modeling capabilities of PowerBI, along with integrated python scripts for machine learning models, this project provides a comprehensive view of the market and the impact of news sentiment highlighting the effects of covid-19 and **the Russian Invasion of Ukraine.** The project also makes use of a machine learning regression models to predict market trends, offering insights into how news sentiment may forecast market changes during the COVID-19 period and **the Russian Invasion of Ukraine.**

The findings revealed significant correlation between news sentiment and market performance. The pandemic news and **news about the Russian Invasion of Ukraine** were associated with an increase in market volatility and trading volumes showing that news sentiment could serve as an indicator for market activity. Additionally, a polynomial regression analysis was conducted through the use of integrated python scripts to capture the non-linear relationship and to provide a better fit.

# Background

This analysis is focused on the correlation between news sentiments and stock market trading, the analysis focuses on the COVID-19 pandemic outbreak that ‘officially’ started on March 11,2020 and the Russian Invasion of Ukraine. The pandemic and the invasion caused investors to change their strategies, creating a unique look into data influenced heavily by news sentiments.

The focus of the study is on four major stock indices: DJI (Dow Jones Industrial Average), NASDAQ, S&P 500, and VIX (Volatility Index). Each of these indices looks at different segments like broad-based market performance (DJI, NASDAQ, S&P 500) to market volatility (VIX). Their movements during the pandemic and the Russian Invasion of Ukraine, are important measures of economic sentiment and financial health.

In the context of the COVID-19 pandemic, our study is aimed towards quantitatively analyzing the relationship between news sentiment and stock market indices to gauge the range of this influence.

Additionally, the period of study encompasses various phases of the pandemic, including initial outbreaks and the global response in terms of lockdowns and economic stimulus.

# Analysis

The analysis begun with data collection for the DJI, NASDAQ, S&P 500, and VIX, and the news sentiment index from January 2019 to December 2023.

Initially exploring the data using PowerBI, we visualized market volatility and trade volumes, especially during key events like the WHO's pandemic announcement and the Russian Invasion of Ukraine. The DOW JONES showed a notable decline post-COVID, while the NASDAQ's rise indicated less impact on the tech sector.

It was found that the DOW JONES shrunk considerably from 26.2% to 19.6% post covid, while the NASDAQ increased from 40.62% to 49.02%, signalling the supply chain issues that the tech sector did not get as impacted compared to the industrial sector.

At the core of our analysis was a polynomial regression model to capture the non-linear relationship between market volatility and news sentiment. 9 degrees was decided to use for the model for its high correlation coefficient and R squared value. Making sure that the model was not overfitting the correlation coefficient and the r squared for both the test and train data remained within tolerance. Using this model, we discovered the relationship between the 30-day moving average of the VIX and the news sentiment.

To conduct our polynomial regression analysis, we had to make use of PowerBI's integration with python scripts to produce and train the model using pandas, numpy, sklearn, and matplotlib libraries. The python script also allowed us to calculate the correlation coefficient and the r squared to be displayed alongside the scatter plot.

Through our analysis we faced challenges with data inconsistencies in the values of the indexes. To solve this, we normalized the data and filtered for non-market days. For the regression analysis we dropped NaN values using ".dropna".

The data was normalized by indexing to a base value, this was accomplished by setting the base values at the date of January 2, 2019, then using that base value we can calculate the percentage change of each index value from its base value. We normalized the values because the VIX volatility index was a much smaller number compared to our other market indices. In order to properly visual all 4 four indices at the same time we needed to view the percentage changes instead of its original values.

To conclude the analysis, we examined and interpreted the results of the regression. The strong correlation coefficient of 0.76 of the test data suggested a relationship between the market sentiment and the market volatility. The R squared of .58 signifies that 58% of the variations were able to be explained by this relationship.

# Conclusion & Recommendations:

Based on this analysis it is evident that there is a connection, between the sentiment expressed in news and the stock market. The performance of market indices is not solely influenced by traditional economic indicators but is also influenced by public sentiment especially during times of global crises.

## Recommendations:

1. Research; It would be valuable to conduct studies that delve into additional factors such as political events and their combined impact on markets. This broader approach would provide a more comprehensive market analysis.

2. Investment Strategies; Investors should consider incorporating news sentiment into their decision-making process. Using tools that can analyze and measure real time news sentiment could prove advantageous.

3. Risk Management; In light of increased volatility, during crises it is essential to reassess risk management strategies and integrate the findings from studies.

4. Policy Implications; Policymakers and regulatory bodies can leverage these insights to gain a grasp of market dynamics during crisis situations potentially leading to effective economic policies and interventions.