

# Stock Exchange Rates in Relation to COVID-19

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## Abstract

Our challenge is to create an accurate model exploring the correlation between key variables that impact the stock market during the COVID-19 pandemic. Existing models don't completely account for the relationship between these key variables.

Our approach is to use a model from the literature as a blueprint and to try to develop a more accurate and generalized model.

## Introduction

In this model, we are provided with the key variables that make up the stock market. (Topcu et al. 2020)

$$sm_{it} = \alpha_0 + \sum_{i=1}^p \alpha_1 exc_{it} + \sum_{i=1}^p \alpha_2 oil_{it} + \sum_{i=1}^p \alpha_3 covid_{it} + \epsilon_{it}$$

However, background research suggests a relationship between variables:

- Oil prices' effect on exchange rates in Beckmann et al. 2020,
- Oil and COVID's interaction in Sorkhabi 2020,
- Exchange rates and COVID's interaction in Hofmann et al. 2021.

Understanding that each variable is further connected, our objective was to construct a more holistic model. The importance of this is to solidify an understanding of how pandemics affect our economy in the case of future pandemics.

## Results

Stock market indices are affected and influenced by the number of covid cases, oil prices and exchange rates.

- Received an R<sup>2</sup> value of 0.65 which means the model is able to account for around 65% of the variation in the stock market indices.

Since we used z-scored variables when building the model we are able to compare the coefficients:

- Oil prices have the largest coefficient hence they have the greatest influence
- Exchange rates have a negative influence on stock market indices

Assumption of linearity:

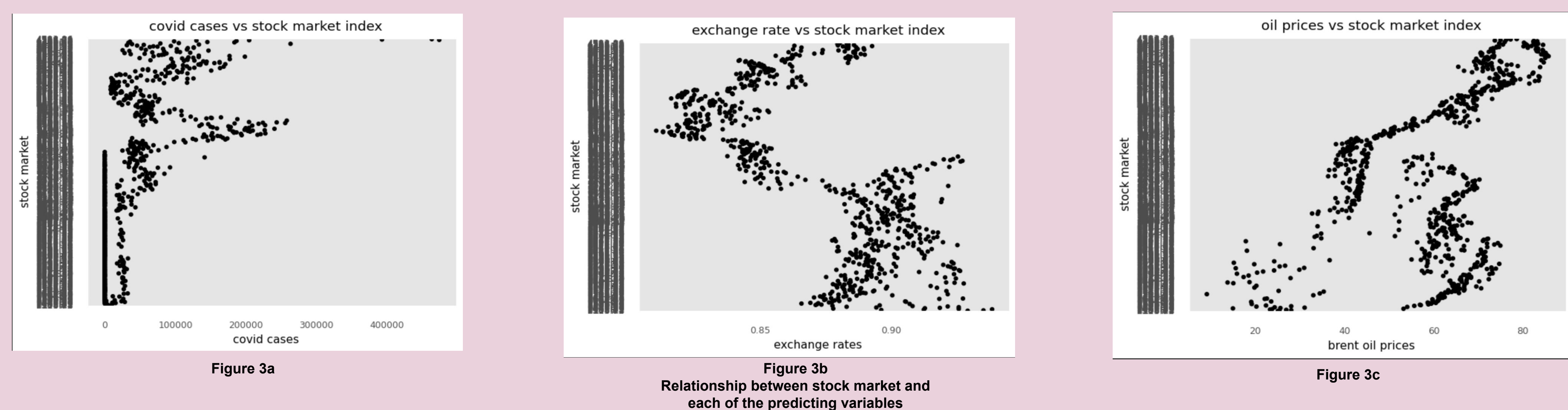
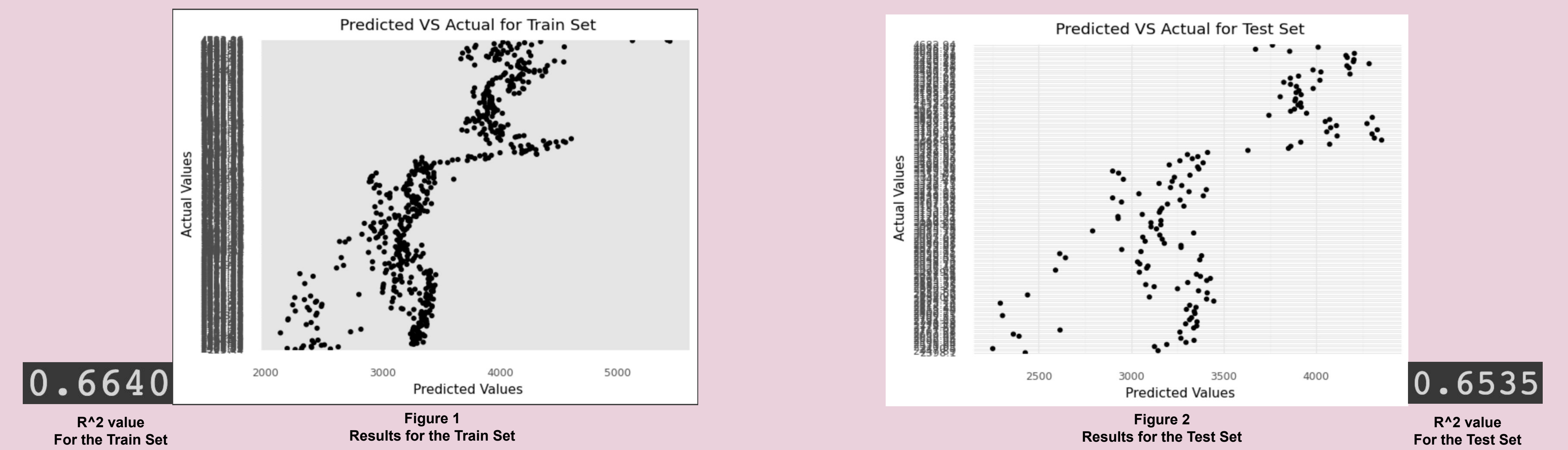
When using a linear regression model we make the assumption that each of the predicting variables has a linear relationship with the y-variable.

**Figure 3(a-c)** shows us these relationships and we can see that there is some sort of linearity but not perfect. This helps explain the low R<sup>2</sup> value of our model.

## Future Work

As the model is not sufficiently accurate, it would be useful to develop a non-linear model to better accommodate real world data.

The model can also be applied to other countries to then capture global trends.



	exchange rates	covid cases	brent oil prices	stock market
1	0.8829	0	54.06	2510.03
2	0.8778	0	53.23	2447.89
3	0.8775	0	55.64	2531.94
6	0.8711	0	57.10	2549.69
7	0.8733	0	56.91	2574.41

**Figure 4**  
A snippet of the dataset

	Names	Coefs
0	exchange rates	-206.911724
1	covid cases	252.150901
2	brent oil prices	285.099055
3	intercept	3480.748311

**Figure 5**  
Coefficients Table

## Methods

- A linear regression model using multiple sources to build a dataset with the different variables we want to analyze. A snippet of the data can be seen in **Figure 4** above. We used this data to build a model using pandas (coding in python).
- We z score our variables because we noticed that they were all on a different scale making it hard to directly compare two variables. The new data points are basically a representation of how far each point is from the mean of the column and each data point is changed based on this.
- 80-20 split - we can use 80% of the dataset to build the model and use the other 20% to test how the model is performing with unseen data.
- The two graphs (**Figure 1 and Figure 2**) above are showing the model's predicted values and how they compare to the actual values. The graphs for both the training and testing set look similar enough to say the model is performing well.
- **Figure 5** shows us the coefficients and because we made sure to z score we can directly compare. The values might look a little high but that is because we would need to use z scored data if we want to directly multiply the data values (use the equation).

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