Introduction

The S&P 500 is an index fund of the top 500 publicly traded companies. The value of the index is determined by how these 500 companies are performing in the stock market. The goal of this data analysis is to determine whether the investment should be encouraged or not.

Methods

      The dataset was initially plotted by date from March 30th to June 28th 2021. The data contains data from a series of weeks and the value of the index fund. A linear model was then plotted based on this data. The regression model showed an upward trend over this period of time with a r-squared value of 0.97. The linearity and constant variance assumptions were assessed by a residual plot against fitted values and normality was assessed by the Q-Q plot.

      Secondly the dataset was transformed to weekly percent change. Let Y_i be the weekly percent change in the i-th week since March 30, 2020, and let X_i be weeks since March 30, 2020. We assumed $Y_i = \beta_0 + \beta_1 X_i + \varepsilon$ (coded as fit2). $\beta_1 = 0$ means there would be a constant percent change, and $\beta_1 \neq 0$ suggests an increasing or decreasing change of value on average. The random weekly market fluctuations are represented by ε in this model. The model assumes linearity, constant variance, and normality. Once again linearity, constant variance and the normality assumption were tested by plotting residuals versus fitted values and examination of a Q-Q plot. $\beta_1 = 0$ was tested at a significance level of $\alpha=0.05$ and there was not sufficient evidence with p=0.1647 to reject that $\beta_1 = 0$. An assessment on the long term behavior of the market is then warranted. To do so we will observe the value of $Y_i = \beta_0 + \varepsilon$ where this model can be interpreted as the constant expected percent change in the S&P 500 index.

Results

Under the first model fit we observed an increase in the value of the S&P 500. Under the second model, fit2, observing percent change there was a lack of evidence to reject $\beta_1 = 0$ with a p-value of 0.1647 and a 95% confidence interval which included zero CI(-0.06,0.01). The point estimate of β_0 was found to be approximately 0.7 with a 95% CI of (0.12,1.28) and a p-value of 0.018. The value of β_0 indicates that on average there has been about a 0.7% gain in value per week during March 30th, 2020 and June 28, 2021

Discussion

There were promising trends in several of the models but statistical analysis did not provide sufficient evidence to conclude that short term gains were any different than zero. Further examination of the constant trend of the market provided sufficient evidence that there was an average gain of value in the S&P 500 of approximately 0.7% over the period of time analyzed. One of the limitations of this analysis is that it is not able to make any recommendations on short term trends within the index fund due to volatility within the market.

Conclusion

It is our recommendation that investments within the S&P 500 should be made with consistent growth expected over time. Short-term buys and sells of this stock are not recommended.

Figure 1. S&P 500 Analysis of Stock Value Trend