

Inference 1 - Our dataset of Fuel Prices is negatively correlated with the number of Covid cases between the dates 03/04/2020 - 03/18/2020

We have inferred this by performing the following tests:

1. Pearson's Correlation Coefficient Test: The correlation coefficient between the number of cases and fuel prices is -0.632, showing a negative linear relation between the datasets.
2. Chi Square Test: Q observed comes out to be 11.43, and the p-value comes out to be 0 in this case, thereby rejecting the Null Hypothesis. (The datasets are not correlated)
3. Multiple Linear Regression: We try to estimate the fuel price on day i based on the number of covid cases on $(i-2)$ th, $(i-1)$ th, and i th days. The MAPE of the testing data is low (32%).

From the above tests, it is evident that the fuel price between the above mentioned dates is negatively dependent on the number of covid cases observed. We attribute this observation to the travel restrictions imposed in various parts of the country due to the onset of Covid this time, thereby reducing the demand of fuel.

Inference 2 - Our dataset of Fuel Prices is positively correlated with the number of Covid cases between the dates 10/11/2020 - 11/21/2020

We have inferred this by performing the following tests:

1. Pearson's Correlation Coefficient Test: The correlation coefficient between the number of cases and fuel prices is 0.652, showing a positive linear relation between the datasets.
2. Chi Square Test: Q observed comes out to be 31.11, and the p-value comes out to be 0 in this case, thereby rejecting the Null Hypothesis. (The datasets are not correlated)
3. Multiple Linear Regression: We try to estimate the fuel price on day i based on the number of covid cases on $(i-2)$ th, $(i-1)$ th, and i th days. The MAPE of the testing data is low (4.48%).

From the above tests, it is evident that the fuel price between the above mentioned dates is positively dependent on the number of covid cases observed. We attribute this observation to the resumption of normal travel and business throughout the country. Due to this, the relaxed restrictions led to the rise in number of cases as well as the increase in demand of fuel causing the observed positive correlation.

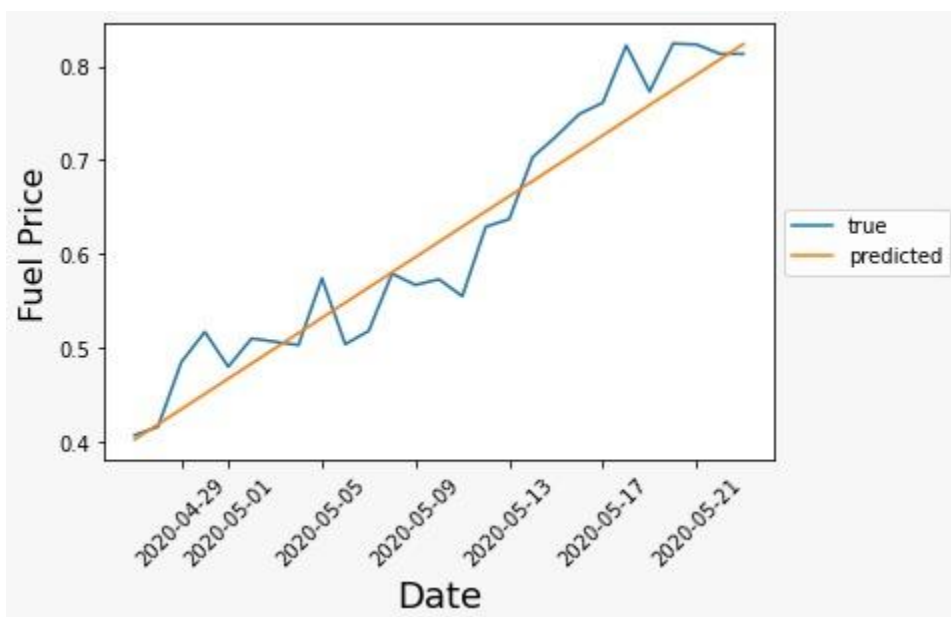
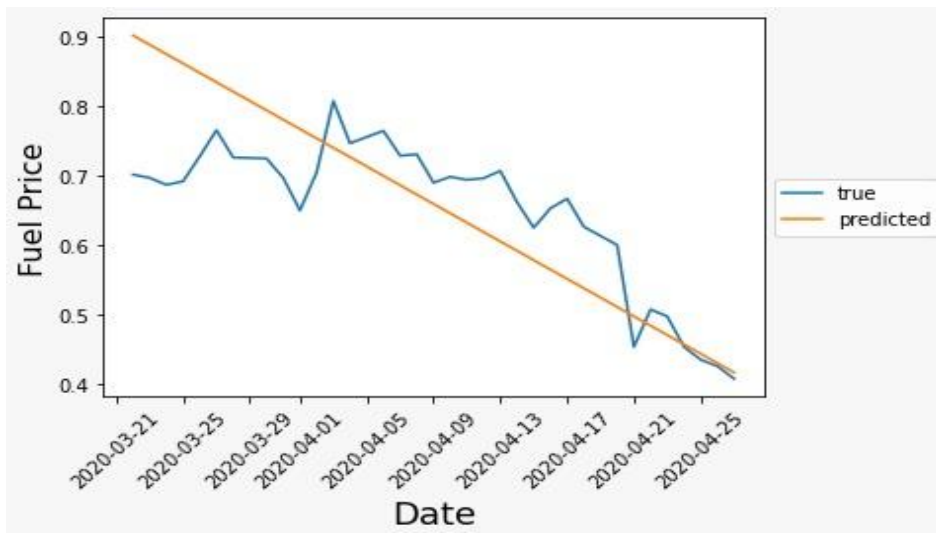
Inference 3: The price of fuel saw an inflection point around 04/27/2020 due to the OPEC cartel introducing a rule to curtail the supply of oil.

We observe that the fuel price data saw an inflection point around 04/27/2020, where the fuel price which was seeing a downward trend till 04/27/2020, started seeing an upward trend. This

was due to the fact that the OPEC (Organization of the Petroleum Exporting Countries), decided to decrease the supply of oil thereby shifting the existing demand-supply ratio of oil and causing an increase in the fuel price. To prove our hypothesis, we further show that this inflection wasn't dependent on the number of covid cases using the following tests: (between the dates 04/20/2020 - 05/10/2020)

1. Pearson's Correlation Coefficient Test: The correlation coefficient between the number of cases and fuel prices is -0.11, showing the absence of a linear relation between the datasets.
2. Chi Square Test: Q observed is 0.154, and the p-value is 0.7, showing the fuel prices and number of cases is independent during this time.

From the graphs below, showing the distribution of fuel prices over time, an inflection point is clearly visible around 04/27/2020 when the OPEC rule was enforced.



More credible information about the observed increase and its cause can be found at
<https://www.bls.gov/opub/mlr/2020/article/from-the-barrel-to-the-pump.htm>
<https://www.flightglobal.com/airlines/jet-fuel-prices-hit-two-decade-lows/137554.article>