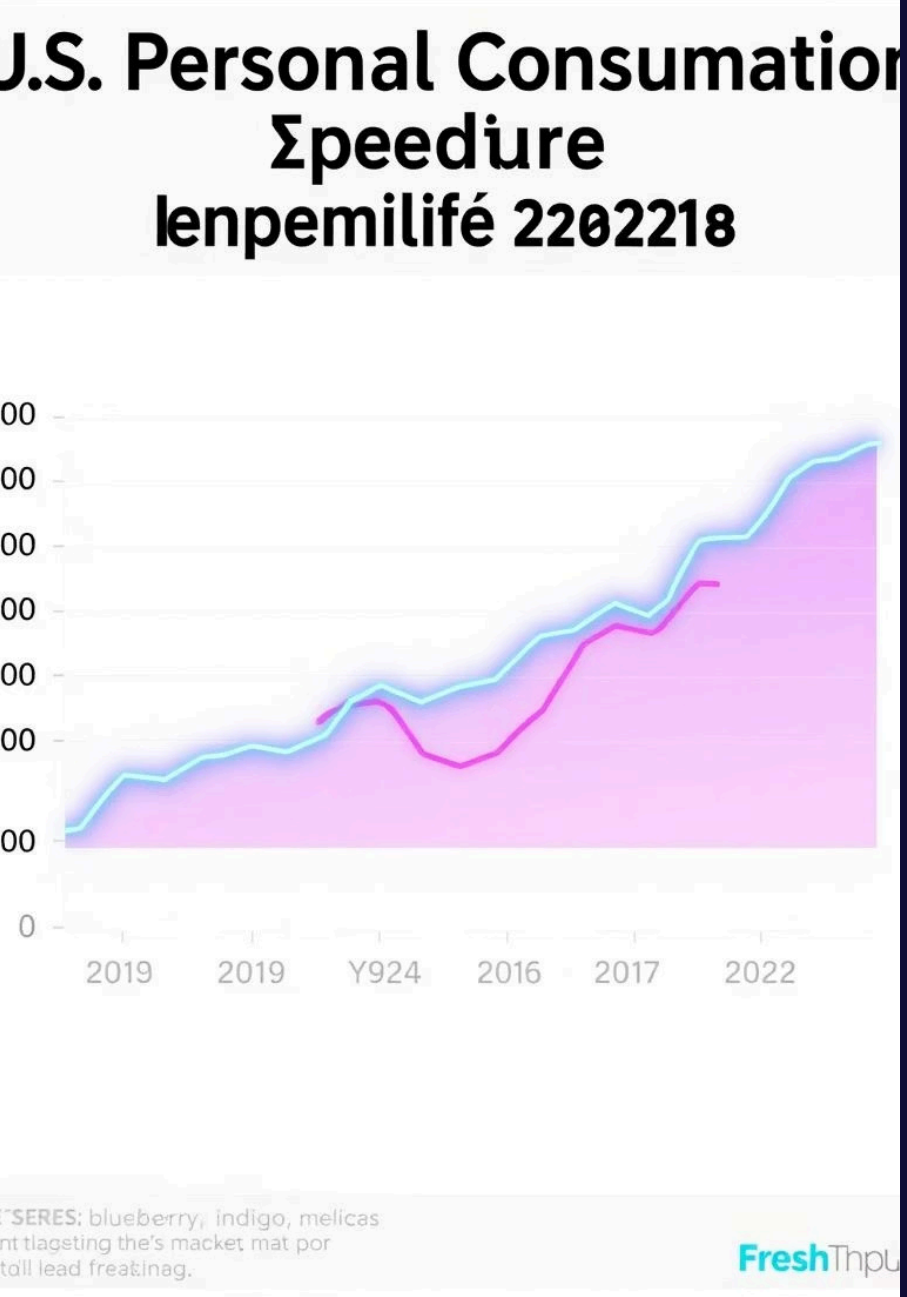
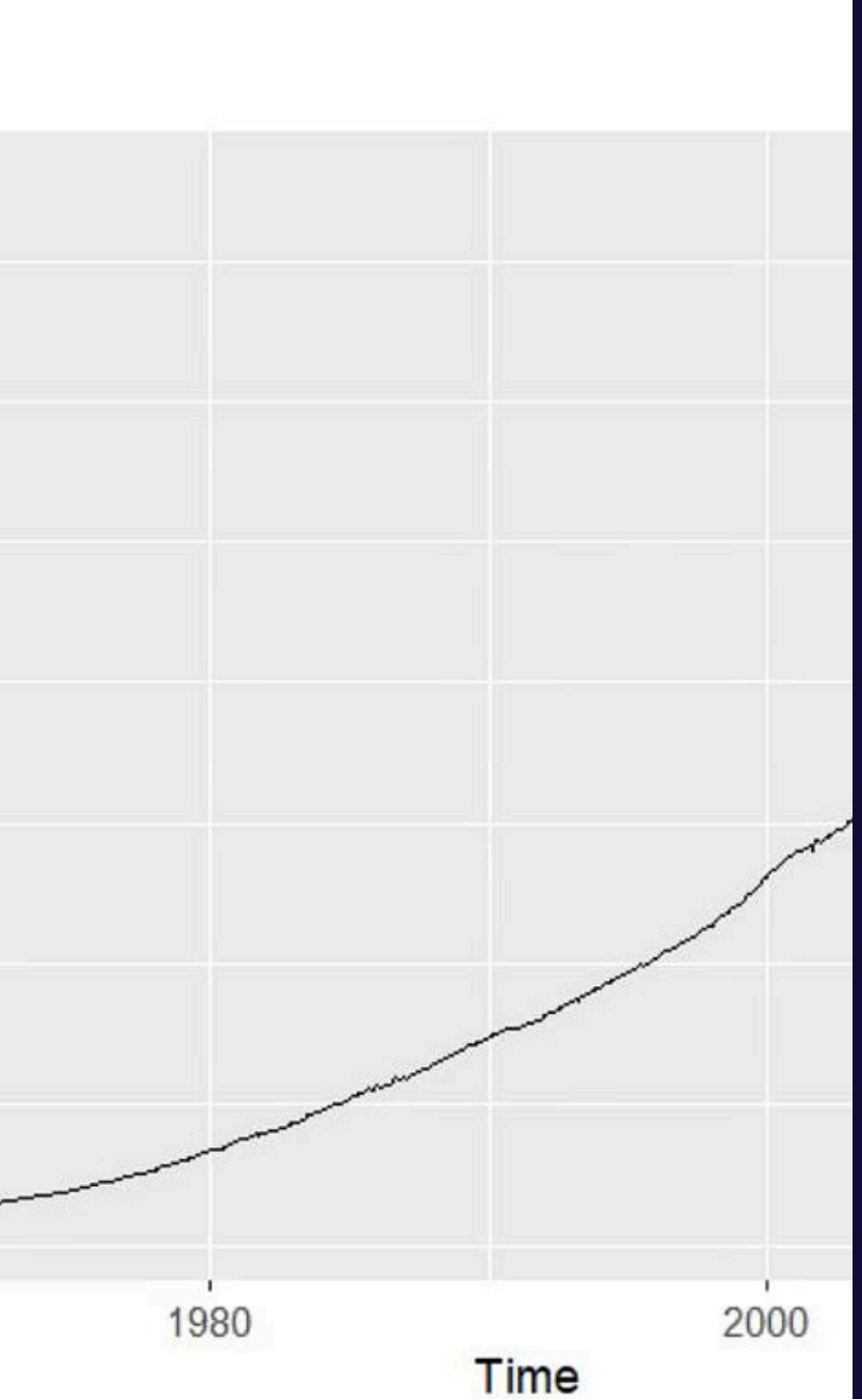


Forecasting US Personal Consumption Expenditure

Comparing forecasting models to predict US PCE from 1959 to 2023.

by Harshal John Robson



Data Preparation and Handling Missing Values

Dataset

779 rows from 1959 to 2023

Missing Values

Filled using linear interpolation

Data Split

80% training, 20% testing

Time Series

Created trainTS, testTS, and dataTS

Simple Forecasting Method: Drift Model

Drift Model

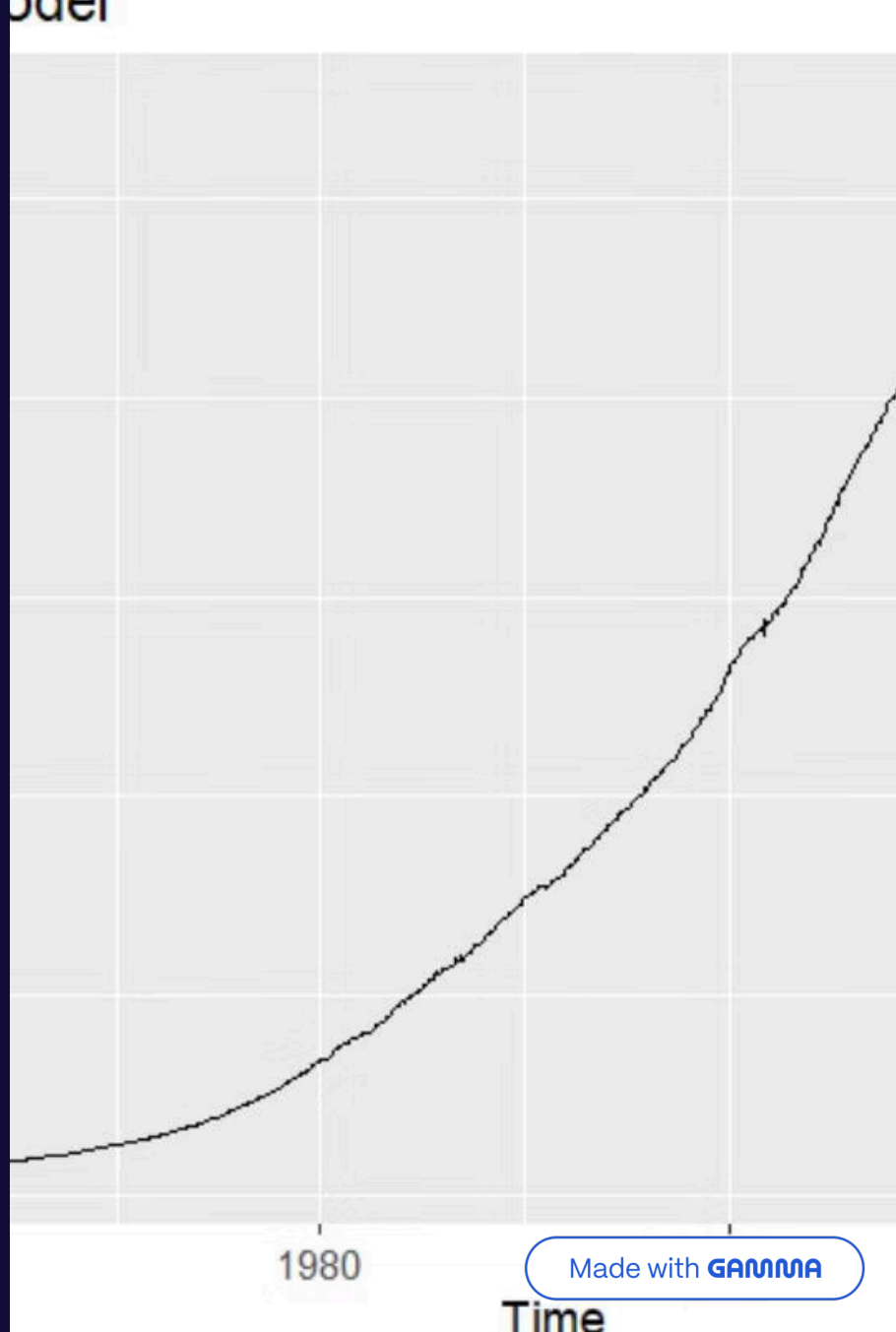
Projects linear trend from first to last data point

Suitable For

Data with clear trend, no seasonality

Implementation

Fitted on trainTS, forecast horizon equals testTS length



Exponential Smoothing Models

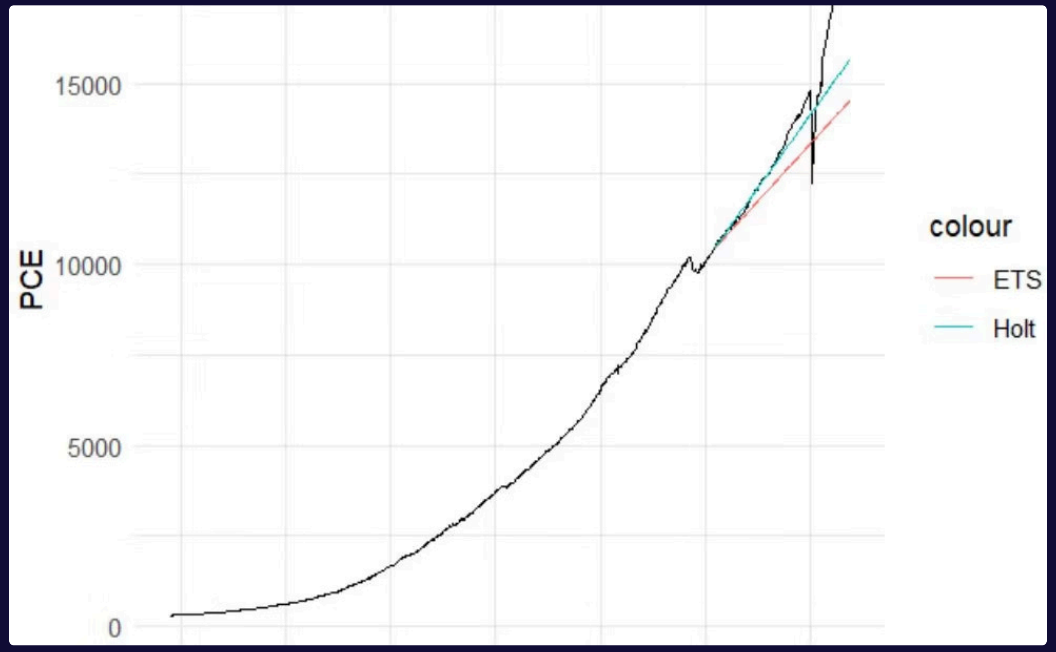
```
ential Smoothing (auto.ses)####

 <- ets(trainTS)

t_ets <- forecast(PCE_ets, h = length(te
t(forecast_ets)

####

 <- holt(trainTS, h= length(testTS))
(fcholt)
t(fcholt)
```



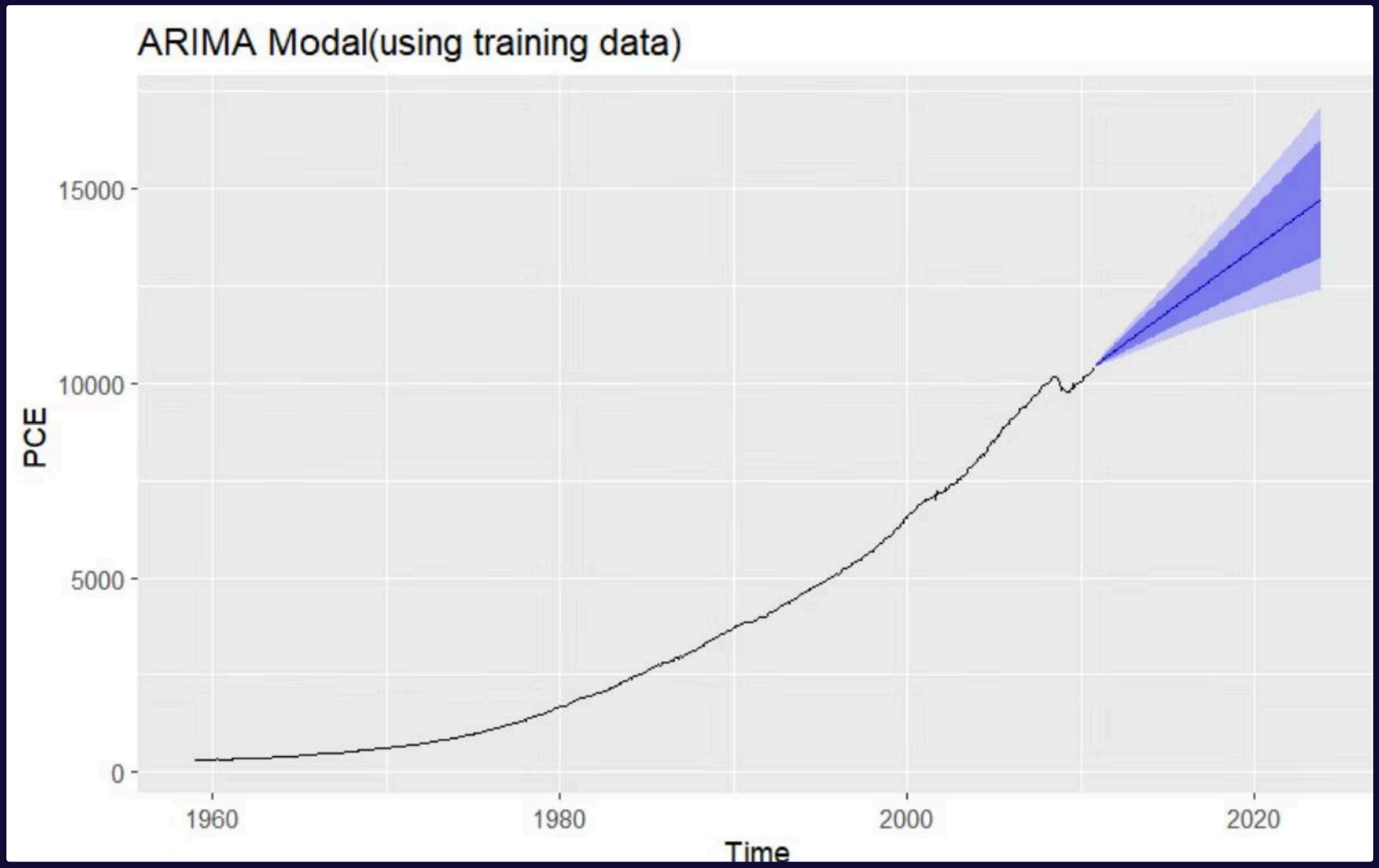
Holt's Linear Method

Best fit for additive trend data

ETS Model

Multiplicative error, additive trend, no seasonality

ARIMA Model Overview



Parameters

- p=3 (AR order)
- d=2 (Differencing)
- q=2 (MA order)

Model

Auto-selected ARIMA (3,2,2)

Use

Forecasts based on past values and errors

Model Comparison and Selection

Model	MAE	MSE	RMSE
ETS	1188.25	2,960,997	1720.75
ARIMA	1076.20	2,611,227	1615.93
Drift	1954.94	6,583,617	2565.86
Holt's	665.89	1,360,380	1166.35

Holt's model has the lowest errors and is selected best.

Model Limitations and Residuals

Residuals

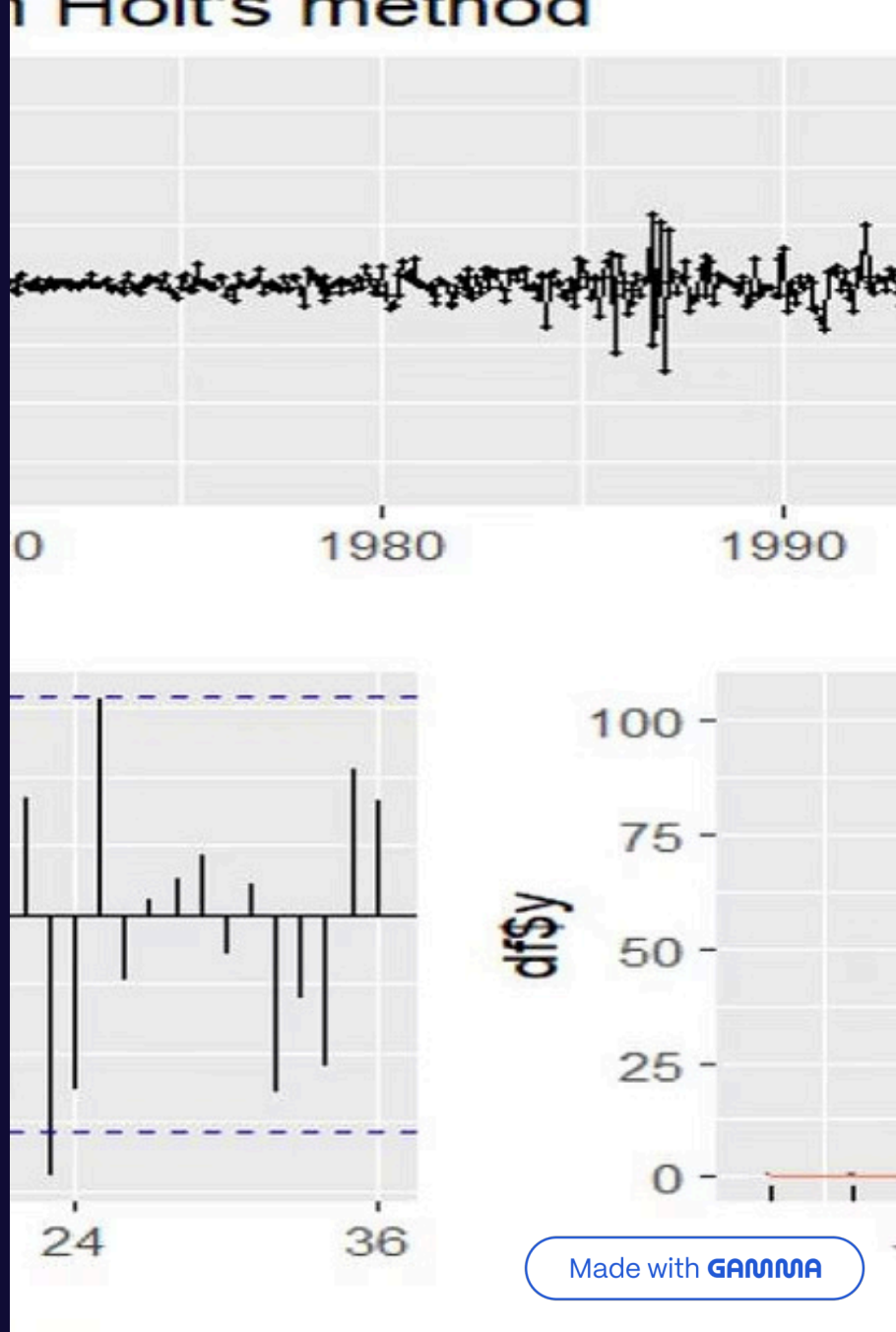
Show autocorrelation at some lags

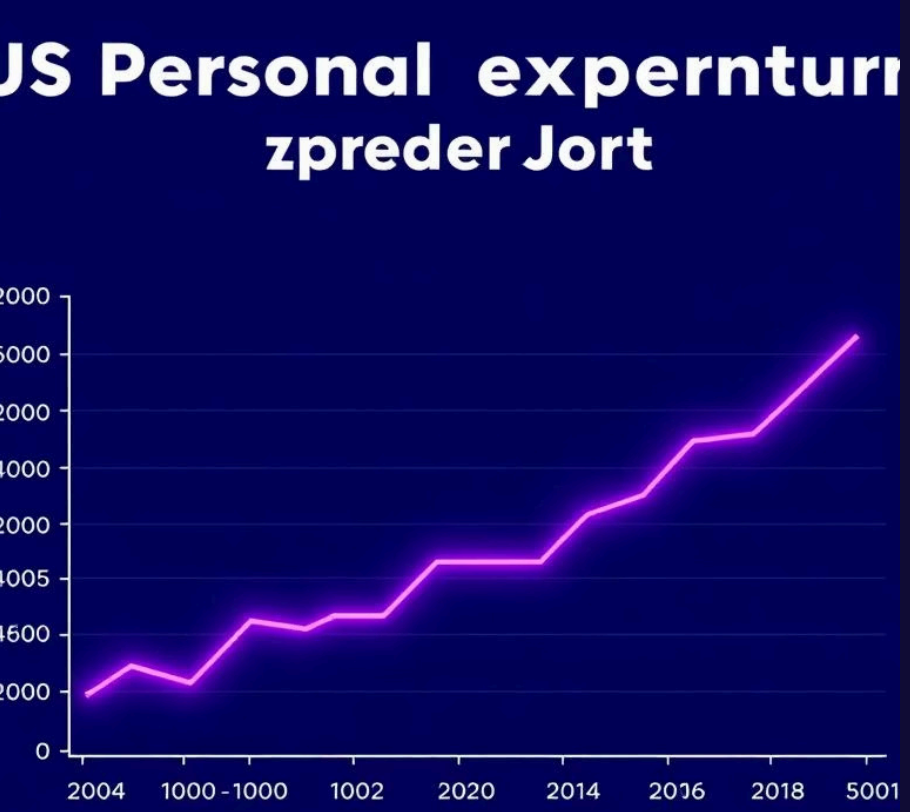
Ljung-Box Test

p-value 0.0295 indicates residual dependence

Conclusion

Holt's residuals less autocorrelated than others





Forecasts for October 2024 and Rolling Forecast

1

October 2024 Forecast

19566.92, 3.85% increase from Oct 2023

2

Rolling Forecast

One-step ahead forecasting method used

3

Model Comparison

Holt's model performs best in rolling forecast