Modeling Imperial Credits

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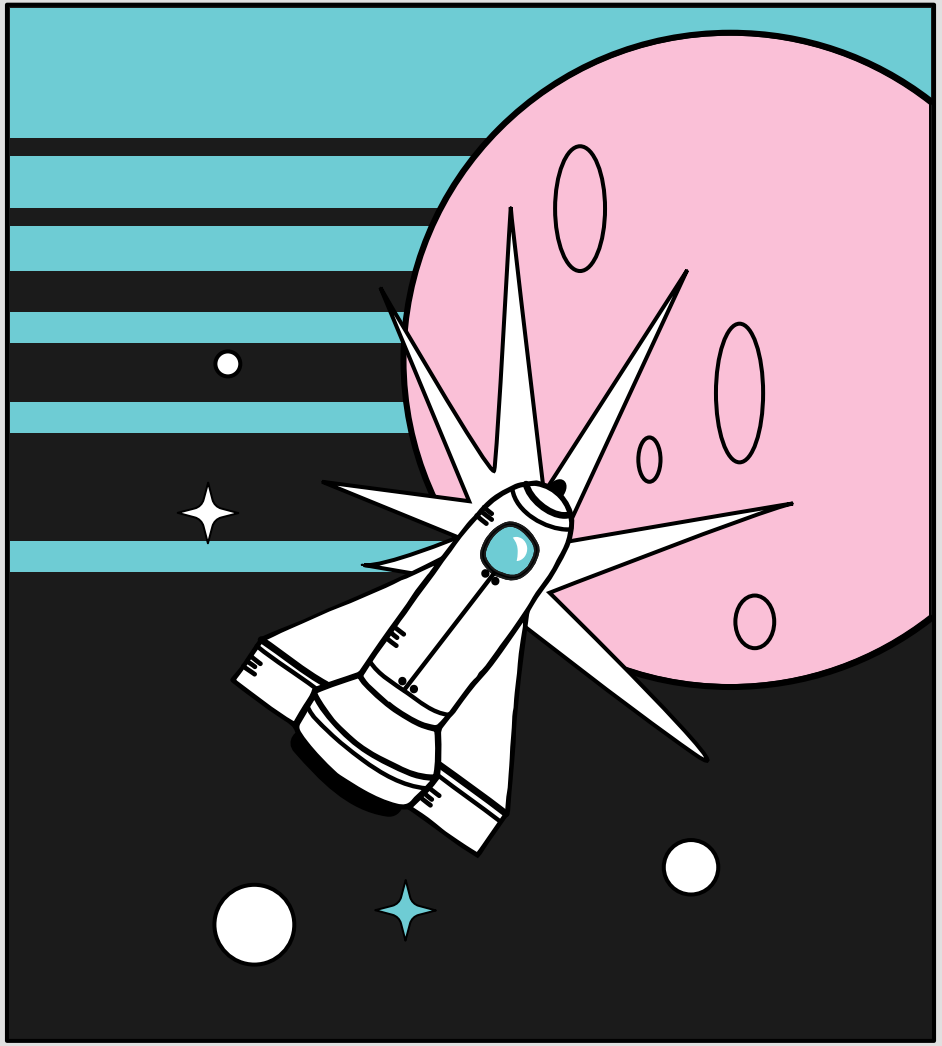
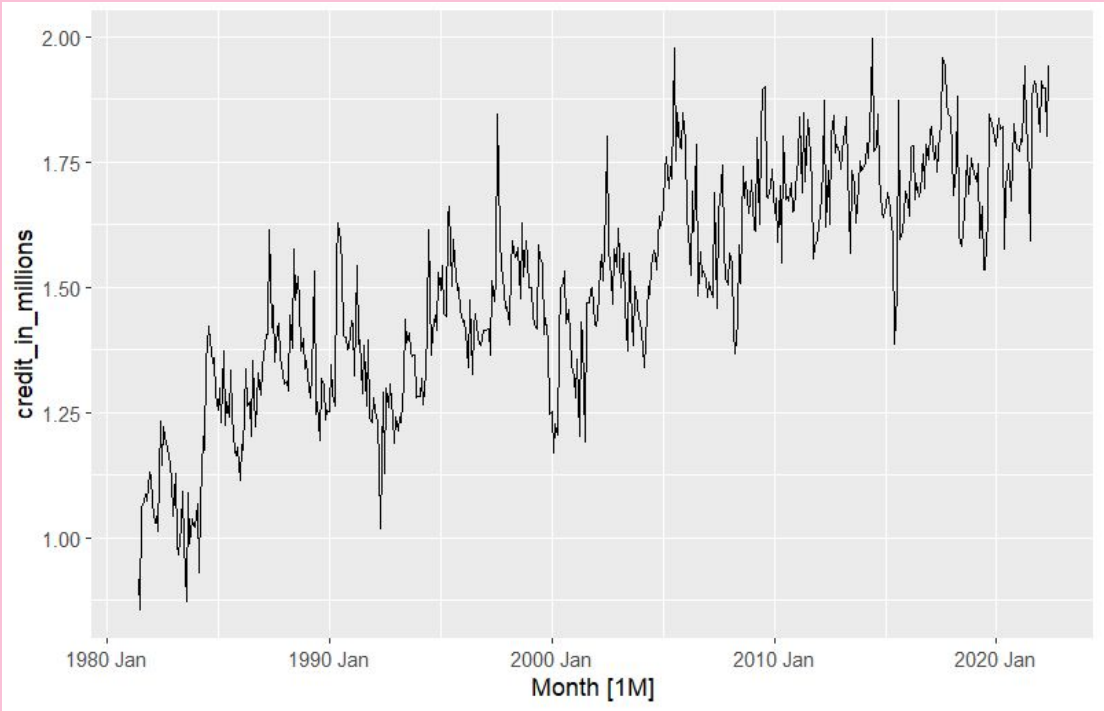
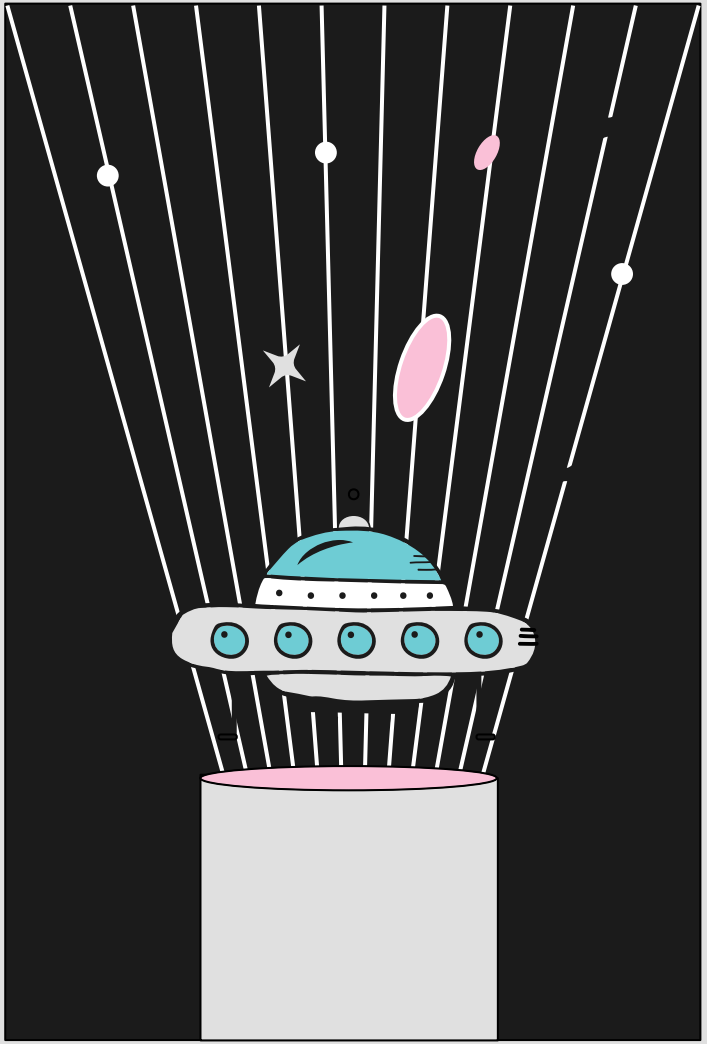


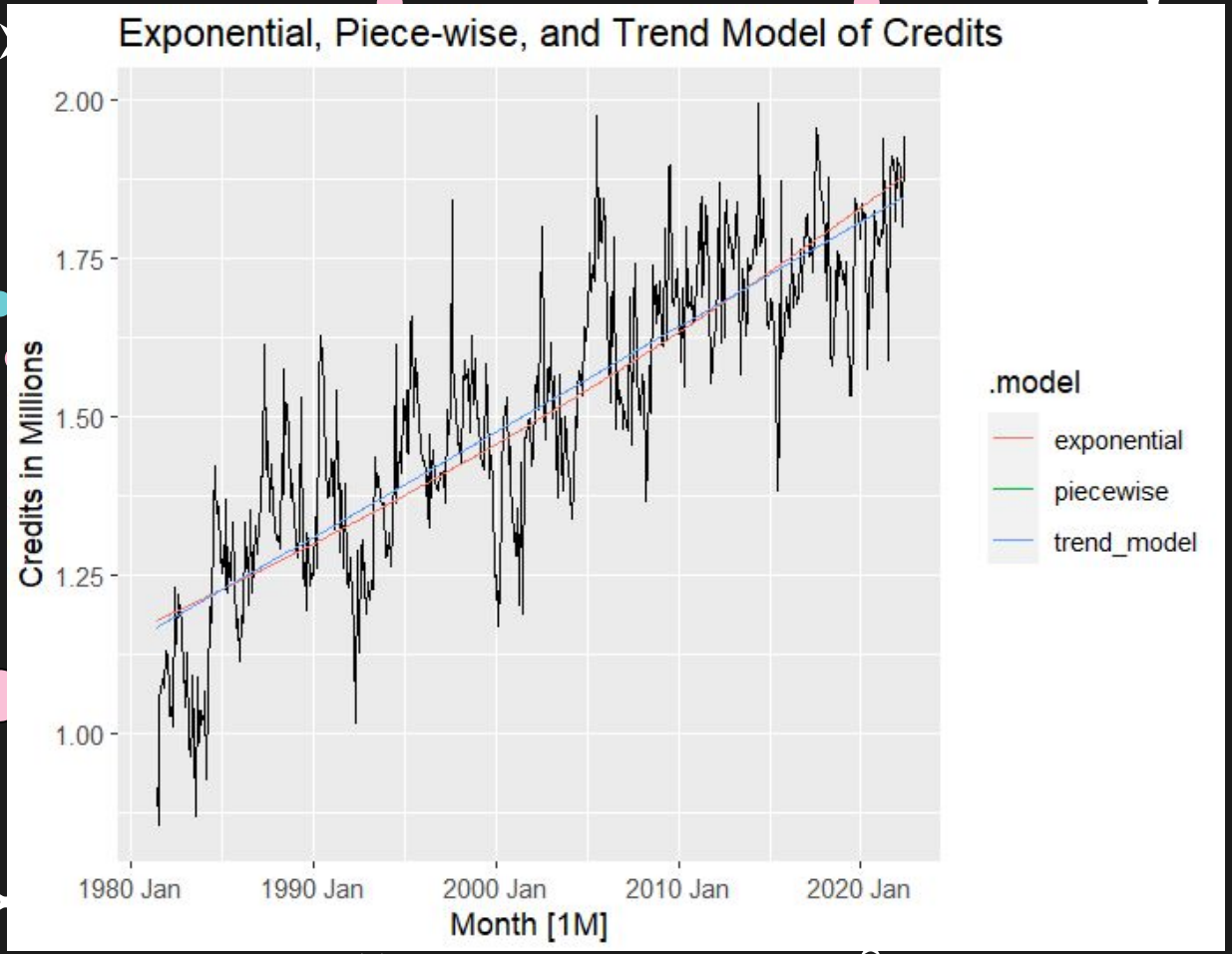
Preparing the Data

1) First we switched the order of the data since it was chronologically listed backwards in the original cv
2) Next we indexed the data by date
3) Then we determined that the data did not need mathematical transformations because there was no homoscedastic issues
4) However, the data was determined to be stationary due to trend and the acf plot
5) Using R, we found that we need to difference the data once in order to make the data stationary
6) Once differenced, the data is ready for use!

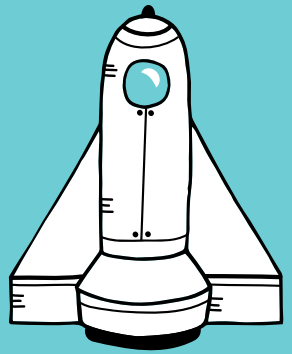


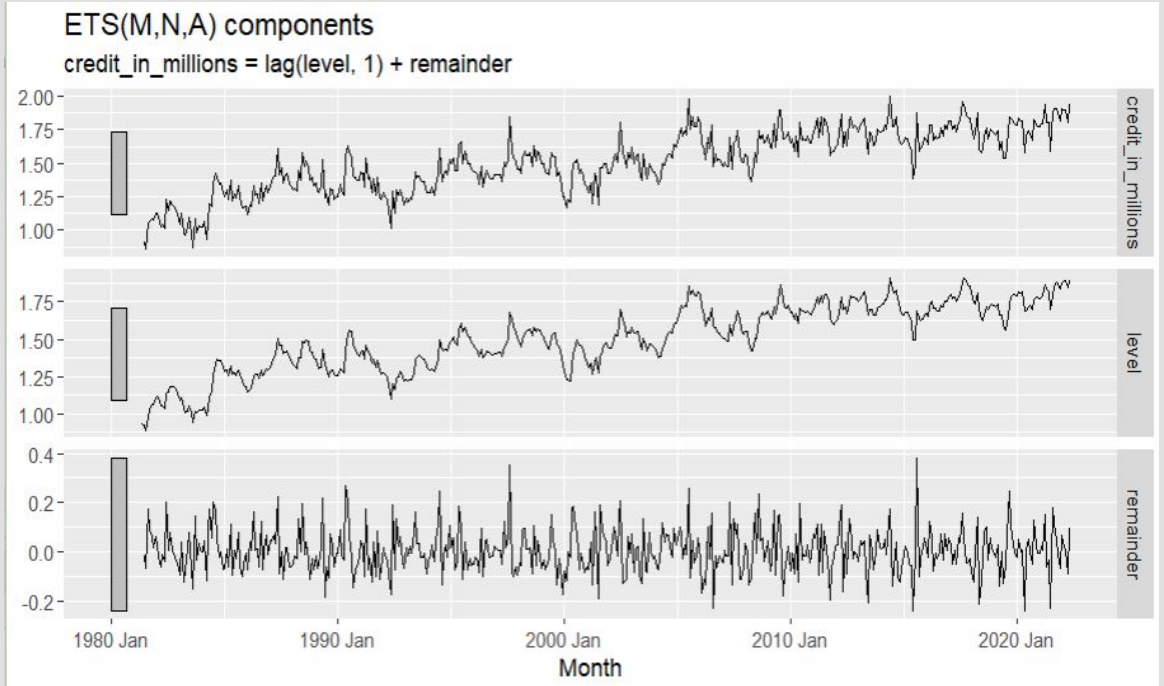
Above is a plot of the differenced credit data. This will be the data that we use for our predictions and modeling.



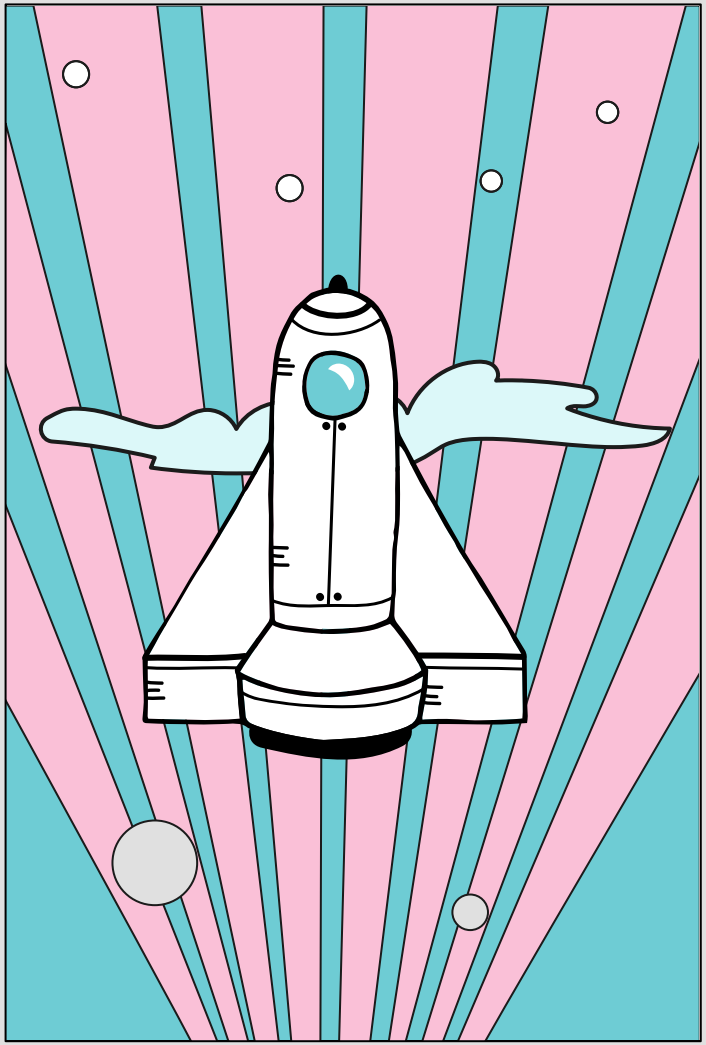


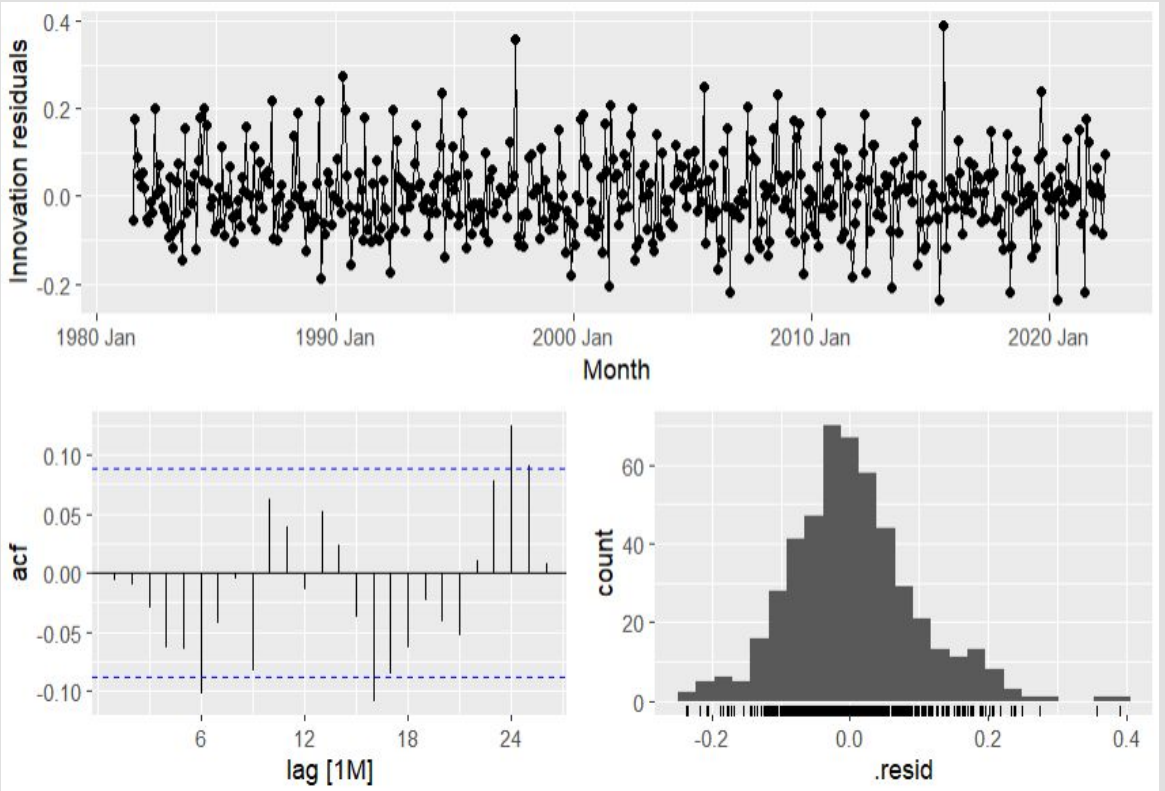
To the left is the exponential, piecewise, and trend model that was fitted to the data. As we can see, the model does not capture the data very well aside from the trend. The RMSEs indicate large misses of 121,000 and 124,000 credits for the trend and piecewise models, respectively.





The remainder portion for the ETS, or the residuals, seems to be heteroskedastic and is mostly centered on zero. It also plays a large part in the predictions made by the model as can be seen in the reference model. The RMSE of the model 0.0868 which is an average miss of about 868,000 credits. Thus the model seems to be a pretty decent fit to the data.





Next we fitted an auto ARIMA model to the data. The non-seasonal ARIMA seems to be a 3,0,0 model. It has an RMSE of .0912 on the differenced credit. This indicates a miss of about 912,000 credits. The residuals seem to be normally distributed and centered around 0, but there are a couple of extreme residuals as well.

0.1230

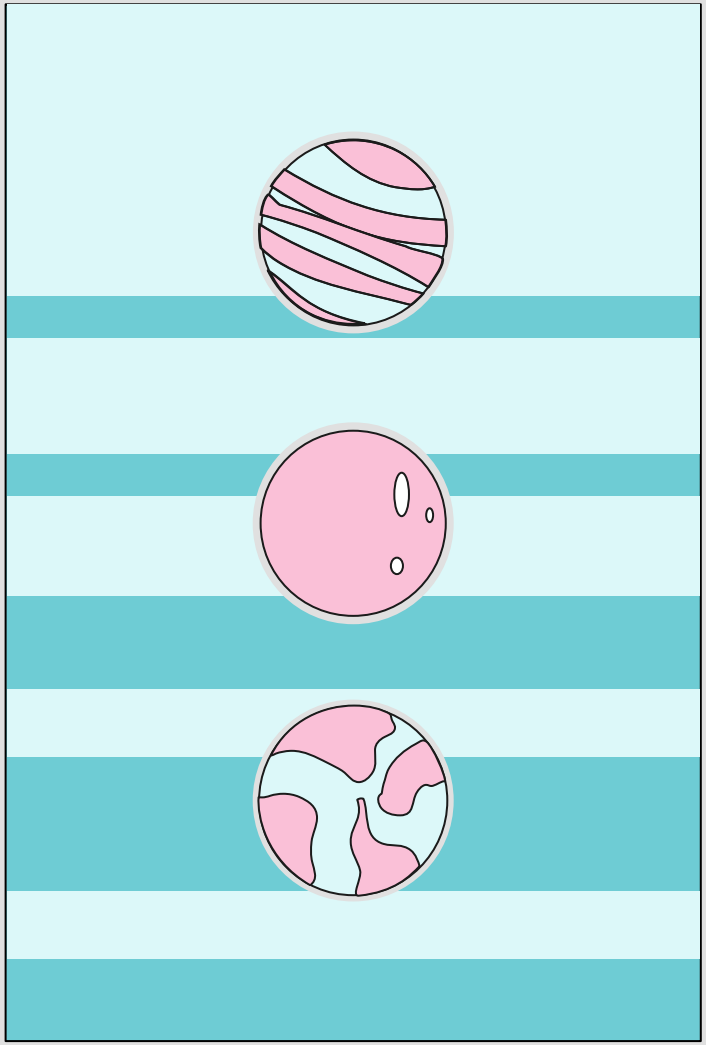
RMSE of the trend model

0.0868

RMSE of the ETS model

0.0900

RMSE of the Arima Model



We will be choosing the model based on the RMSE of each model. As shown in the last slide, the ETS model has the smallest typical miss. This is an indicator that our predictive model will likely be more accurate.

Also note that the since the units are by millions of credits, the typical miss is not as large as it seems!

0.143

RMSE of the naive model after cross validation

0.139

RMSE of the ETS model after cross validation

0.148

RMSE of the Arima Model after cross validation

After Cross Validation...

We see that the RMSE of the ETS model is still the lowest and is therefore the best model to use for predictions. We used cross validation as well as testing the models on training and holdout data. The training data is just 80% of the data we have and we save the last 20% of the data for the holdout. This is to further affirm that the ETS model will provide predictions that are reliable.

Predicted Imperial Credits (in millions) for the Next Year

Month	Predicted Credits
1	1.70446383008983
2	1.73057656707186
3	1.77536349917376
4	1.81495905274494
5	1.81468379136653
6	1.8466037201506

Month	Predicted Credits
7	1.81953602178919
8	1.79973290866652
9	1.7949576753167
10	1.77731728300609
11	1.77379058029364
12	1.771641050583

Conclusions

As we can see from the table, the trend for imperial credits is predicted to continue to be increasing. There is some fluctuation but the overall trend is positive which is consistent with the data we have so far! This is a indicator that the model will be a decent predictor.