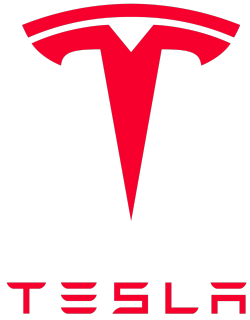
Time Series Forecasting

Tesla Stock Price Analysis and Forecast

Team #02
Chris Fake, Jazz Ling, Nick Miller, Eva Wang



Agenda

Overview & Objectives

Data & Analysis

Conclusions

Company Overview

- Produces electric vehicles, energy storage units, and solar panels
- Deliveries (FY22): 1.3mn
- Revenue (FY22): $81.5bn
- EPS (FY22): $3.62

Objectives

#1

Explore the impact of COVID-19 and the global chip shortage on Tesla stock prices.

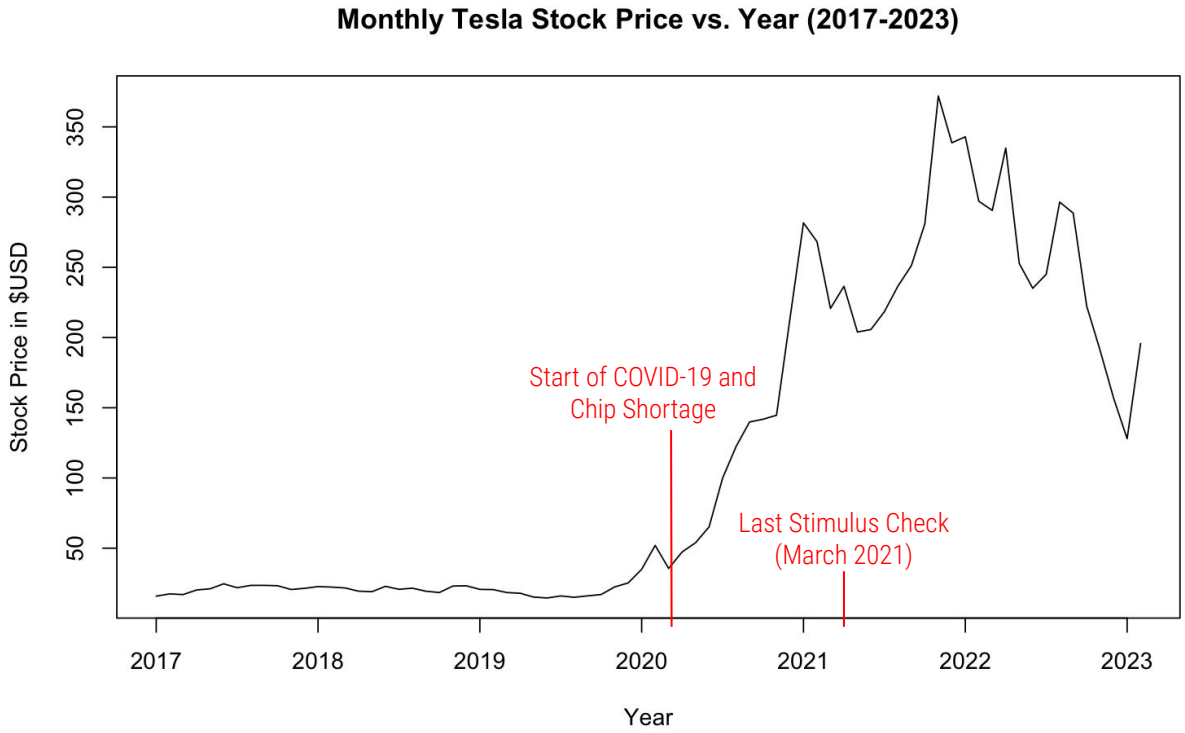
#2

Train forecasting models to predict Tesla's stock price for the next **12** weeks and **3** months of 2023.

Objective #1

Explore the impact of COVID-19 and the global chip shortage on Tesla stock prices.

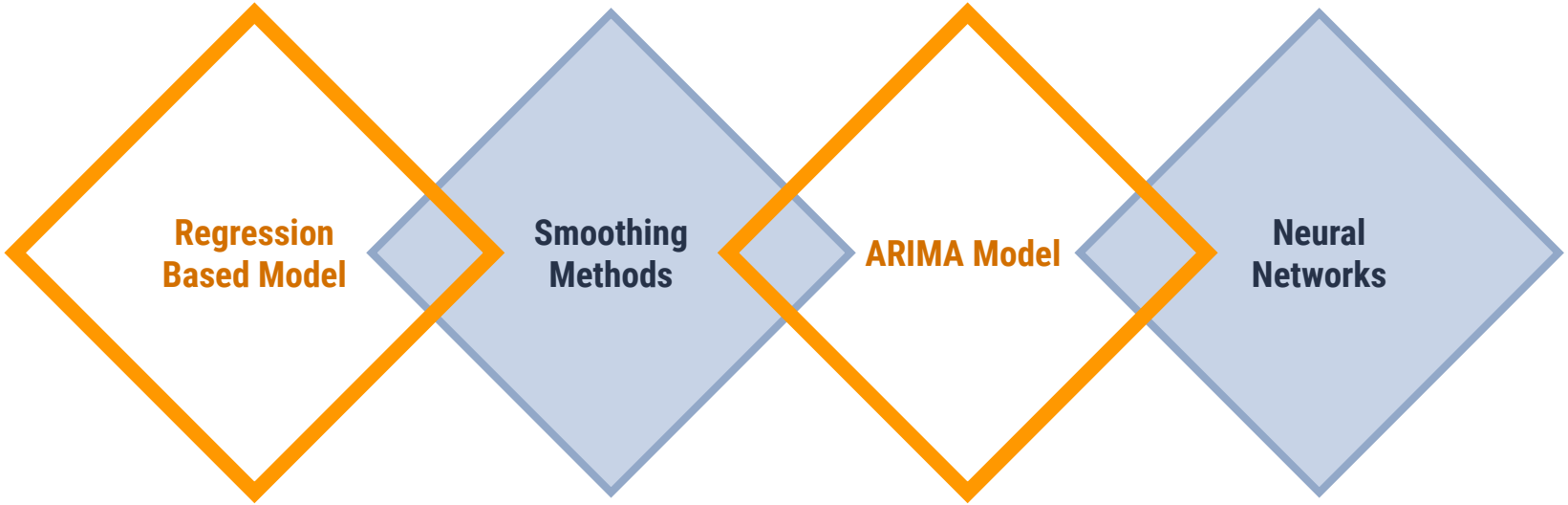
Tesla Stock Prices Over the Years



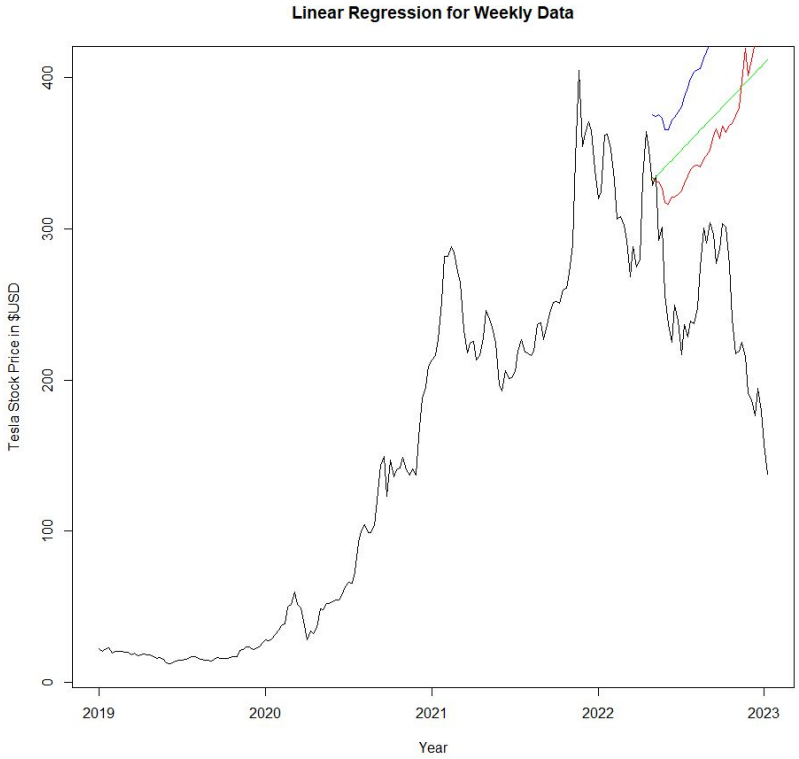
Objective #2

Train forecasting models to predict Tesla's stock price for the next **12** weeks and **3** months of 2023.

Forecast Methods



Regression Based Model - Weekly

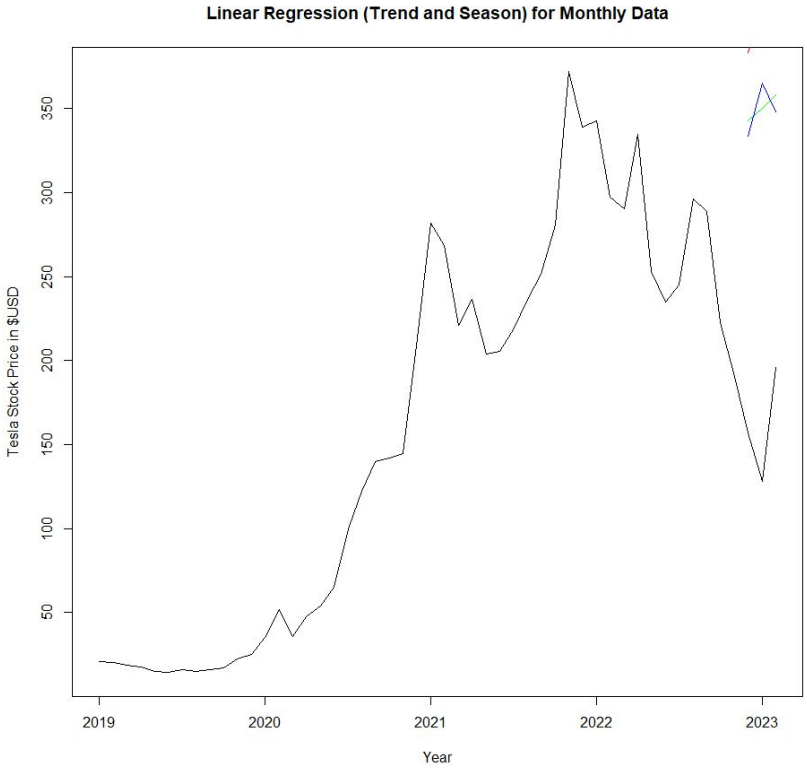


Green = Trend
Red = Trend + Season
Blue = Exp. Trend + Season

Weekly Linear Model MAPE:

- Trend = 58.8
- Trend + Season = 55.7
- Exp. Trend + Season = 85.9

Regression Based Model - Monthly

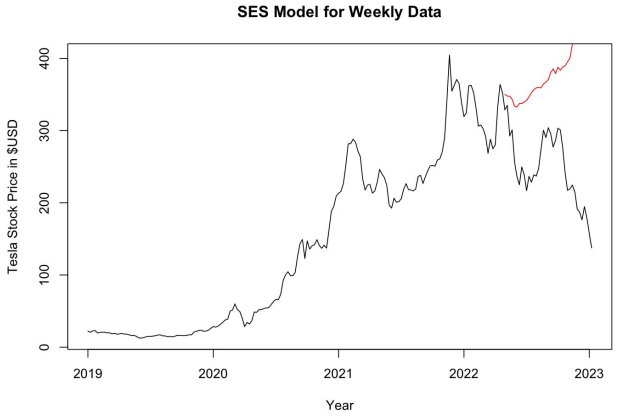


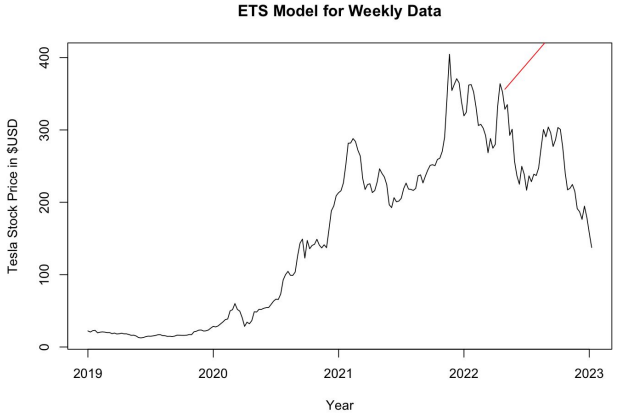
Green = Trend
Red = Trend + Season
Blue = Exp. Trend + Season

Weekly Linear Model MAPE:

- Trend = 124.9
- Trend + Season = 155.6
- Exp. Trend + Season = 125.2

Smoothing Methods - SES vs. ETS - Weekly





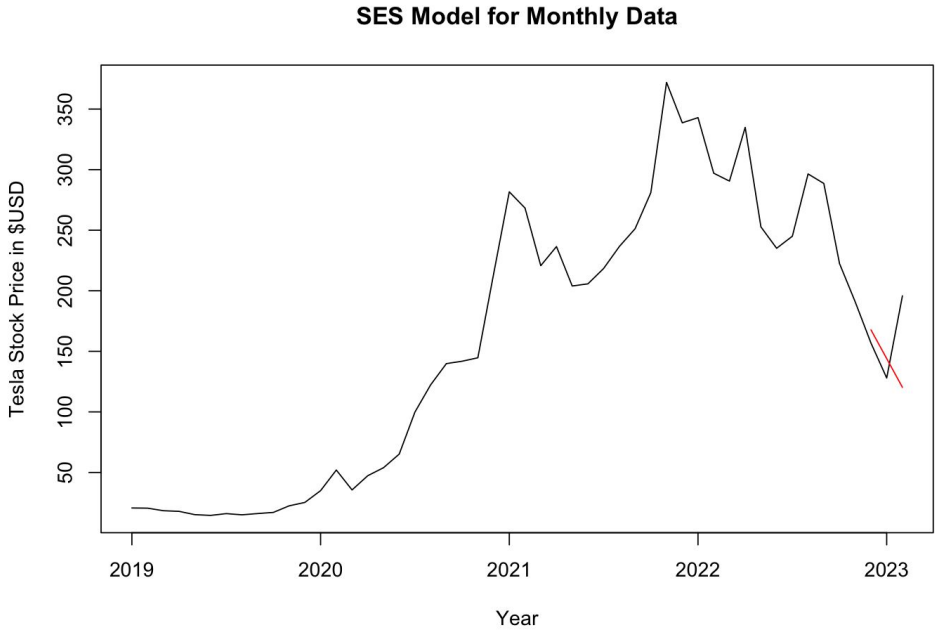
SES Weekly:

- MAE: 133.7566
- MAPE: 63.23887

ETS "MAN" Weekly:

- MAE: 179.5398
- MAPE: 82.86146

Smoothing Methods - SES vs. ETS - Monthly



SES Monthly:

- MAE: 34.1464
- MAPE: 19.34789

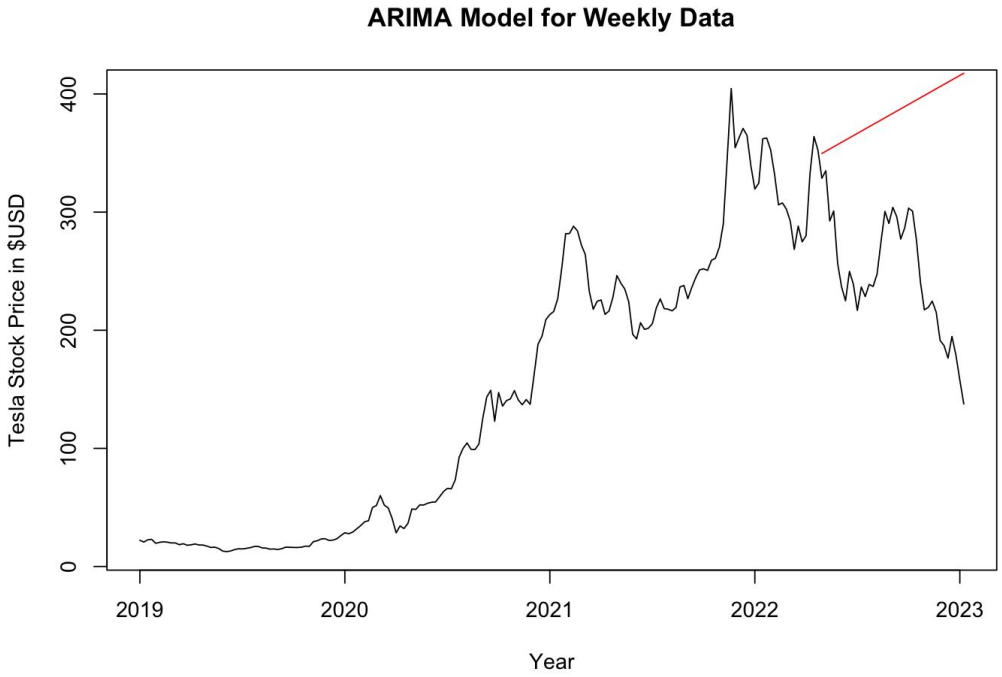
ETS “MAN” Monthly:

- MAE: 34.1464
- MAPE: 19.34789

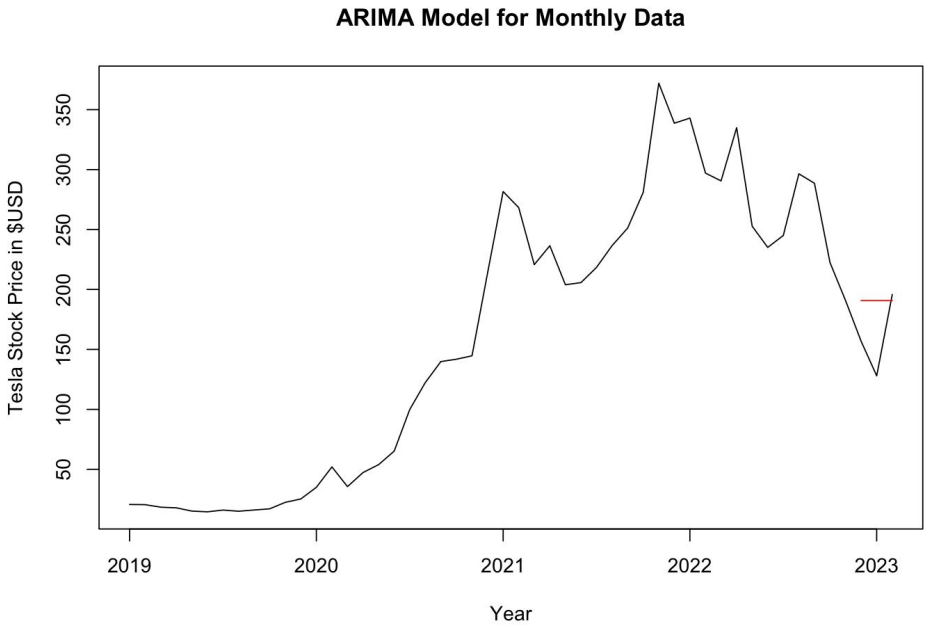
ARIMA Model - Weekly

ARIMA Weekly:

- ARIMA(0,1,1)
- MAE: 137.1278
- MAPE: 63.60255



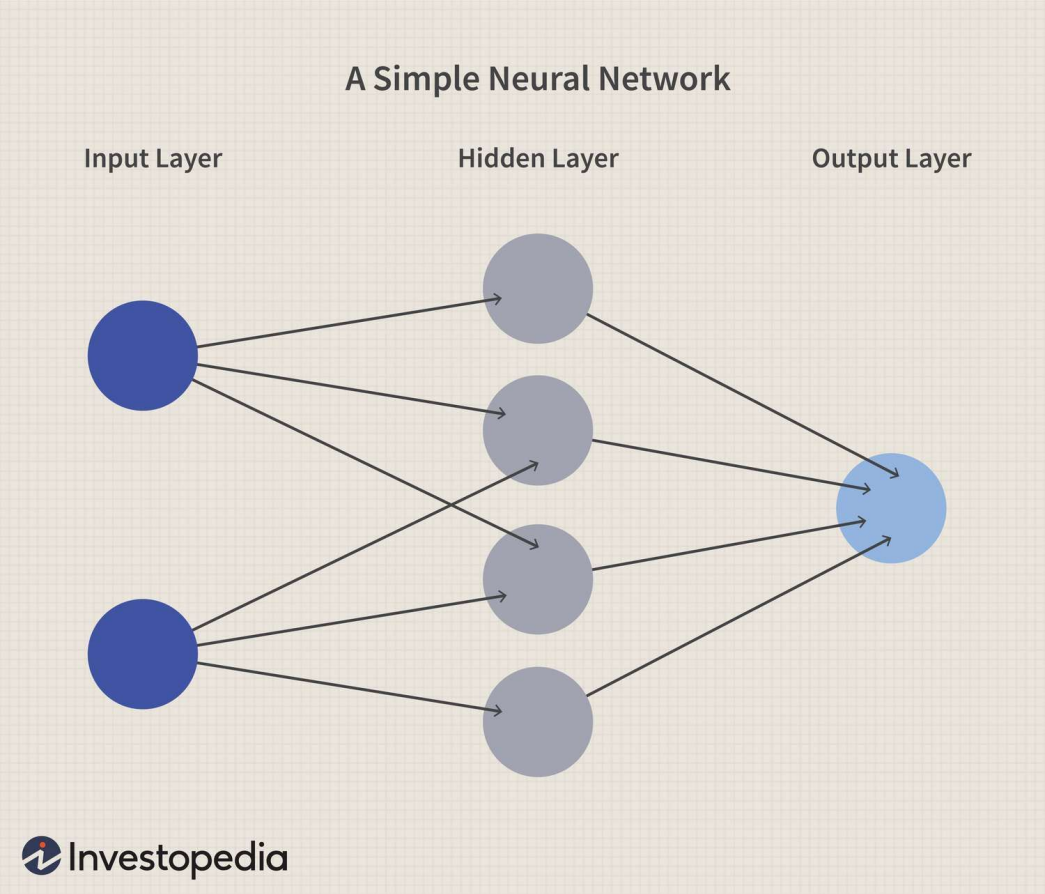
ARIMA Model - Monthly



ARIMA Monthly:

- ARIMA(0,1,0)
- MAE: 33.91
- MAPE: 24.41626

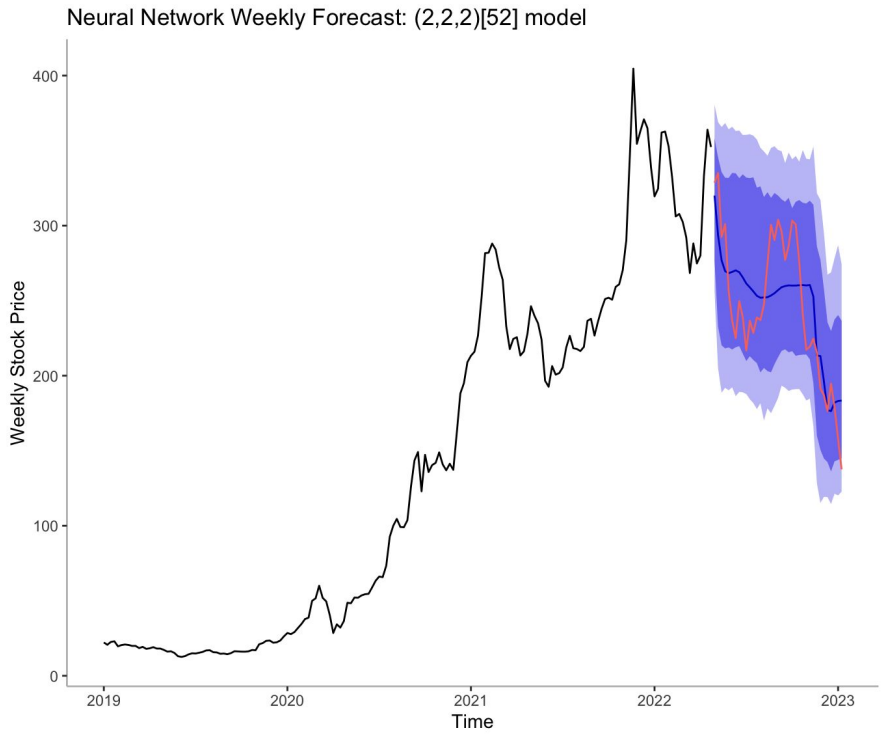
Neural Networks



Complex nature of stock price → Neural Networks + Time Series

- *nnetar*: Feed-forward neural networks with a single hidden layer and lagged inputs for forecasting univariate time series.

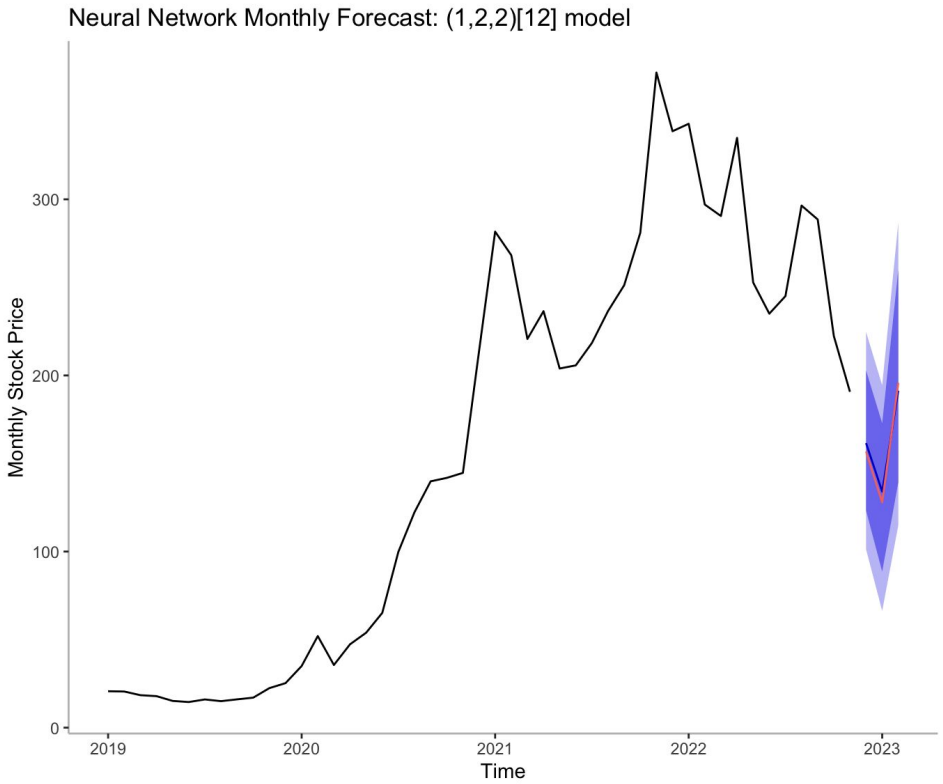
Neural Networks — Weekly



Weekly:

- Seed at 80
- 2 periods of seasonal lag and lambda at 1
- NNAR(2,2,2)[52] model
- MAE: 25.70614
- MAPE: 10.66192

Neural Networks — Monthly

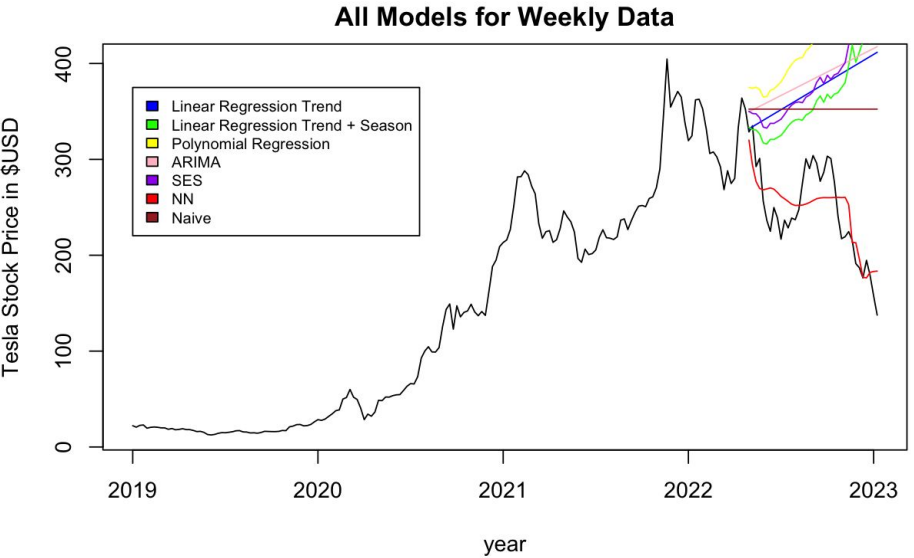


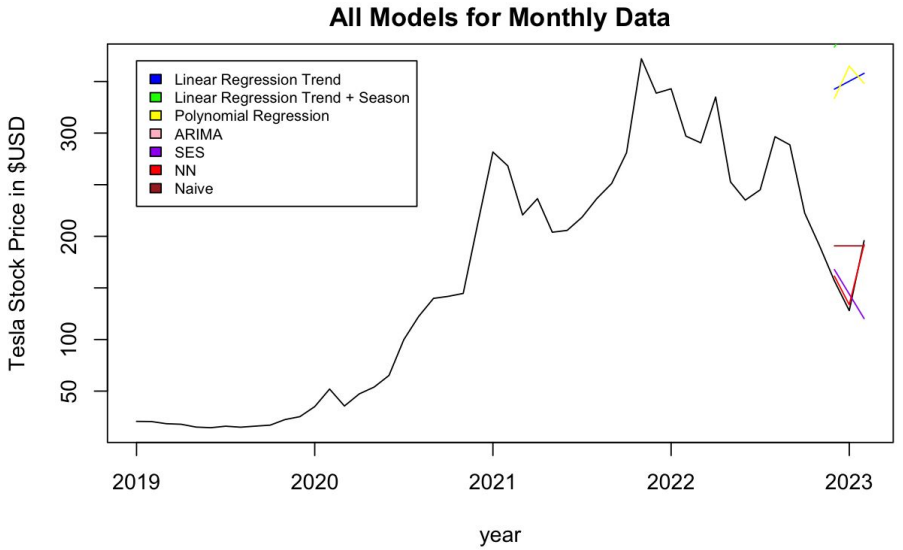
Monthly:

- Seed at 2678
- 2 periods of seasonal lag and lambda at 1
- NNAR(1,2,2)[12] model
- MAE: 5.09701
- MAPE: 3.35368

Neural Networks

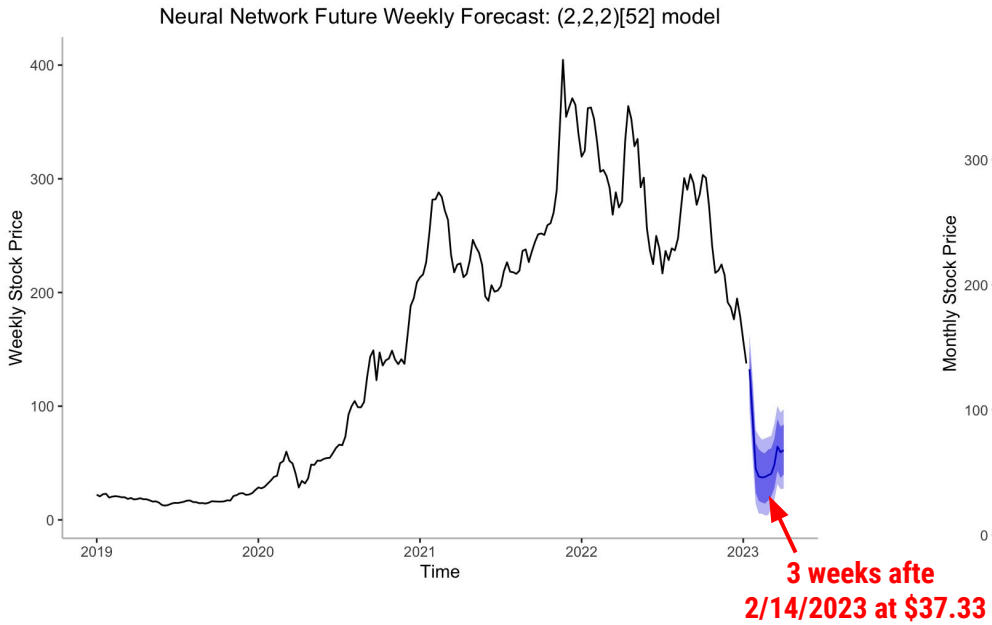
Neural Networks model is the best performing.

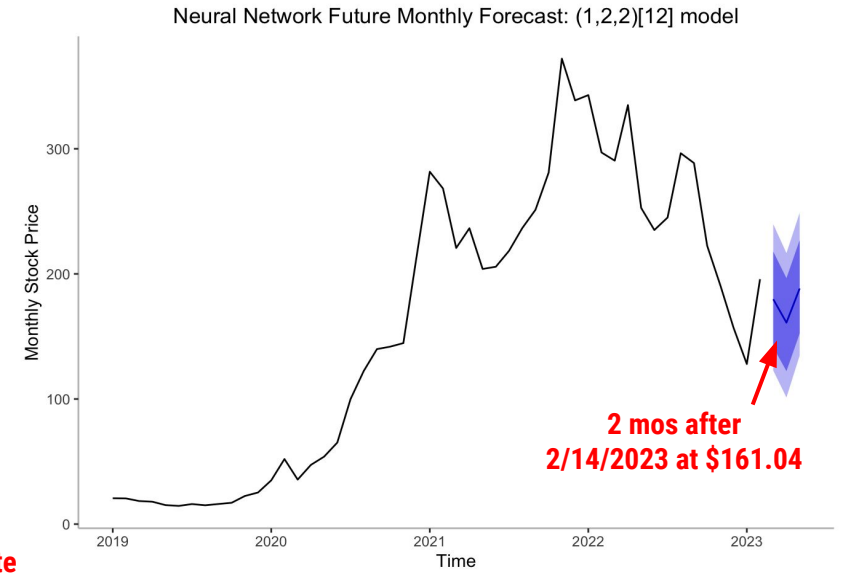




Model Implementation on Full Data + Forecast

Forecast the real future for **3 months** and **12 weeks**





Conclusion

- Neural Networks have highest predictive power
- As per our previous model, investors should buy in at 3 weeks to 2 months from now