NEW ZEALAND GDP FORECASTING

Presented by : Dan Dai

INTRODUCTION

- Background
  - The Investor wants to know if NZ is worth investing
  - Build a Machine learning model to analyse NZ economy growth potential

- Goal of the project
  - Is NZ's Economy safe to invest
  - What factors would affect GDP growth
  - What machine learning model can forecast GDP growth
  - Which is the best Machine learning model

- Key Analysis
  - Exploration Data Analysis
 - Machine Learning Model Comparison(ARIMA and Linear Regression)

ABOUT DATA

- Data source from the World Bank

- Collection of Time-dependent yearly data to analyse patterns in the past data to make future forecasting

- Target Variable: New Zealand GDP

- Features: Time, Agriculture, Service, Manufacturing, Consumption expenditure, Inflation and Unemployment

- Feature engineering to make the data useable, null values were filled

- Limitations: small sample with only about 50 rows of yearly data, quarterly data not available

OVERALL VIEW OF WORLD GDP

Projected GDP (Nominal) Ranking 2021

Rank (1-10) Rank (11-20) Rank (21-30) Rank (31-40) Rank (41-50)
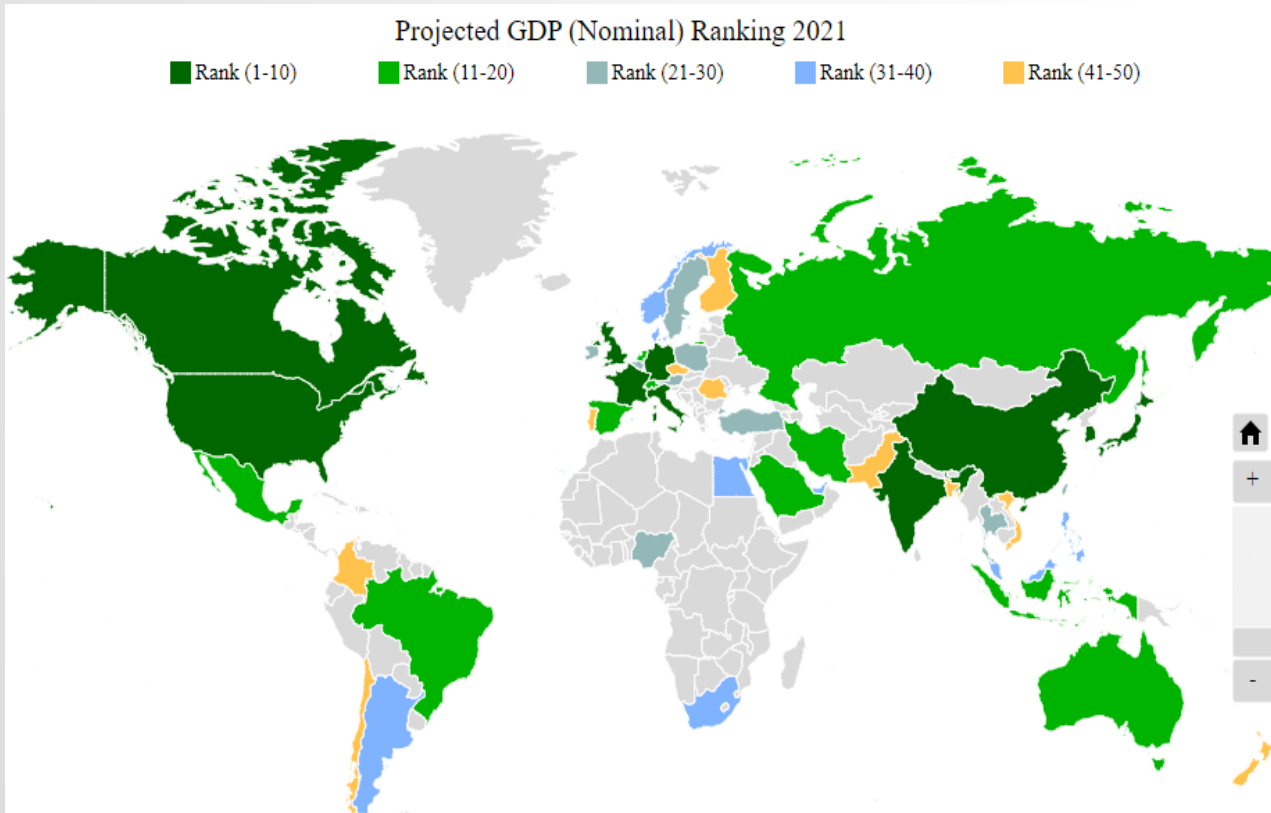
- What does GDP mean for Investors

- Total GDP(Nominal)
  - US Rank 1 | NZ Rank 50

- GDP per capital
  - US Rank 6 | NZ Rank 21

- GDP Growth Rate
  - US 5.97% | NZ 5.06%

- OECD
  - 38 Developed Countries

NEW ZEALAND GDP GROWTH
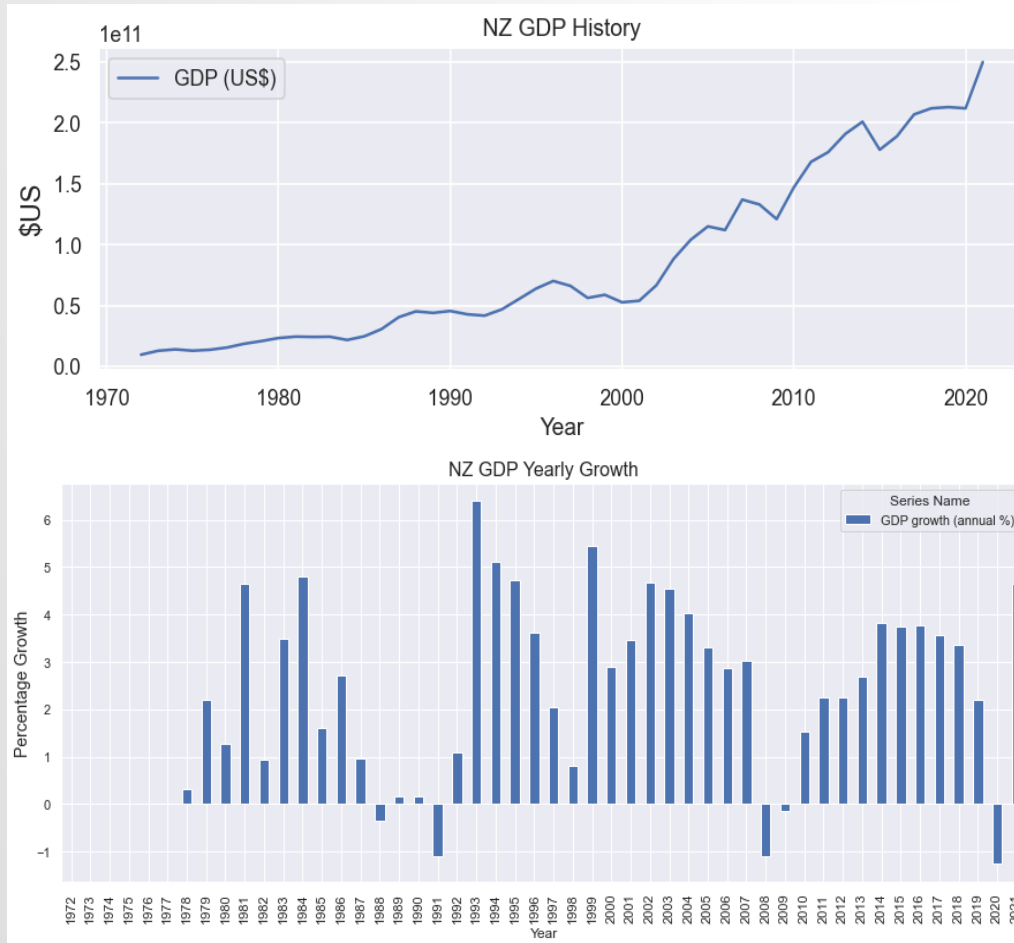
- Stable growth through the years
- doubled from 2000-2003
- doubled from 2003-2013
- Most of the year is in positive growth
- 2008 financial crisis and 2020 Covid-19

CORRELATION
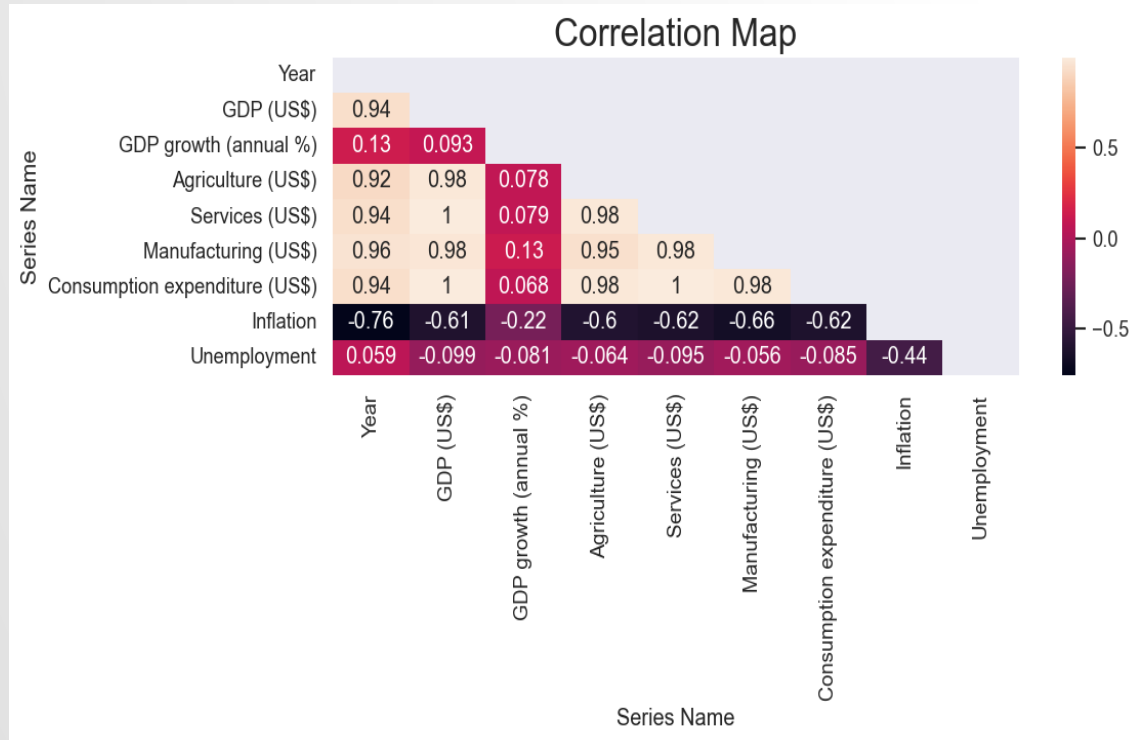
- Factors that affect GDP the most

- Manufacture, service and Agriculture, consumption have the highest correlation with Total GDP

- Inflation and Unemployment has a negative correlation with GDP

GDP COMPONENTS
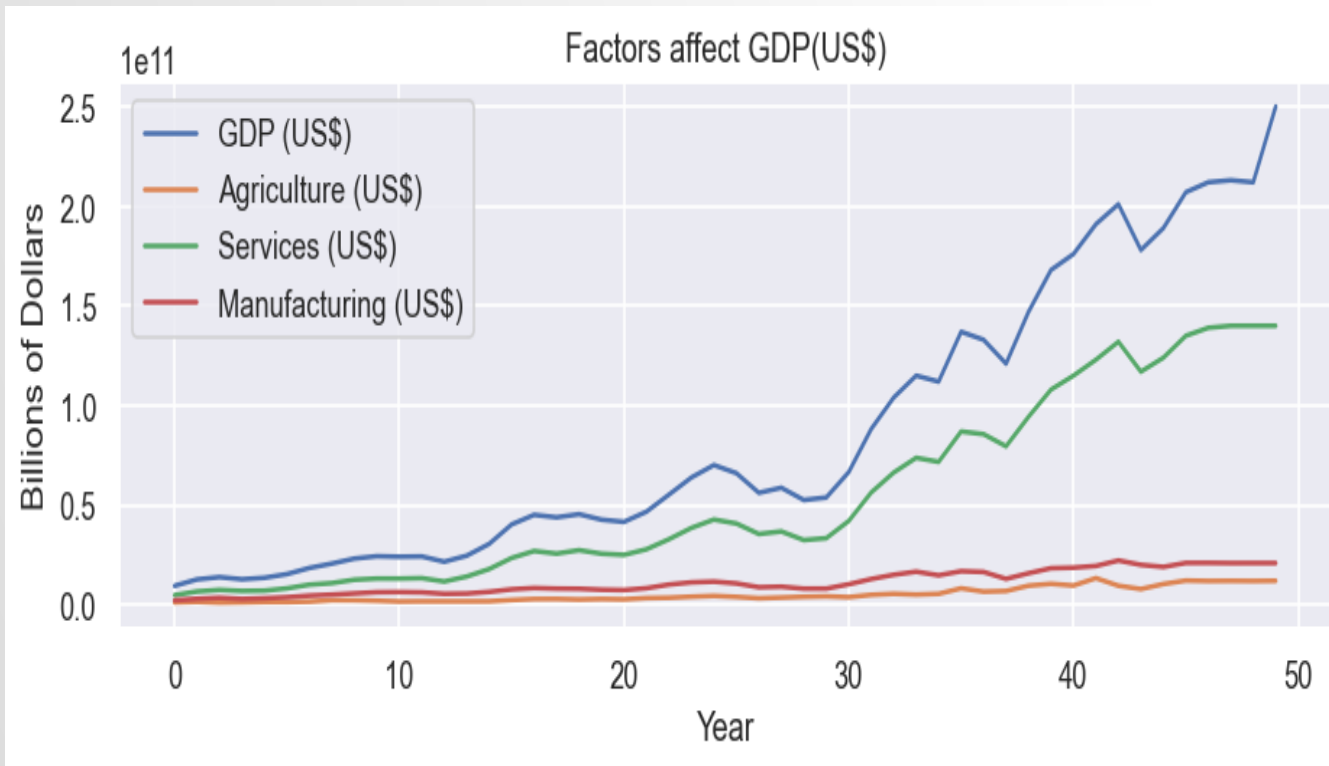
- NZ economy largely relies on the service sector

- Agriculture and Manufacturing only have small amount of growth in the past 50 years

ARIMA MODEL ASSUMPTIONS

- Data for ARIMA model needs to be Stationary
  - With trend or seasonality are not stationary

- Detrend and difference to adjust data to stationary

- Seasonal Adjustments if necessary

- ADF Test to test Null Hypothesize to find out if data is Stationary

ARIMA MODEL ADF TEST
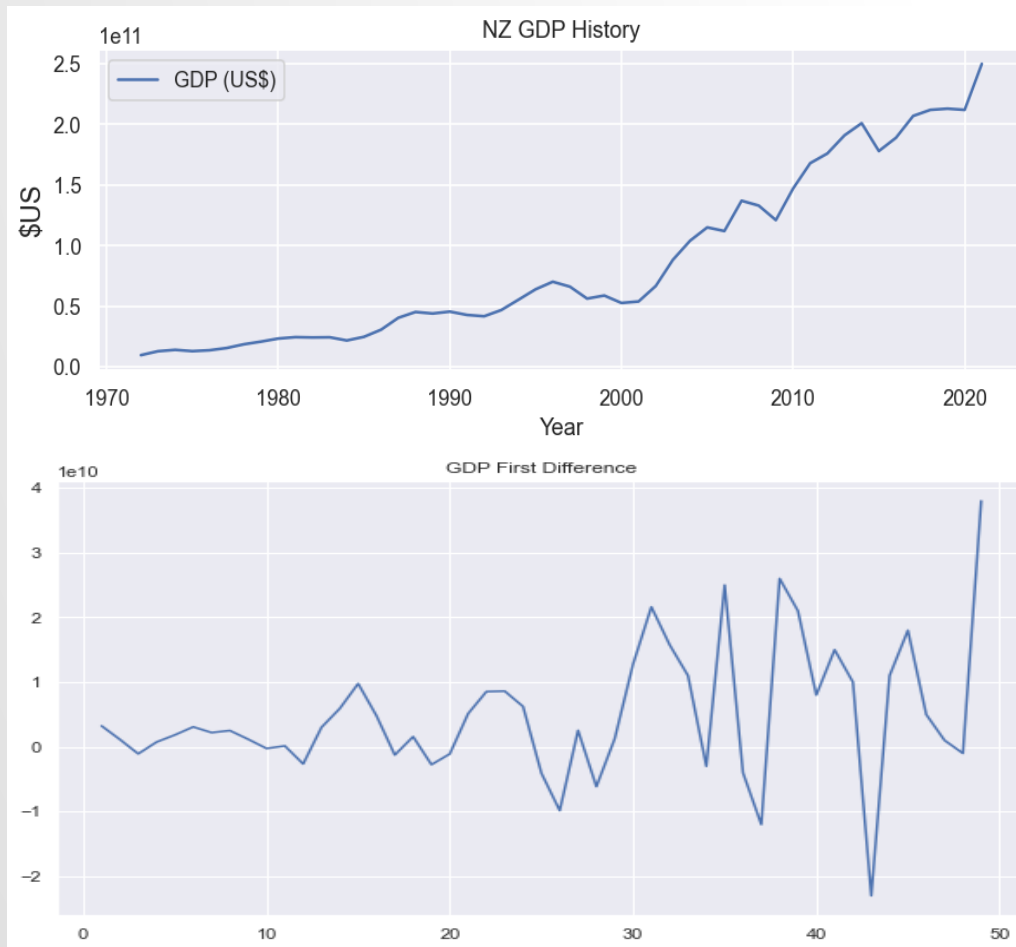
- Original Data Test Result

    ```
    ADF Test Statistic : 1.6044841910455874
    Fail to reject H0, data is non-stationary
    p-value : 0.997870966610532
    ```

- First Difference Test Result

    ```
    ADF Test Statistic : -5.094052437271258
    reject the null hypothesis,data is stationary
    p-value : 1.4410221427457905e-05
    ```

ARIMA MODEL TUNING


- Model Parameters p,q,d

- ACF charts to work out best Parameter of AR model lags p=1

- PACF chart to work out the best parameter of MA model lags q=1

- d means the degree of difference, which is determined by ADF testing d=1

ARIMA MODEL CROSS VALIDATION
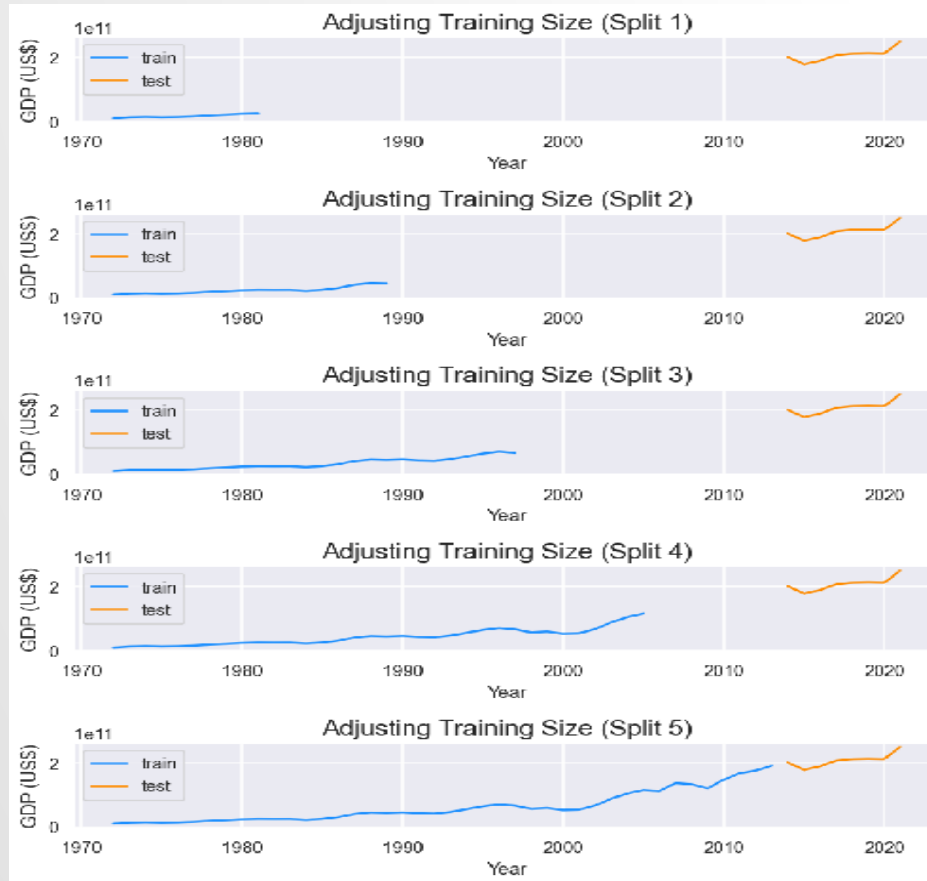
- Time series split

- Use default 5 splits

- Test data from the 42nd which is the year of 2014

- Use Train data to fit the model and test data to do the forecasting

ARIMA MODEL FORECASTING
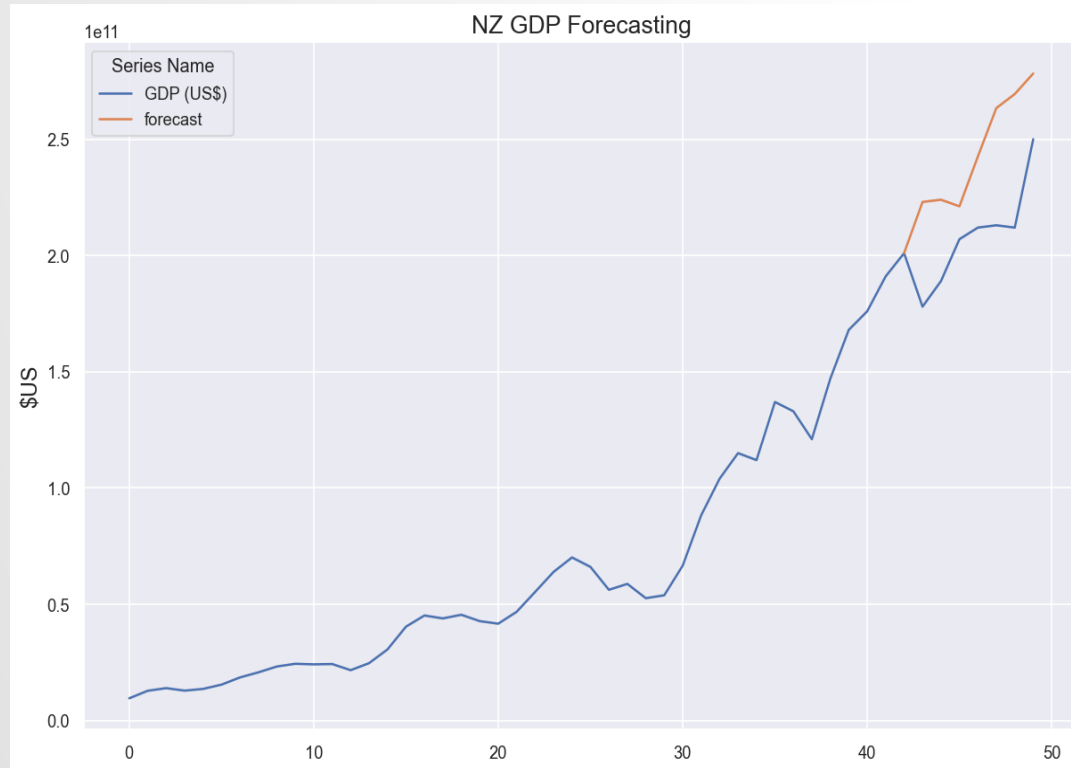
- Use train and test data to build the final forecasting model

- Model forecast GDP growth from the year 2014

- RMSE Value 206.6 billion

LINEAR REGRESSION MODEL

Actual VS Prediction
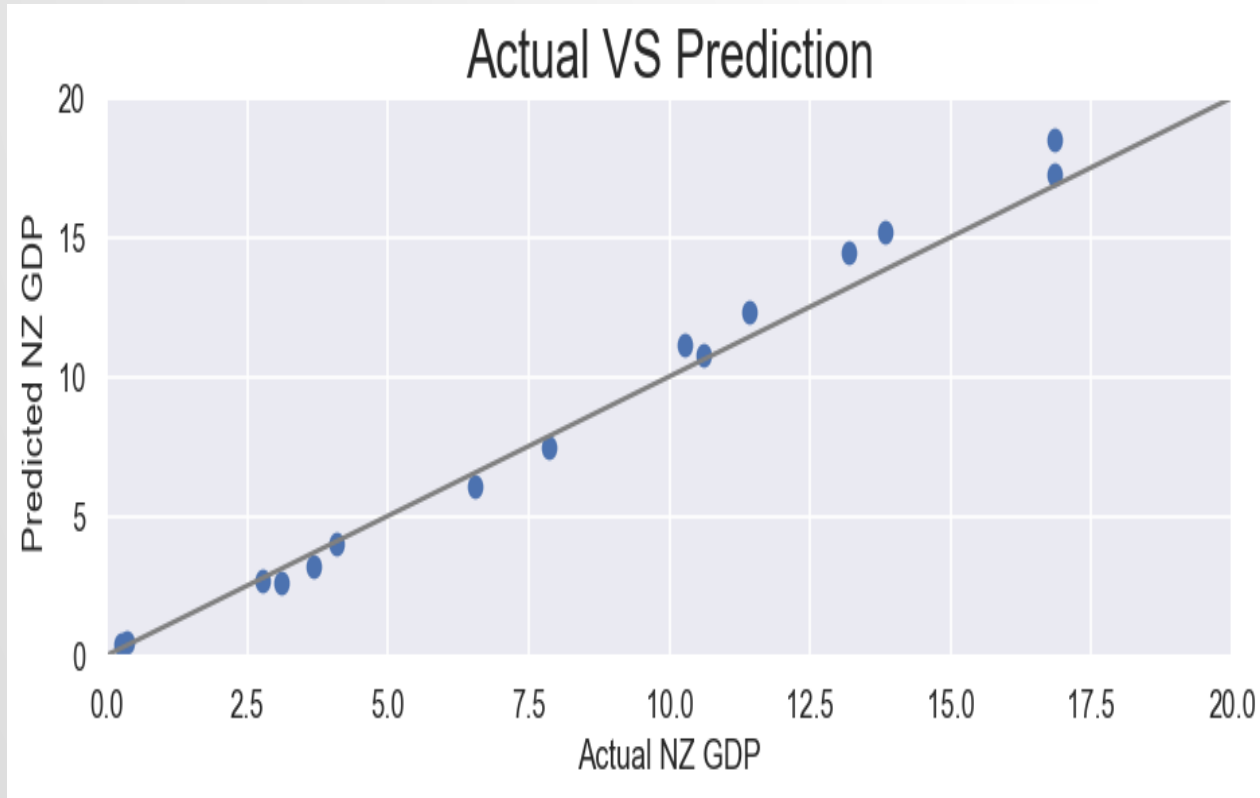
- Outcome variable : GDP

- Responsible variable: All other features expect Year

- All features selected, data normalized

- Train and test the database on a 30% split

- Linear regression model has fit the line perfectly

- RMSE Value 0.77

CONCLUSION

- NZ is a good place to invest with GDP expected to keep on growing in the next few years

- variety of factors affect the growth of GDP including Services, consumption, agriculture sector

- Both ARIMA and Linear regression model can be used to predict GDP growth

- Linear regression model has outperformed ARIMA model with Smaller RMSE value

RECOMMENDATION

- NZ is recommended place to invest with next year's GDP expected to grow at about 5%

- Invest in the service sector as it is highly correlated to GDP, you would expect a similar return of at least 5%

- Inflation is at its highest in past 30 years, do not invest in the cash fund

- Linear Regression model is recommended for GDP growth forecasting

- In order to improve ARIMA model, quarterly data could be used to have more accurate seasonal adjustment

THANK YOU! QUESTIONS?