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# This files loads monthly sales of vehicles

# Data forecast for the next 3 years will be prepared.

# Created by Taiwo Amao

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# Clear all variables in workspace

rm(list=ls())

# Load the forecasting package

library(fpp2)

# Load the data

data <- read.csv("/Users/taiwo/OneDrive/Documents/TOTALSA.csv")

# Declare this as time series data

Y <- ts(data[,2],start=c(1976,1),frequency = 12)

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# Preliminary Analysis

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#Time plot

autoplot(Y) +

ggtitle("Time Plot: TOTALSA.csv") +

ylab("Millions of 2027 Dollars")

# Data has a strong trend. I would investigate the transformations.

# Take the difference of the data to remove the trend.

DY <- diff(Y)

# Time Plot of difference in the date

autoplot(DY) +

ggtitle("Time Plot: Change in TOTALSA.csv") +

ylab("Millions of 2027 Dollars")

# Series appears trend-stationary, use to investigate seasonality.

ggseasonplot(DY) +

ggtitle("Seasonal Plot: Change in Daily Sales") +

ylab("Millions of 2027 Dollars")

# Another method to get seasonal plot, the subseries plot

ggsubseriesplot(DY)

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# Our series , Y has trend and seasonality.

# To remove the trend, take the first difference.

# The first difference series still has seasonality.

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# Forecast with different methods

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# The benchmark method is used for forecasting.

# Seasonal naive method is used as our benchmark method- which takes the mean of the data every month.

# y-t = y\_{t-s} + e-t

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fit <- snaive(DY) # Residual SD = 1.374

print(summary(fit))

checkresiduals(fit)

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# Fit ETS method

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fit\_ets <- ets(Y) # Residual SD = 0.9472

print(summary(fit\_ets))

checkresiduals(fit\_ets)

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# Fit on ARIMA model

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fit\_arima <- auto.arima(Y,d=1,D=1,stepwise = FALSE, approximation=FALSE, trace=TRUE) # Residual SD = 1.099091

print(summary(fit\_arima))

checkresiduals(fit\_arima)

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# Forecast with ARIMA model

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fcst <- forecast(fit\_arima,h=36)

autoplot(fcst,include=60)

print(summary(fcst))