

Project Presentation

Team 3

Economic Forecasting
ECON 4325 – 001
Fall 2022

Team Members

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Producer Price Index for Pet Food in U.S.

Business Context

- Despite the change that has happened in the past few years, surprisingly, the price index has only got stronger since selling pet foods through e-commerce was made while people were stuck at home.

Impact we create

- Our objective is to predict the price changes in the pet food industry over the years through time series forecasting.
- As a Economic Analyst team, we will get some insights from the different forecasting methods and chose the best model.
- These predictions will help investors and customers to avoid unexpected changes to inflation.
- Decision making for business based on the changes in price by industry comparing wholesale and retail prices.

Resources on hand

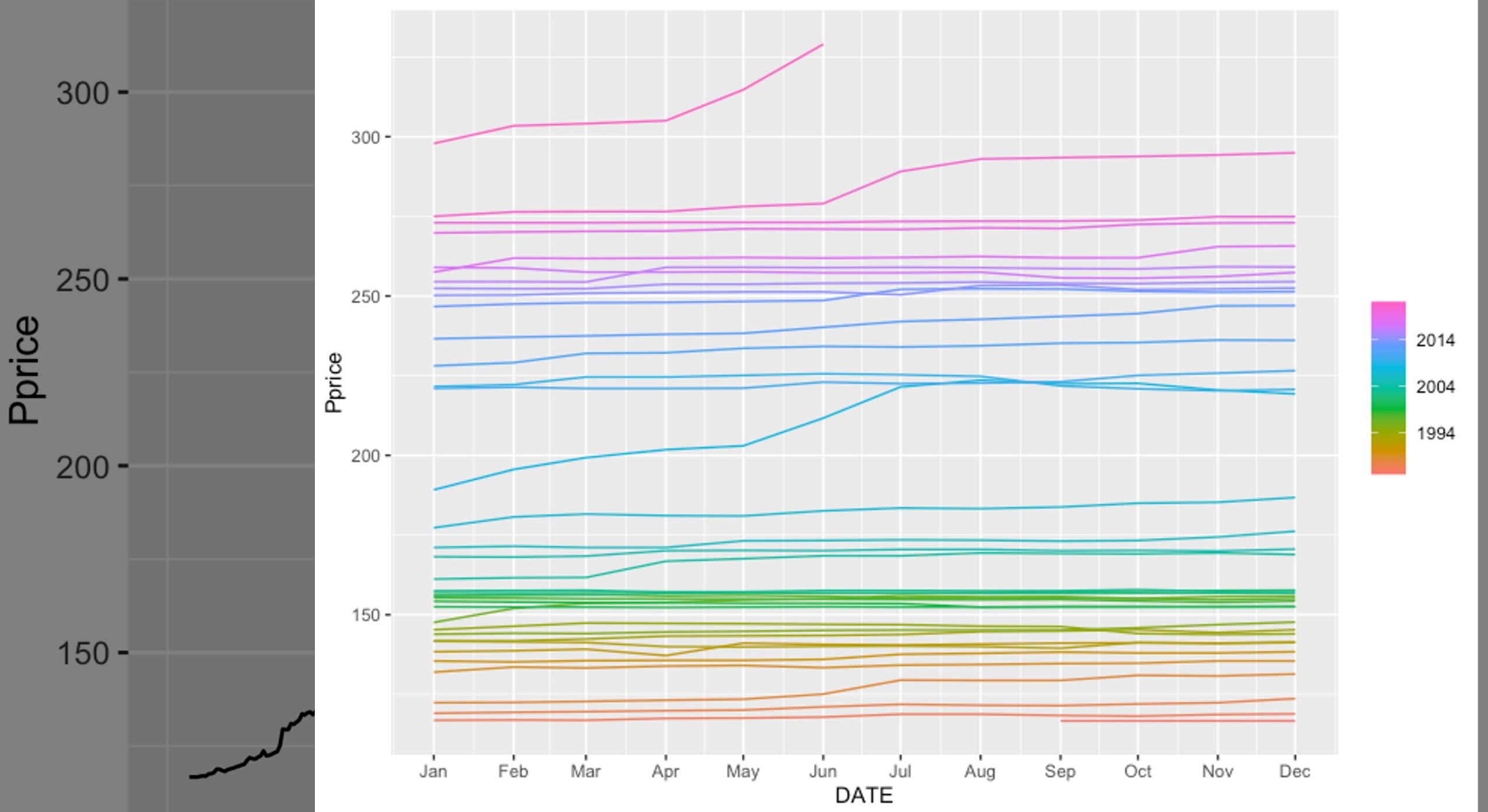
- Data was collected from Fred.
- This dataset contains Date and Producer price index.

Data Exploration

- No null values were found.
- The data set was converted to tsibble form.

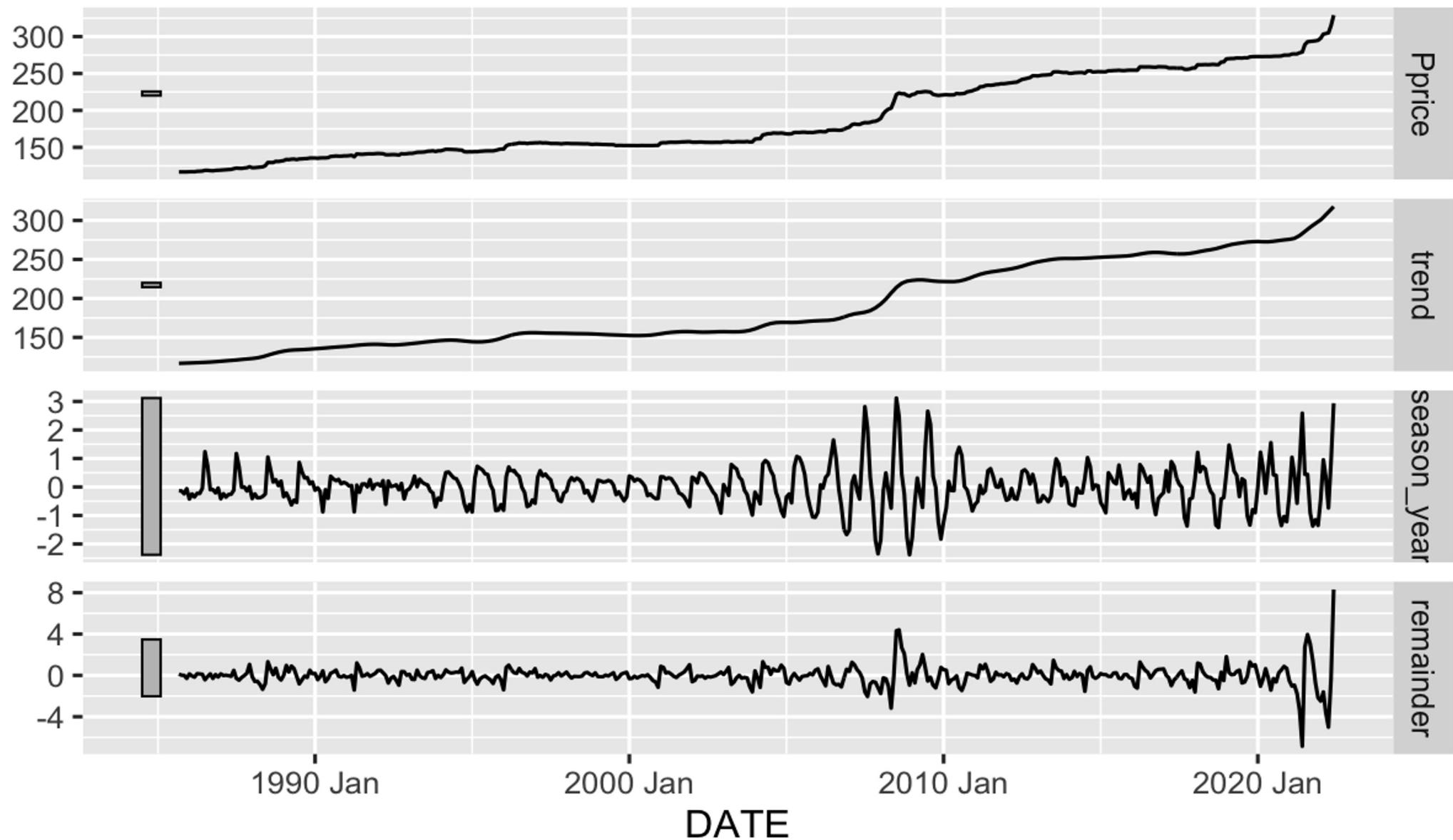
Total number of records	446 records and 1 variable
Target variable	Pprice (Producer price index)
Training dataset	1985 Sep to 2022 June
Testing dataset	2022 July to 2022 October

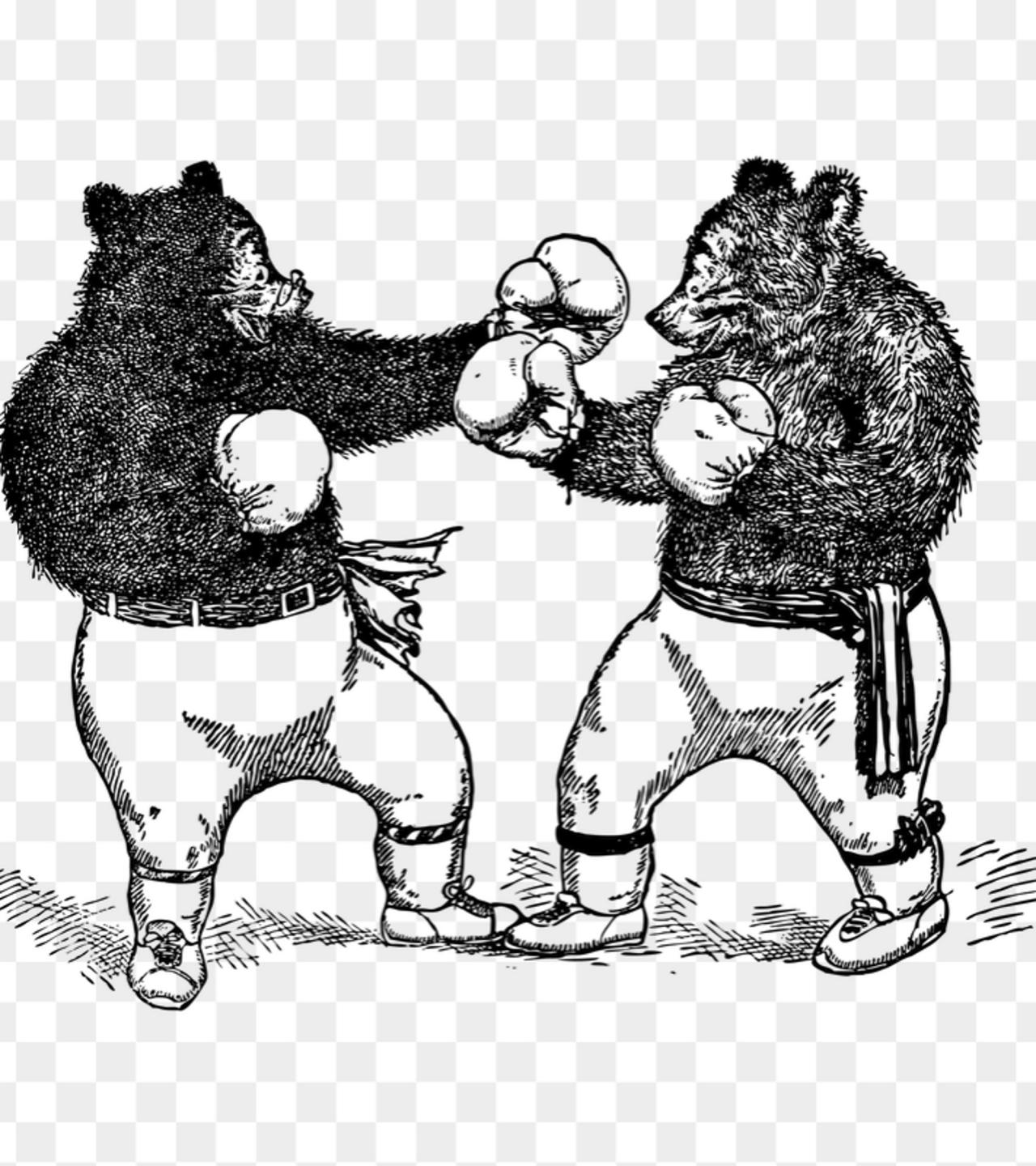
	DATE	WPU029402
1	1985 Sep	116.7
2	1985 Oct	116.7
3	1985 Nov	116.7
4	1985 Dec	116.7
5	1986 Jan	116.9
6	1986 Feb	117.0
7	1986 Mar	116.9
8	1986 Apr	117.5
9	1986 May	117.6



STL decomposition

Pprice = trend + season_year + remainder





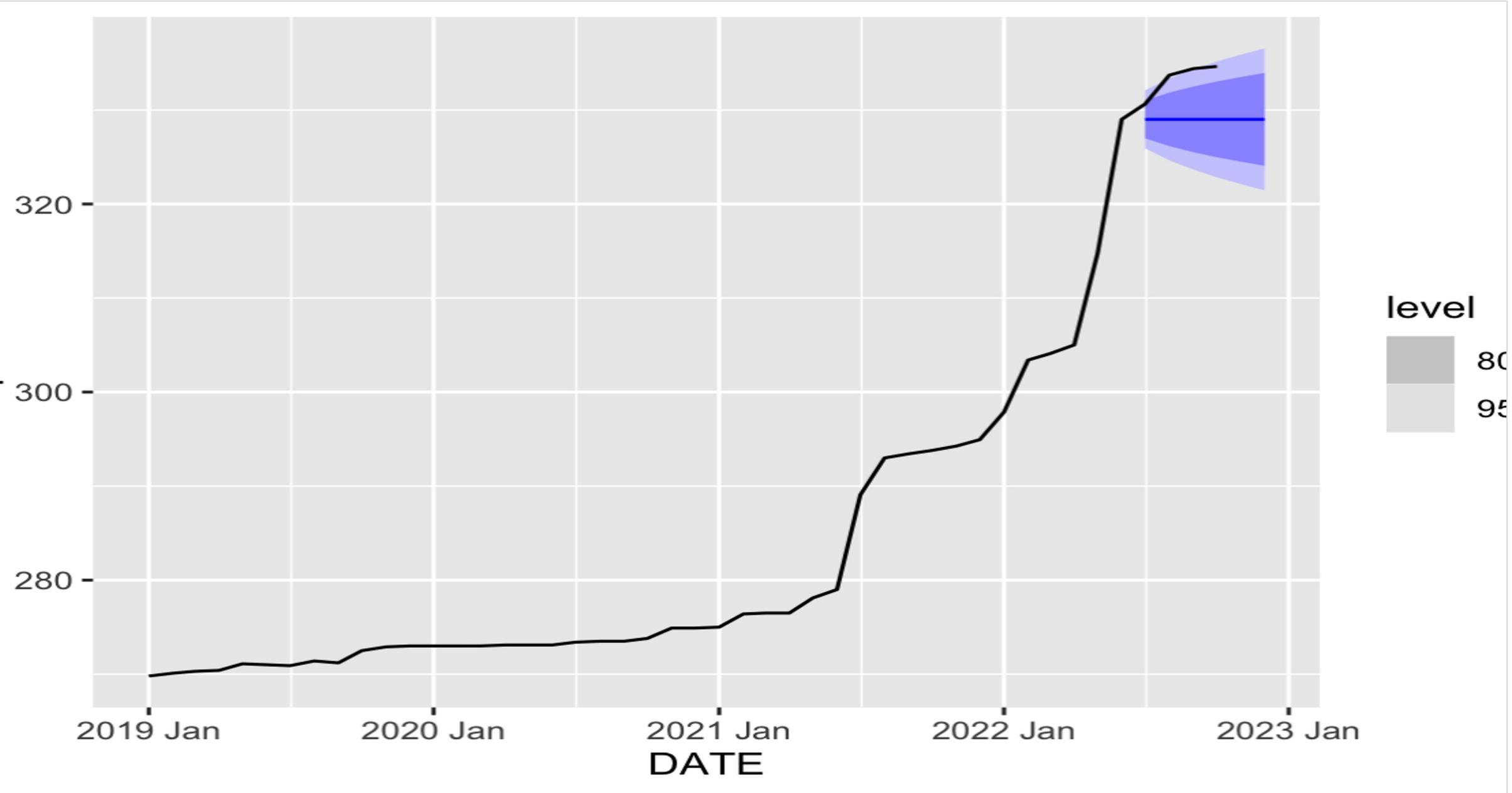
Simple Model Techniques.

Naive Method

ETS Method

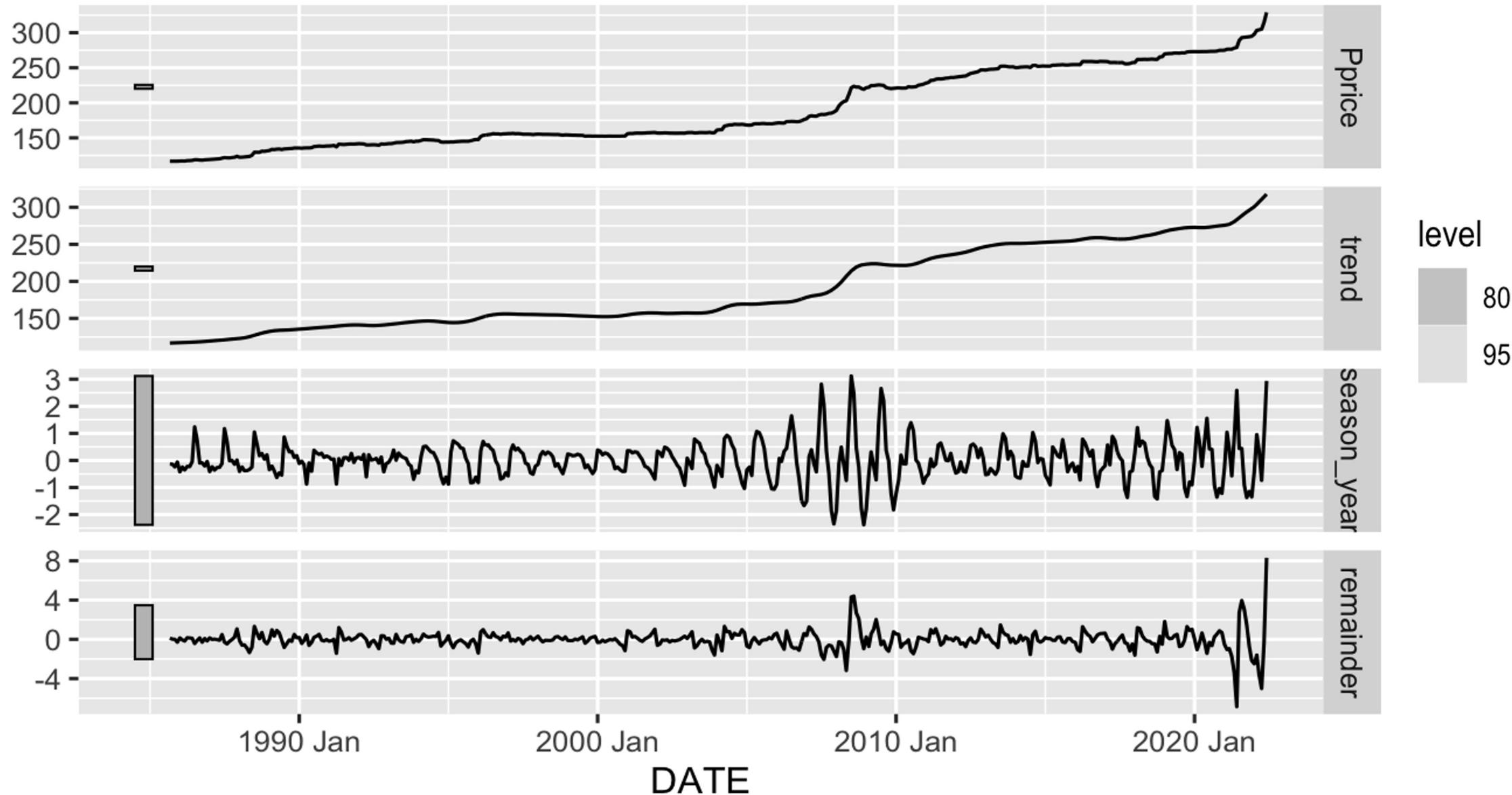
NAIVE MODEL

	.model	DATE	Pprice	.mean
1	NAIVE(Pprice)	2022 Jul	$N(329, 2.5)$ 	329.00
2	NAIVE(Pprice)	2022 Aug	$N(329, 4.9)$ 	329.00
3	NAIVE(Pprice)	2022 Sep	$N(329, 7.4)$ 	329.00
4	NAIVE(Pprice)	2022 Oct	$N(329, 9.9)$ 	329.00
5	NAIVE(Pprice)	2022 Nov	$N(329, 12)$ 	329.00
6	NAIVE(Pprice)	2022 Dec	$N(329, 15)$ 	329.00



STL decomposition

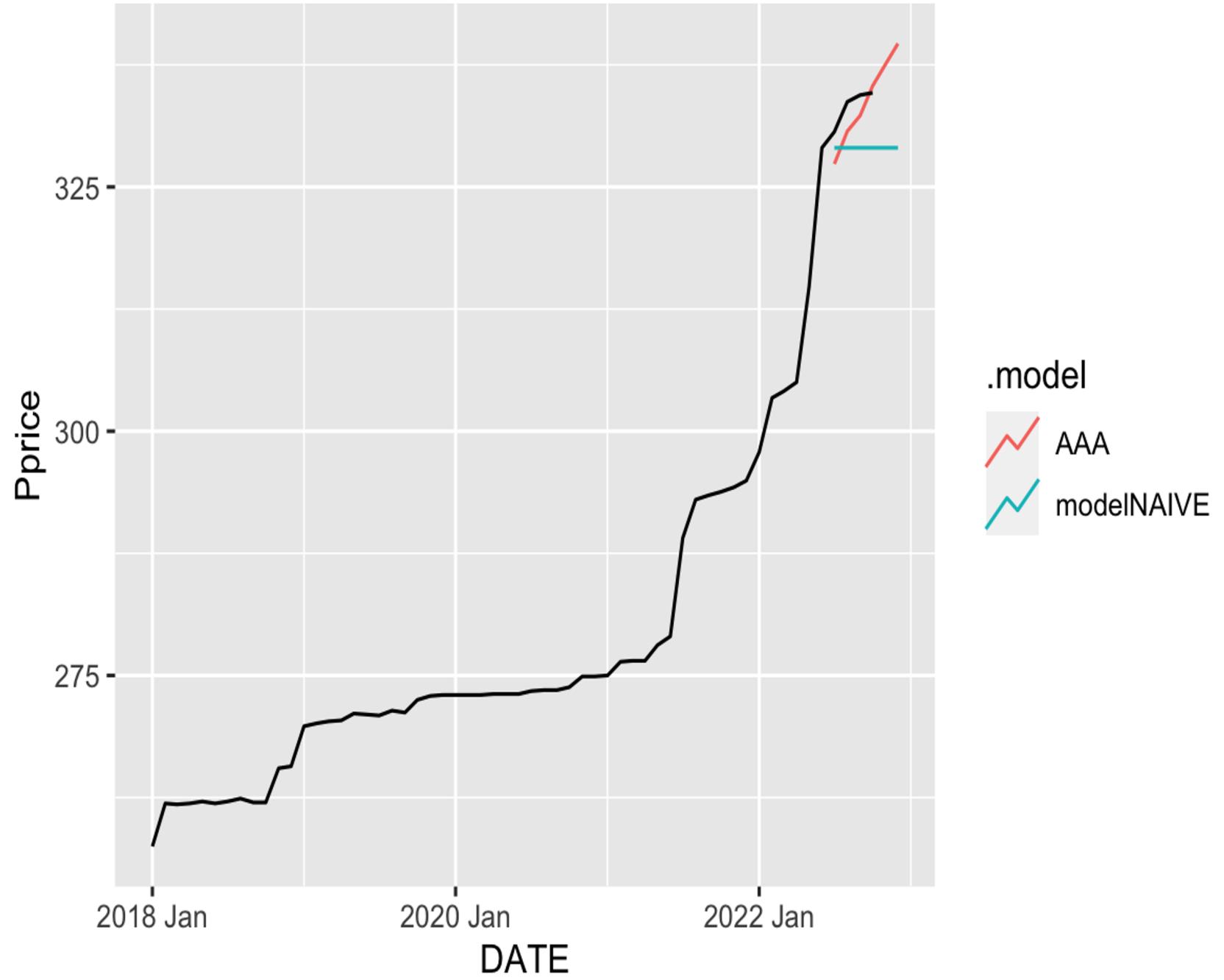
Pprice = trend + season_year + remainder

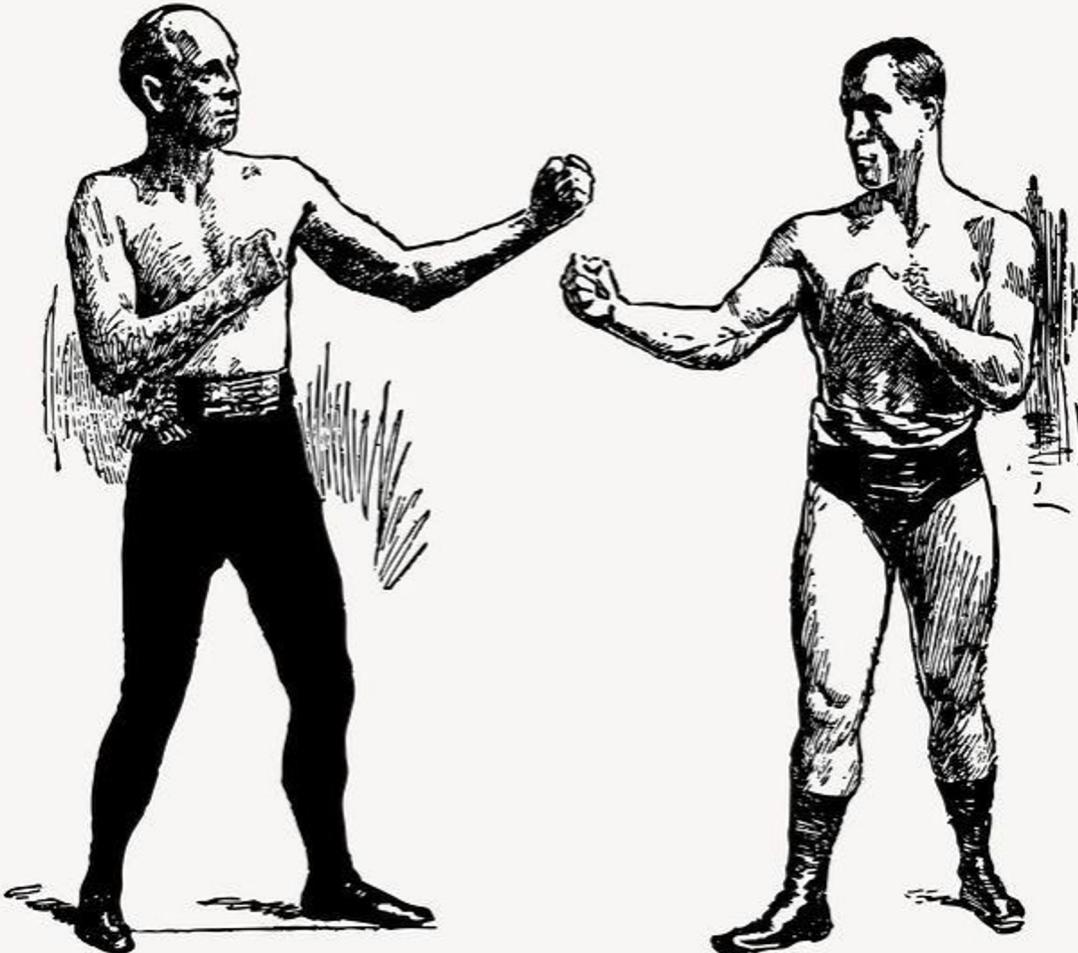


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Comparing both Naive and ETS





Advanced Time Series Model Used

Since the Naive and the ETS method could not give us a great forecast, it is time to advance to other modelling techniques which provide a better forecast.

Models to be used:

- SARIMA Model
- Neural Nets

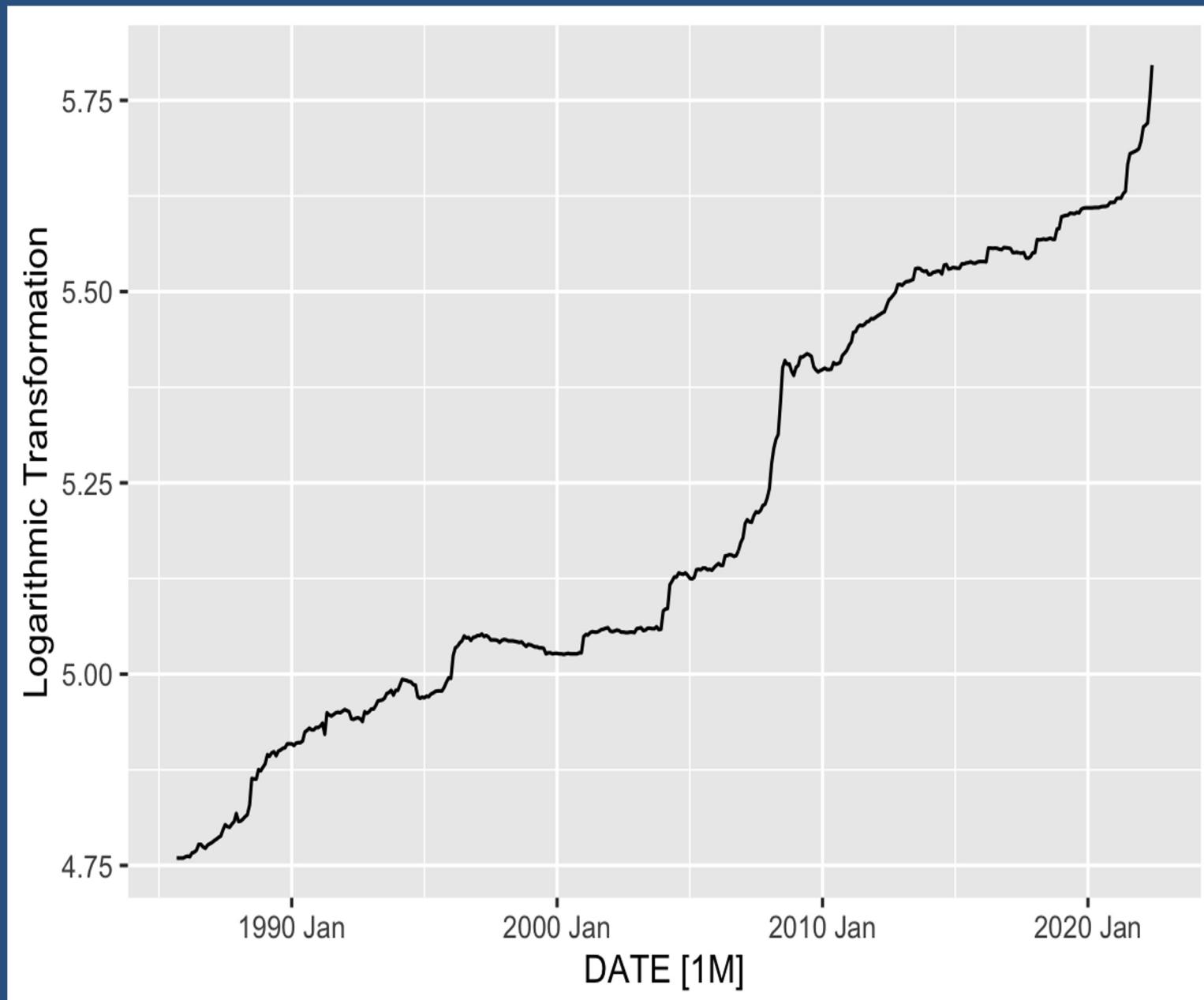
SARIMA MODEL



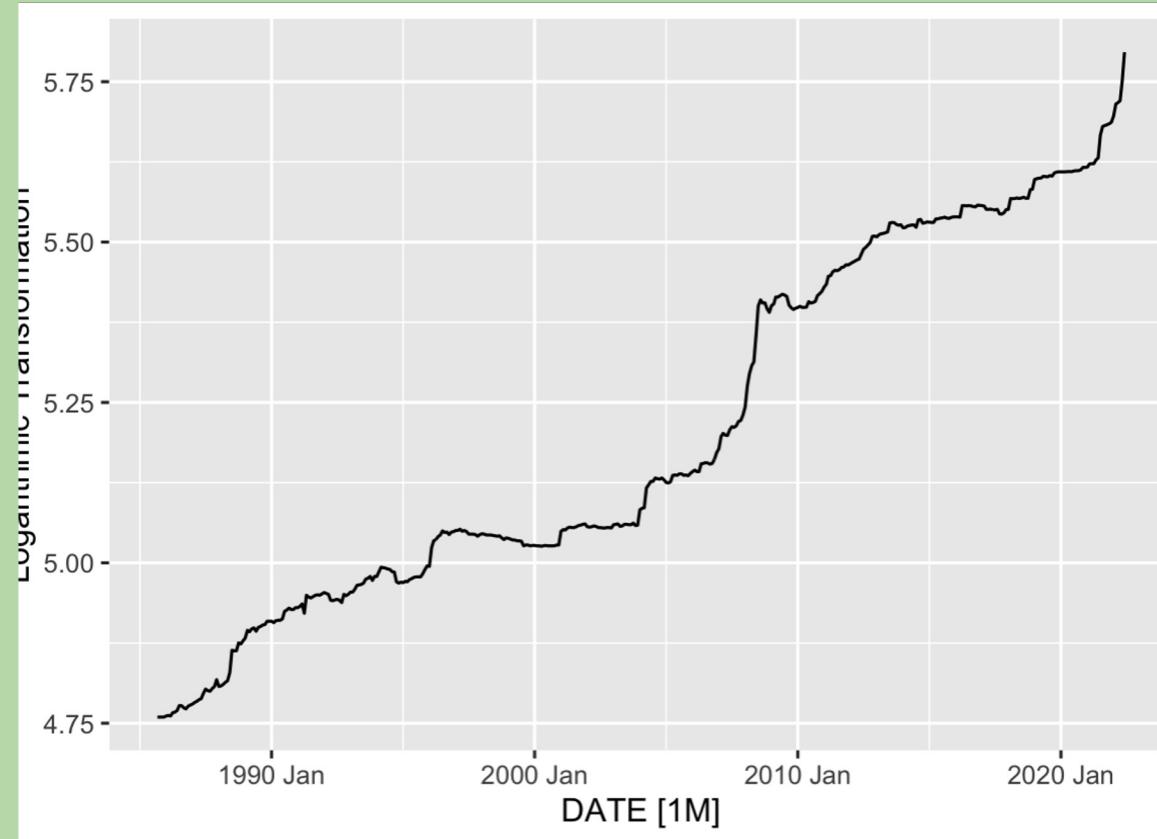
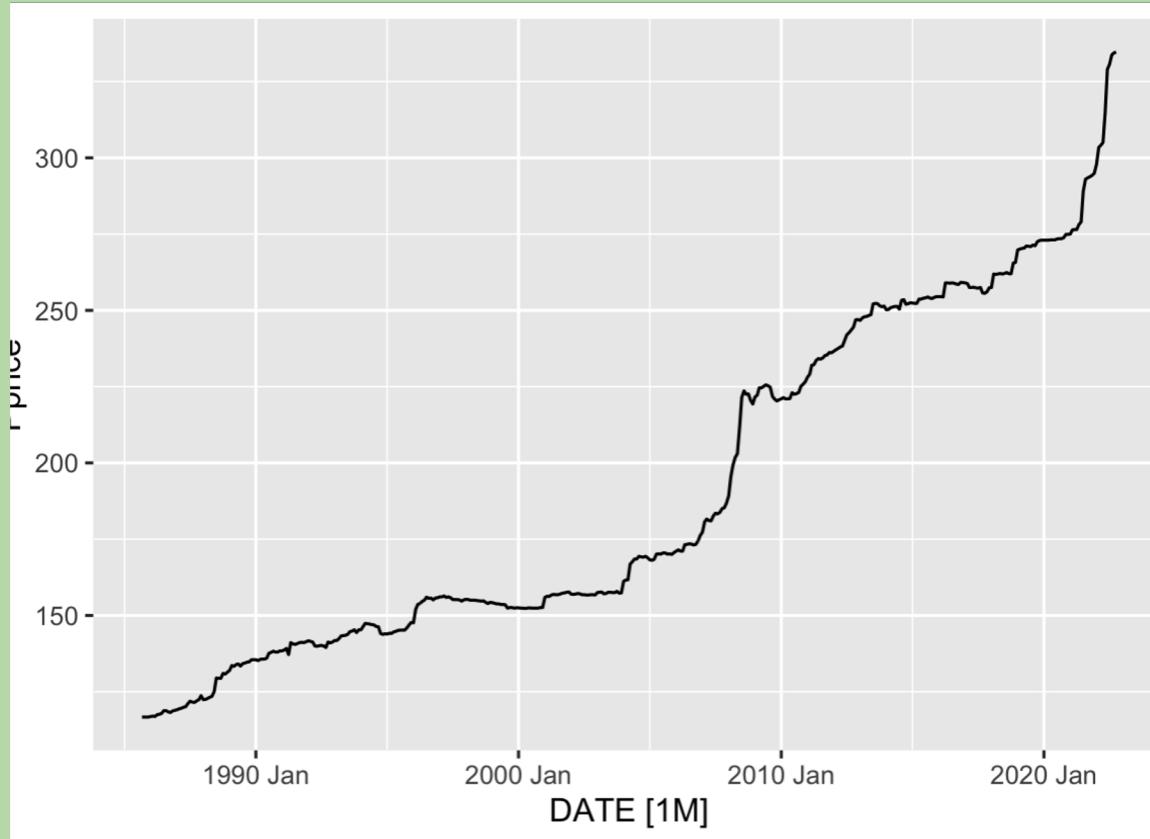
Why perform Logarithmic Transformation?

- Non-linear growth can be observed.
- Helps with a little volatility in our sample
- Yields a series which can be more normally distributed.
- As the data's volatility was not caused by variations in seasonal volatility, the Box-Cox Transformation was not used.

Overall, it seems that the estimated Lamda value increased volatility.



Comparison

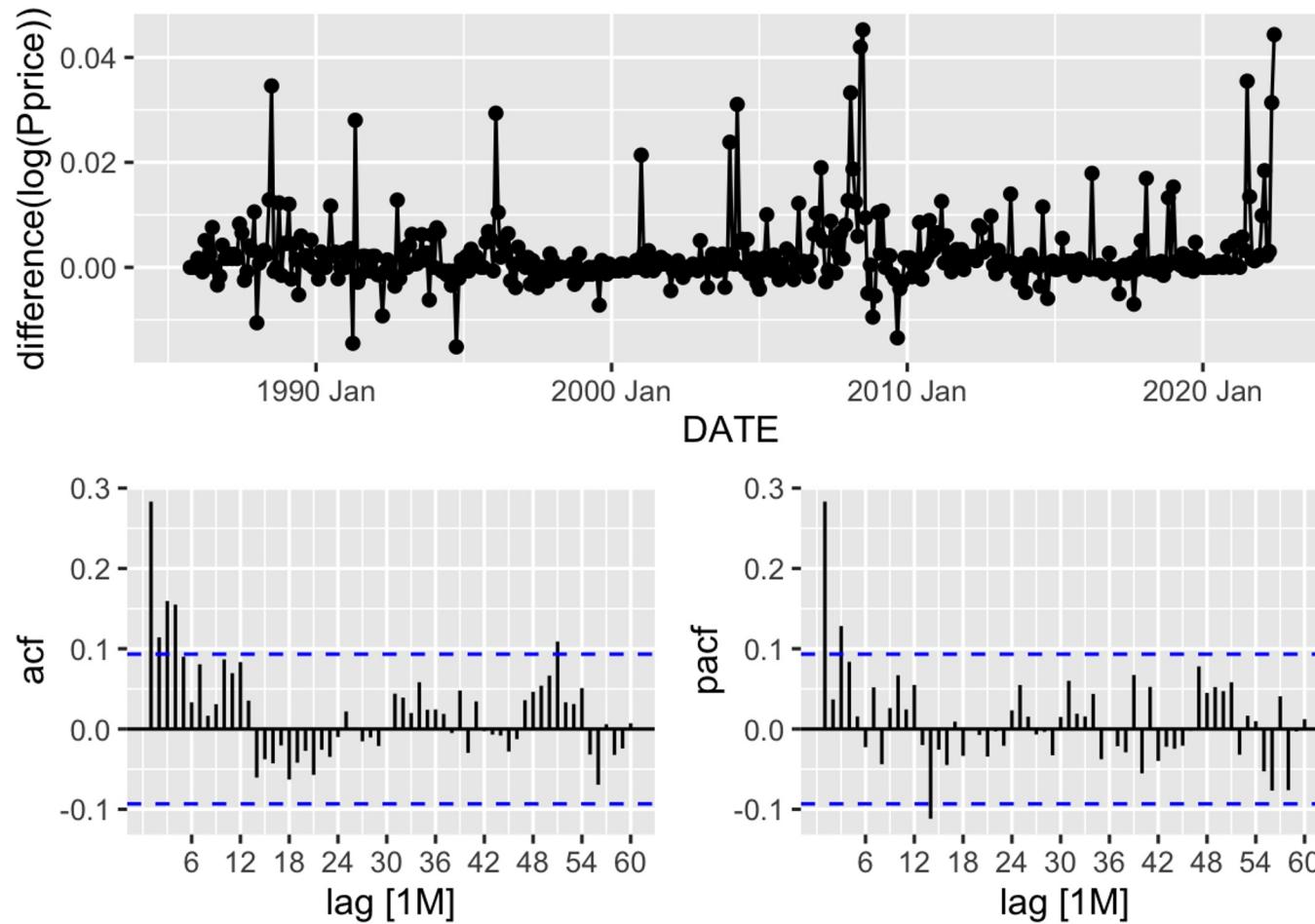




Is Data Covariance Stationary?

- Unit root differencing implies $d = 1$ and $D = 0$

Initial Model Selection ACF and PACF Evaluation



As the test returns a value of 1 for d and a value of 0 for D, we should employ non-seasonal differencing only

We can see the most significant rise in the 2nd lag of both ACF and PACF.

Considering the 2nd lags and others which are above the critical line, we are now ready to estimate our guesses for p,d,q and P,D,Q

Models Implemented

Models Implemented

ARIMA1=pdq(1,1,2) PDQ(2,0,1)

ARIMA2=pdq(2,1,2) PDQ(1,0,1)

ARIMA3=pdq(1,1,2) PDQ(2,0,0)

ARIMA4=pdq(2,1,0) PDQ(1,0,1)

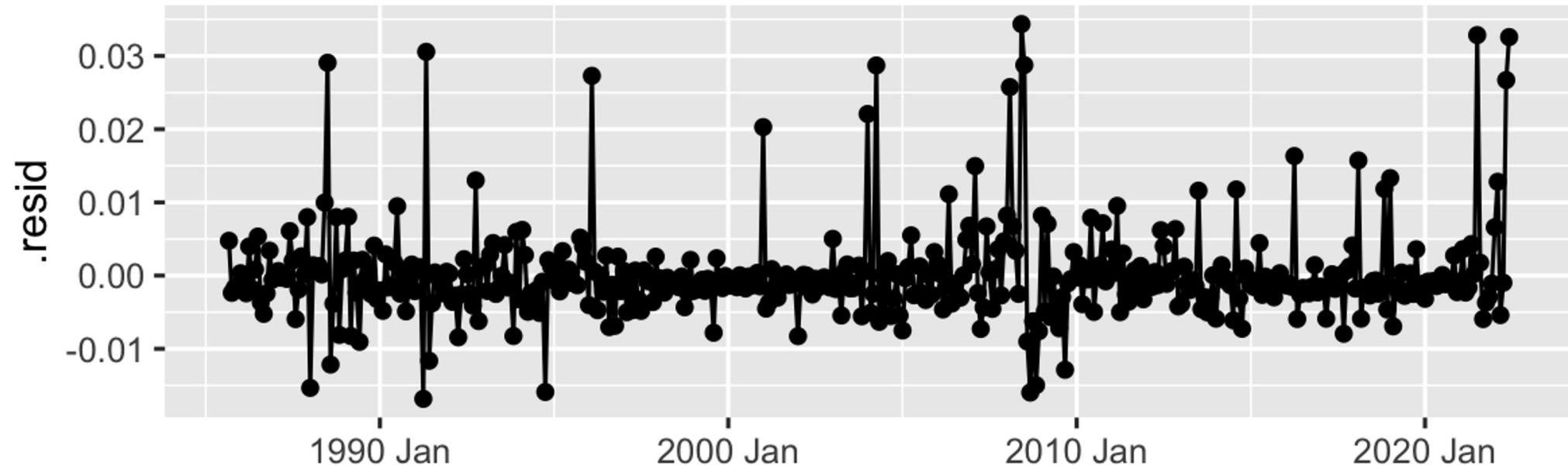
ARIMA5=pdq(1,1,2) PDQ(1,0,1)

AIC and BIC values for the implemented models

- From the models estimated, to choose the best one, we compare AIC and BIC keeping principle of parsimony in mind.
- SARIMA model 3 performs the best

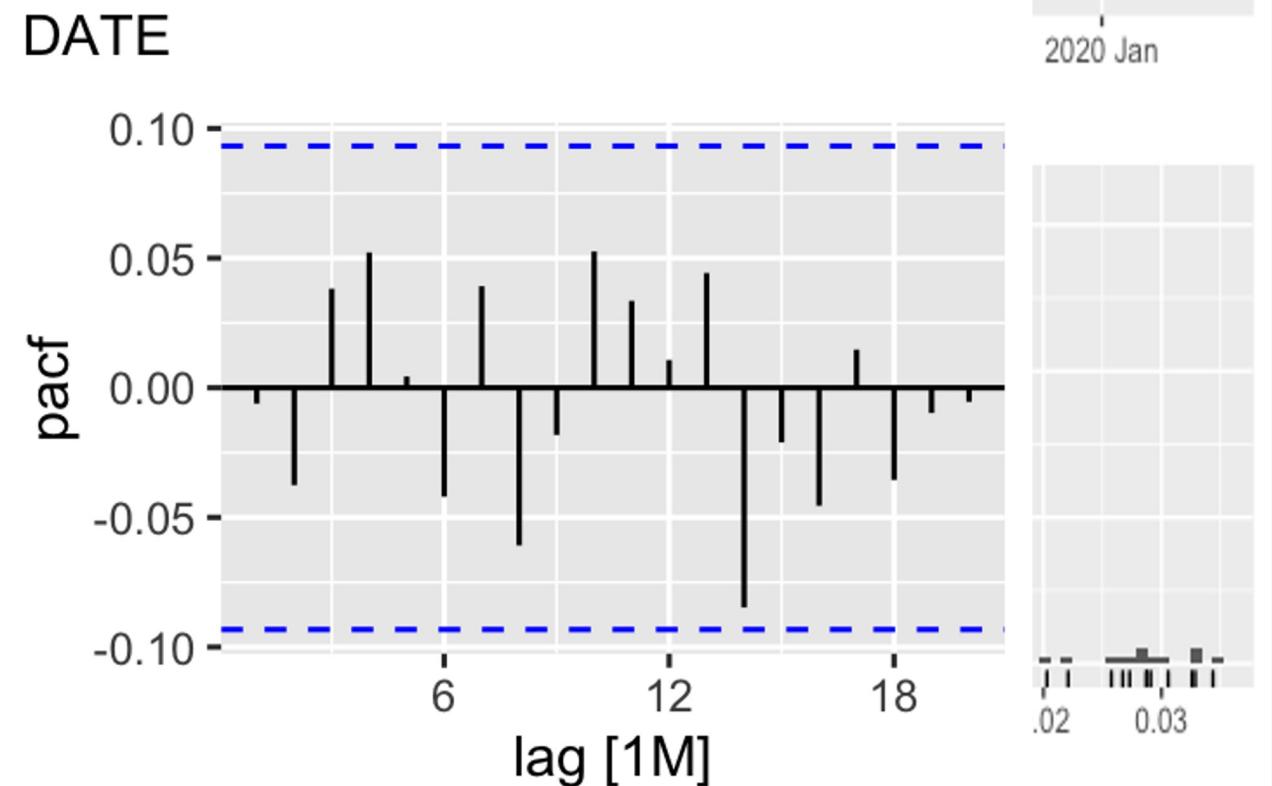
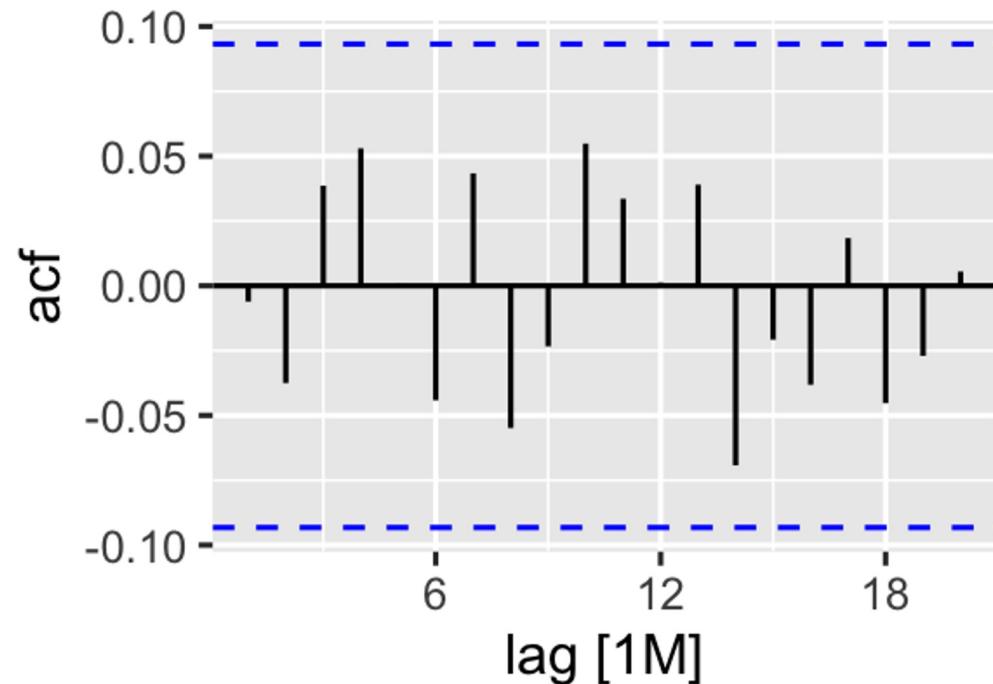
.model	AIC	BIC
ARIMA1	1558.617	1591.401
ARIMA2	1558.531	1591.316
ARIMA3	1556.574	1585.26
ARIMA4	1564.186	1588.774
ARIMA5	1556.595	1585.281
auto	1552.463	1564.75

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Box test.

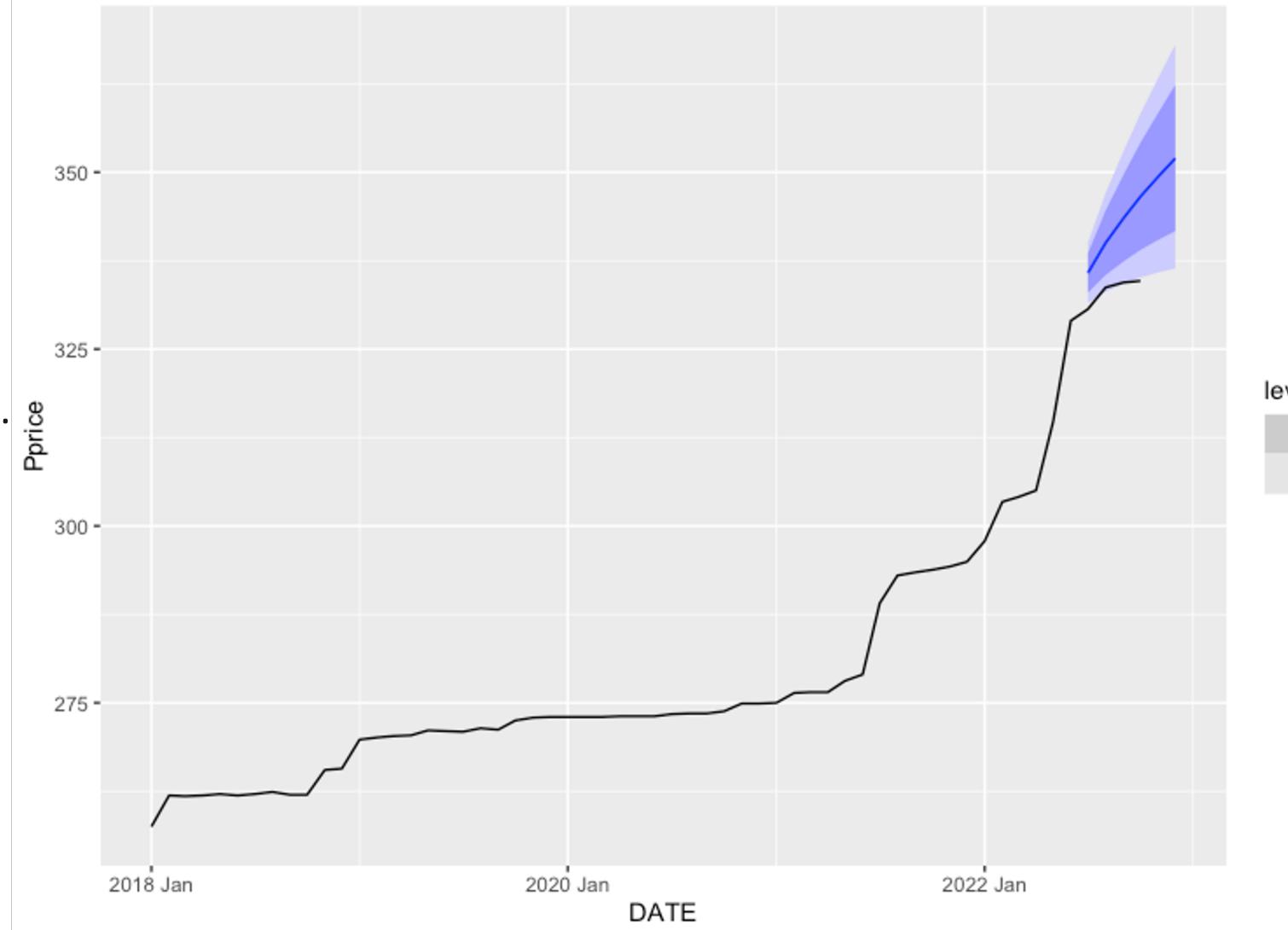
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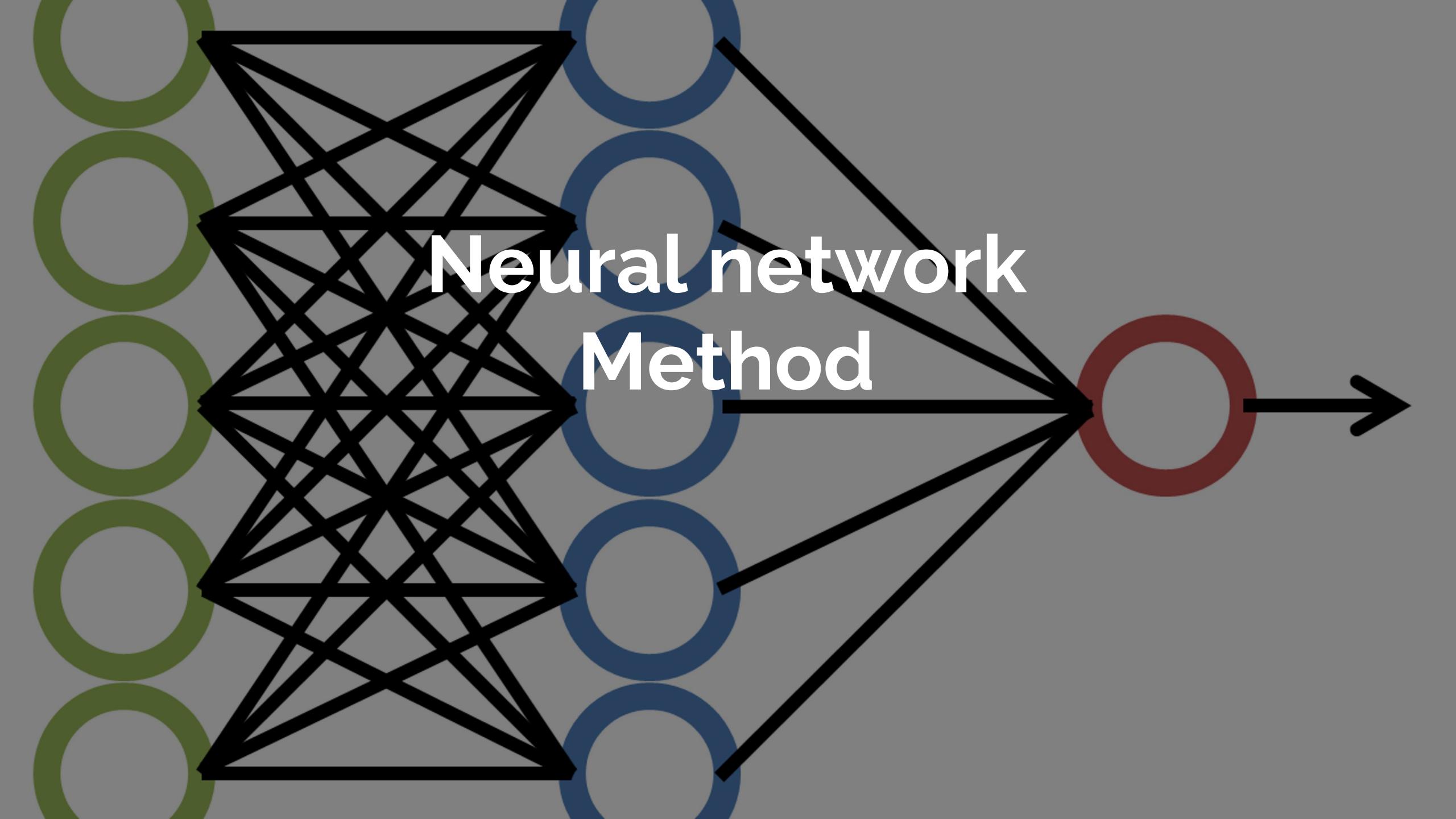


Forecasting the final Model

- The 6-step ahead forecast provides the exact numeric values for the forecast.
with several pre-forecast observations.

DATE	.mean
2022 Jul	335.758
2022 Aug	340.0087
2022 Sep	343.4502
2022 Oct	346.5446
2022 Nov	349.3504
2022 Dec	351.9469





Neural network Method

Neural Networks

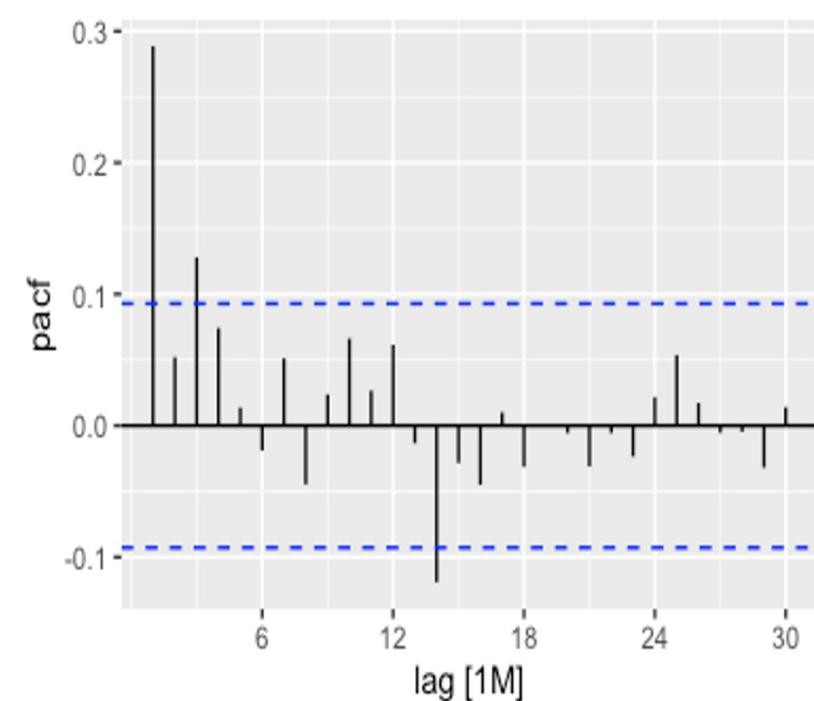
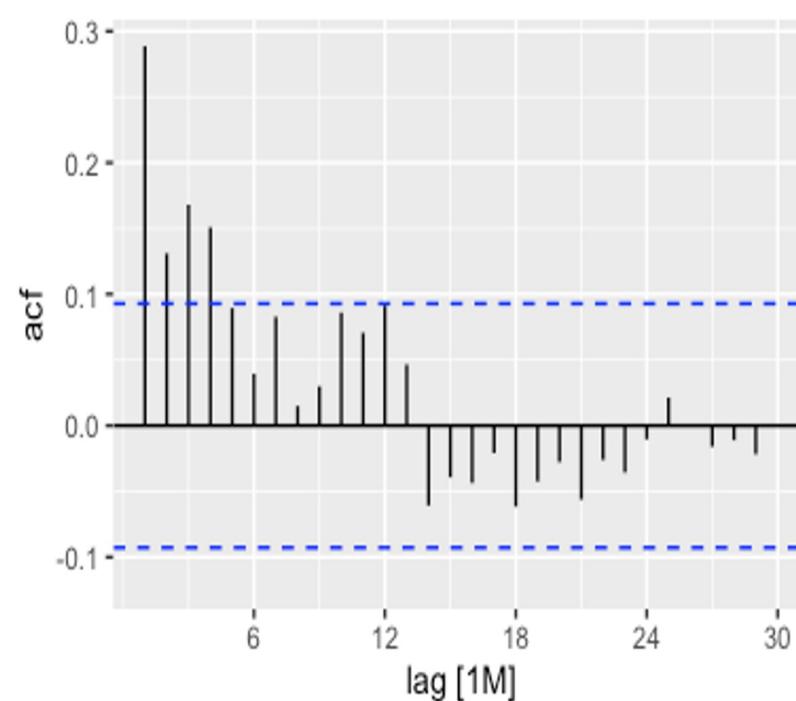
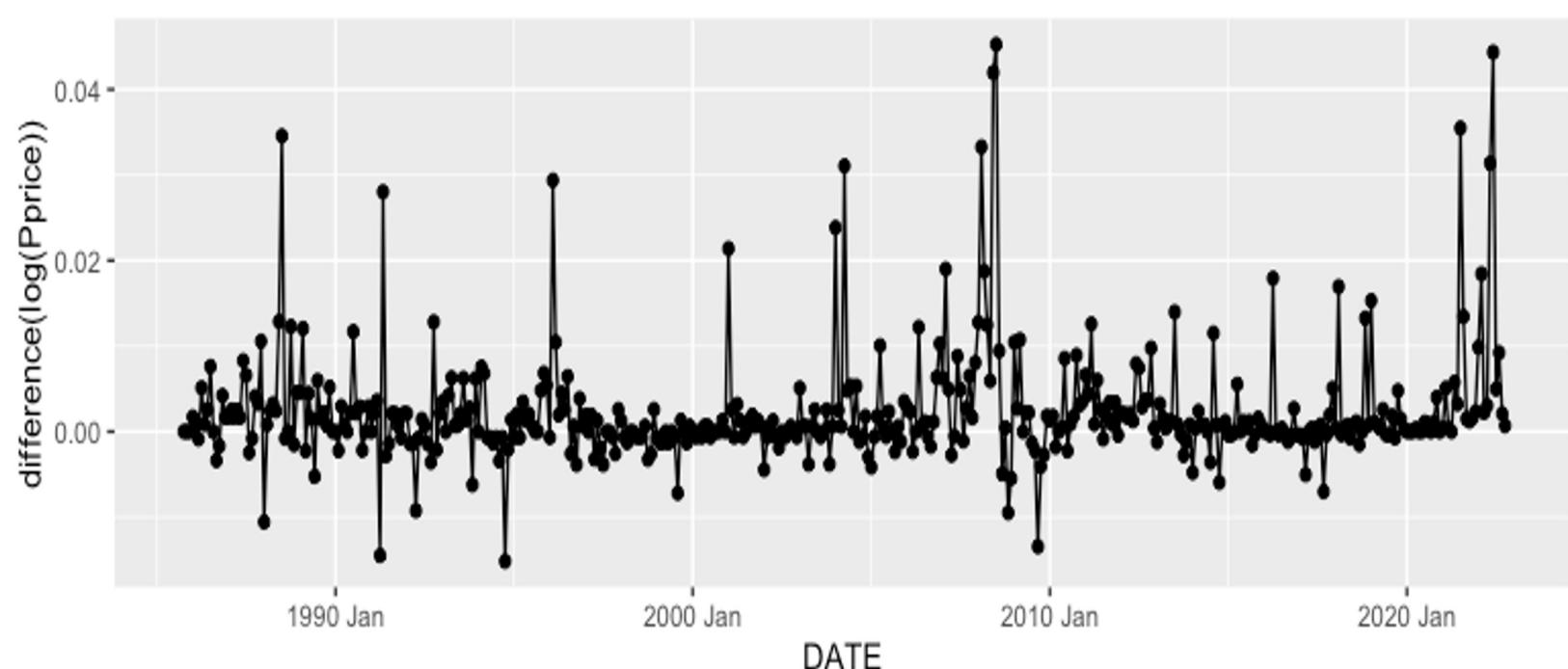
From the PACF, coefficients at lag 1 and 3 appear to be statistically significant Seasonal Ar term is set to 0

Again, given the potential complexity of the model, we likely want to avoid adding in more lags than this. Perhaps we start under the assumption that

$p-1=3$ or $p=4$

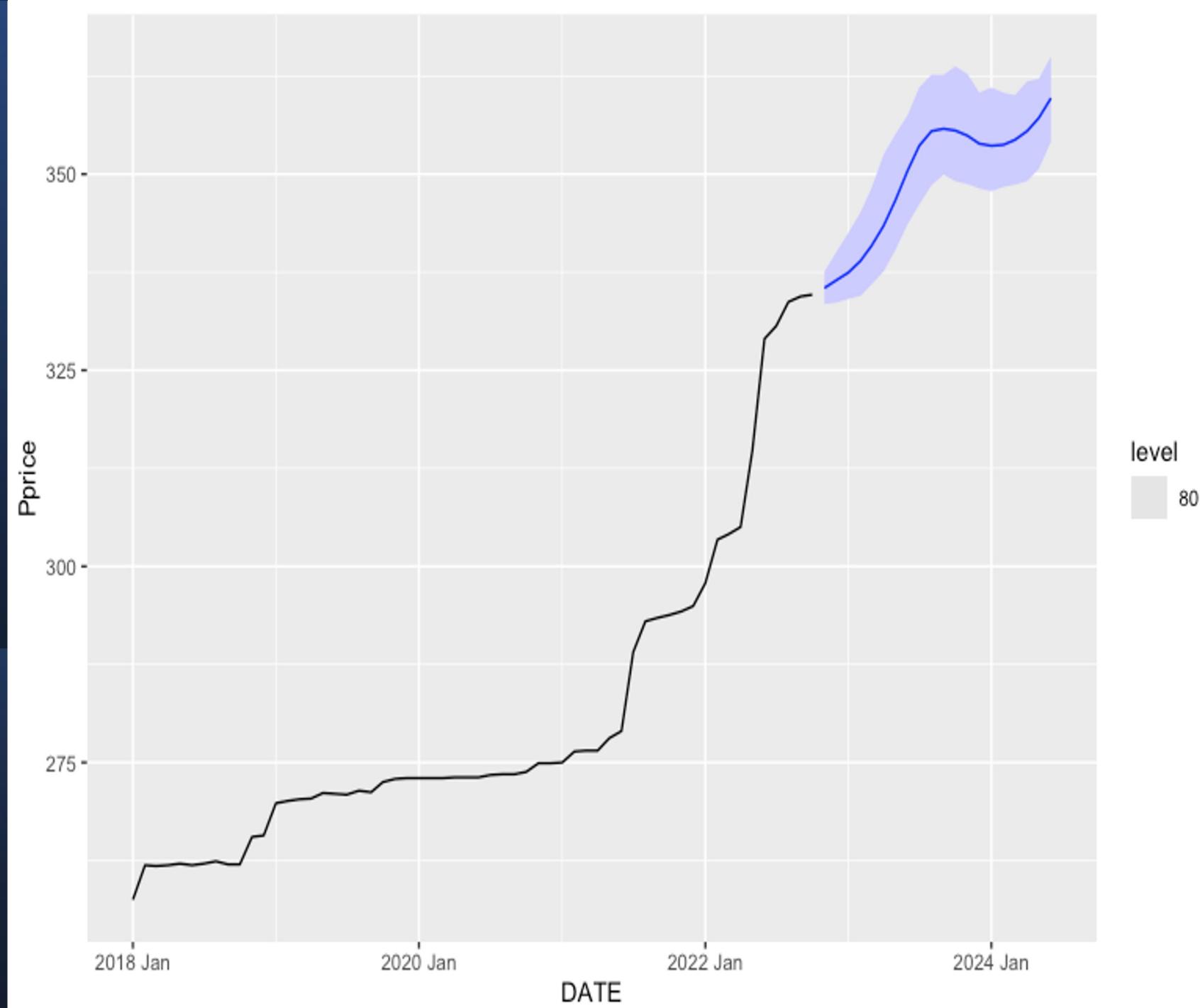
REPORT

Average of 100 networks, each of which is a 4-2-1 network with 13 weights options were - linear output units σ^2 estimated as $3.936e-05$



Forecast Using Final Neural Network

- R draws out the future residuals to get the forecasted values
- Times=100 for faster analysis.
- The future residuals for calculating forecast standard error is used with the help of estimated residuals within the samples.



Final Verdict

Neural Network Method performs the best



Insights

The producer price index is estimate to first increase in a diminishing way which indicates the following:

- The producers may need to increase the product price by only a marginal value initially.
- Consumers will have a marginal impact on purchasing power.
- Investors can use the analysis done for making business decision accordingly.

The producer price index is set to increase exponentially over a year which indicates:

- Producers need increase the price to stay competitive.
- Consumers can make educated decisions based on drastic increase in inflation.
- Investors can plan to invest more , leave or stay with current investments made according to their goals and risk taking capacity.



Thank You...