



# Final Project

Forecasting(1950)-MATH1307

Forecasting using M-Competitions data.

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**Minh Phan**

s3335814

## Overview

The report is a submission to the competitive project for Forecasting (1950). The main goal of the report is to produce the best forecasts using the reduced data from the M-Competitions.

## Goals

1. Use the provided data to fit the best models for all the series and choose the best model for each category
2. Use the best model to forecast and check the quality of the forecast using MASE

## Data

### ● About the data

The data used for this analysis is a reduced version of the M-Competition, the data includes 1000 time series of five categories:

- Microeconomics
- Macroeconomics
- Industry
- Finance
- Demographics
- Other

Each category includes data from three frequencies yearly, quarterly and monthly.

In the following project, we used the first 95% of the observations of each time series for models fitting and the last 5% to check the quality of the forecasts, using Mean absolute scaled error (MASE).

## Methodology

### ● Models fitting

- Yearly data
  - A selection of models, including the Holt's models and Non-seasonality State Models, is fitted to each of the time series.
- Quarterly and Yearly data
  - A selection of models, including the Holt-Winter's models and State Models, is fitted to each of the time series.

### ● Model selection(Training Phase)

- For each time series:

For each of the model in the selections, the customised function recorded the following information in a table form:

- Model's name.
- MASE value.
- AIC value.
- P-value of the Shapiro Wilk's test.

These variables are used to select the best model for each series. The selection the best model is based on the following criteria (in order of priority):

- P-value of the Shapiro Wilk's test has to be larger than 0.05, this ensures that residuals of the best model are normally distributed
- Lowest MASE, this ensures that the selected model is able to forecast with low error.
- Lowest AIC, this ensures that the selected model fitted well and captured as much information as possible.

For some series, none of the models fitted had the P-value of the Shapiro Wilk's test larger than 0.05; we chose the best model based on the MASE and AIC value.

- For each category

In each category, the best models of each time series are recorded in summarised table form which provided the following information:

- Model's name
- Average MASE
- Average AIC
- Average P-value of the Shapiro Wilk's test
- The frequency of the model

The most popular models (based on the frequency) was fitted to all the time series, the model with the lowest forecasting MASE was chosen as the best model.

## ● Forecasting(Testing Phase)

The best model selected for each category is used for forecasting for all the series in that category. The results of the forecasts and the last 5% of the observations of each series are used to calculate the MASE; this helps check the quality of our forecast, the lower the MASE, the better the forecast.

## Result

The quality of our forecasts was recorded using table form, the table includes the mean MASE values of the yearly, quarterly and monthly data for both training and forecasting phase. In addition, the number of models selected (in training phase) with a p-value of the Shapiro Wilk's test smaller than 0.05 is also recorded, as well as the number of time series used.

### ● Microeconomics

Micro	Mean Training MASE	Mean Forecasting MASE	Number of models with p < 0.05	Best model	Number of time series
Year	0.756	2.259	8	ETS(MAN)	60
Quarter	0.589	1.28	28	ETS(MMM)	70
Month	0.666	0.471	23	ETS(MAdM)	84

### ● Macroeconomics

	Mean Training MASE	Mean Forecasting MASE	Number of models with p < 0.05	Best Model	Number of time series
Year	0.548	1.208	1	ETS(MAdN)	83
Quarter	0.306	1.166	9	ETS(MAA)	167
Month	0.258	1.906	27	ETS(AAA)	86

### ● Industry

	Mean Training MASE	Mean Forecasting MASE	Number of models with p < 0.05	Best Model	Number of time series
Year	0.912	1.821	3	ETS(ANN)	38
Quarter	0.498	0.844	9	ETS(MMdM)	54
Month	0.534	1.073	17	ETS(MMM)	52

- Finance

	Mean Training MASE	Mean Forecasting MASE	Number of models with p < 0.05	Best Model	Number of time series
Year	0.849	1.86	1	ETS(MMdN)	36
Quarter	0.375	1.493	3	ETS(ANA)	34
Month	0.272	1.879	19	Holt_Winter Multiplicative season-damped trend	62

- Demographic

	Mean Training MASE	Mean Forecasting MASE	Number of models with p < 0.05	Best Model	Number of time series
Year	0.726	1.257	4	ETS(MAdN)	105
Quarter	0.28	1.274	1	ETS(MAdM)	7
Month	0.265	1.29	6	ETS(MAA)	48

- Other

	Mean Training MASE	Mean Forecasting MASE	Number of models with p < 0.05	Best Model	Number of time series
Year	0.734	0.985	0	ETS(ANN)	11
Quarter	NA	NA	NA		
Month	NA	NA	NA		

## ● Total

All the results were combined in the following table

	Mean Training MASE	Mean Forecasting MASE	Number of models with p < 0.05	Number of time series
Year	0.7212972973	0.7212972973	17	333
Quarter	0.4034156627	0.4034156627	50	332
Month	0.4080843373	0.4080843373	92	332

## Appendix

### ● R-markdown

The codes written for the project are shown in the R markdown below, they include:

- Appendix 1: Customised functions and read data. (p7-24)
- Appendix 2: An example of models fitting and model selection for YEARLY data: Micro-economics. (p25-351)
- Appendix 3: An example of models fitting and model selection for QUARTERLY data: Industry. (p352-734)

\*Note: The code for Monthly data is the same as Quarterly data, the only difference is in frequency in the `ts()` function.

# Appendix 1- Customised functions and data reading

Code ▾

## Requires library

Hide

```
library(TSA)
```

```
Attaching package: 'TSA'
```

```
The following objects are masked from 'package:stats':
```

```
  acf, arima
```

```
The following object is masked from 'package:utils':
```

```
  tar
```

Hide

```
library(forecast)
```

```
package 'forecast' was built under R version 3.5.2
```

Hide

```
library(x12)
```

```
Loading required package: x13binary
```

```
package 'x13binary' was built under R version 3.5.2x12 is ready to use.
```

```
Use the package x12GUI for a Graphical User Interface.
```

```
By default the X13-ARIMA-SEATS binaries provided by the R package x13binary
```

```
are used but this can be changed with x12path(validpath)
```

```
-----
```

```
Suggestions and bug-reports can be submitted at: https://github.com/statistikat/x12/issues
```

Hide

```
library(car)
```

```
Loading required package: carData
```

Hide

```
library(dynlm)
```

```
package 'dynlm' was built under R version 3.5.2Loading required package: zoo
```

```
Attaching package: 'zoo'
```

```
The following objects are masked from 'package:base':
```

```
as.Date, as.Date.numeric
```

Hide

```
library(Hmisc)
```

```
package 'Hmisc' was built under R version 3.5.2Loading required package: lattice
```

```
Loading required package: survival
```

```
Loading required package: Formula
```

```
Loading required package: ggplot2
```

```
package 'ggplot2' was built under R version 3.5.2
```

```
Attaching package: 'Hmisc'
```

```
The following objects are masked from 'package:base':
```

```
format.pval, units
```

Hide

```
library(dLagM)
```

```
package 'dLagM' was built under R version 3.5.2Loading required package: nardl
```

```
Attaching package: 'dLagM'
```

```
The following object is masked from 'package:forecast':
```

```
forecast
```

Hide

```
library(tseries)
```

```
'tseries' version: 0.10-46
```

```
'tseries' is a package for time series analysis and  
computational finance.
```

```
See 'library(help="tseries")' for details.
```

Hide

```
library(tidyverse)
```



```
[37m── [1mAttaching packages [22m ─────────────────── tidyverse 1.2.1 ─ [39m
[37m [32m✓ [37m [34mtibble [37m 2.1.3 [32m✓ [37m [34mpurrr [37m 0.2.5
[32m✓ [37m [34mtidyr [37m 0.8.3 [32m✓ [37m [34mdplyr [37m 0.8.3
[32m✓ [37m [34mreadr [37m 1.1.1 [32m✓ [37m [34mstringr [37m 1.4.0
[32m✓ [37m [34mtibble [37m 2.1.3 [32m✓ [37m [34mforcats [37m 0.3.0 [39m
package 'tibble' was built under R version 3.5.2package 'tidyr' was built under R ver
sion 3.5.2package 'dplyr' was built under R version 3.5.2package 'stringr' was built
under R version 3.5.2 [37m── [1mConflicts [22m ─────────────────── tidyverse_
conflicts() ─
[31m✘ [37m [34mdplyr [37m:: [32mfilter() [37m masks [34mstats [37m::filter()
[31m✘ [37m [34mdplyr [37m:: [32mlag() [37m masks [34mstats [37m::lag()
[31m✘ [37m [34mdplyr [37m:: [32mrecode() [37m masks [34mcar [37m::recode()
[31m✘ [37m [34mpurrr [37m:: [32msome() [37m masks [34mcar [37m::some()
[31m✘ [37m [34mreadr [37m:: [32mspec() [37m masks [34mTSA [37m::spec()
[31m✘ [37m [34mdplyr [37m:: [32msrc() [37m masks [34mHmisc [37m::src()
[31m✘ [37m [34mdplyr [37m:: [32msummarize() [37m masks [34mHmisc [37m::summarize() [39
m
```

Hide

```
library(xts)
```

```
Attaching package: 'xts'
```

```
The following objects are masked from 'package:dplyr':
```

```
first, last
```

Hide

```
library(Metrics)
```

```
Attaching package: 'Metrics'
```

```
The following object is masked from 'package:forecast':
```

```
accuracy
```

Hide

```
library(BBmisc)
```

```
Attaching package: 'BBmisc'
```

```
The following objects are masked from 'package:dplyr':
```

```
  coalesce, collapse
```

```
The following object is masked from 'package:Hmisc':
```

```
  %nin%
```

```
The following object is masked from 'package:base':
```

```
  isFALSE
```

[Hide](#)

```
library(ggplot2)  
library(AER)
```

```
package 'AER' was built under R version 3.5.2Loading required package: lmtest  
Loading required package: sandwich
```

[Hide](#)

```
library(readr)  
library(readxl)
```

## Customised functions

## Reading data row

[Hide](#)

```

#Read each row of the data
read_row <- function(a){
  x <- a
  y<- x [,-c(1,2,3)]
  y<- y %>% gather("X") %>% drop_na()
  y$X<-NULL
  return(y)
}
#Read starting time of the yearly data
read_starting_time<- function (b){
  starting<- c(b$`Starting Year`,b$X__1)
  return(starting)
}
#Read starting time of the quarterly data
read_starting_time_quater<- function (b){
  starting<- c(b$`Starting Year`,b$`Starting Quarter`)
  return(starting)
}
#Read starting time of the monthly data
read_starting_time_month<- function (b){
  starting<- c(b$`Starting Year`,b$`Starting Month`)
  return(starting)
}

```

## Subsetting observations

[Hide](#)

```

#Subsetting the first 95% of the observations for models fitting
subset_95<-function(c){
  if (ceiling(0.05*nrow(c))<2){
    c_95 <- c[1:(nrow(c)-2),]
  }

  else{
    c_95 <- c[1:(floor(0.95*nrow(c))),]
  }
  return (c_95)
}

```

[Hide](#)

```

#Subset the last 5% for quality checking
subset_5<-function(c){
  if (ceiling(0.05*nrow(c))<2)
  {
    c_5<-c[(nrow(c)-1):nrow(c),]
  }
  else{
    c_5<-c[(ceiling(0.95*nrow(c))):nrow(c),]
  }
  return (c_5)
}

```

# Modelling fitting for each time series

## For yearly data

The following function fits all the possible models for a yearly time series and return the best model.

Hide

```

state_model_fitting_year <- function (ts_series,subset_5_series){
  #fit 15 models and list mase, rank if possible
  #No Trend No seasonlity
  h=nrow(subset_5_series)
  model_table<-data.frame(model = NA, mase_v = NA, aic_v= NA, p_val=NA)

  fit_etsA_NN = ets(ts_series, model="ANN")
  fit_etsA_NN_MASE<-fit_etsA_NN %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit_etsA_NN$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit_etsA_NN",fit_etsA_NN_MASE$MASE,fit_etsA_NN$aic,shapirotest_val$p.value)

  fit_etsM_NN = ets(ts_series, model="MNN")
  fit_etsM_NN_MASE<-fit_etsM_NN %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit_etsM_NN$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit_etsM_NN",fit_etsM_NN_MASE$MASE,fit_etsM_NN$aic,shapirotest_val$p.value)
  #Trend with no seasonality

  #Additive Error
  fit_etsA_AN = ets(ts_series, model="AAN")
  fit_etsA_AN_MASE<-fit_etsA_AN %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit_etsA_AN$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit_etsA_AN",fit_etsA_AN_MASE$MASE,fit_etsA_AN$aic,shapirotest_val$p.value)

  fit_etsA_AN_damp = ets(ts_series, model="AAN", damped = TRUE)
  fit_etsA_AN_damp_MASE<-fit_etsA_AN_damp %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit_etsA_AN_damp$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit_etsA_AN_damp",fit_etsA_AN_damp_MASE$MASE,fit_etsA_AN_damp$aic,shapirotest_val$p.value)

  #fit_etsA_MN = ets(ts_series, model="AMN")
  #fit_etsA_MN_damp = ets(ts_series, model="AMN", damped = TRUE)

  #Multiplicative Error

  fit_etsM_AN = ets(ts_series, model="MAN")
  fit_etsM_AN_MASE<-fit_etsM_AN %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit_etsM_AN$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit_etsM_AN",fit_etsM_AN_MASE$MASE,fit_etsM_AN$aic,shapirotest_val$p.value)

  fit_etsM_AN_damp = ets(ts_series, model="MAN", damped = TRUE)
  fit_etsM_AN_damp_MASE<-fit_etsM_AN_damp %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit_etsM_AN_damp$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit_etsM_AN_damp",fit_etsM_AN_damp_MASE$MASE,fit_etsM_AN_damp$aic,shapirotest_val$p.value)

  fit_etsM_MN = ets(ts_series, model="MMN")
  fit_etsM_MN_MASE<-fit_etsM_MN %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit_etsM_MN$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit_etsM_MN",fit_etsM_MN_MASE$MASE,fit_etsM_MN$aic,shapirotest_val$p.value)

```

```

fit_etsM_MN_damp = ets(ts_series, model="MMN", damped = TRUE)
fit_etsM_MN_damp_MASE<-fit_etsM_MN_damp %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsM_MN_damp$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsM_MN_damp",fit_etsM_MN_damp_MASE$MASE,
fit_etsM_MN_damp$aic,shapirotest_val$p.value)
#Exponential smoothing

#Holt linear method A,N
fit1.holt <- holt(ts_series, initial="optimal", h=h)
fit1.holt_MASE<-fit1.holt$model %>% summary() %>% as.data.frame
model_1<-fit1.holt$model
shapirotest_val<-shapiro.test(model_1$residuals)
model_table[nrow(model_table)+1 ,] = c("fit1.holt",fit1.holt_MASE$MASE,model_1$aic,sh
apirotest_val$p.value)

fit2.holt <- holt(ts_series, damped=TRUE, initial="optimal", h=h)
fit2.holt_MASE<-fit2.holt$model %>% summary() %>% as.data.frame
model_1<-fit2.holt$model
shapirotest_val<-shapiro.test(model_1$residuals)
model_table[nrow(model_table)+1 ,] = c("fit2.holt",fit2.holt_MASE$MASE,model_1$aic,sh
apirotest_val$p.value)

fit3.holt <- holt(ts_series, initial="simple", exponential=TRUE, h=h)
fit3.holt_MASE<-fit3.holt$model %>% summary() %>% as.data.frame
model_1<-fit3.holt$model
shapirotest_val<-shapiro.test(model_1$residuals)
model_table[nrow(model_table)+1 ,] = c("fit3.holt",fit3.holt_MASE$MASE,NA,shapirotest
_val$p.value)

model_table$mase_v<- as.numeric(model_table$mase_v)
model_table$p_val<- as.numeric(model_table$p_val)
model_table$aic<- as.numeric(model_table$aic)
#model_table<- model_table %>% arrange(aic_v)#desc(p_val),
select_model_table<- select_model(model_table)
select_model_table<-select_model_table%>% arrange(mase_v,aic_v)
return(select_model_table[1,])

}

```

The following function fits all the possible models for a yearly time series and return the table of all the models fitted.

Hide

```

state_model_fitting_year_table <- function (ts_series,subset_5_series){
  #fit 15 models and list mase, rank if possible
#No Trend No seasonlity
h=nrow(subset_5_series)
model_table<-data.frame(model = NA, mase_v = NA, aic_v= NA, p_val=NA)

fit_etsA_NN = ets(ts_series, model="ANN")
fit_etsA_NN_MASE<-fit_etsA_NN %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsA_NN$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsA_NN",fit_etsA_NN_MASE$MASE,fit_etsA_NN$aic,shapirotest_val$p.value)

fit_etsM_NN = ets(ts_series, model="MNN")
fit_etsM_NN_MASE<-fit_etsM_NN %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsM_NN$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsM_NN",fit_etsM_NN_MASE$MASE,fit_etsM_NN$aic,shapirotest_val$p.value)
#Trend with no seasonality

#Additive Error
fit_etsA_AN = ets(ts_series, model="AAN")
fit_etsA_AN_MASE<-fit_etsA_AN %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsA_AN$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsA_AN",fit_etsA_AN_MASE$MASE,fit_etsA_AN$aic,shapirotest_val$p.value)

fit_etsA_AN_damp = ets(ts_series, model="AAN", damped = TRUE)
fit_etsA_AN_damp_MASE<-fit_etsA_AN_damp %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsA_AN_damp$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsA_AN_damp",fit_etsA_AN_damp_MASE$MASE,fit_etsA_AN_damp$aic,shapirotest_val$p.value)

#fit_etsA_MN = ets(ts_series, model="AMN")
#fit_etsA_MN_damp = ets(ts_series, model="AMN", damped = TRUE)

#Multiplicative Error

fit_etsM_AN = ets(ts_series, model="MAN")
fit_etsM_AN_MASE<-fit_etsM_AN %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsM_AN$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsM_AN",fit_etsM_AN_MASE$MASE,fit_etsM_AN$aic,shapirotest_val$p.value)

fit_etsM_AN_damp = ets(ts_series, model="MAN", damped = TRUE)
fit_etsM_AN_damp_MASE<-fit_etsM_AN_damp %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsM_AN_damp$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsM_AN_damp",fit_etsM_AN_damp_MASE$MASE,fit_etsM_AN_damp$aic,shapirotest_val$p.value)

fit_etsM_MN = ets(ts_series, model="MMN")
fit_etsM_MN_MASE<-fit_etsM_MN %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsM_MN$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsM_MN",fit_etsM_MN_MASE$MASE,fit_etsM_MN$aic,shapirotest_val$p.value)

fit_etsM_MN_damp = ets(ts_series, model="MMN", damped = TRUE)

```

```

fit_etsM_MN_damp_MASE<-fit_etsM_MN_damp %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit_etsM_MN_damp$residuals)
model_table[nrow(model_table)+1 ,] = c("fit_etsM_MN_damp",fit_etsM_MN_damp_MASE$MASE,
fit_etsM_MN_damp$aic,shapirotest_val$p.value)
#Exponential smoothing

#fit2.etsM = ets(ts_series, model="MAN", damped = TRUE)
#fit3.etsA = ets(ts_series, model="AAA")
#fit3.etsM = ets(ts_series, model="MAA")
#fit4.etsM = ets(ts_series, model="MAM")
#fit5 = ets(ts_series)
##model_table[nrow(model_table) ,] = c("fit1.ses",fit1.ses_MASE$MASE)
#Holt linear method A,N
fit1.holt <- holt(ts_series, initial="optimal", h=h)
fit1.holt_MASE<-fit1.holt$model %>% summary() %>% as.data.frame
model_1<-fit1.holt$model
shapirotest_val<-shapiro.test(model_1$residuals)
model_table[nrow(model_table)+1 ,] = c("fit1.holt",fit1.holt_MASE$MASE,model_1$aic,sh
apirotest_val$p.value)

fit2.holt <- holt(ts_series, damped=TRUE, initial="optimal", h=h)
fit2.holt_MASE<-fit2.holt$model %>% summary() %>% as.data.frame
model_1<-fit2.holt$model
shapirotest_val<-shapiro.test(model_1$residuals)
model_table[nrow(model_table)+1 ,] = c("fit2.holt",fit2.holt_MASE$MASE,model_1$aic,sh
apirotest_val$p.value)

fit3.holt <- holt(ts_series, initial="simple", exponential=TRUE, h=h)
fit3.holt_MASE<-fit3.holt$model %>% summary() %>% as.data.frame
model_1<-fit3.holt$model
shapirotest_val<-shapiro.test(model_1$residuals)
model_table[nrow(model_table)+1 ,] = c("fit3.holt",fit3.holt_MASE$MASE,NA,shapirotest
_val$p.value)

model_table$mase_v<- as.numeric(model_table$mase_v)
model_table$p_val<- as.numeric(model_table$p_val)
model_table$aic<- as.numeric(model_table$aic)
#model_table<- model_table %>% arrange(aic_v)#desc(p_val),
select_model_table<- select_model(model_table)
select_model_table<-select_model_table%>% arrange( mase_v,aic_v)
#return(select_model_table[1,])
return(select_model_table)
}

```

## For quarterly and monthly data

The following function fits all the possible models for a quarterly and monthly time series and return the best model.

Hide



```

state_model_fitting_quater_month<-function (ts_series,subset_5_series ){
  h= nrow(subset_5_series)
  model_table<-data.frame(model = NA, mase_v = NA, aic_v= NA, p_val=NA)
  #Holt winter
  fit.hw.add = hw(ts_series, seasonal = "additive", h = h)
  fit.hw.add_MASE<-fit.hw.add$model %>% summary() %>% as.data.frame
  model_1<-fit.hw.add$model
  shapirotest_val<-shapiro.test(model_1$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit.hw.add",fit.hw.add_MASE$MASE,NA,shapirotest_val$p.value)

  fit.hw.add.dmp = hw(ts_series, seasonal = "additive", damped = TRUE, h=h)
  fit.hw.add.dmp_MASE<-fit.hw.add.dmp$model %>% summary() %>% as.data.frame
  model_1<-fit.hw.add.dmp$model
  shapirotest_val<-shapiro.test(model_1$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit.hw.add.dmp",fit.hw.add.dmp_MASE$MASE,model_1$aic,shapirotest_val$p.value)

  fit.hw.mult = hw(ts_series, seasonal = "multiplicative", h = h)

  fit.hw.mult_MASE<-fit.hw.mult$model %>% summary() %>% as.data.frame
  model_1<-fit.hw.mult$model
  shapirotest_val<-shapiro.test(model_1$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit.hw.mult",fit.hw.mult_MASE$MASE,model_1$aic,shapirotest_val$p.value)

  fit.hw.mult.dmp = hw(ts_series, seasonal = "multiplicative",damped = TRUE,h=h)
  fit.hw.mult.dmp_MASE<-fit.hw.mult.dmp$model %>% summary() %>% as.data.frame
  model_1<-fit.hw.mult.dmp$model
  shapirotest_val<-shapiro.test(model_1$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit.hw.mult.dmp",fit.hw.mult.dmp_MASE$MASE,model_1$aic,shapirotest_val$p.value)

  fit.hw.mult.exp = hw(ts_series, seasonal = "multiplicative", exponential = TRUE, h = h)
  fit.hw.mult.exp_MASE<-fit.hw.mult.exp$model %>% summary() %>% as.data.frame
  model_1<-fit.hw.mult.exp$model
  shapirotest_val<-shapiro.test(model_1$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit.hw.mult.exp",fit.hw.mult.exp_MASE$MASE,model_1$aic,shapirotest_val$p.value)
  #State Space
  #No Trend
  fit.ANA = ets(ts_series, model = "ANA")
  fit.ANA_MASE<-fit.ANA %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit.ANA$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit.ANA",fit.ANA_MASE$MASE,fit.ANA$aic,shapirotest_val$p.value)

  fit.MNA = ets(ts_series, model = "MNA")
  fit.MNA_MASE<-fit.MNA %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit.MNA$residuals)
  model_table[nrow(model_table)+1 ,] = c("fit.MNA",fit.MNA_MASE$MASE,fit.MNA$aic,shapirotest_val$p.value)

  fit.MNM = ets(ts_series, model = "MNM")
  fit.MNM_MASE<-fit.MNM %>% summary() %>% as.data.frame
  shapirotest_val<-shapiro.test(fit.MNM$residuals)

```

```

model_table[nrow(model_table)+1 ,] = c("fit.MNM",fit.MNM_MASE$MASE,fit.MNM$aic,shapiro
test_val$p.value)
#Additive error

fit.AAA = ets(ts_series, model = "AAA")
fit.AAA_MASE<-fit.AAA %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.AAA$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.AAA",fit.AAA_MASE$MASE,fit.AAA$aic,shapiro
test_val$p.value)

fit.AAdA = ets(ts_series, model = "AAA", damped = TRUE)
fit.AAdA_MASE<-fit.AAdA %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.AAdA$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.AAdA",fit.AAdA_MASE$MASE,fit.AAdA$aic,sha
pirotest_val$p.value)

#Multi Error

fit.MMM = ets(ts_series, model = "MMM")
fit.MMM_MASE<-fit.MMM %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.MMM$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.MMM",fit.MMM_MASE$MASE,fit.MMM$aic,shapiro
test_val$p.value)

fit.MMdM = ets(ts_series, model = "MMM", damped = TRUE)
fit.MMdM_MASE<-fit.MMdM %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.MMdM$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.MMdM",fit.MMdM_MASE$MASE,fit.MMdM$aic,sha
pirotest_val$p.value)

fit.MAA = ets(ts_series, model = "MAA")
fit.MAA_MASE<-fit.MAA %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.MAA$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.MAA",fit.MAA_MASE$MASE,fit.MAA$aic,shapiro
test_val$p.value)

fit.MAdA = ets(ts_series, model = "MAA", damped = TRUE)
fit.MAdA_MASE<-fit.MAdA %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.MAdA$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.MAdA",fit.MAdA_MASE$MASE,fit.MAdA$aic,sha
pirotest_val$p.value)

fit.MAM = ets(ts_series, model = "MAM")
fit.MAM_MASE<-fit.MAM %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.MAM$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.MAM",fit.MAM_MASE$MASE,fit.MAM$aic,shapiro
test_val$p.value)

fit.MAdM = ets(ts_series, model = "MAM", damped = TRUE)
fit.MAdM_MASE<-fit.MAdM %>% summary() %>% as.data.frame
shapirotest_val<-shapiro.test(fit.MAdM$residuals)
model_table[nrow(model_table)+1 ,] = c("fit.MAdM",fit.MAdM_MASE$MASE,fit.MAdM$aic,sha
pirotest_val$p.value)

model_table$mase_v<- as.numeric(model_table$mase_v)
model_table$p_val<- as.numeric(model_table$p_val)
model_table$aic<- as.numeric(model_table$aic)

```

```
#model_table<- model_table %>% arrange(desc(p_val),mase_v)
select_model_table<- select_model(model_table)
select_model_table<-select_model_table%>% arrange( mase_v,aic_v)
return(select_model_table[1,])
#return(model_table[1,])
#return(best_model)

}
```

## MASE calculation

### Training phase

This function returns the training MASE value for holt's types models

[Hide](#)

```
mase_training_holt<- function (a_model ){
v<-summary(a_model$model)#holt stuff
v_data<- as.data.frame(v)
b<-v_data$MASE
return(b)
}
```

This function returns the training MASE value for State Space types models

[Hide](#)

```
mase_training_ets<- function (a_model ){
v<-summary(a_model)#holt stuff
v_data<- as.data.frame(v)
b<-v_data$MASE
return(b)
}
```

This try/ catch function return the training MASE value for either Holt's types or State Space type models

[Hide](#)

```
mase_try_catch_training <-function (a_model){

b<-mase_training_ets (a_model)

return_val<-1

if (is.null(b)){
return_val<-mase_training_holt(a_model)
return(return_val)
}
else
return(b)
}
```

### Forecasting phase

This function calculates the forecasting MASE value for Holt's types models, using the last 5% of the observations

Hide

```
mase_forecast_holt_2<- function (testing_data,a_model,sub_5_data ){
h=nrow(sub_5_data)
f<- forecast(a_model$model,h=h)
f_data<- as.data.frame(f$mean)
b<- MASE.forecast(testing_data,sub_5_data$value,f_data$x)
return(b)
}
```

This function calculates the forecasting MASE value for State Space types models, using the last 5% of the observations

Hide

```
mase_forecast_ets_2<- function (testing_data,a_model,sub_5_data ){
h=nrow(sub_5_data)
f<- forecast(a_model,h=h)
f_data<- as.data.frame(f$mean)
b<- MASE.forecast(testing_data,sub_5_data$value,f_data$x)
return(b)
}
```

This function calculates the forecasting MASE value for either State Space types models or Holts's types models, using the last 5% of the observations.

Hide

```
mase_trycatch_forecasting_2<- function (testing_data,a_model,subset_data_5){
b<-mase_training_ets(a_model)

return_val<-1

if (is.null(b)){
return_val<-mase_forecast_holt_2(testing_data,a_model,subset_data_5)
return(return_val)
}
else{
return_val<-mase_forecast_ets_2(testing_data,a_model,subset_data_5)
return(return_val)
}

}
```

## General

This function is used to calculate MASE value- provided for the project

Hide

```
MASE.forecast = function(training, test, forecasts){
  # training: Training set, should be vector.
  # test: Test set, should be vector.
  # forecasts: Forecasts obtained by the best model, should be vector.
  # The number of forecasts should be the same as the length of test set.
  n = length(training)
  e.t = test - forecasts
  sum = 0
  for (i in 2:n){
    sum = sum + abs(training[i] - training[i-1] )
  }
  q.t = e.t / (sum/(n-1))
  MASE = mean(abs(q.t))
  return(MASE = MASE)
}
```

## Model selection

This function return all the models with the p value of the Shapiro Wilks test >0.05. If none of the models satisfies this condition, the model return all the models.

[Hide](#)

```
select_model<- function(model_table){
  p_table<- model_table %>% filter(model_table$p_val>0.05)
  if(nrow(p_table)>0){
    return(p_table)
  }
  else{
    return(model_table)
  }
}
```

## a. Importing data

### Year

[Hide](#)

```
data_year<- data_year <- read_excel("data_year.xlsx", col_types = c("blank", "blank",
"text", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric",
"numeric", "numeric","numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric",
, "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeri
c", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "num
eric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric",
"numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeric", "numeri
c", "numeric", "numeric", "numeric"))
data_year_micro <-data_year %>% filter(Category=="MICRO")
data_year_industry <-data_year %>% filter(Category=="INDUSTRY")
data_year_macro <-data_year %>% filter(Category=="MACRO")
data_year_finance <-data_year %>% filter(Category=="FINANCE")
data_year_demographic <-data_year %>% filter(Category=="DEMOGRAPHIC")
data_year_other <-data_year %>% filter(Category=="OTHER")
```





# Results tables for each types of frequency.

[Hide](#)

```
Year_table<-data.frame(Series = NA, best_model = NA, training_mase_mean=NA,forecasting_mase_mean=NA, number_p_less_0.05=NA)
```

[Hide](#)

```
Quater_table<-data.frame(Series = NA, best_model = NA, training_mase_mean=NA,forecasting_mase_mean=NA, number_p_less_0.05=NA)
```

[Hide](#)

```
Month_table<-data.frame(Series = NA, best_model = NA, training_mase_mean=NA,forecasting_mase_mean=NA, number_p_less_0.05=NA)
```



# Appendix 2 : An example of models fitting and model selection for YEARLY DATA-MICROECONOMICS

Code ▾

## a. MICRO

Hide

```
#Fitting best model base on lowest Training MASE
#For loop for all

model_table_micro<-data.frame(model = NA, mase_v = NA, aic_v= NA, p_val=NA, count=NA)
for (i in 1: nrow(data_year_micro)){

  a<- read_row(data_year_micro[i,])
  starting<- read_starting_time(data_year_micro[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting)
  a_5<- subset_5(a)
  best_model<- state_model_fitting_year(a_95_ts,a_5)
  best_model<- best_model%>% as.data.frame()
# training_mase<- mase_try_catch_training(best_model)
#forecast_mase<- mase_trycatch_forecasting(best_model,a_5)
# micro_mase_table[nrow(micro_mase_table)+1 ,]=c(training_mase,forecast_mase)
  model_table_micro[nrow(model_table_micro)+1 ,] = c(best_model[1,1],best_model[1,2],
best_model[1,3], best_model[1,4], 1)
}
```

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 3631.825
```

```
sigma: 810.3569
```

```
AIC      AICc      BIC
```

```
297.0157 298.7300 299.6868
```

Training set error measures:

```
ME      RMSE      MAE      MPE
```

```
Training set 331.1601 764.0118 636.3359 4.798531
```

```
MAPE      MASE      ACF1
```

```
Training set 8.762722 0.9449293 0.4264799
```

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 3585.7083
```

```
sigma: 0.1274
```

```
AIC      AICc      BIC
```

```
298.8670 300.5813 301.5381
```

Training set error measures:

```
ME      RMSE      MAE      MPE
```

```
Training set 333.7224 764.107 638.8982 4.868978
```

```
MAPE      MASE      ACF1
```

```
Training set 8.833169 0.9487342 0.4284176
```

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9951
```

```
beta  = 0.5656
```

Initial states:

```
l = 3472.7728
```

```
b = 308.486
```

```
sigma: 810.6916
```

```

      AIC      AICc      BIC
298.6270 303.6270 303.0788

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 11.43734 714.9628 567.7777 0.4817802
              MAPE      MASE      ACF1
Training set 7.635309 0.8431235 0.1642108
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 1e-04
phi   = 0.9274

```

Initial states:

```

l = 3549.1164
b = 623.433

```

sigma: 793.0626

```

      AIC      AICc      BIC
298.5016 306.1379 303.8438

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 7.18673 673.9736 542.7337 -0.4381037
              MAPE      MASE      ACF1
Training set 7.45521 0.8059342 0.3937801
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```

alpha = 0.9995
beta  = 0.1676

```

Initial states:

```

l = 3246.9931
b = 574.9184

```

sigma: 0.0986

```

      AIC      AICc      BIC
293.5184 298.5184 297.9703

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set -84.5237 711.8016 529.1652 -1.280663
              MAPE      MASE      ACF1
Training set 7.064583 0.7857857 0.3823437
ETS(M,Ad,N)

```

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9523
```

Initial states:

```
l = 3227.0943
b = 623.5976
```

sigma: 0.101

AIC	AICc	BIC
294.9516	302.5880	300.2938

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-51.23296	669.5792	516.3481	-0.9612906
	MAPE	MASE	ACF1	
Training set	6.928423	0.7667528	0.4071797	

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.509
```

Initial states:

```
l = 3645.7965
b = 1.0641
```

sigma: 0.1086

AIC	AICc	BIC
296.8418	301.8418	301.2937

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-100.3953	790.498	616.5761	-0.8741351
	MAPE	MASE	ACF1	
Training set	8.36287	0.9155868	0.2868239	

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.6447
phi   = 0.8
```

Initial states:

```
l = 3548.1482
b = 1.0683
```

```

sigma: 0.107

      AIC      AICc      BIC
296.3626 303.9990 301.7049

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 31.8729 678.0208 557.3191 0.8757797
              MAPE      MASE      ACF1
Training set 7.574277 0.8275929 0.1394913
Holt's method

Call:
holt(y = ts_series, h = h, initial = "optimal")

Smoothing parameters:
alpha = 0.9999
beta  = 0.5724

Initial states:
l = 3464.3162
b = 272.8805

sigma: 809.1417

      AIC      AICc      BIC
298.5581 303.5581 303.0100

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 14.56102 713.5959 567.3114 0.5684708
              MAPE      MASE      ACF1
Training set 7.601656 0.8424311 0.1590588
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04
phi   = 0.9274

Initial states:
l = 3549.1164
b = 623.433

sigma: 793.0625

      AIC      AICc      BIC
298.5016 306.1379 303.8438

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 7.26466 673.9735 542.748 -0.4370569
              MAPE      MASE      ACF1
Training set 7.455315 0.8059556 0.3937736
Holt's method with exponential trend

```

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta = 0.9535
```

Initial states:

```
l = 3637.13
b = 1.1236
```

sigma: 0.1029

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-99.01158	770.6137	653.3365	-1.02869

	MAPE	MASE	ACF1
Training set	9.034987	0.9701742	0.001043169

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1454.3107
```

sigma: 667.2652

	AIC	AICc	BIC
	290.0213	291.7356	292.6925

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	113.6936	629.1037	481.607	3.24257	13.90456

	MASE	ACF1
Training set	0.9452487	0.3408816

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1411.0408
```

sigma: 0.2051

	AIC	AICc	BIC
	289.2068	290.9211	291.8779

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	116.0977	629.2142	484.0111	3.407057

```

                MAPE      MASE      ACF1
Training set 14.06904 0.9499672 0.341942
ETS(A,A,N)

```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.3215
```

Initial states:

```
l = 1099.7156
b = 480.5815
```

sigma: 713.179

```

                AIC      AICc      BIC
294.0134 299.0134 298.4653

```

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set -82.25181 628.9647 503.9363 -2.488083

```

```

                MAPE      MASE      ACF1
Training set 14.1776 0.9890745 0.1222661
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.3023
phi   = 0.8
```

Initial states:

```
l = 1100.389
b = 480.4017
```

sigma: 691.6733

```

                AIC      AICc      BIC
293.5772 301.2135 298.9194

```

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set 14.00253 587.8093 464.3498 0.3134478

```

```

                MAPE      MASE      ACF1
Training set 12.83641 0.911378 0.09409185
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.1111
```

```

Initial states:
  l = 1004.126
  b = 398.4941

sigma: 0.169

      AIC      AICc      BIC
286.8684 291.8684 291.3203

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -163.9525 638.5365 486.9137 -4.741919
              MAPE      MASE      ACF1
Training set 13.36792 0.9556641 0.2566367
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.0098
  phi   = 0.9184

Initial states:
  l = 1001.1519
  b = 480.4602

sigma: 0.1743

      AIC      AICc      BIC
288.2030 295.8394 293.5452

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -94.50641 597.5404 444.4443 -3.396382
              MAPE      MASE      ACF1
Training set 12.21848 0.8723097 0.268694
ETS(M,M,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.251

Initial states:
  l = 1231.8448
  b = 1.1578

sigma: 0.1813

      AIC      AICc      BIC
289.6517 294.6517 294.1036

Training set error measures:
              ME      RMSE      MAE      MPE

```



```
Training set -255.7954 753.6977 581.5495 -5.700293
```

```
          MAPE      MASE      ACF1
```

```
Training set 15.06417 1.141406 0.3211207
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
phi   = 0.8222
```

```
Initial states:
```

```
l = 1118.4881
```

```
b = 1.4182
```

```
sigma: 0.1708
```

```
      AIC      AICc      BIC
```

```
287.5624 295.1988 292.9046
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE
```

```
Training set -109.6759 594.7386 453.8248 -3.626897
```

```
          MAPE      MASE      ACF1
```

```
Training set 12.46941 0.8907206 0.241143
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 0.3218
```

```
Initial states:
```

```
l = 1099.7176
```

```
b = 480.5823
```

```
sigma: 713.179
```

```
      AIC      AICc      BIC
```

```
294.0134 299.0134 298.4653
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE
```

```
Training set -82.18235 628.9647 503.9561 -2.485785
```

```
          MAPE      MASE      ACF1
```

```
Training set 14.17817 0.9891133 0.1221009
```

```
Damped Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 0.3026
```

phi = 0.8

Initial states:

l = 1100.3889

b = 480.4015

sigma: 691.6733

AIC AICc BIC

293.5772 301.2135 298.9194

Training set error measures:

ME RMSE MAE MPE

Training set 13.99922 587.8093 464.3447 0.3136963

MAPE MASE ACF1

Training set 12.83647 0.911368 0.09391849

Holt's method with exponential trend

Call:

holt(y = ts\_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:

alpha = 1

beta = 0.6874

Initial states:

l = 1461.57

b = 1.158

sigma: 0.1907

Training set error measures:

ME RMSE MAE MPE

Training set -152.2226 697.296 560.2457 -3.270922

MAPE MASE ACF1

Training set 15.77857 1.099593 -0.02503165

ETS(A,N,N)

Call:

ets(y = ts\_series, model = "ANN")

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 48.1539

sigma: 1041.712

AIC AICc BIC

306.0569 307.7712 308.7281

Training set error measures:

ME RMSE MAE MPE

Training set 506.8067 982.1353 525.466 22.10863

MAPE MASE ACF1

Training set 24.51281 0.9445031 0.3822671

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.5766
```

Initial states:

```
l = 391.0111
```

```
sigma: 0.6663
```

```
AIC      AICc      BIC
```

```
281.9658 283.6801 284.6369
```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set 664.7608 1243.778 713.6712 -17.90071
```

```

           MAPE      MASE      ACF1
Training set 72.74326 1.282794 0.4169241
```

```
ETS(A,A,N)
```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 0.9999
```

Initial states:

```
l = -115.2389
```

```
b = 121.8932
```

```
sigma: 657.2682
```

```
AIC      AICc      BIC
```

```
291.0743 296.0743 295.5262
```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set 192.1416 579.6561 352.2285 1.777707
```

```

           MAPE      MASE      ACF1
Training set 32.65453 0.6331161 0.2119831
```

```
ETS(A,Ad,N)
```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 0.9999
```

```
phi   = 0.98
```

Initial states:

```
l = -115.9429
```

```
b = 122.489
```

```
sigma: 689.7689
```

```

      AIC      AICc      BIC
293.4779 301.1143 298.8202

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 198.585 586.1909 354.2189 2.536584
              MAPE      MASE      ACF1
Training set 32.71419 0.6366937 0.2192346
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.2474
beta  = 0.2474
```

Initial states:

```
l = -58.7407
b = 103.7112
```

sigma: 0.3429

```

      AIC      AICc      BIC
263.5044 268.5044 267.9563

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 364.8123 914.1963 413.2087 5.181325
              MAPE      MASE      ACF1
Training set 19.37891 0.7427253 0.2708645
ETS(M,Ad,N)

```

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2858
beta  = 0.2858
phi   = 0.9522
```

Initial states:

```
l = -84.9262
b = 132.1613
```

sigma: 0.3805

```

      AIC      AICc      BIC
267.6743 275.3107 273.0166

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 381.9292 937.3001 423.6853 5.461674
              MAPE      MASE      ACF1
Training set 20.2424 0.7615567 0.294497
ETS(M,M,N)

```

Call:

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 7e-04
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 109.252
```

```
b = 1.2644
```

```
sigma: 0.2903
```

```
AIC      AICc      BIC
```

```
262.1612 267.1612 266.6131
```

```
Training set error measures:
```

```
                ME      RMSE      MAE      MPE
Training set 62.97983 471.2692 265.9276 -11.47188
```

```
                MAPE      MASE      ACF1
Training set 27.45649 0.4779937 0.01511665
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.1731
```

```
beta = 0.1731
```

```
phi = 0.8836
```

```
Initial states:
```

```
l = 48.2324
```

```
b = 2.0538
```

```
sigma: 0.371
```

```
AIC      AICc      BIC
```

```
269.4710 277.1073 274.8132
```

```
Training set error measures:
```

```
                ME      RMSE      MAE      MPE
Training set 333.0882 870.0912 424.0322 -3.763587
```

```
                MAPE      MASE      ACF1
Training set 27.82835 0.7621802 0.2621576
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.9999
```

```
Initial states:
```

```
l = -115.2389
```

```
b = 121.8931
```

```
sigma: 657.2682
```

```

      AIC      AICc      BIC
291.0743 296.0743 295.5262

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set 192.1416 579.656 352.2285 1.777712

```

```

           MAPE      MASE      ACF1
Training set 32.65454 0.6331161 0.211983

```

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 0.9999
phi   = 0.98

```

Initial states:

```

l = -115.9429
b = 122.4889

```

sigma: 689.7687

```

      AIC      AICc      BIC
293.4779 301.1143 298.8201

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set 198.5849 586.1907 354.219 2.536583

```

```

           MAPE      MASE      ACF1
Training set 32.71421 0.6366938 0.2192341

```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```

alpha = 1
beta  = 0.906

```

Initial states:

```

l = 48
b = 2.0008

```

sigma: 0.4345

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set 54.21861 544.6503 369.9305 -13.45421

```

```

           MAPE      MASE      ACF1
Training set 38.20021 0.6649347 0.05882754

```

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 80.0374

sigma: 361.552

AIC	AICc	BIC
267.9612	269.6755	270.6323

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	204.2886	340.8745	218.3627	17.61005

  

	MAPE	MASE	ACF1
Training set	19.4959	0.9445496	0.5088561

ETS(M,N,N)

Call:

ets(y = ts\_series, model = "MNN")

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 70.6436

sigma: 0.4139

AIC	AICc	BIC
245.7985	247.5128	248.4696

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	204.8105	340.8819	218.8846	18.26106

  

	MAPE	MASE	ACF1
Training set	20.14691	0.9468073	0.5091302

ETS(A,A,N)

Call:

ets(y = ts\_series, model = "AAN")

Smoothing parameters:

alpha = 0.9999

beta = 0.3765

Initial states:

l = -88.1617

b = 82.7331

sigma: 281.0078

AIC	AICc	BIC
260.4848	265.4848	264.9367

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	56.67936	247.8256	155.0628	1.116186

  

	MAPE	MASE	ACF1
--	------	------	------

```
Training set 27.16583 0.6707398 0.2266663
ETS(A,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 0.9999
phi   = 0.8
```

```
Initial states:
```

```
l = -89.5289
b = 82.0995
```

```
sigma: 287.1344
```

```
      AIC      AICc      BIC
261.9273 269.5637 267.2695
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE
Training set 64.15653 244.0173 158.6352 7.334456
```

```
              MAPE      MASE      ACF1
Training set 27.59707 0.6861926 0.05233656
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 0.5002
```

```
Initial states:
```

```
l = -139.2538
b = -195.1436
```

```
sigma: 0.4668
```

```
      AIC      AICc      BIC
259.8390 264.8390 264.2909
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 75.75261 265.7854 170.6692 33.82409 43.988
```

```
              MASE      ACF1
Training set 0.738247 0.1417443
```

```
ETS(M,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.6733
beta  = 0.0249
phi   = 0.808
```



```

Initial states:
  l = -295.1669
  b = 163.2052

sigma: 0.6116

      AIC      AICc      BIC
267.5464 275.1828 272.8887

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 244.2 418.6599 275.8395 23.14366 39.42706
              MASE      ACF1
Training set 1.193171 0.6605491
ETS(M,M,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04

Initial states:
  l = 81.4755
  b = 1.2385

sigma: 0.2032

      AIC      AICc      BIC
231.6971 236.6971 236.1489

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 19.40114 202.3747 132.4448 -7.5443
              MAPE      MASE      ACF1
Training set 17.11152 0.5729033 0.4550714
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN", damped = TRUE)

Smoothing parameters:
  alpha = 0.1407
  beta  = 1e-04
  phi   = 0.98

Initial states:
  l = 76.6801
  b = 1.2993

sigma: 0.232

      AIC      AICc      BIC
236.7587 244.3951 242.1009

Training set error measures:
              ME      RMSE      MAE      MPE

```

```
Training set 60.55521 255.6242 173.5373 -6.756155
```

```
          MAPE          MASE          ACF1
```

```
Training set 18.83306 0.7506533 0.5838085
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9998
```

```
beta  = 0.3783
```

```
Initial states:
```

```
l = -85.153
```

```
b = 99.3447
```

```
sigma: 280.9426
```

```
          AIC          AICc          BIC
```

```
260.4764 265.4764 264.9283
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE
```

```
Training set 54.03362 247.7681 154.9442 -1.219388
```

```
          MAPE          MASE          ACF1
```

```
Training set 26.61977 0.6702268 0.230588
```

```
Damped Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 0.9999
```

```
phi   = 0.8
```

```
Initial states:
```

```
l = -89.5289
```

```
b = 82.0995
```

```
sigma: 287.1344
```

```
          AIC          AICc          BIC
```

```
261.9273 269.5637 267.2695
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE
```

```
Training set 64.15643 244.0173 158.6353 7.334443
```

```
          MAPE          MASE          ACF1
```

```
Training set 27.59708 0.6861929 0.05233617
```

```
Holt's method with exponential trend
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1
```

```
beta  = 0.1073
```

```

Initial states:
  l = 80.17
  b = 1.3922

sigma: 0.2371
Training set error measures:
           ME      RMSE      MAE      MPE
Training set -76.96213 290.9317 195.7881 -9.1734
           MAPE      MASE      ACF1
Training set 20.04338 0.8469013 0.329871
ETS(A,N,N)

```

```

Call:
ets(y = ts_series, model = "ANN")

```

```

Smoothing parameters:
alpha = 0.9999

```

```

Initial states:
  l = 2290.4782

```

```

sigma: 706.6986

```

```

      AIC      AICc      BIC
292.0884 293.8026 294.7595

```

```

Training set error measures:
           ME      RMSE      MAE      MPE
Training set 411.8349 666.2819 580.3992 1.988723
           MAPE      MASE      ACF1
Training set 23.78395 1.104971 0.2439885
ETS(M,N,N)

```

```

Call:
ets(y = ts_series, model = "MNN")

```

```

Smoothing parameters:
alpha = 0.9999

```

```

Initial states:
  l = 751.2565

```

```

sigma: 0.1846

```

```

      AIC      AICc      BIC
284.4859 286.2002 287.1571

```

```

Training set error measures:
           ME      RMSE      MAE      MPE
Training set 497.3558 562.2268 497.3558 13.04631
           MAPE      MASE      ACF1
Training set 13.04631 0.9468723 0.5585389
ETS(A,A,N)

```

```

Call:
ets(y = ts_series, model = "AAN")

```

## Smoothing parameters:

alpha = 0.9316

beta = 0.9316

## Initial states:

l = 544.7678

b = 34.1576

sigma: 241.7633

AIC	AICc	BIC
255.0696	260.0696	259.5214

## Training set error measures:

	ME	RMSE	MAE	MPE
Training set	46.09095	213.2152	149.8033	2.576923

	MAPE	MASE	ACF1
Training set	4.422301	0.2851975	0.1417386

ETS(A,Ad,N)

## Call:

ets(y = ts\_series, model = "AAN", damped = TRUE)

## Smoothing parameters:

alpha = 0.9999

beta = 0.4964

phi = 0.98

## Initial states:

l = 34.0992

b = 450.5203

sigma: 285.7914

AIC	AICc	BIC
261.7585	269.3949	267.1008

## Training set error measures:

	ME	RMSE	MAE	MPE
Training set	37.07607	242.8759	195.6445	0.657814

	MAPE	MASE	ACF1
Training set	7.865215	0.3724704	0.1350126

ETS(M,A,N)

## Call:

ets(y = ts\_series, model = "MAN")

## Smoothing parameters:

alpha = 0.9999

beta = 0.7575

## Initial states:

l = 274.195

b = 535.5597

sigma: 0.0816

AIC	AICc	BIC
-----	------	-----

262.0903 267.0903 266.5422

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	12.81831	220.1592	155.7645	-1.099816
	MAPE	MASE	ACF1	
Training set	4.913102	0.2965464	0.1654112	

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9726
beta  = 0.8832
phi   = 0.9764
```

Initial states:

```
l = -344.8518
b = 999.6468
```

sigma: 0.1549

AIC	AICc	BIC
286.0338	293.6702	291.3761

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	1.246883	297.403	192.1341	-3.112313
	MAPE	MASE	ACF1	
Training set	8.904528	0.3657874	0.00416786	

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.9987
beta  = 0.6961
```

Initial states:

```
l = 625.3739
b = 1.235
```

sigma: 0.042

AIC	AICc	BIC
238.2671	243.2671	242.7190

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-68.59047	235.4497	151.9316	-1.180001
	MAPE	MASE	ACF1	
Training set	2.879145	0.2892492	0.2255827	

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.9879  
 beta = 0.8866  
 phi = 0.8

## Initial states:

l = 244.7558  
 b = 4.067

sigma: 0.1489

AIC	AICc	BIC
284.8943	292.5307	290.2366

## Training set error measures:

	ME	RMSE	MAE	MPE
Training set	19.52273	312.6701	193.6436	-4.058037

  

	MAPE	MASE	ACF1
Training set	8.670775	0.3686612	0.06360295

Holt's method

## Call:

holt(y = ts\_series, h = h, initial = "optimal")

## Smoothing parameters:

alpha = 0.9316  
 beta = 0.9316

## Initial states:

l = 544.7678  
 b = 34.1576

sigma: 241.7633

AIC	AICc	BIC
255.0696	260.0696	259.5214

## Training set error measures:

	ME	RMSE	MAE	MPE
Training set	46.09095	213.2152	149.8033	2.576923

  

	MAPE	MASE	ACF1
Training set	4.422301	0.2851975	0.1417386

Damped Holt's method

## Call:

holt(y = ts\_series, h = h, damped = TRUE, initial = "optimal")

## Smoothing parameters:

alpha = 0.9999  
 beta = 0.4964  
 phi = 0.98

## Initial states:

l = 34.0992  
 b = 450.5203

sigma: 285.7914

```

      AIC      AICc      BIC
261.7585 269.3949 267.1008

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set 37.07607 242.8759 195.6445 0.657814

```

```

           MAPE      MASE      ACF1
Training set 7.865215 0.3724704 0.1350126

```

Holt's method with exponential trend

Call:

```

holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

```

Smoothing parameters:

```

alpha = 1
beta  = 1

```

Initial states:

```

l = 773.4
b = 1.2149

```

sigma: 0.0761

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set -35.98717 224.7504 169.2628 -0.8616327

```

```

           MAPE      MASE      ACF1
Training set 5.184621 0.3222447 0.1147851

```

ETS(A,N,N)

Call:

```

ets(y = ts_series, model = "ANN")

```

Smoothing parameters:

```

alpha = 0.2152

```

Initial states:

```

l = 4844.4382

```

sigma: 333.2895

```

      AIC      AICc      BIC
265.0310 266.7453 267.7021

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set -52.30412 314.2283 265.0909 -1.50289

```

```

           MAPE      MASE      ACF1
Training set 5.68623 1.002519 0.1333451

```

ETS(M,N,N)

Call:

```

ets(y = ts_series, model = "MNN")

```

Smoothing parameters:

```

alpha = 0.1949

```

Initial states:

l = 4828.6179

sigma: 0.0696

AIC	AICc	BIC
265.1305	266.8448	267.8017

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-51.80073	314.3407	267.0943	-1.498219

  

	MAPE	MASE	ACF1
Training set	5.727159	1.010096	0.1553582

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 1e-04  
beta = 1e-04

Initial states:

l = 5037.3653  
b = -29.1242

sigma: 321.0891

AIC	AICc	BIC
265.2849	270.2849	269.7368

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-11.91126	283.1739	231.1531	-0.5947911

  

	MAPE	MASE	ACF1
Training set	4.893272	0.8741736	0.06715551

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04  
beta = 1e-04  
phi = 0.98

Initial states:

l = 5032.584  
b = -28.2882

sigma: 337.4861

AIC	AICc	BIC
267.7440	275.3803	273.0862

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-47.9955	286.808	235.5249	-1.377124

  

	MAPE	MASE	ACF1
--	------	------	------



Training set 5.032351 0.8907069 0.1034109

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 5038.0269

b = -28.8516

sigma: 0.068

AIC	AICc	BIC
-----	------	-----

265.6109	270.6109	270.0628
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-15.1495	283.2341	231.4224	-0.6641364

	MAPE	MASE	ACF1
Training set	4.902678	0.8751922	0.06826281

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.98

Initial states:

l = 5032.594

b = -27.7749

sigma: 0.071

AIC	AICc	BIC
-----	------	-----

268.0780	275.7144	273.4203
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-52.17802	287.6385	236.4022	-1.466893

	MAPE	MASE	ACF1
Training set	5.055776	0.8940248	0.1062809

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

```
l = 5024.5954
b = 0.9942
```

```
sigma: 0.068
```

```
      AIC      AICc      BIC
265.5180 270.5180 269.9699
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE
Training set -9.098438 282.6893 230.579 -0.5404347
           MAPE      MASE      ACF1
Training set 4.8814 0.8720024 0.07525661
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.969
```

```
Initial states:
```

```
l = 5032.9484
b = 0.9926
```

```
sigma: 0.0706
```

```
      AIC      AICc      BIC
267.5148 275.1512 272.8571
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE
Training set -4.765769 283.2609 231.1273 -0.454849
           MAPE      MASE      ACF1
Training set 4.891145 0.874076 0.0904534
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
```

```
Initial states:
```

```
l = 5037.3664
b = -29.1255
```

```
sigma: 321.089
```

```
      AIC      AICc      BIC
265.2849 270.2849 269.7368
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE
Training set -11.90021 283.1739 231.1523 -0.5945533
```

```

                MAPE      MASE      ACF1
Training set 4.893241 0.8741705 0.06715032
Damped Holt's method

```

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.98

```

Initial states:

```
l = 5032.584
b = -28.2882

```

sigma: 337.486

```

        AIC      AICc      BIC
267.7439 275.3803 273.0862

```

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set -47.99711 286.8079 235.5248 -1.377159

```

```

                MAPE      MASE      ACF1
Training set 5.032351 0.8907066 0.1034119
Holt's method with exponential trend

```

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.6204
beta  = 0.4093

```

Initial states:

```
l = 4591.48
b = 1.0757

```

sigma: 0.0841

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set -66.45639 384.7473 297.6733 -1.616479

```

```

                MAPE      MASE      ACF1
Training set 6.34378 1.125739 0.002419944
ETS(A,N,N)

```

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999

```

Initial states:

```
l = 1569.5583

```

sigma: 313.6239

```

      AIC      AICc      BIC
262.8416 264.5559 265.5127

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 166.1366 295.6875 233.0054 5.498141
              MAPE      MASE      ACF1
Training set 7.365312 0.9444574 -0.0003958836
ETS(M,N,N)

```

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1558.9049
```

```
sigma: 0.1073
```

```

      AIC      AICc      BIC
260.7771 262.4913 263.4482

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 166.7285 295.6981 233.5931 5.535854
              MAPE      MASE      ACF1
Training set 7.402753 0.9468394 -0.0007182232
ETS(A,A,N)

```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 1e-04
```

```
beta = 1e-04
```

Initial states:

```
l = 1334.7319
```

```
b = 185.8202
```

```
sigma: 230.7809
```

```

      AIC      AICc      BIC
253.3959 258.3959 257.8478

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set -4.258445 203.5296 160.1572 -0.460109
              MAPE      MASE      ACF1
Training set 4.982587 0.6491766 0.2850119
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0014
beta  = 0.0014
phi   = 0.98
```

Initial states:

```
l = 1328.8539
b = 216.4153
```

sigma: 265.9446

```
      AIC      AICc      BIC
259.1675 266.8038 264.5097
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -31.68371 226.0094 172.3245 -1.890588
```

```
              MAPE      MASE      ACF1
Training set 5.414091 0.698495 0.4123454
ETS(M,A,N)
```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.0021
beta  = 1e-04
```

Initial states:

```
l = 1333.3194
b = 185.6962
```

sigma: 0.0662

```
      AIC      AICc      BIC
247.2403 252.2403 251.6922
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -1.572739 203.7193 160.2853 -0.3731013
```

```
              MAPE      MASE      ACF1
Training set 4.985499 0.6496956 0.285423
ETS(M,Ad,N)
```

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1329.906
b = 209.9463
```

sigma: 0.0755

```
      AIC      AICc      BIC
```

252.6329 260.2692 257.9751

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	16.25099	229.8295	172.791	-0.4430148

	MAPE	MASE	ACF1
Training set	5.219133	0.7003862	0.4417176

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9467
```

Initial states:

```
l = 1412.6019
b = 1.114
```

sigma: 0.069

AIC	AICc	BIC
249.3545	256.9909	254.6968

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-0.9200181	202.7331	156.264	-0.3406456

	MAPE	MASE	ACF1
Training set	4.770406	0.633396	0.2789328

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9467
```

Initial states:

```
l = 1412.6019
b = 1.114
```

sigma: 0.069

AIC	AICc	BIC
249.3545	256.9909	254.6968

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-0.9200181	202.7331	156.264	-0.3406456

	MAPE	MASE	ACF1
Training set	4.770406	0.633396	0.2789328

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 1334.7338

b = 185.8187

sigma: 230.7809

AIC AICc BIC

253.3959 258.3959 257.8478

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-4.246459	203.5296	160.1561	-0.4597671

	MAPE	MASE	ACF1
Training set	4.982536	0.6491723	0.2850167

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.0014

beta = 0.0014

phi = 0.98

Initial states:

l = 1328.8552

b = 216.4184

sigma: 265.9446

AIC AICc BIC

259.1675 266.8038 264.5097

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-31.7137	226.0094	172.3228	-1.89148

	MAPE	MASE	ACF1
Training set	5.414173	0.6984884	0.4123245

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 1

beta = 0.1051

Initial states:

l = 1569.52

b = 1.103

sigma: 0.0775

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-77.8761	282.2251	224.9099	-2.607874
	MAPE	MASE	ACF1	
Training set	6.915263	0.9116431	0.01075424	

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1975.3133

sigma: 928.1342

AIC	AICc	BIC
301.9009	303.6152	304.5721

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	411.4887	875.0533	499.5472	7.403351
	MAPE	MASE	ACF1	
Training set	8.860682	0.9447849	-0.2636953	

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1876.3589

sigma: 0.2436

AIC	AICc	BIC
305.0324	306.7467	307.7035

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	416.9862	875.3449	504.7036	7.682108
	MAPE	MASE	ACF1	
Training set	9.122132	0.9545371	-0.2674382	

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.0241

beta = 1e-04

Initial states:

l = 1300.323



b = 421.201

sigma: 743.1406

AIC	AICc	BIC
295.4949	300.4949	299.9468

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-142.6421	655.3884	497.6058	-5.534444

  

	MAPE	MASE	ACF1
Training set	11.4223	0.9411131	0.220413

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3981  
beta = 1e-04  
phi = 0.98

Initial states:

l = 1300.972  
b = 490.132

sigma: 842.3721

AIC	AICc	BIC
300.6731	308.3094	306.0153

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	53.65056	715.8786	514.6326	-2.360245

  

	MAPE	MASE	ACF1
Training set	10.82316	0.9733155	0.1457071

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 1e-04  
beta = 1e-04

Initial states:

l = 1382.5272  
b = 378.1747

sigma: 0.1522

AIC	AICc	BIC
292.8699	297.8699	297.3218

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	136.7786	714.2911	532.7296	-0.7550671

  

	MAPE	MASE	ACF1
--	------	------	------

```
Training set 10.52514 1.007542 0.3369132
ETS(M,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.1016
beta  = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 1366.2257
b = 421.9201
```

```
sigma: 0.1805
```

```
      AIC      AICc      BIC
299.1560 306.7923 304.4982
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE
Training set 248.9322 819.4394 623.9646 0.5624579
```

```
              MAPE      MASE      ACF1
Training set 11.74599 1.180093 0.4041639
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9376
```

```
Initial states:
```

```
l = 1502.8788
b = 1.1887
```

```
sigma: 0.1387
```

```
      AIC      AICc      BIC
290.3392 297.9755 295.6814
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE
Training set 18.48476 571.065 392.6249 -0.9451392
```

```
              MAPE      MASE      ACF1
Training set 8.53401 0.7425645 0.09702668
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9376
```

```

Initial states:
  l = 1502.8788
  b = 1.1887

sigma: 0.1387

      AIC      AICc      BIC
290.3392 297.9755 295.6814

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 18.48476 571.065 392.6249 -0.9451392
              MAPE      MASE      ACF1
Training set 8.53401 0.7425645 0.09702668
Holt's method

Call:
holt(y = ts_series, h = h, initial = "optimal")

Smoothing parameters:
  alpha = 0.0241
  beta  = 1e-04

Initial states:
  l = 1300.3227
  b = 421.2012

sigma: 743.1406

      AIC      AICc      BIC
295.4949 300.4949 299.9468

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -142.7159 655.3884 497.5929 -5.53562
              MAPE      MASE      ACF1
Training set 11.42237 0.9410886 0.2204015
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
  alpha = 0.3981
  beta  = 1e-04
  phi   = 0.98

Initial states:
  l = 1300.9721
  b = 490.132

sigma: 842.372

      AIC      AICc      BIC
300.6731 308.3094 306.0153

Training set error measures:

```

	ME	RMSE	MAE	MPE
Training set	53.64908	715.8785	514.6427	-2.360399

  

	MAPE	MASE	ACF1
Training set	10.82342	0.9733347	0.1457334

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.0269

beta = 1

Initial states:

l = 1972.24

b = 1.1056

sigma: 0.1309

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-134.9774	641.9497	455.7553	-4.402095

	MAPE	MASE	ACF1
Training set	9.283973	0.861962	0.1917568

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 3284.012

sigma: 462.9381

	AIC	AICc	BIC
	276.8600	278.5742	279.5311

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	289.9742	436.4623	326.8536	4.997449

	MAPE	MASE	ACF1
Training set	5.46139	0.9445096	0.08825866

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 3257.1859

sigma: 0.0875

	AIC	AICc	BIC

279.7919 281.5062 282.4631

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	291.4647	436.5079	328.3361	5.042836
	MAPE	MASE	ACF1	
Training set	5.506533	0.9487935	0.08913057	

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9865  
beta = 1e-04

Initial states:

l = 3123.1816  
b = 300.9261

sigma: 363.6765

AIC	AICc	BIC
269.7686	274.7686	274.2204

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-1.684567	320.7325	277.2549	0.0578144
	MAPE	MASE	ACF1	
Training set	4.289853	0.801184	0.1027383	

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04  
phi = 0.9657

Initial states:

l = 2969.6941  
b = 411.9106

sigma: 364.6823

AIC	AICc	BIC
270.5340	278.1704	275.8763

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	6.788747	309.9204	271.0265	0.02490397
	MAPE	MASE	ACF1	
Training set	4.194034	0.7831858	0.06684957	

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

## Smoothing parameters:

alpha = 0.9998  
beta = 0.0037

## Initial states:

l = 2913.7986  
b = 360.1705

sigma: 0.0548

AIC	AICc	BIC
266.6551	271.6551	271.1069

## Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-49.771	323.0549	273.7431	-0.6217925

	MAPE	MASE	ACF1
Training set	4.138957	0.791036	0.09438549

ETS(M,Ad,N)

## Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

## Smoothing parameters:

alpha = 0.9999  
beta = 1e-04  
phi = 0.9733

## Initial states:

l = 2896.3622  
b = 425.4895

sigma: 0.0561

AIC	AICc	BIC
268.0643	275.7006	273.4065

## Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-20.73552	310.5085	272.5044	-0.356169

	MAPE	MASE	ACF1
Training set	4.195889	0.7874565	0.06548783

ETS(M,Md,N)

## Call:

ets(y = ts\_series, model = "MMN")

## Smoothing parameters:

alpha = 0.9999  
beta = 1e-04  
phi = 0.9278

## Initial states:

l = 3100.5316  
b = 1.1168

sigma: 0.0587

```

      AIC      AICc      BIC
269.6738 277.3101 275.0160

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set -21.76954 319.8309 278.5798 -0.3585938

```

```

           MAPE      MASE      ACF1
Training set 4.324078 0.8050126 0.07495936

```

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
phi   = 0.9278
```

Initial states:

```
l = 3100.5316
```

```
b = 1.1168
```

```
sigma: 0.0587
```

```

      AIC      AICc      BIC
269.6738 277.3101 275.0160

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set -21.76954 319.8309 278.5798 -0.3585938

```

```

           MAPE      MASE      ACF1
Training set 4.324078 0.8050126 0.07495936

```

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9865
```

```
beta  = 1e-04
```

Initial states:

```
l = 3123.1806
```

```
b = 300.9748
```

```
sigma: 363.6765
```

```

      AIC      AICc      BIC
269.7686 274.7686 274.2204

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set -1.733973 320.7325 277.2547 0.05696009

```

```

           MAPE      MASE      ACF1
Training set 4.289844 0.8011833 0.1027329

```

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9657
```

Initial states:

```
l = 2969.6943
b = 411.9109
```

sigma: 364.6823

```
      AIC      AICc      BIC
270.5340 278.1704 275.8763
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set 6.823958 309.9203 271.0216 0.02543091
```

```
              MAPE      MASE      ACF1
Training set 4.193938 0.7831716 0.06684836
```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta  = 0.2614
```

Initial states:

```
l = 3283.94
b = 1.1063
```

sigma: 0.0596

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -126.3858 392.4476 321.9799 -1.966151
```

```
              MAPE      MASE      ACF1
Training set 5.113473 0.9304258 0.08220795
```

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1642.0222
```

sigma: 653.3462

```
      AIC      AICc      BIC
289.2625 290.9767 291.9336
```

Training set error measures:



```

          ME      RMSE      MAE      MPE
Training set 299.7509 615.9807 417.2158 7.302382
          MAPE      MASE      ACF1
Training set 9.451219 0.9444587 0.1522086
ETS(M,N,N)

```

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1609.4387
```

```
sigma: 0.153
```

```

          AIC      AICc      BIC
283.2903 285.0045 285.9614

```

Training set error measures:

```

          ME      RMSE      MAE      MPE
Training set 301.5613 616.0291 419.0261 7.412625
          MAPE      MASE      ACF1
Training set 9.561461 0.9485569 0.152779
ETS(A,A,N)

```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 1e-04
```

Initial states:

```
l = 1476.0308
```

```
b = 324.2426
```

```
sigma: 606.1432
```

```

          AIC      AICc      BIC
288.1592 293.1592 292.6111

```

Training set error measures:

```

          ME      RMSE      MAE      MPE
Training set -15.27819 534.5681 333.3391 -1.277857
          MAPE      MASE      ACF1
Training set 6.690922 0.7545857 0.1545131
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
phi = 0.98
```

```

Initial states:
  l = 1477.1772
  b = 377.2863

sigma: 631.3953

      AIC      AICc      BIC
290.2946 297.9310 295.6369

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -4.210195 536.5828 336.6964 -1.37601
              MAPE      MASE      ACF1
Training set 6.954379 0.7621856 0.1578593
ETS(M,A,N)

Call:
ets(y = ts_series, model = "MAN")

Smoothing parameters:
  alpha = 0.9997
  beta  = 3e-04

Initial states:
  l = 1457.2556
  b = 310.2821

sigma: 0.1118

      AIC      AICc      BIC
276.6821 281.6821 281.1340

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -0.2739143 534.1554 329.6998 -0.8205403
              MAPE      MASE      ACF1
Training set 6.527125 0.7463474 0.1547857
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
  alpha = 0.9998
  beta  = 2e-04
  phi   = 0.98

Initial states:
  l = 1477.2495
  b = 317.2638

sigma: 0.1198

      AIC      AICc      BIC
279.5252 287.1615 284.8674

Training set error measures:
              ME      RMSE      MAE      MPE

```

```
Training set 45.55514 538.0438 329.2771 0.09232508
```

```
          MAPE          MASE          ACF1
```

```
Training set 6.564747 0.7453904 0.1570421
```

```
ETS(M,M,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
Initial states:
```

```
l = 1591.7101
```

```
b = 1.0916
```

```
sigma: 0.1159
```

```
      AIC      AICc      BIC
```

```
278.0217 283.0217 282.4735
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE
```

```
Training set -66.24184 582.2444 401.6449 -1.009305
```

```
          MAPE          MASE          ACF1
```

```
Training set 8.212783 0.9092107 0.2062477
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
phi   = 0.9637
```

```
Initial states:
```

```
l = 1524.2985
```

```
b = 1.1335
```

```
sigma: 0.1172
```

```
      AIC      AICc      BIC
```

```
279.0884 286.7248 284.4306
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE
```

```
Training set -39.77474 559.509 365.9666 -0.938269
```

```
          MAPE          MASE          ACF1
```

```
Training set 7.401482 0.8284451 0.1657977
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```

Initial states:
  l = 1476.0308
  b = 324.2426

sigma: 606.1432

      AIC      AICc      BIC
288.1592 293.1592 292.6111

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -15.27819 534.568 333.3391 -1.277857
              MAPE      MASE      ACF1
Training set 6.690922 0.7545857 0.154513
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04
  phi   = 0.98

Initial states:
  l = 1477.1772
  b = 377.2863

sigma: 631.3953

      AIC      AICc      BIC
290.2946 297.9310 295.6369

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -4.210264 536.5828 336.6964 -1.376011
              MAPE      MASE      ACF1
Training set 6.95438 0.7621856 0.1578591

```

```
optimization difficulties: ERROR: ABNORMAL_TERMINATION_IN_LNSRCH
```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta = 0.1435
```

Initial states:

```
l = 1642.15
b = 1.1915
```

sigma: 0.1123

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-199.6552	657.4913	448.3342	-5.063819
	MAPE	MASE	ACF1	
Training set	9.282843	1.014902	0.1713208	

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1099.8965
```

sigma: 856.8072

	AIC	AICc	BIC
	299.0223	300.7365	301.6934

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	125.1815	807.8056	500.1168	3.29891
	MAPE	MASE	ACF1	
Training set	16.94264	0.9446966	0.1596956	

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1046.0568
```

sigma: 0.2529

	AIC	AICc	BIC
	287.4772	289.1915	290.1484

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	128.173	807.9149	503.1081	3.570243

	MAPE	MASE	ACF1
Training set	17.21397	0.950347	0.1608239

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.0121

Initial states:

l = 768.4146

b = 352.6481

sigma: 935.8392

	AIC	AICc	BIC
	303.7950	308.7950	308.2469

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-196.079	825.3326	489.5553	-8.97031

	MAPE	MASE	ACF1
Training set	15.96957	0.9247463	0.1602867

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.8765

Initial states:

l = 765.9851

b = 356.9993

sigma: 927.1578

	AIC	AICc	BIC
	304.1255	311.7619	309.4678

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	16.08508	787.9326	452.4083	-1.287358

	MAPE	MASE	ACF1
Training set	14.48534	0.8545774	0.138826

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.997

beta = 0.079

Initial states:

l = 769.6578

b = 316.7824

sigma: 0.215

AIC	AICc	BIC
286.6933	291.6933	291.1452

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-116.6897	830.6572	476.5994	-5.805832

	MAPE	MASE	ACF1
Training set	15.12441	0.9002733	0.1446519

ETS(M,Ad,N)

Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

Smoothing parameters:

alpha = 0.9999

beta = 0.0174

phi = 0.9558

Initial states:

l = 700.0152

b = 356.454

sigma: 0.2245

AIC	AICc	BIC
288.5936	296.2300	293.9358

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-84.70277	801.3678	459.2966	-4.767182

	MAPE	MASE	ACF1
Training set	14.77736	0.8675892	0.1434308

ETS(M,M,N)

Call:

ets(y = ts\_series, model = "MMN")

Smoothing parameters:

alpha = 0.9999

beta = 0.143

Initial states:

l = 806.9765

b = 1.1617

sigma: 0.2284

AIC	AICc	BIC
289.6619	294.6619	294.1138

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-245.2612	974.1723	580.8344	-8.891381
	MAPE	MASE	ACF1	
Training set	19.12849	1.097168	0.1966453	

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 4e-04
phi   = 0.8577
```

Initial states:

```
l = 796.4279
b = 1.3703
```

sigma: 0.2264

AIC	AICc	BIC
288.7764	296.4127	294.1186

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-81.71315	812.8294	472.792	-4.484026
	MAPE	MASE	ACF1	
Training set	15.13041	0.8930814	0.1378913	

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9536
beta  = 1e-04
```

Initial states:

```
l = 656.4132
b = 185.8082
```

sigma: 916.1624

AIC	AICc	BIC
303.0300	308.0300	307.4819

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-38.98996	807.9793	494.3445	-2.259129
	MAPE	MASE	ACF1	
Training set	17.24059	0.933793	0.1889287	

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:



```
alpha = 0.9999
beta  = 1e-04
phi   = 0.8837
```

Initial states:

```
l = 766.4071
b = 356.4766
```

sigma: 927.1096

```
      AIC      AICc      BIC
304.1237 311.7600 309.4659
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set 9.459139 787.8917 451.5502 -1.537324
```

```
              MAPE      MASE      ACF1
Training set 14.43792 0.8529566 0.138894
```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta  = 1
```

Initial states:

```
l = 1102.46
b = 1.2842
```

sigma: 0.3045

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -153.8223 1095.006 656.0125 -4.342205
```

```
              MAPE      MASE      ACF1
Training set 20.91507 1.239176 0.04863441
```

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 691.3622
```

sigma: 284.6669

```
      AIC      AICc      BIC
259.3541 261.0684 262.0252
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set 190.6601 268.3865 232.0551 8.987589
```

```
              MAPE      MASE      ACF1
Training set 10.89866 0.9445874 -0.07267011
```

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 676.2226
```

```
sigma: 0.1649
```

AIC	AICc	BIC
262.9504	264.6647	265.6215

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	191.5012	268.4114	232.8963	9.109193

	MAPE	MASE	ACF1
Training set	11.02027	0.9480114	-0.07508602

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.8816
```

```
beta = 7e-04
```

Initial states:

```
l = 555.0034
```

```
b = 208.5195
```

```
sigma: 207.5873
```

AIC	AICc	BIC
249.5829	254.5829	254.0348

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-8.527899	183.0748	129.545	-1.610904

	MAPE	MASE	ACF1
Training set	6.217101	0.527317	-0.001876533

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9551
```

```
beta = 1e-04
```

```
phi = 0.98
```

Initial states:

```
l = 542.2173
```

```
b = 222.7501
```

```

sigma: 218.0281

      AIC      AICc      BIC
252.0156 259.6519 257.3578

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 15.64697 185.2883 134.9815 -0.718214
              MAPE      MASE      ACF1
Training set 6.383326 0.5494462 -0.02372396
ETS(M,A,N)

Call:
ets(y = ts_series, model = "MAN")

Smoothing parameters:
alpha = 0.7349
beta  = 1e-04

Initial states:
l = 486.1635
b = 192.8212

sigma: 0.0877

      AIC      AICc      BIC
245.2761 250.2761 249.7280

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 20.33929 184.5494 131.6055 0.1026113
              MAPE      MASE      ACF1
Training set 5.830545 0.5357044 0.09869112
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
alpha = 0.837
beta  = 1e-04
phi   = 0.98

Initial states:
l = 542.0551
b = 204.7943

sigma: 0.0973

      AIC      AICc      BIC
249.5728 257.2092 254.9150

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 38.1958 189.1881 141.1147 0.320735
              MAPE      MASE      ACF1
Training set 6.442485 0.5744118 0.07485485
ETS(M,Md,N)

```

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.6957
beta  = 1e-04
phi   = 0.926
```

Initial states:

```
l = 603.4607
b = 1.2383
```

sigma: 0.0952

```
      AIC      AICc      BIC
249.2336 256.8700 254.5758
```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set -9.847908 187.6122 136.0274 -0.8737433
              MAPE      MASE      ACF1
Training set 6.242786 0.5537037 0.08792745
ETS(M,Md,N)
```

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6957
beta  = 1e-04
phi   = 0.926
```

Initial states:

```
l = 603.4607
b = 1.2383
```

sigma: 0.0952

```
      AIC      AICc      BIC
249.2336 256.8700 254.5758
```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set -9.847908 187.6122 136.0274 -0.8737433
              MAPE      MASE      ACF1
Training set 6.242786 0.5537037 0.08792745
Holt's method
```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.882
beta  = 1e-04
```

Initial states:

```
l = 557.3698
```

b = 207.1263

sigma: 207.508

AIC	AICc	BIC
249.5691	254.5691	254.0210

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-7.198341	183.0048	129.6398	-1.550601

  

	MAPE	MASE	ACF1
Training set	6.229261	0.5277026	-0.001871413

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.9551  
beta = 1e-04  
phi = 0.98

Initial states:

l = 542.2174  
b = 222.7501

sigma: 218.0281

AIC	AICc	BIC
252.0156	259.6519	257.3578

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	15.64773	185.2883	134.9817	-0.7182219

  

	MAPE	MASE	ACF1
Training set	6.383328	0.549447	-0.02370035

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.8843  
beta = 0.4634

Initial states:

l = 691.72  
b = 1.2142

sigma: 0.1069

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-80.03336	234.6121	181.1536	-3.448417

  

	MAPE	MASE	ACF1
Training set	8.857864	0.7373914	-0.0685968

ETS(A,N,N)

Call:

```

ets(y = ts_series, model = "ANN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 1509.9089

sigma:  413.7946

      AIC      AICc      BIC
272.8199 274.5342 275.4910

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 332.1248 390.1293 340.0299 8.357991
              MAPE      MASE      ACF1
Training set 8.519938 0.9446356 0.2534905
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 1490.0511

sigma:  0.1213

      AIC      AICc      BIC
274.2538 275.9681 276.9250

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 333.228 390.1553 341.0522 8.431096
              MAPE      MASE      ACF1
Training set 8.587677 0.9474756 0.2552868
ETS(A,A,N)

Call:
ets(y = ts_series, model = "AAN")

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04

Initial states:
  l = 1082.006
  b = 352.8695

sigma:  214.2068

      AIC      AICc      BIC
250.7129 255.7129 255.1648

Training set error measures:

```

	ME	RMSE	MAE	MPE
Training set	3.011335	188.9126	150.1951	-0.2800698
	MAPE	MASE	ACF1	
Training set	3.8349	0.4172564	0.2322614	

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1083.229
b = 400.7219
```

sigma: 234.1145

	AIC	AICc	BIC
	254.5783	262.2146	259.9205

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	23.25015	198.959	163.8379	-0.1847957
	MAPE	MASE	ACF1	
Training set	4.032972	0.4551573	0.2933358	

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9991
beta  = 1e-04
```

Initial states:

```
l = 1176.7327
b = 334.6676
```

sigma: 0.0491

	AIC	AICc	BIC
	246.5248	251.5248	250.9766

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	15.95333	188.8574	147.716	-0.1021675
	MAPE	MASE	ACF1	
Training set	3.507943	0.4103691	0.2493036	

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9977
```

```
beta = 1e-04
phi = 0.98
```

Initial states:

```
l = 1079.646
b = 379.321
```

```
sigma: 0.0552
```

```
      AIC      AICc      BIC
251.2639 258.9002 256.6061
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set 41.26713 201.3955 166.59 0.3687263
```

```
              MAPE      MASE      ACF1
Training set 4.058297 0.462803 0.2900473
```

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 0.4506
```

Initial states:

```
l = 1257.3069
b = 1.1734
```

```
sigma: 0.0564
```

```
      AIC      AICc      BIC
251.9196 256.9196 256.3715
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -52.14078 234.4415 197.8793 -1.31822
```

```
              MAPE      MASE      ACF1
Training set 4.503026 0.5497275 0.1324524
```

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta = 0.2741
phi = 0.9125
```

Initial states:

```
l = 1220.4516
b = 1.2342
```

```
sigma: 0.0548
```

```
      AIC      AICc      BIC
251.0630 258.6994 256.4052
```



Training set error measures:

	ME	RMSE	MAE	MPE
Training set	18.49989	211.5219	166.2314	0.1528439
	MAPE	MASE	ACF1	
Training set	3.864481	0.4618068	0.1849474	

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
```

Initial states:

```
l = 1082.0188
b = 352.8516
```

```
sigma: 214.2067
```

	AIC	AICc	BIC
	250.7129	255.7129	255.1648

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	3.028517	188.9126	150.1964	-0.2795986
	MAPE	MASE	ACF1	
Training set	3.834844	0.4172599	0.2322632	

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1083.229
b = 400.7219
```

```
sigma: 234.1144
```

	AIC	AICc	BIC
	254.5782	262.2146	259.9205

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	23.2501	198.959	163.8379	-0.1847969
	MAPE	MASE	ACF1	
Training set	4.032972	0.4551572	0.2933357	

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

```

Smoothing parameters:
  alpha = 1
  beta  = 0.3491

Initial states:
  l = 1509.18
  b = 1.1642

sigma: 0.0607
Training set error measures:
      ME      RMSE      MAE      MPE
Training set -56.94533 240.7768 207.6499 -1.626673
      MAPE      MASE      ACF1
Training set 5.330145 0.5768712 0.1717683
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 2695.5272

sigma: 563.6954

      AIC      AICc      BIC
283.9491 285.6634 286.6202

Training set error measures:
      ME      RMSE      MAE      MPE
Training set 345.3424 531.4571 429.1162 6.205522
      MAPE      MASE      ACF1
Training set 7.184807 0.9445681 0.4320561
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 2668.0377

sigma: 0.1091

      AIC      AICc      BIC
285.1310 286.8453 287.8021

Training set error measures:
      ME      RMSE      MAE      MPE
Training set 346.8698 531.4978 430.6436 6.262177
      MAPE      MASE      ACF1
Training set 7.241461 0.9479301 0.4314755
ETS(A,A,N)

```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9682
```

```
beta = 1e-04
```

Initial states:

```
l = 2324.9627
```

```
b = 393.4818
```

```
sigma: 454.923
```

```

      AIC      AICc      BIC
277.8276 282.8276 282.2795

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set -26.52479 401.2043 316.2254 -0.5558479
              MAPE      MASE      ACF1
Training set 5.136102 0.6960735 0.4087945
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
phi = 0.9664
```

Initial states:

```
l = 1916.6051
```

```
b = 516.2338
```

```
sigma: 465.4441
```

```

      AIC      AICc      BIC
279.3168 286.9532 284.6590

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 9.449818 395.5515 326.0926 0.02178465
              MAPE      MASE      ACF1
Training set 5.688025 0.7177931 0.3533096
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 1e-04
```

Initial states:

```
l = 1994.1978
```

```
b = 482.2394
```

```

sigma: 0.0741

      AIC      AICc      BIC
275.6903 280.6903 280.1422

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -97.944 414.3803 329.9153 -1.57121
              MAPE      MASE      ACF1
Training set 5.654194 0.7262078 0.3506757
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04
phi   = 0.9774

Initial states:
l = 1988.5532
b = 502.1016

sigma: 0.0764

      AIC      AICc      BIC
277.1033 284.7397 282.4455

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -22.33222 395.0171 323.9601 -0.5039399
              MAPE      MASE      ACF1
Training set 5.570515 0.7130992 0.3608361
ETS(M,M,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
alpha = 0.9999
beta  = 0.9999

Initial states:
l = 2192.759
b = 1.2241

sigma: 0.0721

      AIC      AICc      BIC
274.7694 279.7694 279.2213

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -120.1744 393.6724 300.4676 -1.764475
              MAPE      MASE      ACF1
Training set 5.16304 0.6613876 0.2317725
ETS(M,Md,N)

```

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9998
beta  = 0.9998
phi   = 0.8
```

Initial states:

```
l = 2149.6082
b = 1.321
```

sigma: 0.0714

AIC	AICc	BIC
274.5347	282.1710	279.8769

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-25.07709	353.4614	286.765	-0.1819435

  

	MAPE	MASE	ACF1
Training set	5.015574	0.6312256	0.2565361

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9682
beta  = 1e-04
```

Initial states:

```
l = 2325.2197
b = 393.3772
```

sigma: 454.9229

AIC	AICc	BIC
277.8276	282.8276	282.2795

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-26.4304	401.2043	316.2326	-0.5543354

  

	MAPE	MASE	ACF1
Training set	5.136319	0.6960895	0.4088304

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9664
```

Initial states:

```
l = 1916.6083
```

b = 516.2337

sigma: 465.444

AIC	AICc	BIC
279.3168	286.9532	284.6590

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	9.719603	395.5513	326.0809	0.0259935

	MAPE	MASE	ACF1
Training set	5.687857	0.7177675	0.3533682

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 1  
beta = 1

Initial states:

l = 2695.92  
b = 1.0272

sigma: 0.0511

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-90.51368	372.8622	277.6567	-0.6982964

	MAPE	MASE	ACF1
Training set	4.342902	0.6111763	0.3472438

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 959.4755

sigma: 305.4094

AIC	AICc	BIC
261.8861	263.6004	264.5572

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	217.8726	287.9427	223.9121	8.373269

	MAPE	MASE	ACF1
Training set	9.040528	0.9574381	-0.1367803

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 890.2117

sigma: 0.1388

AIC	AICc	BIC
259.4365	261.1508	262.1076

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	221.7209	287.6792	221.7209	8.79844	8.79844

  

	MASE	ACF1
Training set	0.9480688	-0.1534376

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.7082

beta = 1e-04

Initial states:

l = 569.1506

b = 220.6299

sigma: 196.8568

AIC	AICc	BIC
247.6722	252.6722	252.1240

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	20.37683	173.6114	144.9676	-0.6117857

  

	MAPE	MASE	ACF1
Training set	6.691948	0.6198749	0.02047421

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7027

beta = 0.1539

phi = 0.98

Initial states:

l = 568.6147

b = 250.2558

sigma: 219.1845

AIC	AICc	BIC
252.2060	259.8423	257.5482

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	38.6196	186.271	147.4578	0.06704148

	MAPE	MASE	ACF1
Training set	6.749281	0.630523	0.01804832

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.2074

beta = 0.2074

Initial states:

l = 730.0023

b = 130.77

sigma: 0.0809

	AIC	AICc	BIC
	244.1893	249.1893	248.6411

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	57.44586	170.9954	129.8219	2.078149

	MAPE	MASE	ACF1
Training set	5.284385	0.5551125	0.1683523

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7676

beta = 1e-04

phi = 0.98

Initial states:

l = 599.4428

b = 215.4786

sigma: 0.0959

	AIC	AICc	BIC
	251.2302	258.8666	256.5725

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	70.71183	196.1146	147.6092	1.240341

	MAPE	MASE	ACF1
Training set	6.277348	0.6311703	0.07995034

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.1687



beta = 0.1687

Initial states:

l = 773.2042

b = 1.1409

sigma: 0.0723

AIC	AICc	BIC
241.8004	246.8004	246.2522

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-59.97036	177.9952	127.7612	-2.526283

	MAPE	MASE	ACF1
Training set	5.386749	0.5463011	0.2391145

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.9363

Initial states:

l = 668.9372

b = 1.2091

sigma: 0.0719

AIC	AICc	BIC
241.1270	248.7633	246.4692

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	9.80367	132.2314	101.065	0.6469204

	MAPE	MASE	ACF1
Training set	4.666919	0.4321495	0.1056324

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.7432

beta = 1e-04

Initial states:

l = 645.3935

b = 218.9365

sigma: 195.8639

AIC	AICc	BIC
247.4902	252.4902	251.9420

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	16.70679	172.7357	141.1807	-1.076549
	MAPE	MASE	ACF1	
Training set	6.306821	0.6036823	0.008673592	

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.7027
beta  = 0.154
phi   = 0.98
```

Initial states:

```
l = 568.6147
b = 250.2558
```

```
sigma: 219.1845
```

	AIC	AICc	BIC
	252.2060	259.8423	257.5482

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	38.61695	186.271	147.4573	0.06705391
	MAPE	MASE	ACF1	
Training set	6.749263	0.6305208	0.01801888	

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.5376
beta  = 0.2637
```

Initial states:

```
l = 905.12
b = 1.1517
```

```
sigma: 0.0771
```

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-59.67436	184.0954	138.6276	-2.924348
	MAPE	MASE	ACF1	
Training set	6.310936	0.5927652	0.06913842	

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1234.6728
```

sigma: 418.6433

AIC	AICc	BIC
273.2393	274.9536	275.9104

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	283.0907	394.7007	287.1576	8.489693

	MAPE	MASE	ACF1
Training set	8.638188	0.9446266	-0.1151605

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1216.5115

sigma: 0.1289

AIC	AICc	BIC
265.0715	266.7858	267.7426

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	284.0998	394.7224	288.0975	8.571461

	MAPE	MASE	ACF1
Training set	8.714348	0.9477183	-0.1180725

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.356

beta = 0.34

Initial states:

l = 1029.3469

b = 206.8009

sigma: 264.1278

AIC	AICc	BIC
258.2546	263.2546	262.7065

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	60.72112	232.9388	165.4078	0.9856975

	MAPE	MASE	ACF1
Training set	5.132965	0.5441213	-0.06496222

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.3628
beta  = 0.3628
phi   = 0.98
```

```
Initial states:
```

```
l = 977.4425
b = 291.9245
```

```
sigma: 284.2205
```

```
      AIC      AICc      BIC
261.5601 269.1965 266.9023
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE
Training set 58.03088 241.541 178.3071 0.4270704
```

```
           MAPE      MASE      ACF1
Training set 5.902566 0.5865547 -0.02317162
ETS(M,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.3772
beta  = 0.2724
```

```
Initial states:
```

```
l = 1017.5263
b = 164.7981
```

```
sigma: 0.0736
```

```
      AIC      AICc      BIC
249.0349 254.0349 253.4868
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 82.70212 235.251 162.1327 1.89044 4.880797
```

```
           MASE      ACF1
Training set 0.5333477 -0.05642828
ETS(M,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.389
beta  = 0.2916
phi   = 0.98
```

```
Initial states:
```

```
l = 977.9085
b = 232.1273
```

```

sigma: 0.0808

      AIC      AICc      BIC
253.2419 260.8783 258.5841

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 80.96064 240.6006 169.5186 1.403499
              MAPE      MASE      ACF1
Training set 5.244451 0.5576441 -0.0372175
ETS(M,M,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
alpha = 0.4652
beta  = 1e-04

Initial states:
l = 1070.1016
b = 1.103

sigma: 0.0625

      AIC      AICc      BIC
243.8872 248.8872 248.3391

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -16.03814 195.673 141.029 -0.1197444
              MAPE      MASE      ACF1
Training set 4.525474 0.4639255 -0.1783547
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN", damped = TRUE)

Smoothing parameters:
alpha = 0.3127
beta  = 1e-04
phi   = 0.976

Initial states:
l = 1024.6259
b = 1.131

sigma: 0.0651

      AIC      AICc      BIC
245.9487 253.5850 251.2909

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 7.996627 202.3682 149.7764 0.03290981
              MAPE      MASE      ACF1
Training set 4.646244 0.4927007 0.01507879
Holt's method

```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.3558
```

```
beta = 0.3398
```

Initial states:

```
l = 1029.2267
```

```
b = 206.9266
```

```
sigma: 264.1278
```

```
AIC      AICc      BIC
```

```
258.2546 263.2546 262.7065
```

Training set error measures:

```
ME      RMSE      MAE      MPE
```

```
Training set 60.73578 232.9388 165.4033 0.9848191
```

```
MAPE      MASE      ACF1
```

```
Training set 5.133155 0.5441065 -0.06466693
```

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.3626
```

```
beta = 0.3626
```

```
phi = 0.98
```

Initial states:

```
l = 977.4423
```

```
b = 291.9246
```

```
sigma: 284.2205
```

```
AIC      AICc      BIC
```

```
261.5601 269.1965 266.9023
```

Training set error measures:

```
ME      RMSE      MAE      MPE
```

```
Training set 58.06787 241.5409 178.3064 0.4274936
```

```
MAPE      MASE      ACF1
```

```
Training set 5.902785 0.5865524 -0.02288252
```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.0286
```

```
beta = 0.4272
```

Initial states:

```
l = 1234.05
```

```
b = 1.0977
```

```

sigma: 0.0566
Training set error measures:
              ME      RMSE      MAE      MPE
Training set -34.34416 170.3496 133.1003 -2.215822
              MAPE      MASE      ACF1
Training set 4.82885 0.4378435 -0.05077702
ETS(A,N,N)

```

```

Call:
ets(y = ts_series, model = "ANN")

```

```

Smoothing parameters:
alpha = 0.9999

```

```

Initial states:
l = 1308.1443

```

```

sigma: 496.5848

```

```

      AIC      AICc      BIC
279.3857 281.1000 282.0569

```

```

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 275.8749 468.1846 370.1931 2.777831
              MAPE      MASE      ACF1
Training set 23.31394 1.082395 0.229102
ETS(M,N,N)

```

```

Call:
ets(y = ts_series, model = "MNN")

```

```

Smoothing parameters:
alpha = 0.9999

```

```

Initial states:
l = 441.0892

```

```

sigma: 0.2186

```

```

      AIC      AICc      BIC
268.6438 270.3581 271.3149

```

```

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 324.0494 423.303 324.0494 13.26666
              MAPE      MASE      ACF1
Training set 13.26666 0.9474771 0.376145
ETS(A,A,N)

```

```

Call:
ets(y = ts_series, model = "AAN")

```

```

Smoothing parameters:
alpha = 0.9893
beta  = 0.654

```

```

Initial states:
  l = 218.5807
  b = 294.158

sigma: 256.8711

      AIC      AICc      BIC
257.2517 262.2517 261.7036

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 52.87018 226.539 200.0036 -0.4682472
              MAPE      MASE      ACF1
Training set 10.08817 0.5847836 -0.0386897
ETS(A,Ad,N)

Call:
ets(y = ts_series, model = "AAN", damped = TRUE)

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.6583
  phi   = 0.98

Initial states:
  l = 59.2352
  b = 248.2792

sigma: 276.2458

      AIC      AICc      BIC
260.5356 268.1719 265.8778

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 64.54399 234.7638 214.7151 1.386134
              MAPE      MASE      ACF1
Training set 12.2945 0.6277981 -0.04300943
ETS(M,A,N)

Call:
ets(y = ts_series, model = "MAN")

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.1511

Initial states:
  l = 258.5598
  b = 203.6419

sigma: 0.1163

      AIC      AICc      BIC
252.2103 257.2103 256.6622

Training set error measures:
              ME      RMSE      MAE      MPE

```



Training set 102.7128 252.9532 198.0448 1.239485

MAPE MASE ACF1

Training set 8.617191 0.5790564 0.257542

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.8815

phi = 0.8936

Initial states:

l = 53.0757

b = 445.4499

sigma: 0.1451

AIC AICc BIC

260.9577 268.5941 266.2999

Training set error measures:

ME RMSE MAE MPE

Training set 71.98886 241.8628 215.0814 0.6308851

MAPE MASE ACF1

Training set 10.44008 0.6288691 -0.1285115

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.9697

beta = 0.9697

phi = 0.8

Initial states:

l = 169.265

b = 3.3361

sigma: 0.1728

AIC AICc BIC

267.9585 275.5949 273.3007

Training set error measures:

ME RMSE MAE MPE

Training set 44.09436 261.5033 229.5293 -1.932963

MAPE MASE ACF1

Training set 12.53948 0.671113 -0.1097909

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9697

```
beta = 0.9697
phi = 0.8
```

## Initial states:

```
l = 169.265
b = 3.3361
```

```
sigma: 0.1728
```

```
      AIC      AICc      BIC
267.9585 275.5949 273.3007
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE
Training set 44.09436 261.5033 229.5293 -1.932963
```

```
           MAPE      MASE      ACF1
Training set 12.53948 0.671113 -0.1097909
```

```
Holt's method
```

## Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

## Smoothing parameters:

```
alpha = 0.9894
beta = 0.6541
```

## Initial states:

```
l = 218.4265
b = 294.1195
```

```
sigma: 256.8711
```

```
      AIC      AICc      BIC
257.2517 262.2517 261.7036
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE
Training set 52.86888 226.539 200.0006 -0.4669128
```

```
           MAPE      MASE      ACF1
Training set 10.08673 0.584775 -0.03882017
```

```
Damped Holt's method
```

## Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

## Smoothing parameters:

```
alpha = 0.9999
beta = 0.6584
phi = 0.98
```

## Initial states:

```
l = 59.2352
b = 248.2792
```

```
sigma: 276.2458
```

```
      AIC      AICc      BIC
260.5356 268.1719 265.8778
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	64.54365	234.7638	214.7151	1.38613	12.2945

  

	MASE	ACF1
Training set	0.6277983	-0.04301575

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta = 0.3424
```

Initial states:

```
l = 459.28
b = 1.429
```

sigma: 0.1258

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-37.24393	229.321	183.3638	-5.058675

  

	MAPE	MASE	ACF1
Training set	11.302	0.5361312	0.01066696

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 3489.469
```

sigma: 687.3029

	AIC	AICc	BIC
	291.0865	292.8008	293.7576

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	301.9233	647.9954	420.8899	4.8111	6.333775

  

	MASE	ACF1
Training set	0.9444593	0.2410255

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 3454.2846
```

sigma: 0.1072

```

      AIC      AICc      BIC
284.1070 285.8213 286.7782

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set 303.8781 648.0486 422.8448 4.867121

```

```

              MAPE      MASE      ACF1
Training set 6.389796 0.9488459 0.2411664
ETS(A,A,N)

```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```

alpha = 0.7972
beta  = 0.7292

```

Initial states:

```

l = 3202.5681
b = 343.2167

```

sigma: 682.2913

```

      AIC      AICc      BIC
292.4195 297.4195 296.8713

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set -52.47388 601.7244 348.699 -0.4208404

```

```

              MAPE      MASE      ACF1
Training set 4.918549 0.7824658 -0.022047
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9971
beta  = 1e-04
phi   = 0.9794

```

Initial states:

```

l = 3575.5933
b = 369.1084

```

sigma: 686.1945

```

      AIC      AICc      BIC
293.2909 300.9273 298.6331

```

Training set error measures:

```

              ME      RMSE      MAE      MPE
Training set -7.332773 583.1532 429.9921 -1.316405

```

```

              MAPE      MASE      ACF1
Training set 6.801996 0.9648842 0.2618546
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.8232
```

```
beta = 0.8232
```

Initial states:

```
l = 3576.266
```

```
b = 248.2856
```

```
sigma: 0.0799
```

```
AIC      AICc      BIC
```

```
277.0225 282.0225 281.4744
```

Training set error measures:

```
ME      RMSE      MAE      MPE
```

```
Training set -41.56513 614.202 351.5678 -0.2418625
```

```
MAPE      MASE      ACF1
```

```
Training set 5.384869 0.7889034 -0.1397322
```

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.8248
```

```
beta = 0.8248
```

```
phi = 0.9658
```

Initial states:

```
l = 3576.3887
```

```
b = 264.7533
```

```
sigma: 0.0833
```

```
AIC      AICc      BIC
```

```
279.1078 286.7442 284.4501
```

Training set error measures:

```
ME      RMSE      MAE      MPE
```

```
Training set -28.66237 605.5821 354.6713 -0.07092644
```

```
MAPE      MASE      ACF1
```

```
Training set 5.418582 0.7958674 -0.146209
```

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.8485
```

```
beta = 0.8485
```

Initial states:

```
l = 3276.9997
```

```
b = 1.0626
```

```

sigma: 0.0776

      AIC      AICc      BIC
276.2431 281.2431 280.6950

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -109.0723 710.9187 314.7451 -1.012794
              MAPE      MASE      ACF1
Training set 4.389603 0.7062747 -0.1117976
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN", damped = TRUE)

Smoothing parameters:
alpha = 0.8569
beta  = 0.8569
phi   = 0.8209

Initial states:
l = 3579.3345
b = 0.9917

sigma: 0.0833

      AIC      AICc      BIC
278.8921 286.5285 284.2343

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -6.34015 629.5769 355.7778 0.5722363
              MAPE      MASE      ACF1
Training set 5.20785 0.7983504 -0.1749733
Holt's method

Call:
holt(y = ts_series, h = h, initial = "optimal")

Smoothing parameters:
alpha = 0.7973
beta  = 0.7292

Initial states:
l = 3202.1833
b = 343.2244

sigma: 682.2913

      AIC      AICc      BIC
292.4195 297.4195 296.8713

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -52.4703 601.7244 348.6803 -0.4208025
              MAPE      MASE      ACF1
Training set 4.918274 0.782424 -0.0222398
Damped Holt's method

```

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9783
```

Initial states:

```
l = 3575.5382
b = 369.0702
```

sigma: 686.0504

```
      AIC      AICc      BIC
293.2833 300.9197 298.6256
```

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -4.508745 583.0307 429.0297 -1.265922
              MAPE      MASE      ACF1
Training set 6.777428 0.9627246 0.2600034
Holt's method with exponential trend
```

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta  = 0
```

Initial states:

```
l = 3489.5
b = 1.0705
```

sigma: 0.0792

Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -95.27146 604.8977 439.2738 -1.897276
              MAPE      MASE      ACF1
Training set 6.413422 0.9857119 0.2229726
ETS(A,N,N)
```

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2124.2956
```

sigma: 300.5313

```
      AIC      AICc      BIC
261.3065 263.0207 263.9776
```

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	104.0178	283.3436	208.145	3.007106
	MAPE	MASE	ACF1	
Training set	7.292593	0.9477203	0.2325408	

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 2113.453

sigma: 0.1119

	AIC	AICc	BIC
	260.8894	262.6037	263.5605

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	104.6202	283.3823	208.7475	3.035296
	MAPE	MASE	ACF1	
Training set	7.320784	0.9504635	0.2324113	

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

Initial states:

l = 1991.0825

b = 102.7704

sigma: 298.1206

	AIC	AICc	BIC
	262.6130	267.6130	267.0648

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	8.656414	262.9176	185.2077	-0.4502487
	MAPE	MASE	ACF1	
Training set	6.746473	0.8432827	0.2280137	

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.98



Initial states:

l = 1992.0197

b = 102.2295

sigma: 312.6947

AIC	AICc	BIC
264.9973	272.6336	270.3395

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	26.52388	265.7394	185.8483	0.1620859

	MAPE	MASE	ACF1
Training set	6.700804	0.8461997	0.2378558

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

Initial states:

l = 1990.8103

b = 101.1472

sigma: 0.1055

AIC	AICc	BIC
261.6124	266.6124	266.0642

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	10.29354	262.9785	185.0424	-0.3894993

	MAPE	MASE	ACF1
Training set	6.734925	0.8425303	0.2279972

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.98

Initial states:

l = 1991.8494

b = 102.3188

sigma: 0.1114

AIC	AICc	BIC
264.0576	271.6940	269.3999

Training set error measures:

```

      ME      RMSE      MAE      MPE
Training set 26.45928 265.7352 185.8523 0.1597447
      MAPE      MASE      ACF1
Training set 6.701273 0.8462178 0.2378542
ETS(M,M,N)

```

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

Initial states:

```
l = 2004.8737
```

```
b = 1.0437
```

```
sigma: 0.1056
```

```

      AIC      AICc      BIC
261.8492 266.8492 266.3010

```

Training set error measures:

```

      ME      RMSE      MAE      MPE
Training set -7.084416 264.7919 187.3286 -0.9103528
      MAPE      MASE      ACF1
Training set 6.8307 0.8529394 0.2043338
ETS(M,Md,N)

```

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
phi   = 0.98
```

Initial states:

```
l = 1996.693
```

```
b = 1.0513
```

```
sigma: 0.1106
```

```

      AIC      AICc      BIC
264.1039 271.7402 269.4461

```

Training set error measures:

```

      ME      RMSE      MAE      MPE
Training set -1.299984 266.4892 186.6644 -0.764727
      MAPE      MASE      ACF1
Training set 6.812037 0.8499153 0.2184357
Holt's method

```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
```

beta = 1e-04

Initial states:

l = 1991.0825

b = 102.7704

sigma: 298.1206

AIC AICc BIC

262.6130 267.6130 267.0648

Training set error measures:

ME RMSE MAE MPE

Training set 8.65639 262.9176 185.2077 -0.4502496

MAPE MASE ACF1

Training set 6.746473 0.8432828 0.2280137

Damped Holt's method

Call:

holt(y = ts\_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.98

Initial states:

l = 1992.0196

b = 102.2295

sigma: 312.6946

AIC AICc BIC

264.9973 272.6336 270.3395

Training set error measures:

ME RMSE MAE MPE

Training set 26.52382 265.7394 185.8483 0.1620839

MAPE MASE ACF1

Training set 6.700804 0.8461996 0.2378557

Holt's method with exponential trend

Call:

holt(y = ts\_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:

alpha = 1

beta = 0

Initial states:

l = 2137.06

b = 1.025

sigma: 0.0963

Training set error measures:

ME RMSE MAE MPE

Training set 35.78917 266.7281 184.6267 0.5473972

MAPE MASE ACF1

```
Training set 6.653121 0.8406374 0.2172819
ETS(A,N,N)
```

```
Call:
```

```
ets(y = ts_series, model = "ANN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
Initial states:
```

```
l = 5722.8386
```

```
sigma: 705.831
```

```
      AIC      AICc      BIC
292.0441 293.7584 294.7152
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE
Training set 221.8181 665.4639 473.8059 2.047006
```

```
              MAPE      MASE      ACF1
Training set 8.497165 1.236408 0.1325302
```

```
ETS(M,N,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MNN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
Initial states:
```

```
l = 5722.8386
```

```
sigma: 0.125
```

```
      AIC      AICc      BIC
296.0862 297.8005 298.7573
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 221.8182 665.464 473.806 2.047007 8.497166
```

```
              MASE      ACF1
Training set 1.236408 0.1325306
```

```
ETS(A,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "AAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9768
```

```
beta = 0.5633
```

```
Initial states:
```

```
l = 3436.0144
```

```
b = 192.1514
```

```
sigma: 369.4519
```

AIC	AICc	BIC
270.3358	275.3358	274.7876

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	28.72726	325.8259	234.3135	0.5887903

	MAPE	MASE	ACF1
Training set	3.469018	0.6114465	0.02643774

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3736.7062
b = 374.9381
```

sigma: 391.7201

AIC	AICc	BIC
273.1088	280.7452	278.4510

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	20.99218	332.8981	243.9599	-0.0486445

	MAPE	MASE	ACF1
Training set	3.916192	0.636619	0.3794573

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
```

Initial states:

```
l = 3659.931
b = 376.1066
```

sigma: 0.0607

AIC	AICc	BIC
273.0090	278.0090	277.4608

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-39.65778	325.7647	244.7979	-0.8367382

	MAPE	MASE	ACF1
Training set	3.931289	0.6388059	0.3809817

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 3660.2838
```

```
b = 388.2814
```

```
sigma: 0.0635
```

```
AIC      AICc      BIC
```

```
275.0111 282.6475 280.3533
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE
```

```
Training set 14.16587 327.8532 239.8337 -0.1146146
```

```
MAPE      MASE      ACF1
```

```
Training set 3.816997 0.6258517 0.3847109
```

```
ETS(M,M,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 3988.2243
```

```
b = 1.0528
```

```
sigma: 0.0722
```

```
AIC      AICc      BIC
```

```
279.0456 284.0456 283.4974
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE
```

```
Training set -18.88444 351.4148 266.5529 -0.3868195
```

```
MAPE      MASE      ACF1
```

```
Training set 4.391275 0.695576 0.3558585
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
phi = 0.9554
```

```
Initial states:
```

```
l = 3848.6131
```

```
b = 1.0821
```

```

sigma: 0.0701

      AIC      AICc      BIC
278.6216 286.2580 283.9638

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -0.3741546 345.7989 247.6452 -0.2856117
              MAPE      MASE      ACF1
Training set 4.011678 0.646236 0.3783429
Holt's method

Call:
holt(y = ts_series, h = h, initial = "optimal")

Smoothing parameters:
alpha = 0.9768
beta  = 0.5634

Initial states:
l = 3435.658
b = 192.0033

sigma: 369.4519

      AIC      AICc      BIC
270.3358 275.3358 274.7876

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 28.73351 325.8259 234.3426 0.5891374
              MAPE      MASE      ACF1
Training set 3.469692 0.6115223 0.02630025
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04
phi   = 0.98

Initial states:
l = 3736.7062
b = 374.9381

sigma: 391.72

      AIC      AICc      BIC
273.1088 280.7452 278.4510

Training set error measures:
              ME      RMSE      MAE      MPE
Training set 20.99175 332.898 243.9599 -0.04865047
              MAPE      MASE      ACF1
Training set 3.916192 0.6366189 0.3794573
Holt's method with exponential trend

```

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta = 0
```

Initial states:

```
l = 3709.24
b = 1.0641
```

sigma: 0.0583

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-74.8062	347.6885	269.0652	-1.023204

	MAPE	MASE	ACF1
Training set	4.188223	0.7021319	0.4027175

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1393.4209
```

sigma: 323.6759

	AIC	AICc	BIC
	263.9773	265.6916	266.6485

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	173.2944	305.1646	260.1868	5.966053

	MAPE	MASE	ACF1
Training set	8.230201	0.9445537	0.2691829

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1374.2649
```

sigma: 0.1249

	AIC	AICc	BIC
	270.0492	271.7635	272.7203

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	174.3586	305.199	261.251	6.042417	8.306564



```

                MASE      ACF1
Training set 0.9484173 0.2711713
ETS(A,A,N)

```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.1726
```

Initial states:

```
l = 1106.0881
b = 274.9211
```

sigma: 287.0876

```

        AIC      AICc      BIC
261.2554 266.2554 265.7072

```

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set -53.39345 253.1875 176.5799 -1.211708
                MAPE      MASE      ACF1
Training set 5.113002 0.6410364 0.1725331
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9313
```

Initial states:

```
l = 1157.9638
b = 330.0756
```

sigma: 269.9616

```

        AIC      AICc      BIC
259.7072 267.3435 265.0494

```

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set 6.726659 229.4232 179.8577 0.1775868
                MAPE      MASE      ACF1
Training set 5.381015 0.652936 0.1788953
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.1757
```

```

Initial states:
  l = 1077.2373
  b = 305.7013

sigma: 0.0719

      AIC      AICc      BIC
254.6613 259.6613 259.1132

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -62.2812 253.7083 176.25 -1.576204
              MAPE      MASE      ACF1
Training set 5.134284 0.6398388 0.1580997
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04
  phi   = 0.9522

Initial states:
  l = 1077.577
  b = 330.4837

sigma: 0.0728

      AIC      AICc      BIC
255.3617 262.9980 260.7039

Training set error measures:
              ME      RMSE      MAE      MPE
Training set -23.51229 231.962 174.8753 -0.4801295
              MAPE      MASE      ACF1
Training set 5.063069 0.6348482 0.1870141
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04
  phi   = 0.8622

Initial states:
  l = 1184.5147
  b = 1.2783

sigma: 0.0727

      AIC      AICc      BIC
255.3853 263.0216 260.7275

Training set error measures:

```

```

                ME      RMSE      MAE      MPE
Training set -23.68003 231.4915 166.2346 -0.71539
                MAPE      MASE      ACF1
Training set 5.011069 0.6034802 0.1544672
ETS(M,Md,N)

```

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
phi   = 0.8622
```

Initial states:

```
l = 1184.5147
```

```
b = 1.2783
```

```
sigma: 0.0727
```

```

        AIC      AICc      BIC
255.3853 263.0216 260.7275

```

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set -23.68003 231.4915 166.2346 -0.71539
                MAPE      MASE      ACF1
Training set 5.011069 0.6034802 0.1544672
Holt's method

```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 0.1723
```

Initial states:

```
l = 1106.0251
```

```
b = 274.8527
```

```
sigma: 287.0875
```

```

        AIC      AICc      BIC
261.2554 266.2554 265.7072

```

Training set error measures:

```

                ME      RMSE      MAE      MPE
Training set -53.41929 253.1874 176.5841 -1.211691
                MAPE      MASE      ACF1
Training set 5.113335 0.6410516 0.1726999
Damped Holt's method

```

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 1e-04
phi = 0.9313
```

Initial states:

```
l = 1157.9637
b = 330.0756
```

```
sigma: 269.9615
```

```
      AIC      AICc      BIC
259.7071 267.3435 265.0494
```

Training set error measures:

```
           ME      RMSE      MAE      MPE
Training set 6.810868 229.4232 179.8608 0.1799883
```

```
           MAPE      MASE      ACF1
Training set 5.381068 0.6529472 0.1788725
```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta = 0.5307
```

Initial states:

```
l = 1393.7
b = 1.1616
```

```
sigma: 0.0846
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -72.17633 296.6568 217.656 -2.070738 6.930234 0.7901546 0.0519232
```

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.5853
```

Initial states:

```
l = 1237.2902
```

```
sigma: 535.2019
```

```
      AIC      AICc      BIC
282.0818 283.7961 284.7529
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 102.5053 504.5932 335.6165 1.751262 16.53464 1.000496 0.1004377
```

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.3035

Initial states:

l = 1210.7744

sigma: 0.3571

	AIC	AICc	BIC
	286.8538	288.5681	289.5249

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	220.6426	526.965	379.9099	7.089247	17.88285	1.132538	0.2015552

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.0085

beta = 1e-04

Initial states:

l = 1341.5728

b = 76.312

sigma: 497.847

	AIC	AICc	BIC
	281.0736	286.0736	285.5254

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-59.01278	439.0598	364.3105	-9.395257	20.85887	1.086035	0.2588826

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.9564

Initial states:

l = 1318.676

b = 107.2829

sigma: 521.5727

	AIC	AICc	BIC
	283.4156	291.0520	288.7579

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-89.73717	443.2516	364.8828	-11.44265	21.61172	1.087741	0.2840591

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.0133
```

```
beta = 0.0133
```

Initial states:

```
l = 1316.8028
```

```
b = 98.7152
```

```
sigma: 0.2431
```

AIC	AICc	BIC
281.3526	286.3526	285.8044

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-105.0387	452.472	369.7862	-11.87175	21.70875	1.102359	0.2601386

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
phi = 0.9482
```

Initial states:

```
l = 1314.9035
```

```
b = 109.7989
```

```
sigma: 0.2519
```

AIC	AICc	BIC
282.7705	290.4068	288.1127

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-65.5514	444.1181	368.3086	-10.35683	21.56649	1.097954	0.3045187

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 1e-04
```

```
beta = 1e-04
```

Initial states:

```
l = 1317.928
```

```
b = 1.0437
```

```
sigma: 0.2416
```

AIC	AICc	BIC
-----	------	-----

279.6036 284.6036 284.0555

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-28.3961	440.8718	357.1921	-7.090646	19.62555	1.064815	0.2431479

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 3e-04
beta  = 1e-04
phi   = 0.979
```

Initial states:

```
l = 1317.6008
b = 1.0511
```

```
sigma: 0.2481
```

AIC	AICc	BIC
281.4211	289.0575	286.7634

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-33.86073	434.998	357.1447	-7.690819	19.94129	1.064673	0.2458291

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.0085
beta  = 1e-04
```

Initial states:

```
l = 1341.5759
b = 76.3102
```

```
sigma: 497.847
```

AIC	AICc	BIC
281.0736	286.0736	285.5254

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-58.99854	439.0597	364.3126	-9.394588	20.85883	1.086041	0.2588897

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9564
```

```

Initial states:
  l = 1318.6832
  b = 107.2891

sigma: 521.5726

      AIC      AICc      BIC
283.4156 291.0520 288.7579

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -89.56721 443.2515 364.9109 -11.4351 21.61164 1.087825 0.2842014
Holt's method with exponential trend

Call:
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:
  alpha = 0.0554
  beta  = 1

Initial states:
  l = 1164.97
  b = 1.0969

sigma: 0.2155
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -163.1641 490.5002 366.5623 -13.72008 21.32528 1.092748 0.2368858
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
  alpha = 0.5207

Initial states:
  l = 1916.5805

sigma: 856.172

      AIC      AICc      BIC
298.9956 300.7098 301.6667

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 221.634 807.2067 617.6508 3.59232 18.27113 0.7847113 -0.2341773
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
  alpha = 0.4992

Initial states:
  l = 2009.242

```



sigma: 0.3007

AIC	AICc	BIC
302.0429	303.7572	304.7140

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	221.3331	807.7694	622.9311	3.297935	18.65741	0.7914198	-0.20639

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9195
```

Initial states:

```
l = 1257.0364
b = 360.2373
```

sigma: 810.7241

AIC	AICc	BIC
299.2945	306.9309	304.6367

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	129.2368	688.983	512.0863	0.9143082	15.09536	0.6505939	0.02190443

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9195
```

Initial states:

```
l = 1257.0364
b = 360.2373
```

sigma: 810.7241

AIC	AICc	BIC
299.2945	306.9309	304.6367

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	129.2368	688.983	512.0863	0.9143082	15.09536	0.6505939	0.02190443

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

## Smoothing parameters:

alpha = 0.2458

beta = 0.101

## Initial states:

l = 1257.9904

b = 353.0626

sigma: 0.2352

AIC AICc BIC

299.5079 304.5079 303.9598

## Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set -238.5007 807.6535 620.9178 -9.609108 19.02932 0.7888619

ACF1

Training set -0.02076798

ETS(M,Ad,N)

## Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

## Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.9239

## Initial states:

l = 1257.2111

b = 360.0409

sigma: 0.2452

AIC AICc BIC

298.6669 306.3032 304.0091

## Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set 76.37995 692.202 521.6629 -0.4839885 15.43819 0.6627608

ACF1

Training set 0.04556287

ETS(M,Md,N)

## Call:

ets(y = ts\_series, model = "MMN")

## Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.8

## Initial states:

l = 1333.737

b = 1.3429

sigma: 0.213

```

      AIC      AICc      BIC
294.7388 302.3752 300.0811

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 5.412865 615.1203 436.1282 -3.434434 13.4323 0.5540909 -0.1433576
ETS(M,Md,N)

```

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 1e-04
beta  = 1e-04
phi   = 0.8

```

Initial states:

```

l = 1333.737
b = 1.3429

```

```
sigma: 0.213
```

```

      AIC      AICc      BIC
294.7388 302.3752 300.0811

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 5.412865 615.1203 436.1282 -3.434434 13.4323 0.5540909 -0.1433576
Holt's method

```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```

alpha = 0.3948
beta  = 0.0964

```

Initial states:

```

l = 1264.729
b = 320.7526

```

```
sigma: 901.7216
```

```

      AIC      AICc      BIC
302.4580 307.4580 306.9099

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -185.553 795.2437 599.844 -7.995668 18.51331 0.7620881 -0.1774699
Damped Holt's method

```

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```

alpha = 1e-04
beta  = 1e-04
phi   = 0.9195

```

Initial states:

l = 1257.0364

b = 360.2373

sigma: 810.7241

AIC	AICc	BIC
299.2945	306.9309	304.6367

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	129.3178	688.983	512.072	0.9164552	15.09485	0.6505757	0.02187141

optimization difficulties: ERROR: ABNORMAL\_TERMINATION\_IN\_LNSRCH

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.4016
```

```
beta = 1
```

Initial states:

```
l = 1870
```

```
b = 0.699
```

```
sigma: 0.4081
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-83.38554	963.6433	791.0996	-2.191996	23.41777	1.005074

ACF1

Training set -0.06910816

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.8671
```

Initial states:

```
l = 1442.7324
```

```
sigma: 320.1226
```

	AIC	AICc	BIC
	263.5799	265.2942	266.2511

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	126.709	301.8145	242.9767	4.651197	10.24851	0.9516863	-0.2449225

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9024
```

Initial states:

```
l = 1412.1359
```

```
sigma: 0.1391
```

	AIC	AICc	BIC
	260.6567	262.3710	263.3278

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	124.3711	302.1631	242.4256	4.612908	10.24364	0.9495278	-0.2812951

```
ETS(A,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "AAN")
```

```
Smoothing parameters:
```

```
alpha = 0.6945
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 1428.5798
```

```
b = 123.219
```

```
sigma: 303.8987
```

```
      AIC      AICc      BIC
263.3040 268.3040 267.7559
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -19.55342 268.0135 203.5895 -2.098399 8.884994 0.7974152
```

```
      ACF1
```

```
Training set -0.06512134
```

```
ETS(A,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.6965
```

```
beta = 1e-04
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 1387.5005
```

```
b = 121.8305
```

```
sigma: 316.9704
```

```
      AIC      AICc      BIC
265.4862 273.1226 270.8284
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 14.21883 269.373 204.0508 -0.6196299 8.657135 0.799222
```

```
      ACF1
```

```
Training set -0.05559632
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.726
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 1363.7188
```

b = 121.8555

sigma: 0.1184

	AIC	AICc	BIC
	258.7450	263.7450	263.1969

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-11.29984	266.7335	196.1362	-1.592275	8.430237	0.7682222

ACF1

Training set -0.1018784

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7201  
beta = 1e-04  
phi = 0.98

Initial states:

l = 1365.2349  
b = 121.6612

sigma: 0.1256

	AIC	AICc	BIC
	261.1481	268.7845	266.4903

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	16.26362	269.1378	200.2946	-0.47126	8.458274	0.7845097

ACF1

Training set -0.08309799

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.7397  
beta = 1e-04

Initial states:

l = 1442.4984  
b = 1.0535

sigma: 0.1214

	AIC	AICc	BIC
	259.5643	264.5643	264.0161

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-9.513022	270.5348	196.5351	-1.354306	8.576447	0.7697847

ACF1

Training set -0.1237902

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7365

beta = 1e-04

phi = 0.98

Initial states:

l = 1399.6303

b = 1.0655

sigma: 0.1257

AIC	AICc	BIC
261.4119	269.0483	266.7541

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-5.297574	271.7427	196.5545	-1.219735	8.46914	0.7698606	-0.106803

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.6842

beta = 9e-04

Initial states:

l = 1392.4324

b = 108.2809

sigma: 302.5814

AIC	AICc	BIC
263.1476	268.1476	267.5995

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	4.291799	266.8517	202.3157	-0.9588742	8.632118	0.7924261

ACF1

Training set -0.05428455

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.6964

beta = 1e-04

phi = 0.98

Initial states:

l = 1387.5006



b = 121.8301

sigma: 316.9703

AIC	AICc	BIC
265.4862	273.1225	270.8284

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	14.21816	269.373	204.0633	-0.6197565	8.657632	0.7992709

ACF1

Training set -0.05544112

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.7623

beta = 0.0466

Initial states:

l = 1424.7

b = 1.0855

sigma: 0.1095

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-66.29476	288.1382	198.4041	-3.936494	8.830147	0.7771053

ACF1

Training set -0.1216557

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 3903.0786

sigma: 756.6793

AIC	AICc	BIC
294.5484	296.2627	297.2195

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	275.9043	713.4041	556.6739	3.923706	8.952179	0.9444566

ACF1

Training set -0.07638167

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 3845.5591

sigma: 0.1306

AIC	AICc	BIC
291.9216	293.6358	294.5927

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	279.1001	713.5325	559.8603	4.005587	9.03382	0.9498628	-0.07886316

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9331

beta = 1e-04

Initial states:

l = 4085.6178

b = 194.5976

sigma: 755.1208

AIC	AICc	BIC
296.0706	301.0706	300.5225

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	71.50951	665.954	545.6822	0.09133237	9.160373	0.9258081

ACF1

Training set -0.007459151

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9465

beta = 1e-04

phi = 0.98

Initial states:

l = 4088.44

b = 227.294

sigma: 790.5869

AIC	AICc	BIC
298.3890	306.0254	303.7312

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	77.43892	671.8697	550.2959	0.1408992	9.23236	0.9336358

ACF1

Training set -0.01111414

ETS(M,A,N)

Call:

ets(y = ts\_series, model = "MAN")

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

Initial states:

l = 4088.9499

b = 198.2914

sigma: 0.1241

AIC AICc BIC

293.1262 298.1262 297.5781

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	67.29339	667.005	544.994	0.06356397	9.12051	0.9246406	-0.06814321

ETS(M,Ad,N)

Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.98

Initial states:

l = 4088.4286

b = 229.671

sigma: 0.13

AIC AICc BIC

295.4396 303.0760 300.7818

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	75.00791	672.6501	549.6236	0.1385934	9.195991	0.9324951

ACF1

Training set -0.05988612

ETS(M,M,N)

Call:

ets(y = ts\_series, model = "MMN")

Smoothing parameters:

alpha = 0.9999

beta = 9e-04

Initial states:

l = 4096.8578

b = 1.0498

sigma: 0.1222

AIC	AICc	BIC
292.9937	297.9937	297.4456

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-8.943306	666.1974	540.1876	-1.145052	9.138919	0.9164859

ACF1

Training set -0.08721751

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04  
phi = 0.98

Initial states:

l = 4095.6563  
b = 1.0574

sigma: 0.1282

AIC	AICc	BIC
295.3093	302.9457	300.6516

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	8.425435	671.6601	546.3569	-0.9253049	9.227156	0.9269529

ACF1

Training set -0.07403942

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.933  
beta = 1e-04

Initial states:

l = 4085.614  
b = 194.5991

sigma: 755.1208

AIC	AICc	BIC
296.0706	301.0706	300.5225

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	71.50928	665.9539	545.6831	0.09118358	9.160477	0.9258097

ACF1

Training set -0.007295376  
Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9463
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 4088.44
b = 227.2941
```

sigma: 790.5868

AIC	AICc	BIC
298.3890	306.0254	303.7312

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	77.44066	671.8696	550.2977	0.1407676	9.232485	0.9336389

ACF1

Training set -0.01093826

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.9603
beta  = 0.0976
```

Initial states:

```
l = 3903
b = 0.9823
```

sigma: 0.1208

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	189.4577	700.2382	565.9433	2.681721	9.273758	0.9601833	-0.0686838

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1566.9016
```

sigma: 250.7344

AIC	AICc	BIC
254.7848	256.4991	257.4559

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	4.079047	236.3946	174.337	-1.153752	11.63063	0.944615	0.2728235

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1512.4733

sigma: 0.2034

AIC	AICc	BIC
263.6795	265.3938	266.3506

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	7.103138	236.7358	177.3048	-0.9606884	11.82009	0.9606953

ACF1

Training set 0.2594016

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 6e-04

Initial states:

l = 1698.9864

b = 5.0672

sigma: 270.5978

AIC	AICc	BIC
259.1258	264.1258	263.5777

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-8.257996	238.6448	182.3294	-1.943717	12.14448	0.9879201

ACF1

Training set 0.2986284

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.9375

Initial states:

l = 1686.7191  
b = 15.663

sigma: 280.7629

AIC	AICc	BIC
261.1195	268.7558	266.4617

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-11.53838	238.6026	181.9084	-2.172607	12.12654	0.985639	0.2979913

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04

Initial states:

l = 1537.1087  
b = 83.652

sigma: 0.1994

AIC	AICc	BIC
266.5032	271.5032	270.9550

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-77.85377	248.9267	196.5183	-6.457845	13.29998	1.0648	0.265669

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04  
phi = 0.98

Initial states:

l = 1686.8953  
b = 25.6218

sigma: 0.22

AIC	AICc	BIC
269.4857	277.1221	274.8279

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-23.83301	239.3961	183.8383	-2.965975	12.26058	0.9960959

ACF1

Training set 0.2974847

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.7614
```

```
beta = 1e-04
```

Initial states:

```
l = 1688.3747
```

```
b = 1.0074
```

```
sigma: 0.2233
```

	AIC	AICc	BIC
	269.2791	274.2791	273.7309

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-14.99854	260.5495	201.8536	-3.013021	13.58066	1.093709	0.4395497

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
phi = 0.8138
```

Initial states:

```
l = 1688.6334
```

```
b = 0.9816
```

```
sigma: 0.2267
```

	AIC	AICc	BIC
	269.9198	277.5562	275.2621

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	4.082061	237.0685	179.4156	-1.132841	11.94031	0.9721323	0.2937786

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 6e-04
```

Initial states:

```
l = 1698.9831
```

```
b = 5.0708
```

```
sigma: 270.5978
```

	AIC	AICc	BIC
	259.1258	264.1258	263.5777



Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-8.261447	238.6448	182.3296	-1.943941	12.14449	0.9879211

ACF1

Training set 0.2986279

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.937
```

Initial states:

```
l = 1686.7178
b = 15.6625
```

sigma: 280.7629

AIC	AICc	BIC
261.1195	268.7558	266.4617

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-11.50442	238.6026	181.9053	-2.170441	12.12633	0.9856223

ACF1

Training set 0.2979984

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta  = 0.1236
```

Initial states:

```
l = 1566.4
b = 0.8577
```

sigma: 0.2314

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	61.03472	260.9355	203.1789	3.271281	13.24496	1.100889	0.2835113

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 1281.0744
```

sigma: 1342.844

AIC	AICc	BIC
315.1982	316.9125	317.8693

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	138.8452	1266.046	848.4212	2.800534	16.45497	0.9446289	0.1376053

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1143.9015

sigma: 0.392

AIC	AICc	BIC
318.6570	320.3713	321.3281

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	146.4668	1266.473	856.0429	3.39438	17.04882	0.9531149	0.1377267

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.1875

Initial states:

l = -738.9036

b = 882.9968

sigma: 1534.16

AIC	AICc	BIC
321.5896	326.5896	326.0415

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-337.9068	1353.002	1073.026	-9.129255	29.02084	1.194703

ACF1

Training set -0.05934892

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

```
phi = 0.8698
```

```
Initial states:
```

```
l = -737.928
```

```
b = 882.0709
```

```
sigma: 1482.98
```

```
    AIC    AICc    BIC
```

```
321.0342 328.6706 326.3764
```

```
Training set error measures:
```

```
          ME    RMSE    MAE    MPE    MAPE    MASE    ACF1
```

```
Training set -49.77143 1260.291 922.044 -1.583215 23.78618 1.0266 0.05734223
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.177
```

```
Initial states:
```

```
l = -218.9369
```

```
b = 1350.3176
```

```
sigma: 0.3305
```

```
    AIC    AICc    BIC
```

```
320.8693 325.8693 325.3211
```

```
Training set error measures:
```

```
          ME    RMSE    MAE    MPE    MAPE    MASE
```

```
Training set -492.4509 1357.682 1071.78 -17.38331 27.91724 1.193315
```

```
          ACF1
```

```
Training set -0.05506759
```

```
ETS(M,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.9999
```

```
phi = 0.98
```

```
Initial states:
```

```
l = -738.3958
```

```
b = 882.3901
```

```
sigma: 2.5884
```

```
    AIC    AICc    BIC
```

```
386.5545 394.1909 391.8968
```

```
Training set error measures:
```

```
          ME    RMSE    MAE    MPE    MAPE    MASE
```

```
Training set -61.55039 1707.946 1435.585 -1.906107 35.21556 1.598375
```

```
ACF1
```

```
Training set -0.3916829
```

```
ETS(M,M,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 0.9995
```

```
beta = 0.9995
```

```
Initial states:
```

```
l = 61.3038
```

```
b = 8.1073
```

```
sigma: 0.6383
```

```
AIC AICc BIC
```

```
344.5712 349.5712 349.0230
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set -1803.117 6376.533 2987.022 -100.2613 127.2399 3.325739
```

```
ACF1
```

```
Training set -0.1512011
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9253
```

```
beta = 0.9253
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 6.9611
```

```
b = 15.4678
```

```
sigma: 3.443
```

```
AIC AICc BIC
```

```
416.9865 424.6228 422.3287
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE ACF1
```

```
Training set -21262.13 61015.93 22740.89 -1413.713 1452.378 25.31962 0.4568882
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.1875
```

```
Initial states:
```

l = -738.9035

b = 882.9987

sigma: 1534.16

AIC	AICc	BIC
321.5896	326.5896	326.0415

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-337.9496	1353.002	1073.025	-9.130219	29.0209	1.194702

ACF1

Training set -0.05932673

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.8697

Initial states:

l = -737.9281

b = 882.071

sigma: 1482.98

AIC	AICc	BIC
321.0342	328.6706	326.3764

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-49.66061	1260.291	921.9937	-1.580119	23.78434	1.026544

ACF1

Training set 0.05735248

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 1

beta = 0

Initial states:

l = 1283.4

b = 1.1393

sigma: 0.3117

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-506.1478	1506.749	1094.607	-10.75277	21.1213	1.218732	0.2200576

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.901

Initial states:

l = 1493.4748

sigma: 590.4443

	AIC	AICc	BIC
	285.6181	287.3324	288.2892

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	179.3794	556.6762	452.391	4.608614	15.13864	0.9533585	-0.1269218

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.7124

Initial states:

l = 2142.2966

sigma: 0.2281

	AIC	AICc	BIC
	290.6468	292.3610	293.3179

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	176.1422	581.5159	479.7957	2.686821	17.17554	1.01111	0.01705719

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 4e-04

beta = 1e-04

Initial states:

l = 1995.3008

b = 140.9839

sigma: 569.2159

	AIC	AICc	BIC
	285.8964	290.8964	290.3482

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-52.85556	502.0012	408.1012	-5.686327	15.20106	0.8600231

ACF1

Training set	0.3804843
--------------	-----------

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6625
beta  = 1e-04
phi   = 0.9783
```

Initial states:

```
l = 1970.6067
b = 182.0339
```

sigma: 632.4818

AIC	AICc	BIC
290.3565	297.9929	295.6988

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-15.46556	537.5062	444.718	-3.55851	16.10983	0.9371885	0.0575684

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.8202
beta  = 0.0248
```

Initial states:

```
l = 1375.7821
b = 397.1652
```

sigma: 0.1786

AIC	AICc	BIC
287.7826	292.7826	292.2345

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-223.2574	570.2256	438.7436	-8.971513	15.15671	0.9245981

ACF1

Training set	-0.05413866
--------------	-------------

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5653
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1970.6705
b = 188.6618
```

sigma: 0.2039

AIC	AICc	BIC
291.4493	299.0857	296.7916

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-28.76129	538.7343	436.8972	-4.21514	15.82888	0.9207072	0.1356191

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.0011  
beta = 1e-04

Initial states:

l = 2018.0986  
b = 1.0486

sigma: 0.1991

AIC	AICc	BIC
289.5809	294.5809	294.0328

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	17.08884	501.2591	412.7034	-2.96101	14.74693	0.8697218	0.3528073

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.5521  
beta = 1e-04  
phi = 0.9294

Initial states:

l = 1989.4356  
b = 1.1071

sigma: 0.2084

AIC	AICc	BIC
292.3546	299.9910	297.6968

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-39.1269	556.4847	446.9164	-4.696331	16.2932	0.9418214	0.1662195

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 4e-04



```
beta = 1e-04
```

```
Initial states:
```

```
l = 1995.283
```

```
b = 140.9934
```

```
sigma: 569.2158
```

```
AIC      AICc      BIC
```

```
285.8964 290.8964 290.3482
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -52.92815 502.0012 408.1049 -5.68831 15.20135 0.860031 0.3804769
Damped Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.662
```

```
beta = 1e-04
```

```
phi = 0.9783
```

```
Initial states:
```

```
l = 1970.6065
```

```
b = 182.0344
```

```
sigma: 632.4818
```

```
AIC      AICc      BIC
```

```
290.3565 297.9929 295.6988
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -15.48881 537.5061 444.6925 -3.560245 16.10876 0.9371347
           ACF1
Training set 0.05796259
Holt's method with exponential trend
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.7459
```

```
beta = 0.6013
```

```
Initial states:
```

```
l = 1439.5
```

```
b = 1.3398
```

```
sigma: 0.2158
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -177.4659 645.4368 478.9263 -7.297927 16.38144 1.009278
           ACF1
Training set -0.1035957
ETS(A,N,N)
```

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2344.8577
```

```
sigma: 610.9554
```

	AIC	AICc	BIC
	286.8475	288.5617	289.5186

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	221.0169	576.0143	437.1965	4.750594	8.261432	0.944557	0.3231747

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2299.0893
```

```
sigma: 0.1516
```

	AIC	AICc	BIC
	297.0598	298.7741	299.7310

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	223.5598	576.118	439.7395	4.859013	8.369851	0.9500509	0.3304347

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 0.1677
```

Initial states:

```
l = 2872.9903
```

```
b = 454.8888
```

```
sigma: 650.4038
```

	AIC	AICc	BIC
	290.6964	295.6964	295.1483

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-149.3335	573.6023	498.4177	-3.08952	10.09614	1.076824	0.03342236

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.9058

Initial states:

l = 2874.539

b = 453.6941

sigma: 623.5066

	AIC	AICc	BIC
	289.8420	297.4784	295.1843

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-10.0123	529.8787	426.6153	-0.8756844	8.915393	0.9216964

ACF1

Training set 0.1000449

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.2783

Initial states:

l = 1525.651

b = 854.2761

sigma: 0.0888

	AIC	AICc	BIC
	282.4400	287.4400	286.8919

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-188.2214	512.1953	420.0893	-3.17942	6.963738	0.907597

ACF1

Training set -0.02944306

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9694

beta = 1e-04

phi = 0.9422

Initial states:

l = 2613.1346

b = 454.2512

sigma: 0.1242

AIC	AICc	BIC
294.4856	302.1220	299.8279

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-66.68891	516.931	421.1512	-1.449049	8.383064	0.9098913	0.1843854

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.534

Initial states:

l = 1806.806

b = 1.2872

sigma: 0.1052

AIC	AICc	BIC
288.5931	293.5931	293.0450

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-200.9727	604.0271	481.9752	-3.392772	8.140678	1.041301

ACF1

Training set -0.004512889

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8261

beta = 1e-04

phi = 0.8362

Initial states:

l = 2938.2665

b = 1.2413

sigma: 0.1348

AIC	AICc	BIC
297.8841	305.5204	303.2263

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-104.754	553.4266	421.1325	-3.005215	8.946501	0.9098509	0.159826

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.8473
```

```
beta = 0.3146
```

Initial states:

```
l = 1984.7522
```

```
b = 931.4205
```

```
sigma: 609.7837
```

```
      AIC      AICc      BIC
288.3748 293.3748 292.8266
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -195.2492 537.7786 444.006 -4.050358 8.128214 0.9592688
```

```
      ACF1
```

```
Training set 0.03570098
```

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
phi = 0.9058
```

Initial states:

```
l = 2874.539
```

```
b = 453.6941
```

```
sigma: 623.5065
```

```
      AIC      AICc      BIC
289.8420 297.4784 295.1843
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -10.01481 529.8787 426.6153 -0.8757271 8.915392 0.9216965
```

```
      ACF1
```

```
Training set 0.1000453
```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
```

```
beta = 0.5496
```

Initial states:

```
l = 2345.4
```

```
b = 1.3846
```

```

sigma: 0.1181
Training set error measures:
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -209.7246 636.6638 537.4224 -4.534914 10.46526 1.161094
      ACF1
Training set -0.1048036
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
alpha = 0.8091

Initial states:
l = 3322.0997

sigma: 615.4711

      AIC      AICc      BIC
287.1126 288.8268 289.7837

Training set error measures:
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 156.0837 580.2717 488.1038 2.542655 10.97463 0.9292322
      ACF1
Training set -0.03552418
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
alpha = 0.6659

Initial states:
l = 3258.6747

sigma: 0.1513

      AIC      AICc      BIC
286.7840 288.4983 289.4551

Training set error measures:
      ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 199.0274 584.0376 480.9804 3.444321 10.73322 0.915671 0.03039545
ETS(A,A,N)

Call:
ets(y = ts_series, model = "AAN")

Smoothing parameters:
alpha = 0.381
beta = 6e-04

Initial states:
l = 3280.4979
b = 156.6315

```

sigma: 608.4778

AIC	AICc	BIC
288.2976	293.2976	292.7495

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-40.82471	536.627	438.1773	-2.713133	10.38279	0.8341841	0.1847081

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4705  
beta = 1e-04  
phi = 0.98

Initial states:

l = 3360.1674  
b = 149.3052

sigma: 644.1774

AIC	AICc	BIC
291.0162	298.6525	296.3584

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	18.96095	547.4455	457.1901	-1.305359	10.68084	0.87038	0.1610033

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.3348  
beta = 0.0017

Initial states:

l = 3206.0561  
b = 108.5762

sigma: 0.14

AIC	AICc	BIC
286.7342	291.7342	291.1861

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	90.829	543.5145	426.9026	0.4059407	9.667017	0.8127198	0.2188436

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4187
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3361.6689
b = 127.538
```

sigma: 0.1482

```
      AIC      AICc      BIC
289.7163 297.3527 295.0585
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 60.36276 551.0698 452.3023 -0.3938475 10.45038 0.8610747
```

ACF1

Training set 0.1976314

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.2412
beta  = 1e-04
```

Initial states:

```
l = 3362.3582
b = 1.0327
```

sigma: 0.1344

```
      AIC      AICc      BIC
286.1756 291.1756 290.6275
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -12.07224 529.9827 434.5235 -2.143958 10.19905 0.8272283
```

ACF1

Training set 0.2549403

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3547
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3362.5559
b = 1.0402
```

sigma: 0.1434

```
      AIC      AICc      BIC
```



289.0987 296.7351 294.4409

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-4.334594	541.4889	446.232	-1.923667	10.47434	0.8495184	0.2080387

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.3797

beta = 1e-04

Initial states:

l = 3277.0662

b = 157.5626

sigma: 608.1235

	AIC	AICc	BIC
	288.2766	293.2766	292.7285

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-43.99941	536.3145	437.8197	-2.785242	10.38207	0.8335033	

Training set 0.1843911

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.4708

beta = 1e-04

phi = 0.98

Initial states:

l = 3360.1657

b = 149.3062

sigma: 644.1773

	AIC	AICc	BIC
	291.0162	298.6525	296.3584

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	18.94651	547.4454	457.2541	-1.305122	10.68212	0.8705018	0.1607634

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.0807

beta = 1

```

Initial states:
  l = 3329.5
  b = 0.9812

sigma: 0.1386
Training set error measures:
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 216.2167 554.8339 421.4862 4.224015 9.343492 0.8024084 0.1621055
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 1744.3829

sigma: 1537.569

      AIC      AICc      BIC
320.0731 321.7874 322.7442

Training set error measures:
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -4.060086 1449.634 767.2783 -18.41635 40.99704 0.9447529
           ACF1
Training set 0.2416606
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 1599.6235

sigma: 0.3384

      AIC      AICc      BIC
290.2056 291.9199 292.8767

Training set error measures:
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 3.982907 1450.056 775.321 -17.95625 41.4571 0.954656 0.2452238
ETS(A,A,N)

Call:
ets(y = ts_series, model = "AAN")

Smoothing parameters:
  alpha = 2e-04
  beta  = 2e-04

```

```

Initial states:
  l = 4899.798
  b = -234.2726

sigma: 1963.58

      AIC      AICc      BIC
330.4739 335.4739 334.9258

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -169.3409 1731.715 1444.509 -44.84303 78.18988 1.77863 0.5541764
ETS(A,Ad,N)

Call:
ets(y = ts_series, model = "AAN", damped = TRUE)

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04
  phi   = 0.9494

Initial states:
  l = 4843.7535
  b = -232.5321

sigma: 1895.739

      AIC      AICc      BIC
329.8742 337.5106 335.2164

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -28.94628 1611.069 967.7159 -20.02974 51.22974 1.191553 0.1329582
ETS(M,A,N)

Call:
ets(y = ts_series, model = "MAN")

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.1283

Initial states:
  l = 4507.3949
  b = 1168.178

sigma: 0.3428

      AIC      AICc      BIC
297.0184 302.0184 301.4703

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -494.7102 1798.931 919.3289 -39.20616 54.76805 1.131973 0.1292616
ETS(M,Ad,N)

Call:

```

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9019
```

```
Initial states:
```

```
l = 4843.9206
b = 11.4293
```

```
sigma: 0.4126
```

```
      AIC      AICc      BIC
301.9011 309.5375 307.2433
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-181.0818	1623.705	938.3363	-28.51629	50.84051	1.155377	0.1301754

ETS(M,M,N)

```
Call:
```

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
```

```
Initial states:
```

```
l = 5351.6656
b = 1.0356
```

```
sigma: 0.3874
```

```
      AIC      AICc      BIC
300.3503 305.3503 304.8021
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-300.8104	1728.929	976.7546	-34.50542	53.91065	1.202682	0.1102845

ETS(M,Md,N)

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.801
```

```
Initial states:
```

```
l = 5349.2111
b = 1.3752
```

```
sigma: 0.3723
```

```
      AIC      AICc      BIC
300.8348 308.4712 306.1770
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-485.7865	1916.028	996.2466	-41.44136	57.64695	1.226682

ACF1

Training set 0.07863623

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 2e-04
beta = 2e-04
```

Initial states:

```
l = 4899.8276
b = -234.2975
```

sigma: 1963.58

AIC	AICc	BIC
330.4739	335.4739	334.9258

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-169.1362	1731.715	1444.508	-44.82958	78.18638	1.778628	0.5541698

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
phi = 0.9496
```

Initial states:

```
l = 4843.7533
b = -232.5311
```

sigma: 1895.739

AIC	AICc	BIC
329.8742	337.5106	335.2164

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-28.77385	1611.068	967.8042	-20.01871	51.23524	1.191661	0.1329509

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta = 1
```

```

Initial states:
  l = 1748.1
  b = 1.5543

sigma: 0.9436
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -464.2461 1452.799 870.2769 -23.77254 47.95068 1.071575 0.1062089
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
  alpha = 0.4775

Initial states:
  l = 2988.9565

sigma: 1275.987

      AIC      AICc      BIC
313.3597 315.0740 316.0308

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 404.5059 1203.012 756.0868 6.363252 12.8595 0.9644717 -0.147267
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
  alpha = 0.8209

Initial states:
  l = 2722.1318

sigma: 0.2364

      AIC      AICc      BIC
305.9935 307.7077 308.6646

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 230.8665 1273.32 764.3308 3.473934 12.75136 0.9749878 -0.3107685
ETS(A,A,N)

Call:
ets(y = ts_series, model = "AAN")

Smoothing parameters:
  alpha = 0.0252
  beta  = 0.0252

Initial states:
  l = 2367.199
  b = 304.0151

```

```

sigma: 1075.94

      AIC      AICc      BIC
308.8172 313.8172 313.2691

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -167.6605 948.8901 663.6651 -5.387365 12.07908 0.8465777
              ACF1
Training set -0.1198867
ETS(A,Ad,N)

Call:
ets(y = ts_series, model = "AAN", damped = TRUE)

Smoothing parameters:
alpha = 1e-04
beta  = 1e-04
phi   = 0.9787

Initial states:
l = 2259.3767
b = 317.3772

sigma: 1066.782

      AIC      AICc      BIC
309.1756 316.8119 314.5178

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -7.409858 906.5907 594.4966 -2.003806 10.49503 0.7583457
              ACF1
Training set -0.1230726
ETS(M,A,N)

Call:
ets(y = ts_series, model = "MAN")

Smoothing parameters:
alpha = 1e-04
beta  = 1e-04

Initial states:
l = 2337.3076
b = 270.7105

sigma: 0.1662

      AIC      AICc      BIC
297.2631 302.2631 301.7149

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -34.60822 911.5136 626.6136 -2.275848 11.0034 0.7993144
              ACF1
Training set -0.1326341

```

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 2225.9015
b = 303.8089
```

sigma: 0.1824

	AIC	AICc	BIC
	300.2843	307.9206	305.6265

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	116.0678	915.2153	567.054	0.530067	9.820477	0.7233396	-0.1148327

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 2415.8852
b = 1.0699
```

sigma: 0.181

	AIC	AICc	BIC
	299.5217	304.5217	303.9736

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-6.211465	1021.315	753.2272	-0.3884622	13.21917	0.960824

ACF1

Training set	-0.01090006
--------------	-------------

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9391
```

Initial states:

```
l = 2326.4668
b = 1.1139
```



sigma: 0.1722

	AIC	AICc	BIC
	299.0649	306.7012	304.4071

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-24.13328	910.1428	624.3422	-1.875847	10.90455	0.796417

ACF1

Training set -0.1314989

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.0253

beta = 0.0253

Initial states:

l = 2367.1964

b = 304.0156

sigma: 1075.94

	AIC	AICc	BIC
	308.8172	313.8172	313.2691

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-167.4181	948.89	663.6036	-5.38315	12.07763	0.8464992	-0.1198558

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.9795

Initial states:

l = 2259.3027

b = 315.9211

sigma: 1066.747

	AIC	AICc	BIC
	309.1744	316.8107	314.5166

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-9.348459	906.5605	596.1779	-2.020741	10.52148	0.7604903

ACF1

Training set -0.1241757

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.2693
```

```
beta = 0.1363
```

Initial states:

```
l = 2867.76
```

```
b = 0.9944
```

```
sigma: 0.2211
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	266.4409	1166.853	839.1482	4.746013	14.87105	1.070426	-0.03813966

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9667
```

Initial states:

```
l = 5428.7432
```

```
sigma: 1634.906
```

	AIC	AICc	BIC
	322.2829	323.9972	324.9540

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-288.5538	1541.405	1254.845	-35.44173	51.86111	1.084179

ACF1

Training set -0.009275342

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 5428.5392
```

```
sigma: 0.3943
```

	AIC	AICc	BIC
	325.1771	326.8914	327.8482

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-281.6064	1542.258	1254.809	-34.38618	51.14598	1.084148

ACF1

Training set -0.04236236

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.7731
beta  = 0.2217
```

Initial states:

```
l = 2307.846
b = 605.0733
```

sigma: 1562.137

AIC	AICc	BIC
322.2402	327.2402	326.6920

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-368.6201	1377.675	1086.455	-24.18563	37.00069	0.9386916

ACF1

Training set -0.03416276

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7945
beta  = 0.1799
phi   = 0.8385
```

Initial states:

```
l = 2307.7407
b = 605.7366
```

sigma: 1580.46

AIC	AICc	BIC
323.3261	330.9624	328.6683

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-256.4906	1343.133	1089.382	-28.02414	42.18256	0.9412203

ACF1

Training set -0.008688004

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.2209
beta  = 0.1516
```

Initial states:

```
l = 1437.0881
b = 943.7614
```

sigma: 0.2947

	AIC	AICc	BIC
	315.5972	320.5972	320.0491

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-783.534	1650.917	1388.135	-17.9052	28.94512	1.199341	0.4498106

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2139  
beta = 0.1647  
phi = 0.98

Initial states:

l = 2098.4385  
b = 605.7542

sigma: 0.3317

	AIC	AICc	BIC
	319.2408	326.8772	324.5831

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-594.0382	1721.992	1425.963	-14.37277	28.47304	1.232024	0.548811

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.4332  
beta = 0.4332

Initial states:

l = 2209.6919  
b = 1.0285

sigma: 0.3683

	AIC	AICc	BIC
	324.0739	329.0739	328.5257

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-603.9647	1983.942	1269.238	-31.13579	45.22971	1.096615	0.3680778

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4301
beta  = 0.4301
phi   = 0.879
```

Initial states:

```
l = 2209.2473
b = 1.0402
```

sigma: 0.377

```
      AIC      AICc      BIC
325.5390 333.1753 330.8812
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -488.5192 1716.228 1216.109 -31.67404 46.08104 1.050711 0.2818969
Holt's method
```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.7733
beta  = 0.2218
```

Initial states:

```
l = 2307.8472
b = 605.0694
```

sigma: 1562.137

```
      AIC      AICc      BIC
322.2402 327.2402 326.6920
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -368.4692 1377.675 1086.448 -24.17954 36.9981 0.9386855
              ACF1
Training set -0.03440231
Damped Holt's method
```

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.7942
beta  = 0.1802
phi   = 0.8387
```

Initial states:

```
l = 2307.7401
b = 605.7368
```

sigma: 1580.46

```
      AIC      AICc      BIC
323.3261 330.9624 328.6683
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-256.5177	1343.133	1089.354	-28.01342	42.17239	0.9411962

ACF1

Training set -0.008702924

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.8792

beta = 0.3113

Initial states:

l = 2518.05

b = 1.2567

sigma: 0.3374

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-700.7203	1669.014	1214.409	-35.41002	45.41002	1.049243

ACF1

Training set -0.05752293

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.3664

Initial states:

l = 1620.1369

sigma: 1534.827

	AIC	AICc	BIC
	320.0088	321.7231	322.6799

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	439.5019	1447.049	1024.273	-19.60188	56.4383	1.067268	-0.3193324

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.4511

Initial states:

l = 1245.3742

sigma: 0.3683

	AIC	AICc	BIC
	304.2201	305.9343	306.8912

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	404.8222	1460.957	967.7783	-19.56246	55.95652	1.008402	-0.3881199

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 988.9523
b = 251.2478
```

sigma: 1349.983

AIC	AICc	BIC
316.9855	321.9855	321.4374

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	65.78614	1190.573	634.7476	-28.50258	42.98316	0.661392	-0.177902

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9762
```

Initial states:

```
l = 778.3133
b = 315.5997
```

sigma: 1377.5

AIC	AICc	BIC
318.3780	326.0144	323.7202

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	95.39003	1170.65	627.9146	-26.24261	41.77036	0.6542722	-0.2246656

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.1315
beta  = 0.0018
```

Initial states:

```
l = 771.088
```

b = 277.6596

sigma: 0.2507

AIC	AICc	BIC
297.6094	302.6094	302.0612

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-85.92439	1273.641	527.6186	-34.37611	45.37267	0.5497661

ACF1

Training set -0.1798938

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.1248  
beta = 0.0225  
phi = 0.98

Initial states:

l = 749.2034  
b = 314.4922

sigma: 0.2616

AIC	AICc	BIC
299.9696	307.6060	305.3119

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-82.57573	1270.901	541.2308	-34.63269	45.49718	0.5639497

ACF1

Training set -0.1998453

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 1e-04  
beta = 1e-04  
phi = 0.8964

Initial states:

l = 823.8653  
b = 1.3012

sigma: 0.2584

AIC	AICc	BIC
299.2623	306.8986	304.6045

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-85.1399	1199.31	483.7341	-31.92096	42.3475	0.5040395	-0.1638209



ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8964
```

Initial states:

```
l = 823.8653
b = 1.3012
```

sigma: 0.2584

	AIC	AICc	BIC
	299.2623	306.8986	304.6045

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-85.1399	1199.31	483.7341	-31.92096	42.3475	0.5040395	-0.1638209
Holt's method							

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 988.9653
b = 251.2438
```

sigma: 1349.983

	AIC	AICc	BIC
	316.9855	321.9855	321.4374

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	65.81107	1190.573	634.767	-28.50173	42.98326	0.6614122	-0.1779052
Damped Holt's method							

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9762
```

Initial states:

```
l = 778.3132
b = 315.5998
```

sigma: 1377.5

```

      AIC      AICc      BIC
318.3780 326.0144 323.7202

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 95.42424 1170.65 627.9365 -26.24135 41.77028 0.654295 -0.2246724
Holt's method with exponential trend

```

Call:

```

holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

```

Smoothing parameters:

```

alpha = 0.2282
beta  = 1

```

Initial states:

```

l = 1194.15
b = 1.1913

```

sigma: 0.2431

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -343.0581 1413.329 674.9235 -44.00758 51.18032 0.7032543
              ACF1

```

Training set -0.3950555

ETS(A,N,N)

Call:

```

ets(y = ts_series, model = "ANN")

```

Smoothing parameters:

```

alpha = 1e-04

```

Initial states:

```

l = 7272.104

```

sigma: 2189.898

```

      AIC      AICc      BIC
332.8046 334.5189 335.4757

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -0.7830428 2064.656 1320.158 -193.8513 208.4394 0.8590044
              ACF1

```

Training set 0.1857932

ETS(M,N,N)

Call:

```

ets(y = ts_series, model = "MNN")

```

Smoothing parameters:

```

alpha = 0.2168

```

Initial states:

```

l = 6219.1049

```

sigma: 0.2997

AIC	AICc	BIC
331.4510	333.1652	334.1221

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	189.4359	2206.932	1338.728	-214.6417	232.733	0.8710873	0.1167598

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.0058  
beta = 0.0058

Initial states:

l = 6245.4503  
b = 73.913

sigma: 2454.012

AIC	AICc	BIC
338.5003	343.5003	342.9522

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	173.8047	2164.235	1202.091	-207.1171	222.5709	0.7821797	0.2489719

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04  
beta = 1e-04  
phi = 0.8254

Initial states:

l = 6137.6867  
b = 303.2483

sigma: 2405.627

AIC	AICc	BIC
338.4495	346.0858	343.7917

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	64.20717	2044.39	1164.144	-198.9446	212.6139	0.7574885	0.1749078

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.1977

beta = 0.0075

Initial states:

l = 5775.7764

b = 109.5996

sigma: 0.3018

AIC	AICc	BIC
334.9600	339.9600	339.4118

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-167.2489	2269.35	1274.934	-237.0571	250.1594	0.8295776	0.1724242

ETS(M,Ad,N)

Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

Smoothing parameters:

alpha = 0.1102

beta = 1e-04

phi = 0.8914

Initial states:

l = 5579.3651

b = 303.5806

sigma: 0.3128

AIC	AICc	BIC
336.6254	344.2618	341.9677

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-80.27572	2163.241	1180.01	-223.6416	236.3652	0.7678124	0.1744774

ETS(M,M,N)

Call:

ets(y = ts\_series, model = "MMN")

Smoothing parameters:

alpha = 0.1941

beta = 1e-04

Initial states:

l = 5842.7016

b = 1.0147

sigma: 0.304

AIC	AICc	BIC
334.8620	339.8620	339.3139

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-87.88968	2248.109	1275.809	-232.479	246.526	0.8301472	0.1690188

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.219
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 5689.0666
b = 1.022
```

sigma: 0.3128

AIC	AICc	BIC
336.9162	344.5526	342.2585

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-169.5425	2259.094	1283.084	-235.9521	249.2269	0.8348808

ACF1

Training set 0.1504606

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.0058
beta  = 0.0058
```

Initial states:

```
l = 6245.4468
b = 73.9204
```

sigma: 2454.012

AIC	AICc	BIC
338.5003	343.5003	342.9522

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	173.7489	2164.235	1202.085	-207.1202	222.5733	0.7821761	0.2489748

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8253
```

Initial states:

```
l = 6137.6868
b = 303.2484
```

```

sigma: 2405.627

      AIC      AICc      BIC
338.4495 346.0858 343.7917

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 64.42829 2044.39 1164.266 -198.9322 212.6057 0.7575678 0.1749019
Holt's method with exponential trend

Call:
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:
alpha = 0.4769
beta  = 0.1146

Initial states:
l = 6509.2
b = 1.0595

sigma: 0.3224
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -541.9276 2402.55 1479.606 -235.2176 246.5492 0.9627543
              ACF1
Training set -0.06240723
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
alpha = 0.9999

Initial states:
l = 1623.2999

sigma: 683.7749

      AIC      AICc      BIC
290.9012 292.6155 293.5724

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 355.6845 644.6692 537.5066 7.812375 11.56881 0.9444902 -0.0383165
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
alpha = 0.9999

Initial states:
l = 1582.3554

sigma: 0.1738

```

```

      AIC      AICc      BIC
293.4113 295.1256 296.0824

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 357.9595 644.7414 539.776 7.952518 11.70861 0.9484779 -0.03746807
ETS(A,A,N)

```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```

alpha = 0.9625
beta  = 1e-04

```

Initial states:

```

l = 1490.209
b = 411.8333

```

```
sigma: 607.2658
```

```

      AIC      AICc      BIC
288.2258 293.2258 292.6777

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -50.13772 535.5581 398.3584 -1.926498 8.33991 0.6999832
              ACF1
Training set -0.001428749
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.949
beta  = 1e-04
phi   = 0.973

```

Initial states:

```

l = 1490.5411
b = 484.5998

```

```
sigma: 626.6178
```

```

      AIC      AICc      BIC
290.0212 297.6576 295.3634

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -14.58499 532.5228 392.5339 -1.747972 8.325575 0.6897486
              ACF1
Training set 0.004801019
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

## Smoothing parameters:

alpha = 0.7263  
beta = 1e-04

## Initial states:

l = 1446.357  
b = 414.7223

sigma: 0.1114

	AIC	AICc	BIC
	282.8323	287.8323	287.2842

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-57.18479	545.12	407.233	-2.154429	8.059201	0.7155775	0.1961877

ETS(M,Ad,N)

## Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

## Smoothing parameters:

alpha = 0.7443  
beta = 1e-04  
phi = 0.98

## Initial states:

l = 1490.5239  
b = 417.2383

sigma: 0.1206

	AIC	AICc	BIC
	285.8215	293.4579	291.1637

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	28.58348	541.0712	406.4226	-0.7304527	8.161955	0.7141533

ACF1

Training set 0.1798981

ETS(M,M,N)

## Call:

ets(y = ts\_series, model = "MMN")

## Smoothing parameters:

alpha = 0.8513  
beta = 1e-04

## Initial states:

l = 1661.736  
b = 1.0981

sigma: 0.1327

	AIC	AICc	BIC
	288.8038	293.8038	293.2557



Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-133.0021	649.8653	492.7716	-1.502435	10.12086	0.8658833

ACF1

Training set 0.2671497

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.5941  
beta = 1e-04  
phi = 0.925

Initial states:

l = 1592.4837  
b = 1.2036

sigma: 0.1221

AIC	AICc	BIC
286.5494	294.1857	291.8916

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-40.32692	572.3064	431.0025	-1.584708	8.59492	0.7573445	0.2861214

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.9623  
beta = 1e-04

Initial states:

l = 1490.2092  
b = 411.8337

sigma: 607.2658

AIC	AICc	BIC
288.2258	293.2258	292.6777

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-50.14304	535.5581	398.3602	-1.926686	8.339739	0.6999864

ACF1

Training set -0.001305184

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.9491

```
beta = 1e-04
phi = 0.9729
```

```
Initial states:
```

```
l = 1490.5406
b = 484.5994
```

```
sigma: 626.6178
```

```
      AIC      AICc      BIC
290.0212 297.6576 295.3634
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -14.52816 532.5227 392.524 -1.746763 8.325577 0.6897312
```

```
      ACF1
```

```
Training set 0.00468993
```

```
Holt's method with exponential trend
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9007
beta = 0.4364
```

```
Initial states:
```

```
l = 1623.25
b = 1.3187
```

```
sigma: 0.1316
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -224.4153 674.3777 525.2944 -5.434158 11.44859 0.9230313
```

```
      ACF1
```

```
Training set -0.09732008
```

```
ETS(A,N,N)
```

```
Call:
```

```
ets(y = ts_series, model = "ANN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
Initial states:
```

```
l = 2032.3376
```

```
sigma: 4405.855
```

```
      AIC      AICc      BIC
357.9714 359.6857 360.6425
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 302.4171 4153.88 2558.741 1.191397 24.44982 0.9445151 0.5439957
```

```
ETS(M,N,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MNN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
Initial states:
```

```
l = 1709.6473
```

```
sigma: 0.5242
```

```
AIC      AICc      BIC
```

```
337.3217 339.0359 339.9928
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	320.3462	4154.575	2576.633	2.073729	25.3303	0.9511195	0.5436955

ETS(A,A,N)

```
Call:
```

```
ets(y = ts_series, model = "AAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 1288.9688
```

```
b = 395.9726
```

```
sigma: 4698.712
```

```
AIC      AICc      BIC
```

```
361.8846 366.8846 366.3365
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-52.57247	4143.875	2621.646	-7.294389	28.68325	0.9677351	

Training set 0.5427841

ETS(A,Ad,N)

```
Call:
```

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.1017
```

```
phi = 0.8
```

```
Initial states:
```

```
l = 1289.6217
```

```
b = 394.8837
```

```
sigma: 4869.736
```

```
AIC      AICc      BIC
```

```
363.8377 371.4741 369.1799
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	64.09546	4138.48	2576.642	-1.385299	26.68785	0.9511227	0.5259902

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 0.3567
```

Initial states:

```
l = 1288.916
b = 265.9758
```

sigma: 0.5131

AIC	AICc	BIC
340.6391	345.6391	345.0910

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-478.2964	4312.398	2680.521	-4.843898	27.6638	0.9894679	0.461016

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta = 0.4512
phi = 0.8
```

Initial states:

```
l = 1290.3664
b = 265.4187
```

sigma: 0.5499

AIC	AICc	BIC
342.4426	350.0790	347.7848

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-148.2242	3950.222	2479.989	-0.7701941	25.58032	0.915445

ACF1

Training set	0.4202769
--------------	-----------

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
```

Initial states:

```
l = 1325.7904
b = 1.1821
```

```
sigma: 0.4547
```

```
      AIC      AICc      BIC
339.3182 344.3182 343.7701
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -1019.212 4873.56 3139.156 -14.52342 34.06435 1.158765 0.5763031
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9998
beta  = 1e-04
phi   = 0.9794
```

```
Initial states:
```

```
l = 1328.3534
b = 1.1669
```

```
sigma: 0.4953
```

```
      AIC      AICc      BIC
341.6241 349.2604 346.9663
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -583.6373 4515.969 2903.307 -9.888701 31.15674 1.071705 0.557242
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
```

```
Initial states:
```

```
l = 1288.9688
b = 395.9727
```

```
sigma: 4698.712
```

```
      AIC      AICc      BIC
361.8846 366.8846 366.3365
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -52.5718 4143.874 2621.645 -7.294387 28.68325 0.967735 0.5427841
Damped Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.9999  
beta = 0.1017  
phi = 0.8

Initial states:

l = 1289.6217  
b = 394.8837

sigma: 4869.736

AIC	AICc	BIC
363.8377	371.4741	369.1799

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	64.09411	4138.48	2576.642	-1.385304	26.68785	0.9511227	0.52599

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 1  
beta = 0

Initial states:

l = 2032  
b = 1.0261

sigma: 0.4724

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	106.3763	4208.042	2568.532	-1.387255	25.08613	0.948129	0.5459977

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1148.8778

sigma: 698.6772

AIC	AICc	BIC
291.6774	293.3917	294.3485

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	307.695	658.7192	542.2515	4.063392	28.4135	0.9944095	0.2300765

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.966

Initial states:

l = 608.928

sigma: 0.3224

	AIC	AICc	BIC
	280.1150	281.8293	282.7861

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	350.1072	659.4424	523.6673	8.974702	24.7307	0.9603289	0.2632663

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.1933

Initial states:

l = 499.2588

b = 147.9006

sigma: 632.5221

	AIC	AICc	BIC
	289.6928	294.6928	294.1446

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	106.6279	557.832	429.0143	-1.482607	23.0509	0.7867491	0.001362937

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8163

beta = 0.625

phi = 0.8

Initial states:

l = 499.053

b = 147.8975

sigma: 650.933

	AIC	AICc	BIC
	291.3917	299.0281	296.7340

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	104.5829	553.1867	410.0732	0.9683523	23.28155	0.752014

ACF1

Training set -0.07244713

ETS(M,A,N)

Call:

ets(y = ts\_series, model = "MAN")

Smoothing parameters:

alpha = 0.9842

beta = 1e-04

Initial states:

l = 477.0722

b = 178.238

sigma: 0.2632

AIC AICc BIC

278.9381 283.9381 283.3899

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	169.8363	578.3329	443.064	-3.307291	22.14646	0.8125142	0.2402385

ETS(M,Ad,N)

Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

Smoothing parameters:

alpha = 0.9028

beta = 0.0931

phi = 0.98

Initial states:

l = 498.916

b = 103.9221

sigma: 0.2997

AIC AICc BIC

282.4203 290.0567 287.7626

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	207.2057	586.434	465.6043	1.885756	22.80978	0.8538498	0.1747458

ETS(M,M,N)

Call:

ets(y = ts\_series, model = "MMN")

Smoothing parameters:

alpha = 0.8838

beta = 1e-04

Initial states:

l = 513.0413

b = 1.1791



sigma: 0.2303

	AIC	AICc	BIC
	275.5160	280.5160	279.9679

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-42.04063	572.9434	358.7563	-7.186429	20.14306	0.6579064

ACF1

Training set 0.04689583

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8997

beta = 1e-04

phi = 0.98

Initial states:

l = 512.7264

b = 1.2089

sigma: 0.2453

	AIC	AICc	BIC
	278.1423	285.7786	283.4845

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	10.5878	548.4235	378.0776	-6.342678	20.7568	0.6933387	0.04774063

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.1934

Initial states:

l = 499.2584

b = 147.8995

sigma: 632.5221

	AIC	AICc	BIC
	289.6928	294.6928	294.1446

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	106.5768	557.832	428.9941	-1.482998	23.05123	0.7867121

ACF1

Training set 0.001274002

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.8163
beta  = 0.625
phi   = 0.8
```

Initial states:

```
l = 499.053
b = 147.8975
```

```
sigma: 650.933
```

```
      AIC      AICc      BIC
291.3917 299.0281 296.7340
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 104.5829 553.1867 410.0732 0.9683523 23.28155 0.752014
```

```
      ACF1
```

```
Training set -0.07244713
```

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.9523
beta  = 0
```

Initial states:

```
l = 658.7
b = 1.1845
```

```
sigma: 0.2066
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -68.31179 577.7131 360.1934 -8.98506 21.0628 0.6605417
```

```
      ACF1
```

```
Training set 0.007662806
```

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 224.107
```

```
sigma: 418.1262
```

```
      AIC      AICc      BIC
273.1948 274.9091 275.8659
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
```

```
Training set 277.1923 394.2132 277.1998 15.68917 15.69249 0.9445421 0.629516
ETS(M,N,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MNN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
Initial states:
```

```
l = 213.5968
```

```
sigma: 0.2401
```

```
      AIC      AICc      BIC
250.9358 252.6501 253.6069
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 277.7763 394.2208 277.7763 15.94981 15.94981 0.9465064 0.6300826
ETS(A,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "AAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 0.5314
```

```
Initial states:
```

```
l = -58.8834
```

```
b = 136.5408
```

```
sigma: 259.5547
```

```
      AIC      AICc      BIC
257.6259 262.6259 262.0777
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 41.24977 228.9058 130.8328 0.6320467 14.54543 0.4458052 0.1293366
ETS(A,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 0.6568
```

```
phi   = 0.9562
```

```
Initial states:
```

```
l = -59.7929
```

```
b = 137.4079
```

```
sigma: 269.2835
```

```
      AIC      AICc      BIC
```

259.6166 267.2530 264.9588

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	47.84614	228.8469	133.5043	1.75428	14.88223	0.4549082	0.06233055

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.9999

Initial states:

l = 57.6226

b = 182.5799

sigma: 0.1477

	AIC	AICc	BIC
	241.3673	246.3673	245.8191

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	18.01131	228.7629	131.9843	-1.010652	9.732417	0.4497288	

Training set -0.09686436

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9996

beta = 0.9996

phi = 0.98

Initial states:

l = -25.5921

b = 134.9459

sigma: 0.3515

	AIC	AICc	BIC
	271.8980	279.5344	277.2403

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	26.07341	232.557	141.3363	0.7160095	14.0921	0.4815954	-0.1219368

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.9975

```

Initial states:
  l = 24.9236
  b = 8.6227

sigma: 0.2572

      AIC      AICc      BIC
265.5411 270.5411 269.9930

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -137.9412 521.5358 252.4035 -41.67458 48.17282 0.8600503
              ACF1
Training set -0.1203171
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN", damped = TRUE)

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04
  phi   = 0.8001

Initial states:
  l = 21.8126
  b = 7.49

sigma: 0.4418

      AIC      AICc      BIC
286.4235 294.0598 291.7657

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 14.03175 346.7475 258.7017 -26.72489 39.50209 0.8815109 0.626193
Holt's method

Call:
holt(y = ts_series, h = h, initial = "optimal")

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.5314

Initial states:
  l = -58.8834
  b = 136.5408

sigma: 259.5547

      AIC      AICc      BIC
257.6259 262.6259 262.0777

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 41.24977 228.9058 130.8328 0.6320467 14.54543 0.4458052 0.1293366

```

## Damped Holt's method

## Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

## Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 0.657
```

```
phi = 0.956
```

## Initial states:

```
l = -59.7922
```

```
b = 137.4079
```

```
sigma: 269.2834
```

	AIC	AICc	BIC
259.6166	267.2530	264.9588	

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	47.88254	228.8469	133.5216	1.758407	14.88296	0.4549671	0.06218234

Holt's method with exponential trend

## Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

## Smoothing parameters:

```
alpha = 1
```

```
beta = 0.0681
```

## Initial states:

```
l = 224.04
```

```
b = 1.058
```

```
sigma: 0.1292
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	62.41391	228.618	129.4305	6.070025	8.187588	0.4410269	0.2573258

ETS(A,N,N)

## Call:

```
ets(y = ts_series, model = "ANN")
```

## Smoothing parameters:

```
alpha = 0.8227
```

## Initial states:

```
l = 2932.7869
```

```
sigma: 1470.189
```

	AIC	AICc	BIC
318.4599	320.1741	321.1310	

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-118.9364	1386.107	1072.037	-21.97264	45.60328	0.9954271

## ACF1

Training set 0.06369783

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.774

Initial states:

l = 1393.1466

sigma: 0.3992

AIC	AICc	BIC
311.8926	313.6069	314.5637

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-16.14532	1352.808	1027.935	-16.58349	42.70066	0.9544772

ACF1

Training set 0.1192226

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.2453

beta = 0.2453

Initial states:

l = 1312.3358

b = 454.6729

sigma: 1497.725

AIC	AICc	BIC
320.7243	325.7243	325.1762

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-359.4109	1320.869	1007.285	-19.60121	42.09792	0.9353024

ACF1

Training set 0.08334627

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2538

beta = 0.2538

phi = 0.9589

Initial states:

l = 1311.9339

b = 455.1476

sigma: 1552.296

AIC	AICc	BIC
322.6787	330.3151	328.0210

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-327.9838	1319.198	1019.916	-20.28084	42.73106	0.9470308

ACF1

Training set 0.1019896

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9744

beta = 1e-04

Initial states:

l = 1237.3299

b = 307.6415

sigma: 0.3732

AIC	AICc	BIC
314.1639	319.1639	318.6158

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-315.4181	1387.267	971.4072	-25.00353	40.46609	0.9019885

ACF1

Training set -0.01926787

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7689

beta = 1e-04

phi = 0.8938

Initial states:

l = 1193.1775

b = 454.8732

sigma: 0.3886

AIC	AICc	BIC
316.1480	323.7844	321.4902

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-240.406	1332.087	921.9746	-24.95337	40.33921	0.8560886

ACF1



Training set 0.06402269

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.7951

beta = 1e-04

Initial states:

l = 1292.2574

b = 1.0444

sigma: 0.4033

AIC	AICc	BIC
-----	------	-----

315.5741	320.5741	320.0259
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-205.0757	1400.357	980.7615	-22.31023	43.18335	0.9106744

ACF1

Training set 0.1110188

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7323

beta = 1e-04

phi = 0.8091

Initial states:

l = 1291.6874

b = 1.2864

sigma: 0.3914

AIC	AICc	BIC
-----	------	-----

316.2225	323.8588	321.5647
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-230.9224	1332.533	930.6539	-24.56263	40.60198	0.8641476

ACF1

Training set 0.07702716

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.2453

beta = 0.2453

Initial states:

l = 1312.3357

b = 454.673

sigma: 1497.725

AIC	AICc	BIC
320.7243	325.7243	325.1762

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-359.4154	1320.869	1007.287	-19.60151	42.09808	0.935304	0.0833485
Damped Holt's method							

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.2539

beta = 0.2539

phi = 0.9587

Initial states:

l = 1311.9326

b = 455.1485

sigma: 1552.296

AIC	AICc	BIC
322.6787	330.3151	328.0210

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-327.7609	1319.198	1019.956	-20.28096	42.73235	0.9470679	

Training set 0.1020689

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.2713

beta = 1

Initial states:

l = 1514.05

b = 1.2031

sigma: 0.3271

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-618.7398	1447.337	1104.353	-31.90768	44.62637	1.025433	0.145112
ETS(A,N,N)							

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1728.1773

sigma: 973.2576

AIC	AICc	BIC
303.6100	305.3242	306.2811

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	490.9936	917.5961	683.4345	8.668366	13.42668	0.9464463

ACF1

Training set -0.01918255

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1644.6421

sigma: 0.2008

AIC	AICc	BIC
298.1574	299.8717	300.8285

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	495.635	917.6761	685.1894	8.941027	13.52977	0.9488766	-0.01964268

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.6534

beta = 1e-04

Initial states:

l = 1642.1846

b = 468.4984

sigma: 869.9947

AIC	AICc	BIC
301.1686	306.1686	305.6204

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-3.307219	767.2632	577.7489	-3.939676	11.468	0.8000889	0.1136542

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 1629.5267
b = 471.9294
```

```
sigma: 930.6886
```

```
      AIC      AICc      BIC
304.2624 311.8987 309.6046
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 104.8212 790.9332 564.7135 -1.187935 10.59146 0.782037
```

```
      ACF1
```

```
Training set -0.002938237
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 0.0097
```

```
Initial states:
```

```
l = 1491.6985
b = 309.1379
```

```
sigma: 0.1559
```

```
      AIC      AICc      BIC
293.4211 298.4211 297.8730
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 189.1968 792.4627 569.5981 1.724446 10.24878 0.7888014 -0.0224304
```

```
ETS(M,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 1629.57
b = 390.815
```

```
sigma: 0.1657
```

```

      AIC      AICc      BIC
296.6721 304.3085 302.0143

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 172.0813 800.447 564.7926 0.5604436 10.40046 0.7821465

```

ACF1

```

Training set -0.006093707

```

ETS(M,M,N)

Call:

```

ets(y = ts_series, model = "MMN")

```

Smoothing parameters:

```

alpha = 0.7179

```

```

beta  = 1e-04

```

Initial states:

```

l = 1729.2726

```

```

b = 1.1106

```

```

sigma: 0.1516

```

```

      AIC      AICc      BIC
293.7483 298.7483 298.2001

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -72.43347 775.696 638.54 -2.080489 12.20546 0.8842748 0.1132271

```

ETS(M,Md,N)

Call:

```

ets(y = ts_series, model = "MMN", damped = TRUE)

```

Smoothing parameters:

```

alpha = 0.001

```

```

beta  = 1e-04

```

```

phi   = 0.9647

```

Initial states:

```

l = 1673.1746

```

```

b = 1.1449

```

```

sigma: 0.1436

```

```

      AIC      AICc      BIC
292.3658 300.0022 297.7081

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 5.484781 638.9006 526.8514 -1.616865 10.92549 0.729604 0.266973

```

Holt's method

Call:

```

holt(y = ts_series, h = h, initial = "optimal")

```

Smoothing parameters:

```

alpha = 0.6546

```

```

beta = 1e-04

Initial states:
l = 1642.1758
b = 468.465

sigma: 869.9945

      AIC      AICc      BIC
301.1686 306.1686 305.6204

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -3.129853 767.263 577.7547 -3.932889 11.46525 0.8000969 0.1131261
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
alpha = 0.9998
beta = 1e-04
phi = 0.98

Initial states:
l = 1629.5277
b = 471.9292

sigma: 930.6866

      AIC      AICc      BIC
304.2623 311.8987 309.6045

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 104.8138 790.9315 564.7093 -1.188186 10.59137 0.7820312
              ACF1
Training set -0.002915444
Holt's method with exponential trend

Call:
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:
alpha = 1
beta = 0.128

Initial states:
l = 1702.2
b = 1.2254

sigma: 0.1431
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -212.9015 874.2541 664.2493 -5.998717 12.49143 0.9198779
              ACF1
Training set -0.0157593
ETS(A,N,N)

```

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 5596.3146
```

```
sigma: 2278.339
```

	AIC	AICc	BIC
	334.2299	335.9442	336.9010

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-0.4841429	2148.039	1810.156	-125.5679	149.1073	0.9221982

ACF1

Training set 0.346743

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 5604.7148
```

```
sigma: 0.4065
```

	AIC	AICc	BIC
	334.2296	335.9439	336.9007

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-8.877349	2148.057	1809.224	-125.9062	149.3142	0.9217234

ACF1

Training set 0.3467427

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 2e-04
```

```
beta = 1e-04
```

Initial states:

```
l = 6030.2262
```

```
b = -41.4522
```

```
sigma: 2432.404
```

	AIC	AICc	BIC
	338.1819	343.1819	342.6338

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-40.01852	2145.178	1826.093	-124.914	148.1676	0.9303177	0.3373409

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9596
```

Initial states:

```
l = 6012.363
b = -6.1266
```

sigma: 2563.611

AIC	AICc	BIC
340.7393	348.3756	346.0815

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-370.3075	2178.651	1787.671	-140.2315	158.2975	0.9107431	

Training set 0.3453462

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.0138
beta  = 1e-04
```

Initial states:

```
l = 6096.2677
b = -31.3761
```

sigma: 0.4273

AIC	AICc	BIC
338.6743	343.6743	343.1261

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-177.9335	2165.479	1828.298	-131.1427	152.5057	0.931441	0.3381917

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0541
beta  = 1e-04
phi   = 0.8
```



```

Initial states:
  l = 6010.3763
  b = 111.4481

sigma: 0.4301

      AIC      AICc      BIC
341.7139 349.3503 347.0562

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -532.1511 2260.513 1834.5 -147.4459 164.0314 0.9346008 0.3413372
ETS(M,M,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04

Initial states:
  l = 6013.1115
  b = 0.9945

sigma: 0.4291

      AIC      AICc      BIC
338.4050 343.4050 342.8568

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -109.7427 2146.25 1815.81 -128.2155 150.3365 0.9250789 0.3385569
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN", damped = TRUE)

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04
  phi   = 0.8995

Initial states:
  l = 6012.1139
  b = 0.9891

sigma: 0.4471

      AIC      AICc      BIC
340.4022 348.0385 345.7444

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -86.12753 2144.982 1810.541 -127.275 149.6051 0.9223947 0.3390265
Holt's method

```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 2e-04
```

```
beta = 1e-04
```

Initial states:

```
l = 6030.1958
```

```
b = -41.3919
```

```
sigma: 2432.403
```

```
      AIC      AICc      BIC
338.1819 343.1819 342.6338
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-40.55889	2145.178	1826.03	-124.9391	148.1842	0.9302853	0.3373475
Damped Holt's method							

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
phi = 0.98
```

Initial states:

```
l = 6012.1902
```

```
b = -6.1874
```

```
sigma: 2561.965
```

```
      AIC      AICc      BIC
340.7162 348.3525 346.0584
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-363.3696	2177.251	1787.829	-139.9133	158.0779	0.9108237
ACF1						
Training set	0.3450798					
Holt's method with exponential trend						

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.6736
```

```
beta = 0
```

Initial states:

```
l = 4759.35
```

```
b = 0.9457
```

```
sigma: 0.7734
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	492.4057	2361.122	2008.267	-77.60451	115.6814	1.023128	0.05052445

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 1e-04

Initial states:

l = 5640.8447

sigma: 1170.101

AIC	AICc	BIC
310.2410	311.9553	312.9121

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-0.08805338	1103.182	643.6396	-11.34909	21.37303	0.7085999

ACF1

Training set 0.009351602

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 1e-04

Initial states:

l = 5640.3322

sigma: 0.2074

AIC	AICc	BIC
310.2394	311.9537	312.9105

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	0.4227953	1103.183	643.6962	-11.33902	21.37211	0.7086622

ACF1

Training set 0.009351705

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.0127

beta = 0.0127

Initial states:

l = 5831.0091

b = 17.0607

sigma: 1296.959

```

      AIC      AICc      BIC
315.5430 320.5430 319.9949

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -226.3638 1143.81 631.7134 -16.00462 22.18561 0.69547 0.01680397
ETS(A,Ad,N)

```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 3e-04
beta  = 3e-04
phi   = 0.8

```

Initial states:

```

l = 5782.652
b = 16.379

```

sigma: 1318.516

```

      AIC      AICc      BIC
316.8025 324.4389 322.1448

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -192.1783 1120.523 622.8025 -15.16924 21.76916 0.6856597
              ACF1
Training set 0.01100866
ETS(M,A,N)

```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```

alpha = 1e-04
beta  = 1e-04

```

Initial states:

```

l = 5569.4714
b = 17.3003

```

sigma: 0.218

```

      AIC      AICc      BIC
314.2152 319.2152 318.6670

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -93.26406 1123.97 637.2019 -13.48322 21.96031 0.7015124
              ACF1
Training set 0.03974592
ETS(M,Ad,N)

```

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

## Smoothing parameters:

alpha = 1e-04  
 beta = 1e-04  
 phi = 0.8306

## Initial states:

l = 5569.9867  
 b = 17.0652

sigma: 0.23

	AIC	AICc	BIC
	316.1671	323.8035	321.5093

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	8.822268	1104.274	645.3277	-11.21336	21.42263	0.7104583

ACF1

Training set 0.01204579

ETS(M,M,N)

## Call:

ets(y = ts\_series, model = "MMN")

## Smoothing parameters:

alpha = 5e-04  
 beta = 5e-04

## Initial states:

l = 5588.011  
 b = 1.0015

sigma: 0.2201

	AIC	AICc	BIC
	314.1657	319.1657	318.6176

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-31.8063	1112.747	642.4865	-12.14186	21.66634	0.7073304

ACF1

Training set 0.02522831

ETS(M,Md,N)

## Call:

ets(y = ts\_series, model = "MMN", damped = TRUE)

## Smoothing parameters:

alpha = 1e-04  
 beta = 1e-04  
 phi = 0.9755

## Initial states:

l = 5568.5958  
 b = 1.0023

sigma: 0.2282

```

      AIC      AICc      BIC
316.1287 323.7651 321.4710

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -30.77201 1111.751 642.3947 -12.11755 21.66239 0.7072293

```

ACF1

Training set 0.02461251

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.0042

beta = 1e-04

Initial states:

l = 5903.9453

b = -28.0938

sigma: 1240.156

```

      AIC      AICc      BIC
313.9308 318.9308 318.3826

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 3.562555 1093.714 654.4735 -10.84022 21.0325 0.7205271

```

ACF1

Training set -0.01825795

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 3e-04

beta = 3e-04

phi = 0.8

Initial states:

l = 5782.652

b = 16.379

sigma: 1318.516

```

      AIC      AICc      BIC
316.8025 324.4389 322.1448

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -192.1783 1120.523 622.8025 -15.16924 21.76916 0.6856598

```

ACF1

Training set 0.01100866

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.3589
```

```
beta = 1
```

Initial states:

```
l = 5275.58
```

```
b = 1.1056
```

```
sigma: 0.2715
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-290.8897	1384.066	876.9269	-17.17928	27.19304	0.965432

ACF1

Training set -0.3025093

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 350.1701
```

```
sigma: 780.4981
```

	AIC	AICc	BIC
	295.6642	297.3784	298.3353

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	429.9476	735.8607	544.0908	15.17401	16.58521	0.9445876	0.4106208

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 329.4548
```

```
sigma: 0.2791
```

	AIC	AICc	BIC
	284.3910	286.1053	287.0621

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	431.0986	735.878	545.2417	15.502	16.9132	0.9465857	0.4104639

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9028
```

```
beta = 0.9028
```

```
Initial states:
```

```
l = 40.5651
```

```
b = 272.098
```

```
sigma: 597.7174
```

```
AIC      AICc      BIC
```

```
287.6553 292.6553 292.1071
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -70.73931 527.1372 325.1756 -0.5889434 10.35166 0.5645323
```

```
ACF1
```

```
Training set 0.07487179
```

```
ETS(A,Ad,N)
```

```
Call:
```

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9148
```

```
beta = 0.9148
```

```
phi = 0.8075
```

```
Initial states:
```

```
l = 40.8266
```

```
b = 271.9135
```

```
sigma: 596.3192
```

```
AIC      AICc      BIC
```

```
288.2370 295.8734 293.5793
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 38.50818 506.7739 349.7045 3.721501 11.35411 0.6071165 0.05811561
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.8181
```

```
beta = 0.8181
```

```
Initial states:
```

```
l = 181.384
```

```
b = 144.6943
```

```
sigma: 0.1229
```

```
AIC      AICc      BIC
```



262.2909 267.2909 266.7427

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-63.77057	537.2361	333.3438	1.055954	8.769139	0.5787131	0.2319977

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7539
beta  = 0.7481
phi   = 0.98
```

Initial states:

```
l = 59.3307
b = 240.3757
```

```
sigma: 0.1407
```

	AIC	AICc	BIC
	267.9712	275.6075	273.3134

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-58.83554	556.8677	359.3217	0.5128345	10.28113	0.6238128	0.327348

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.855
beta  = 0.852
```

Initial states:

```
l = 239.884
b = 1.4295
```

```
sigma: 0.1236
```

	AIC	AICc	BIC
	264.1634	269.1634	268.6152

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-219.1614	623.4321	390.9221	-3.712542	9.870251	0.6786737

ACF1

Training set 0.2560144

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7854
beta  = 0.7854
```

```

phi = 0.8

Initial states:
l = 155.505
b = 2.5206

sigma: 0.1369

AIC      AICc      BIC
267.4906 275.1270 272.8329

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -66.96298 532.6575 338.4916 -0.9789681 9.610223 0.58765 0.2601755
Holt's method

Call:
holt(y = ts_series, h = h, initial = "optimal")

Smoothing parameters:
alpha = 0.9029
beta = 0.9029

Initial states:
l = 40.5674
b = 272.0997

sigma: 597.7173

AIC      AICc      BIC
287.6553 292.6553 292.1071

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE
Training set -70.73924 527.1371 325.1835 -0.5890165 10.35193 0.5645461
                ACF1
Training set 0.07477873
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
alpha = 0.9148
beta = 0.9148
phi = 0.8076

Initial states:
l = 40.8263
b = 271.9139

sigma: 596.3192

AIC      AICc      BIC
288.2370 295.8734 293.5793

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE      ACF1

```

Training set 38.45859 506.7738 349.6899 3.719542 11.3536 0.6070913 0.05810712  
Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.9518
beta = 1
```

Initial states:

```
l = 350.9
b = 1.4044
```

sigma: 0.1585

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-199.4131	603.1859	399.8383	-3.996195	13.86687	0.6941532	
Training set	0.0442237						

ETS(A,N,N)

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2236.7265
```

sigma: 437.6029

	AIC	AICc	BIC
274.8338	276.5481	277.5049	

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	188.1939	412.576	244.5752	4.555881	7.255015	0.9902913	0.454152
ETS(M,N,N)							

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2203.1259
```

sigma: 0.1273

	AIC	AICc	BIC
263.3485	265.0628	266.0196	

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	190.0608	411.7295	242.7087	4.64771	7.163205	0.9827338	0.4570273

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.8922

beta = 0.8922

Initial states:

l = 1954.1474

b = 107.4929

sigma: 307.5511

AIC	AICc	BIC
263.7341	268.7341	268.1860

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	71.6695	271.2346	170.7843	1.454433	5.762361	0.6915103	-0.03621346

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9005

beta = 0.9005

phi = 0.98

Initial states:

l = 1968.1054

b = 120.8737

sigma: 320.9155

AIC	AICc	BIC
265.9315	273.5679	271.2737

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	72.99823	272.7257	173.3916	1.484743	5.855418	0.7020671

ACF1

Training set	-0.03481376
--------------	-------------

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.7744

beta = 0.4888

Initial states:

l = 1951.8219

b = 44.3016

sigma: 0.1075

	AIC	AICc	BIC
	259.7150	264.7150	264.1668

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	110.6646	309.1013	177.3073	2.38161	5.393566	0.7179219	0.3574504

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7654  
beta = 0.5189  
phi = 0.98

Initial states:

l = 1967.984  
b = 72.169

sigma: 0.1122

	AIC	AICc	BIC
	261.9654	269.6018	267.3077

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	109.2013	309.4536	177.395	2.299893	5.391165	0.718277	0.3576323

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.7582  
beta = 0.4683

Initial states:

l = 1969.071  
b = 1.0091

sigma: 0.1007

	AIC	AICc	BIC
	257.5030	262.5030	261.9548

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	97.42154	284.0166	163.597	2.105433	5.06152	0.6624087	0.3166555

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7535

```
beta = 0.4949
phi  = 0.98
```

Initial states:

```
l = 1968.8128
b = 1.0099
```

```
sigma: 0.1054
```

```
      AIC      AICc      BIC
259.7647 267.4011 265.1070
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 99.0159 284.8741 164.6606 2.16486 5.100137 0.6667153 0.3149852
Holt's method
```

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.8924
beta  = 0.8924
```

Initial states:

```
l = 1954.4421
b = 107.656
```

```
sigma: 307.5511
```

```
      AIC      AICc      BIC
263.7341 268.7341 268.1860
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 71.63897 271.2346 170.8001 1.453545 5.763424 0.6915741
              ACF1
Training set -0.03662504
Damped Holt's method
```

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9005
beta  = 0.9005
phi   = 0.98
```

Initial states:

```
l = 1968.1051
b = 120.8737
```

```
sigma: 320.9154
```

```
      AIC      AICc      BIC
265.9315 273.5678 271.2737
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	72.99661	272.7257	173.3922	1.484712	5.855472	0.7020697

ACF1

Training set -0.03484666

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.8234

beta = 1

Initial states:

l = 2033.02

b = 1.0085

sigma: 0.0957

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	61.21146	251.308	147.6986	1.316553	5.059001	0.5980357	-0.08548806

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1936.7425

sigma: 1063.72

	AIC	AICc	BIC
	306.8096	308.5239	309.4807

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	267.2347	1002.885	723.2399	5.291238	13.75111	0.9445147	0.2124199

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 1871.8397

sigma: 0.1999

	AIC	AICc	BIC
	298.5061	300.2203	301.1772

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
--	----	------	-----	-----	------	------	------

```
Training set 270.8407 1003.001 726.8245 5.477446 13.93621 0.949196 0.2131138
ETS(A,A,N)
```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 0.0087
```

Initial states:

```
l = 988.477
b = 383.228
```

sigma: 1113.841

```
      AIC      AICc      BIC
310.0635 315.0635 314.5154
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -67.3646 982.3156 650.7232 -1.577917 13.36648 0.8498115 0.209626
ETS(A,Ad,N)
```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
phi = 0.9469
```

Initial states:

```
l = 1027.1485
b = 471.7458
```

sigma: 1133.624

```
      AIC      AICc      BIC
311.3634 318.9997 316.7056
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 25.43755 963.3951 663.0728 -0.2984105 13.39416 0.8659395
              ACF1
Training set 0.1843578
ETS(M,A,N)
```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
```

Initial states:

```
l = 1026.0313
b = 472.6421
```



sigma: 0.1853

AIC	AICc	BIC
300.7415	305.7415	305.1934

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-154.8223	987.3485	638.905	-3.846235	13.23388	0.8343776	0.2127563

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04  
phi = 0.98

Initial states:

l = 1027.0235  
b = 471.8299

sigma: 0.1964

AIC	AICc	BIC
302.9551	310.5915	308.2974

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-73.84727	970.675	643.5855	-2.284302	13.13825	0.8404901	0.1958662

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04

Initial states:

l = 1157.0388  
b = 1.1233

sigma: 0.2151

AIC	AICc	BIC
305.9833	310.9833	310.4352

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-276.0252	1137.048	682.7845	-3.881983	13.80082	0.891682	0.3163608

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.8344
```

Initial states:

```
l = 1159.6923
b = 1.4549
```

sigma: 0.202

```
      AIC      AICc      BIC
303.8291 311.4654 309.1713
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-18.91461	962.364	650.3805	-1.874342	13.37126	0.849364	0.151927
Holt's method							

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.0087
```

Initial states:

```
l = 988.6977
b = 383.7426
```

sigma: 1113.841

```
      AIC      AICc      BIC
310.0635 315.0635 314.5154
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-67.83233	982.3154	650.6033	-1.590314	13.36409	0.849655	0.2096355
Damped Holt's method							

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9469
```

Initial states:

```
l = 1027.1484
b = 471.7457
```

sigma: 1133.624

```
      AIC      AICc      BIC
311.3634 318.9997 316.7056
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
--	----	------	-----	-----	------	------

```
Training set 25.34493 963.3951 663.0517 -0.3003152 13.39386 0.8659119
```

```
ACF1
```

```
Training set 0.1843632
```

```
Holt's method with exponential trend
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1
```

```
beta = 0.7503
```

```
Initial states:
```

```
l = 1936.55
```

```
b = 1.1327
```

```
sigma: 0.2097
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set -52.63609 1032.607 659.6873 -1.050944 13.19609 0.8615181
```

```
ACF1
```

```
Training set -0.04302167
```

```
ETS(A,N,N)
```

```
Call:
```

```
ets(y = ts_series, model = "ANN")
```

```
Smoothing parameters:
```

```
alpha = 0.3747
```

```
Initial states:
```

```
l = 1879.515
```

```
sigma: 1718.796
```

```
AIC AICc BIC
```

```
324.0842 325.7985 326.7554
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE ACF1
```

```
Training set 597.765 1620.496 1296.321 -40.83163 81.44627 1.079315 -0.2456481
```

```
ETS(M,N,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MNN")
```

```
Smoothing parameters:
```

```
alpha = 0.3808
```

```
Initial states:
```

```
l = 2442.5854
```

```
sigma: 0.4549
```

```
AIC AICc BIC
```

```
317.5125 319.2267 320.1836
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	508.8936	1629.798	1313.893	-46.03509	83.81328	1.093945	-0.2096764

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.0522

beta = 0.0522

Initial states:

l = 818.8273

b = 409.3128

sigma: 1614.203

	AIC	AICc	BIC
	323.4205	328.4205	327.8724

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-304.407	1423.593	712.4909	-73.55426	81.02878	0.593219	-0.1359862

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.9589

Initial states:

l = 818.3217

b = 412.3133

sigma: 1475.011

	AIC	AICc	BIC
	320.8402	328.4766	326.1825

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	19.39824	1253.518	737.2515	-53.84401	69.33397	0.6138347	-0.22944

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.139

beta = 1e-04

Initial states:

l = 769.7266

b = 338.7131

```

sigma: 0.2987

      AIC      AICc      BIC
308.5039 313.5039 312.9558

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -142.2455 1363.355 686.9693 -63.4509 76.44271 0.5719697
              ACF1
Training set -0.1769769
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
alpha = 1e-04
beta  = 1e-04
phi   = 0.9649

Initial states:
l = 781.2862
b = 411.9019

sigma: 0.3069

      AIC      AICc      BIC
309.8566 317.4930 315.1988

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -54.19355 1259.055 692.2441 -56.32973 69.92207 0.5763615
              ACF1
Training set -0.2097549
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
alpha = 1e-04
beta  = 1e-04
phi   = 0.8642

Initial states:
l = 885.0671
b = 1.3772

sigma: 0.3118

      AIC      AICc      BIC
309.7805 317.4168 315.1227

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 4.217472 1273.668 708.3248 -55.00306 70.55246 0.5897503
              ACF1
Training set -0.2009464

```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8642
```

```
Initial states:
```

```
l = 885.0671
b = 1.3772
```

```
sigma: 0.3118
```

```
      AIC      AICc      BIC
309.7805 317.4168 315.1227
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 4.217472 1273.668 708.3248 -55.00306 70.55246 0.5897503
```

```
ACF1
```

```
Training set -0.2009464
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 2e-04
beta  = 2e-04
```

```
Initial states:
```

```
l = 1198.5929
b = 275.0742
```

```
sigma: 1417.482
```

```
      AIC      AICc      BIC
318.7420 323.7420 323.1938
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 34.17685 1250.102 787.8326 -52.92297 69.40879 0.6559484
```

```
ACF1
```

```
Training set -0.2151995
```

```
Damped Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9589
```

```
Initial states:
```

l = 818.3216

b = 412.3129

sigma: 1475.011

AIC	AICc	BIC
320.8402	328.4766	326.1825

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	19.35725	1253.518	737.2282	-53.84552	69.33425	0.6138152

ACF1

Training set -0.2294344

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.3388

beta = 0

Initial states:

l = 1397

b = 1.118

sigma: 0.2666

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-382.2887	1584.895	787.2315	-79.09923	88.31816	0.6554479

ACF1

Training set -0.1255646

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

alpha = 0.6526

Initial states:

l = 1636.7224

sigma: 965.2517

AIC	AICc	BIC
303.3126	305.0269	305.9837

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	304.9481	910.0481	612.3926	6.837511	15.80893	0.9079604	-0.2482807

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.6435

```

Initial states:
  l = 1519.9417

sigma:  0.2835

      AIC      AICc      BIC
299.5953 301.3096 302.2664

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 320.1595 910.6423 609.0872 7.594005 15.55098 0.9030598 -0.2472324
ETS(A,A,N)

Call:
ets(y = ts_series, model = "AAN")

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04

Initial states:
  l = 1375.8433
  b = 260.5548

sigma:  847.1368

      AIC      AICc      BIC
300.2101 305.2101 304.6619

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -94.92974 747.1045 496.9874 -7.542616 13.73276 0.7368556
              ACF1
Training set 0.08564804
ETS(A,Ad,N)

Call:
ets(y = ts_series, model = "AAN", damped = TRUE)

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04
  phi   = 0.9727

Initial states:
  l = 1344.0599
  b = 325.0122

sigma:  916.1984

      AIC      AICc      BIC
303.6975 311.3338 309.0397

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -173.2103 778.619 581.7007 -10.71705 17.0255 0.8624552 0.1616079
ETS(M,A,N)

```



Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 1343.9489
b = 241.7378
```

sigma: 0.2046

	AIC	AICc	BIC
	293.1631	298.1631	297.6149

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	114.9214	773.8585	488.5107	-2.004417	11.849	0.7242876	0.1585456

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2586
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1344.9282
b = 266.6921
```

sigma: 0.2298

	AIC	AICc	BIC
	297.7581	305.3944	303.1003

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	100.3212	807.2006	441.217	-1.350413	10.85417	0.6541679

ACF1

Training set	0.006024662
--------------	-------------

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.0016
beta  = 1e-04
```

Initial states:

```
l = 1392.2767
b = 1.098
```

sigma: 0.1985

```

      AIC      AICc      BIC
291.8979 296.8979 296.3498

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -46.84953 903.2555 524.4265 -1.653541 12.79928 0.7775381

```

ACF1

Training set 0.1260455

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 2e-04
beta  = 2e-04
phi   = 0.9596

```

Initial states:

```

l = 1366.9856
b = 1.1346

```

sigma: 0.1884

```

      AIC      AICc      BIC
291.3291 298.9654 296.6713

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -27.41006 746.6313 409.3471 -3.152229 10.52411 0.6069161

```

ACF1

Training set -0.007237147

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```

alpha = 1e-04
beta  = 1e-04

```

Initial states:

```

l = 1375.8476
b = 260.5525

```

sigma: 847.1368

```

      AIC      AICc      BIC
300.2101 305.2101 304.6619

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -94.9124 747.1044 496.9866 -7.542211 13.73264 0.7368544

```

ACF1

Training set 0.08565593

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9727
```

Initial states:

```
l = 1344.0598
b = 325.0123
```

sigma: 916.1984

```
      AIC      AICc      BIC
303.6975 311.3338 309.0397
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -173.2055 778.6189 581.7012 -10.71695 17.02549 0.862456 0.1616117
Holt's method with exponential trend
```

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.4254
beta  = 1
```

Initial states:

```
l = 1475
b = 1.2373
```

sigma: 0.2116

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -268.0986 1024.053 697.5058 -8.014595 16.90983 1.034153
              ACF1
Training set -0.08373368
ETS(A,N,N)
```

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 3808.8529
```

sigma: 1076.874

```
      AIC      AICc      BIC
307.2520 308.9663 309.9231
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -30.98311 1015.286 738.5325 -10.07047 23.90335 0.715355 0.3422211
```

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 3778.0013
```

```
sigma: 0.2849
```

	AIC	AICc	BIC
	307.2354	308.9497	309.9065

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-0.1577088	1014.814	738.529	-9.179644	23.70979	0.7153516

ACF1

Training set 0.3422218

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 1e-04
```

```
beta = 1e-04
```

Initial states:

```
l = 3848.2657
```

```
b = -5.5199
```

```
sigma: 1151.42
```

	AIC	AICc	BIC
	311.2581	316.2581	315.7099

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-17.79805	1015.457	745.1088	-9.710471	24.02534	0.7217249

ACF1

Training set 0.3413395

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
phi = 0.9347
```

Initial states:

```
l = 3848.1572
```

```
b = -9.1221
```

```

sigma: 1194.391

      AIC      AICc      BIC
313.2432 320.8795 318.5854

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -12.64944 1015.037 743.9931 -9.550893 23.94883 0.7206443
              ACF1
Training set 0.3411249
ETS(M,A,N)

Call:
ets(y = ts_series, model = "MAN")

Smoothing parameters:
alpha = 0.0016
beta  = 1e-04

Initial states:
l = 3906.8563
b = -13.4205

sigma: 0.304

      AIC      AICc      BIC
311.1645 316.1645 315.6164

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -0.6917776 1017.972 754.5869 -9.250005 24.21315 0.7309055
              ACF1
Training set 0.3413591
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
alpha = 0.0179
beta  = 0.0134
phi   = 0.8

Initial states:
l = 3848.0517
b = 75.0194

sigma: 0.3103

      AIC      AICc      BIC
314.4857 322.1220 319.8279

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -206.9799 1061.989 770.014 -15.48044 26.09895 0.7458485 0.3530717
ETS(M,M,N)

Call:

```

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 3848.3583
```

```
b = 0.9976
```

```
sigma: 0.3051
```

```
      AIC      AICc      BIC
311.1537 316.1537 315.6055
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	14.63811	1016	748.9842	-8.784308	23.94143	0.7254787	0.3411354

ETS(M,Md,N)

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
phi = 0.9161
```

```
Initial states:
```

```
l = 3848.2704
```

```
b = 0.9962
```

```
sigma: 0.3166
```

```
      AIC      AICc      BIC
313.1894 320.8258 318.5316
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	11.13519	1015.039	745.5768	-8.862378	23.84097	0.7221782	0.3407245

Holt's method

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 3848.3644
```

```
b = -5.685
```

```
sigma: 1151.418
```

```
      AIC      AICc      BIC
311.2580 316.2580 315.7099
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-16.33321	1015.456	745.3002	-9.668714	24.02208	0.7219103

ACF1

Training set 0.3413235

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9347
```

Initial states:

```
l = 3848.1572
b = -9.1221
```

sigma: 1194.39

AIC	AICc	BIC
313.2432	320.8795	318.5854

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-12.65327	1015.037	743.9925	-9.551	23.94884	0.7206436	0.3411249

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta  = 0
```

Initial states:

```
l = 3618
b = 0.9285
```

sigma: 0.3891

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	293.4456	1158.956	941.9542	3.074367	25.11986	0.9123927	0.02528771

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 938.994
```

sigma: 603.3845

AIC	AICc	BIC
-----	------	-----

286.3986 288.1129 289.0697

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	295.0643	568.8764	399.7082	9.113344	13.10681	0.9445032	-0.1536013

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.9999

Initial states:

l = 905.1555

sigma: 0.21

AIC	AICc	BIC
279.9827	281.6970	282.6538

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	296.9444	568.9334	401.5883	9.3135	13.30697	0.9489459	-0.1541107

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.3601

beta = 1e-04

Initial states:

l = 995.5189

b = 243.0826

sigma: 516.5889

AIC	AICc	BIC
282.4039	287.4039	286.8558

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	12.88898	455.5886	353.2493	-4.36135	13.4712	0.8347216	0.06374732

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.5172

beta = 2e-04

phi = 0.9797

Initial states:

l = 834.7491

b = 332.4762



sigma: 552.0448

AIC	AICc	BIC
285.4597	293.0961	290.8020

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-18.35954	469.1479	347.5357	-5.237122	12.92653	0.8212205

ACF1

Training set 0.02365415

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.0012

Initial states:

l = 952.3573

b = 174.6268

sigma: 0.1675

AIC	AICc	BIC
276.3778	281.3778	280.8297

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	119.3451	501.3186	361.7115	1.584065	12.11595	0.8547176	-0.1535735

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.98

Initial states:

l = 995.7723

b = 227.5776

sigma: 0.1762

AIC	AICc	BIC
279.2894	286.9258	284.6316

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	103.0193	505.1271	359.9086	0.3112068	12.2382	0.8504574	-0.1394854

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04

Initial states:

l = 1079.0596  
b = 1.1146

sigma: 0.1669

	AIC	AICc	BIC
	277.5576	282.5576	282.0095

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-25.39825	488.4394	388.8271	-2.229346	13.66961	0.9187914

ACF1

Training set -0.1536735

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9993  
beta = 8e-04  
phi = 0.98

Initial states:

l = 1029.4636  
b = 1.1451

sigma: 0.1696

	AIC	AICc	BIC
	278.8578	286.4941	284.2000

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-18.69644	489.6492	381.4903	-2.309285	13.21932	0.9014545

ACF1

Training set -0.1601607

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.3599  
beta = 1e-04

Initial states:

l = 995.5191  
b = 243.083

sigma: 516.5889

```

      AIC      AICc      BIC
282.4039 287.4039 286.8558

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 12.8552 455.5885 353.2595 -4.363419 13.47219 0.8347457 0.06387276
Damped Holt's method

```

Call:

```

holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

```

Smoothing parameters:

```

alpha = 0.517
beta  = 1e-04
phi   = 0.9798

```

Initial states:

```

l = 834.2456
b = 332.6738

```

sigma: 551.9232

```

      AIC      AICc      BIC
285.4518 293.0882 290.7940

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -19.23271 469.0445 347.4717 -5.265232 12.92803 0.8210693
              ACF1
Training set 0.02343713
Holt's method with exponential trend

```

Call:

```

holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

```

Smoothing parameters:

```

alpha = 0.7451
beta  = 0.2047

```

Initial states:

```

l = 939.3
b = 1.2659

```

sigma: 0.1571

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -131.3688 539.1514 411.0626 -7.559835 14.51428 0.9713334
              ACF1
Training set -0.03315038
ETS(A,N,N)

```

Call:

```

ets(y = ts_series, model = "ANN")

```

Smoothing parameters:

```

alpha = 0.8088

```

Initial states:

l = 3520.6205

sigma: 1937.12

AIC	AICc	BIC
328.3891	330.1034	331.0602

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	50.95178	1826.334	1420.047	-29.46395	55.36585	0.9974005

ACF1

Training set -0.02772949

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

alpha = 0.345

Initial states:

l = 2779.4687

sigma: 0.4965

AIC	AICc	BIC
329.4175	331.1318	332.0887

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	470.9685	1957.063	1515.708	-19.30108	53.08068	1.06459	0.2923242

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.0255

beta = 1e-04

Initial states:

l = 3647.1853

b = 167.3721

sigma: 2108.086

AIC	AICc	BIC
333.0303	338.0303	337.4822

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-431.0408	1859.157	1296.174	-51.2277	61.59008	0.9103957	0.4076254

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.8031
beta  = 1e-04
phi   = 0.9012
```

Initial states:

```
l = 3647.0308
b = 178.3101
```

sigma: 2148.39

```
      AIC      AICc      BIC
334.3781 342.0145 339.7204
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -51.04117 1825.78 1416.877 -32.51002 55.99685 0.9951743
```

ACF1

Training set -0.0211491

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 3772.3521
b = 135.6102
```

sigma: 0.3864

```
      AIC      AICc      BIC
329.9438 334.9438 334.3957
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -379.6983 1843.845 1298.226 -49.95431 61.04696 0.9118374
```

ACF1

Training set 0.4278856

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9748
```

Initial states:

```
l = 3647.3444
b = 178.9996
```

sigma: 0.3992

```
      AIC      AICc      BIC
```

331.9712 339.6075 337.3134

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-409.9116	1853.054	1297.667	-51.12206	61.72805	0.9114447

ACF1

Training set 0.4324573

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 3647.662

b = 1.0312

sigma: 0.3817

AIC	AICc	BIC
328.5948	333.5948	333.0467

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-268.0965	1804.691	1237.78	-46.02796	58.16078	0.8693816	0.4034211

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.98

Initial states:

l = 3647.5515

b = 1.026

sigma: 0.4492

AIC	AICc	BIC
332.3063	339.9427	337.6486

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	135.1241	1859.894	1299.069	-34.96574	54.05557	0.9124295	0.4681116

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.0255

beta = 1e-04

```

Initial states:
  l = 3647.1852
  b = 167.3722

sigma: 2108.086

      AIC      AICc      BIC
333.0303 338.0303 337.4822

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -430.9764 1859.157 1296.171 -51.22576 61.58902 0.9103939
              ACF1
Training set 0.4076273
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
  alpha = 0.8027
  beta  = 1e-04
  phi   = 0.9014

Initial states:
  l = 3647.0308
  b = 178.3112

sigma: 2148.39

      AIC      AICc      BIC
334.3781 342.0145 339.7204

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -51.11091 1825.78 1417.001 -32.51044 55.99612 0.9952613
              ACF1
Training set -0.02081867
Holt's method with exponential trend

Call:
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:
  alpha = 0
  beta  = 0

Initial states:
  l = 3326.29
  b = 1.042

sigma: 0.3212
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -355.1371 1797.88 1197.938 -47.69182 58.45349 0.8413975 0.357864
ETS(A,N,N)

```

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2933.5295
```

```
sigma: 1633.363
```

```

      AIC      AICc      BIC
322.2489 323.9631 324.9200
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 108.9467 1539.949 1092.415 -2.112284 25.39934 0.9872973
```

```
ACF1
```

```
Training set 0.09508484
```

```
ETS(M,N,N)
```

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.837
```

Initial states:

```
l = 1848.4943
```

```
sigma: 0.3613
```

```

      AIC      AICc      BIC
313.8922 315.6065 316.5633
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 195.2037 1555.358 1072.357 0.7821623 23.91712 0.9691687 0.1788471
```

```
ETS(A,A,N)
```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.0048
```

```
beta  = 0.0048
```

Initial states:

```
l = 2241.2076
```

```
b = 257.3435
```

```
sigma: 1738.936
```

```

      AIC      AICc      BIC
326.1001 331.1001 330.5519
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
```



```
Training set -333.1811 1533.597 1196.426 -19.777 30.60384 1.0813 0.457015
ETS(A,Ad,N)
```

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.9381
```

Initial states:

```
l = 2241.8141
b = 295.5948
```

sigma: 1787.368

```
      AIC      AICc      BIC
327.7551 335.3914 333.0973
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -22.69701 1518.97 1067.979 -5.729564 24.8385 0.9652127 0.08720253
ETS(M,A,N)
```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.827
beta  = 5e-04
```

Initial states:

```
l = 2183.3069
b = 298.4343
```

sigma: 0.3317

```
      AIC      AICc      BIC
316.4440 321.4440 320.8959
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -181.1366 1557.185 1086.233 -10.52218 26.10998 0.9817102
              ACF1
Training set 0.1861188
ETS(M,Ad,N)
```

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.8045
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 2241.758
```

b = 220.0797

sigma: 0.3605

AIC	AICc	BIC
318.9226	326.5590	324.2648

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-48.19647	1550.067	1082.315	-7.126332	25.3376	0.9781688	0.1964986

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 2247.05

b = 1.0659

sigma: 0.3221

AIC	AICc	BIC
316.3471	321.3471	320.7989

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-146.385	1511.577	1107.723	-13.10751	26.87511	1.001132	0.4284866

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8172

beta = 1e-04

phi = 0.98

Initial states:

l = 2247.301

b = 1.0887

sigma: 0.3544

AIC	AICc	BIC
319.0101	326.6465	324.3524

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-173.0106	1616.999	1107.87	-9.447104	26.22078	1.001265	0.2051232

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

## Smoothing parameters:

alpha = 0.0283

beta = 1e-04

## Initial states:

l = 2274.4243

b = 239.8945

sigma: 1729.528

AIC AICc BIC

325.9048 330.9048 330.3566

## Training set error measures:

ME RMSE MAE MPE MAPE MASE ACF1

Training set -259.7819 1525.3 1154.079 -17.83443 29.19821 1.043027 0.4522824

Damped Holt's method

## Call:

holt(y = ts\_series, h = h, damped = TRUE, initial = "optimal")

## Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.938

## Initial states:

l = 2241.8141

b = 295.5947

sigma: 1787.368

AIC AICc BIC

327.7551 335.3914 333.0973

## Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set -22.66722 1518.97 1067.979 -5.728797 24.83834 0.9652124

ACF1

Training set 0.08720254

Holt's method with exponential trend

## Call:

holt(y = ts\_series, h = h, initial = "simple", exponential = TRUE)

## Smoothing parameters:

alpha = 1

beta = 0.0053

## Initial states:

l = 2080.5

b = 0.9084

sigma: 0.4108

## Training set error measures:

ME RMSE MAE MPE MAPE MASE ACF1

Training set 483.3136 1544.946 1057.464 8.439356 22.73094 0.9557095 0.09152516

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 4109.9811
```

```
sigma: 1564.477
```

```

      AIC      AICc      BIC
320.6977 322.4119 323.3688
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 0.1493575 1475.003 1104.931 -49.44842 69.4211 0.8534614 0.3095124
ETS(M,N,N)
```

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 4144.9536
```

```
sigma: 0.3775
```

```

      AIC      AICc      BIC
320.7066 322.4209 323.3778
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -34.79342 1475.409 1097.161 -50.71878 69.82205 0.8474593
              ACF1
Training set 0.3095089
ETS(A,A,N)
```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 6e-04
```

```
beta = 6e-04
```

Initial states:

```
l = 4624.7197
```

```
b = -58.7585
```

```
sigma: 1618.606
```

```

      AIC      AICc      BIC
323.5186 328.5186 327.9704
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	41.28267	1427.477	1092.18	-45.53683	65.97038	0.8436124	0.2715571

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.0286

beta = 0.0286

phi = 0.9791

Initial states:

l = 4602.9715

b = 32.7892

sigma: 1816.427

	AIC	AICc	BIC
	328.3357	335.9720	333.6779

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-378.1483	1543.666	1147.141	-64.77719	78.12864	0.8860645

ACF1

Training set 0.3040997

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.0299

beta = 0.0299

Initial states:

l = 4397.2218

b = 32.2363

sigma: 0.3909

	AIC	AICc	BIC
	326.2705	331.2705	330.7224

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-364.7483	1563.257	1146.8	-65.58496	79.20171	0.8858009	0.3220946

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.0362

beta = 1e-04

phi = 0.8003

Initial states:

l = 4395.3838

b = 32.5494

sigma: 0.4012

AIC	AICc	BIC
327.7965	335.4329	333.1387

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-349.9611	1528.597	1116.036	-63.01619	76.35917	0.8620385

ACF1

Training set 0.3036678

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 4394.9446

b = 0.9933

sigma: 0.4048

AIC	AICc	BIC
324.6295	329.6295	329.0814

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-16.00023	1444.409	1081.123	-48.86035	67.9226	0.835072	0.2861773

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.0021

beta = 1e-04

phi = 0.98

Initial states:

l = 4394.9538

b = 0.9925

sigma: 0.4199

AIC	AICc	BIC
326.6802	334.3165	332.0224

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-22.91173	1449.045	1083.133	-49.23945	68.20324	0.8366241

ACF1

Training set 0.2881827

## Holt's method

## Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

## Smoothing parameters:

```
alpha = 6e-04
```

```
beta = 6e-04
```

## Initial states:

```
l = 4624.7545
```

```
b = -58.6888
```

```
sigma: 1618.606
```

```
      AIC      AICc      BIC
323.5186 328.5186 327.9704
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	40.60269	1427.476	1092.079	-45.56436	65.98211	0.8435343	0.2715748

Damped Holt's method

## Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

## Smoothing parameters:

```
alpha = 0.0286
```

```
beta = 0.0286
```

```
phi = 0.98
```

## Initial states:

```
l = 4602.9754
```

```
b = 32.8209
```

```
sigma: 1816.412
```

```
      AIC      AICc      BIC
328.3354 335.9717 333.6776
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-378.1914	1543.653	1147.212	-64.78098	78.13328	0.8861192	0.304104

Holt's method with exponential trend

## Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

## Smoothing parameters:

```
alpha = 0.6654
```

```
beta = 0.1151
```

## Initial states:

```
l = 3757
```

```
b = 1.1206
```

```
sigma: 0.4092
```

## Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE      MASE
Training set -632.0539 1812.611 1308.782 -70.60269 85.29476 1.010918
                ACF1
Training set 0.02342313
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
alpha = 1e-04

Initial states:
l = 2911.4913

sigma: 879.5845

                AIC      AICc      BIC
299.9668 301.6811 302.6379

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE
Training set 0.1752451 829.2803 536.2062 -19.49234 32.98881 0.8105654
                ACF1
Training set 0.1415065
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
alpha = 1e-04

Initial states:
l = 2912.0062

sigma: 0.302

                AIC      AICc      BIC
299.9653 301.6796 302.6364

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE
Training set -0.3390976 829.2801 536.206 -19.51344 32.99463 0.8105652
                ACF1
Training set 0.1415064
ETS(A,A,N)

Call:
ets(y = ts_series, model = "AAN")

Smoothing parameters:
alpha = 8e-04
beta = 1e-04

Initial states:
l = 2830.1442
b = 4.1288

```



sigma: 944.0982

AIC	AICc	BIC
304.1113	309.1113	308.5632

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	41.43935	832.6164	534.4474	-18.02267	32.74675	0.8079067	0.1478178

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8
```

Initial states:

```
l = 2841.1352
b = 51.4451
```

sigma: 979.7151

AIC	AICc	BIC
306.1105	313.7469	311.4527

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-90.194	832.5978	527.4618	-23.43232	34.07349	0.7973468	0.1422865

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 2617.7386
b = 34.1678
```

sigma: 0.3106

AIC	AICc	BIC
302.8797	307.8797	307.3316

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-31.30432	860.7906	529.5549	-22.479	35.336	0.8005109	0.2131338

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9331
```

Initial states:

```
l = 2624.5654
b = 52.9116
```

sigma: 0.3202

```
      AIC      AICc      BIC
304.8202 312.4566 310.1624
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -43.79553 845.2198 515.8371 -22.44391 34.37493 0.7797741
```

ACF1

Training set 0.1808125

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 2622.914
b = 1.0119
```

sigma: 0.3112

```
      AIC      AICc      BIC
302.9189 307.9189 307.3708
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -28.40583 863.1225 532.3652 -22.43343 35.47377 0.8047591
```

ACF1

Training set 0.2178281

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.013
beta  = 1e-04
phi   = 0.9006
```

Initial states:

```
l = 2624.8192
b = 1.0225
```

sigma: 0.3206

```
      AIC      AICc      BIC
```

304.8972 312.5336 310.2395

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-46.25537	845.4863	517.849	-22.47855	34.37495	0.7828155	0.1691676

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 2830.4642
b = 4.4133
```

sigma: 943.7556

AIC	AICc	BIC
304.0983	309.0983	308.5501

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	39.0004	832.3142	533.7079	-18.12515	32.75436	0.8067889	0.1482092

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8
```

Initial states:

```
l = 2841.1352
b = 51.4451
```

sigma: 979.715

AIC	AICc	BIC
306.1105	313.7469	311.4527

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-90.19408	832.5977	527.4617	-23.43232	34.07348	0.7973467

Training set 0.1422864

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.0539
beta  = 1
```

```

Initial states:
  l = 2644.66
  b = 1.0335

sigma: 0.2711
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -284.7241 936.2171 573.7696 -33.14457 39.7947 0.8673487 0.1590063
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 360.303

sigma: 482.623

      AIC      AICc      BIC
278.3591 280.0734 281.0302

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 353.4832 455.0213 353.4832 14.88528 14.88528 0.9445837 0.7625513
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

Smoothing parameters:
  alpha = 0.9999

Initial states:
  l = 348.4891

sigma: 0.1995

      AIC      AICc      BIC
258.1626 259.8769 260.8338

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 354.1396 455.0304 354.1396 15.06725 15.06725 0.9463376 0.7646899
ETS(A,A,N)

Call:
ets(y = ts_series, model = "AAN")

Smoothing parameters:
  alpha = 0.9994
  beta  = 0.9994

Initial states:
  l = 305.3634

```

b = -11.4731

sigma: 122.3699

AIC	AICc	BIC
230.5568	235.5568	235.0086

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	53.95772	107.9201	77.00959	3.332828	4.635935	0.2057863	0.05084454

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.9999

phi = 0.98

Initial states:

l = 24.5212

b = 184.5426

sigma: 154.0509

AIC	AICc	BIC
239.5113	247.1476	244.8535

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	49.619	130.9181	97.77785	1.440741	9.066581	0.2612836	-0.04383742

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.9999

Initial states:

l = 234.5373

b = 162.2274

sigma: 0.0664

AIC	AICc	BIC
225.7174	230.7174	230.1693

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	44.27479	107.6175	76.95648	0.8444011	4.548827	0.2056444	0.106669

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.9409  
 beta = 0.9409  
 phi = 0.8

## Initial states:

l = -73.7664  
 b = 474.1957

sigma: 0.1392

	AIC	AICc	BIC
	252.3374	259.9738	257.6797

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	103.2533	180.0919	136.4754	1.920105	8.868557	0.3646919	0.4157666

ETS(M,Md,N)

## Call:

```
ets(y = ts_series, model = "MMN")
```

## Smoothing parameters:

alpha = 0.9701  
 beta = 0.97  
 phi = 0.8

## Initial states:

l = 112.5792  
 b = 4.13

sigma: 0.1577

	AIC	AICc	BIC
	258.3117	265.9481	263.6539

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	43.92638	170.3474	112.2155	-3.26697	9.658526	0.2998642	0.1884371

ETS(M,Md,N)

## Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.9701  
 beta = 0.97  
 phi = 0.8

## Initial states:

l = 112.5792  
 b = 4.13

sigma: 0.1577

	AIC	AICc	BIC
	258.3117	265.9481	263.6539

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	43.92638	170.3474	112.2155	-3.26697	9.658526	0.2998642	0.1884371

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.8848
beta = 0.8848
```

Initial states:

```
l = 140.9233
b = 102.4924
```

sigma: 138.7519

	AIC	AICc	BIC
	235.0798	240.0798	239.5316

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	54.76521	122.3677	90.51088	2.285588	6.516318	0.2418647	0.1156821

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 0.9999
phi = 0.98
```

Initial states:

```
l = 24.5212
b = 184.5427
```

sigma: 154.0509

	AIC	AICc	BIC
	239.5113	247.1477	244.8535

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	49.61906	130.9181	97.77785	1.440743	9.06657	0.2612836	-0.04383577

optimization difficulties: ERROR: ABNORMAL\_TERMINATION\_IN\_LNSRCH

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta = 0.1296
```

Initial states:

```
l = 360.7
b = 1.2094
```

sigma: 0.0551

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-19.25787	82.02361	61.7953	-1.311653	4.010245	0.1651304

ACF1

Training set 0.06919284

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2247.2245
```

sigma: 590.0783

	AIC	AICc	BIC
	285.5958	287.3101	288.2669

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	371.9376	556.3311	422.752	7.002758	7.804702	0.9446847

ACF1

Training set -0.009992006

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2208.0665
```

sigma: 0.145

	AIC	AICc	BIC
	290.5329	292.2472	293.2040

Training set error measures:



	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	374.114	556.4143	424.9282	7.099522	7.901464	0.9495478	-0.00536886

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.9963

beta = 1e-04

Initial states:

l = 1659.2872

b = 388.3821

sigma: 461.2287

	AIC	AICc	BIC
	278.3232	283.3232	282.7751

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	16.16688	406.7655	300.8791	-0.04843744	6.4244	0.6723466	

Training set 0.06472688

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9998

beta = 1e-04

phi = 0.98

Initial states:

l = 1618.708

b = 488.7339

sigma: 481.1355

	AIC	AICc	BIC
	280.5105	288.1468	285.8527

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	1.245776	408.8866	306.7557	-0.7259773	6.512798	0.6854785	

Training set 0.07053678

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

```

Initial states:
  l = 1781.5397
  b = 395.4387

sigma: 0.0998

      AIC      AICc      BIC
281.5344 286.5344 285.9862

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 2.336363 404.2283 293.3085 -0.5033513 6.110044 0.6554294
              ACF1
Training set 0.04751172
ETS(M,Ad,N)

Call:
ets(y = ts_series, model = "MAN", damped = TRUE)

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04
  phi   = 0.98

Initial states:
  l = 1736.173
  b = 439.872

sigma: 0.1049

      AIC      AICc      BIC
283.8360 291.4724 289.1783

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 35.23337 408.4368 302.0321 -0.08880542 6.236923 0.6749233
              ACF1
Training set 0.05784299
ETS(M,M,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04

Initial states:
  l = 1860.9037
  b = 1.0961

sigma: 0.1125

      AIC      AICc      BIC
285.9700 290.9700 290.4218

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE

```

```
Training set -100.3261 478.5127 348.9508 -0.8877551 7.044831 0.779768
```

```
ACF1
```

```
Training set 0.2120466
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
phi = 0.9186
```

```
Initial states:
```

```
l = 1851.6807
```

```
b = 1.207
```

```
sigma: 0.1075
```

```
AIC AICc BIC
```

```
285.0161 292.6524 290.3583
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set -15.0539 418.9278 309.0232 -0.876071 6.445728 0.6905456
```

```
ACF1
```

```
Training set 0.02749681
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9963
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 1659.3235
```

```
b = 388.3592
```

```
sigma: 461.2287
```

```
AIC AICc BIC
```

```
278.3232 283.3232 282.7751
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set 16.18786 406.7655 300.8797 -0.04802516 6.424351 0.672348
```

```
ACF1
```

```
Training set 0.06472531
```

```
Damped Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.9998
```

```
beta = 1e-04
```

```

phi = 0.98

Initial states:
l = 1618.7013
b = 488.7381

sigma: 481.1352

      AIC      AICc      BIC
280.5104 288.1468 285.8527

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 1.223626 408.8863 306.756 -0.7263793 6.512862 0.6854792
              ACF1
Training set 0.07054431
Holt's method with exponential trend

Call:
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:
alpha = 1
beta = 0.3309

Initial states:
l = 2248.7
b = 1.3301

sigma: 0.1189
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -202.2913 560.8282 446.351 -5.280808 9.968514 0.9974193
              ACF1
Training set -0.0678556
ETS(A,N,N)

Call:
ets(y = ts_series, model = "ANN")

Smoothing parameters:
alpha = 0.5731

Initial states:
l = 4229.5277

sigma: 1634.226

      AIC      AICc      BIC
322.2679 323.9822 324.9390

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 50.93656 1540.763 848.229 -16.89193 31.71236 0.8917104 0.00138026
ETS(M,N,N)

Call:
ets(y = ts_series, model = "MNN")

```

Smoothing parameters:

alpha = 0.4586

Initial states:

l = 3954.8393

sigma: 0.2505

	AIC	AICc	BIC
	315.0310	316.7453	317.7021

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	120.3985	1555.226	893.4393	-15.93232	32.46538	0.9392382	0.1231027

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

alpha = 0.5687

beta = 1e-04

Initial states:

l = 3668.5227

b = 48.4911

sigma: 1751.932

	AIC	AICc	BIC
	326.3681	331.3681	330.8200

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	24.45742	1545.059	835.1226	-17.31556	31.88045	0.8779321

ACF1

Training set	0.007300988
--------------	-------------

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.525

beta = 1e-04

phi = 0.8724

Initial states:

l = 3505.6668

b = 335.4297

sigma: 1795.771

	AIC	AICc	BIC
	327.9239	335.5603	333.2662

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-80.0416	1526.112	803.6196	-19.66463	31.45706	0.8448142

ACF1

Training set 0.01720037

ETS(M,A,N)

Call:

ets(y = ts\_series, model = "MAN")

Smoothing parameters:

alpha = 0.4944

beta = 1e-04

Initial states:

l = 3767.4658

b = 304.2207

sigma: 0.2444

	AIC	AICc	BIC
	319.3894	324.3894	323.8413

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-456.0977	1618.717	800.5716	-27.73227	33.23032	0.84161	0.08737393

ETS(M,Ad,N)

Call:

ets(y = ts\_series, model = "MAN", damped = TRUE)

Smoothing parameters:

alpha = 0.4079

beta = 1e-04

phi = 0.9115

Initial states:

l = 3339.006

b = 335.4453

sigma: 0.2596

	AIC	AICc	BIC
	320.2906	327.9270	325.6328

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-130.2454	1541.65	776.156	-21.11425	31.36297	0.8159429	0.1361224

ETS(M,M,N)

Call:

ets(y = ts\_series, model = "MMN")

Smoothing parameters:

alpha = 0.448

beta = 1e-04

Initial states:

l = 3537.6708

b = 1.0261

sigma: 0.2537

AIC	AICc	BIC
318.4873	323.4873	322.9391

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-123.7728	1601.723	789.746	-21.04747	32.23463	0.8302294	0.163567

ETS(M,Md,N)

Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4138

beta = 1e-04

phi = 0.9032

Initial states:

l = 3442.7866

b = 1.0671

sigma: 0.2605

AIC	AICc	BIC
320.2269	327.8632	325.5691

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-112.3852	1553.316	773.1369	-20.73222	31.36197	0.8127689

ACF1

Training set 0.1435503

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 0.5695

beta = 1e-04

Initial states:

l = 3668.3235

b = 48.7824

sigma: 1751.931

AIC	AICc	BIC
326.3681	331.3681	330.8199

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	23.85668	1545.058	834.8727	-17.32445	31.87712	0.8776694

ACF1

Training set 0.006458206

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.5244
beta  = 1e-04
phi   = 0.8723
```

Initial states:

```
l = 3505.6664
b = 335.4298
```

sigma: 1795.771

```
      AIC      AICc      BIC
327.9239 335.5603 333.2661
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-79.94129	1526.112	803.6086	-19.6653	31.4569	0.8448026	0.01784412

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.3488
beta  = 1
```

Initial states:

```
l = 4308.15
b = 0.9278
```

sigma: 0.2589

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-297.995	1535.55	917.3748	-20.23888	31.79342	0.9644007	-0.1216524

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2136.2129
```

sigma: 629.8042

```
      AIC      AICc      BIC
287.9413 289.6556 290.6124
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	170.5375	593.7851	491.7851	2.481645	16.49346	1.069577	0.4179567

ETS(M,N,N)



Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 0.9999
```

Initial states:

```
l = 2136.2129
```

```
sigma: 0.2026
```

	AIC	AICc	BIC
	287.6692	289.3835	290.3403

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	170.5375	593.7851	491.7851	2.481645	16.49346	1.069577	0.4179567

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.9251
```

```
beta = 0.7566
```

Initial states:

```
l = 697.7268
```

```
b = 465.7027
```

```
sigma: 463.1689
```

	AIC	AICc	BIC
	278.4743	283.4743	282.9262

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-83.45666	408.4766	325.7621	-2.160133	8.464448	0.7084955

ACF1

Training set 0.001266241

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9647
```

```
beta = 0.7811
```

```
phi = 0.8112
```

Initial states:

```
l = 541.9549
```

```
b = 346.0307
```

```
sigma: 471.2797
```

	AIC	AICc	BIC
--	-----	------	-----

279.7654 287.4017 285.1076

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	4.103021	400.5107	319.6197	1.416572	9.097607	0.6951366

ACF1

Training set -0.002173658

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

alpha = 0.8994

beta = 0.8994

Initial states:

l = 1013.2971

b = 58.494

sigma: 0.0875

	AIC	AICc	BIC
	260.6143	265.6143	265.0662

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-48.2872	404.2068	307.102	0.2962913	6.65603	0.667912	-0.1011123

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.98

Initial states:

l = 538.3269

b = 344.5348

sigma: 0.1434

	AIC	AICc	BIC
	279.3551	286.9914	284.6973

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-26.68571	485.4718	366.1222	-0.9679763	9.551393	0.7962742

ACF1

Training set 0.4807513

ETS(M,M,N)

Call:

```
ets(y = ts_series, model = "MMN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.9784
```

## Initial states:

```
l = 673.7601
b = 1.6106
```

```
sigma: 0.1252
```

```
      AIC      AICc      BIC
274.9823 279.9823 279.4342
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -153.6962 482.9666 343.102 -4.381134 9.364142 0.7462079
```

## ACF1

```
Training set -0.2128574
```

```
ETS(M,Md,N)
```

## Call:

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 0.9932
phi   = 0.8007
```

## Initial states:

```
l = 674.4614
b = 1.8249
```

```
sigma: 0.1173
```

```
      AIC      AICc      BIC
272.4126 280.0490 277.7548
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -68.14802 421.4572 314.7014 -1.651351 8.253723 0.6844398
```

## ACF1

```
Training set -0.1689919
```

```
Holt's method
```

## Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

## Smoothing parameters:

```
alpha = 0.925
beta  = 0.7566
```

## Initial states:

```
l = 697.5543
b = 465.571
```

```
sigma: 463.1689
```

```
      AIC      AICc      BIC
278.4743 283.4743 282.9262
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-83.44376	408.4766	325.7642	-2.15908	8.463975	0.7085001

ACF1

Training set 0.001287283

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

```
alpha = 0.822
beta  = 0.822
phi   = 0.8203
```

Initial states:

```
l = 539.9137
b = 348.1189
```

sigma: 468.8048

AIC	AICc	BIC
279.5758	287.2122	284.9180

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	0.1209805	398.4075	329.206	1.30989	9.493263	0.7159856	0.05555083

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1
beta  = 0
```

Initial states:

```
l = 1101
b = 1.0886
```

sigma: 0.1094

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-95.4102	576.8901	403.8139	-0.4682642	8.873338	0.8782494	0.579953

ETS(A,N,N)

Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 6324.952
```

sigma: 1185.136

```

      AIC      AICc      BIC
310.7007 312.4149 313.3718

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 0.09802926 1117.357 717.3372 -6.471216 16.46023 0.7068386

```

ACF1

Training set -0.1745726

ETS(M,N,N)

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 6325.2978
```

```
sigma: 0.1874
```

```

      AIC      AICc      BIC
310.6993 312.4135 313.3704

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -0.2475851 1117.357 717.2606 -6.477035 16.45992 0.7067631

```

ACF1

Training set -0.1745727

ETS(A,A,N)

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 0.0386
```

```
beta = 0.0386
```

Initial states:

```
l = 6267.6653
```

```
b = 86.3962
```

```
sigma: 1350.889
```

```

      AIC      AICc      BIC
317.0097 322.0097 321.4615

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -302.0488 1191.372 689.0254 -11.85008 17.14896 0.6789411

```

ACF1

Training set -0.1798092

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8001
```

Initial states:

```
l = 6176.0539
b = 84.6168
```

sigma: 1316.006

```
      AIC      AICc      BIC
316.7339 324.3703 322.0762
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -115.5572 1118.39 674.0311 -8.456969 16.1675 0.6641663 -0.1776457
ETS(M,A,N)
```

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.0263
beta  = 1e-04
```

Initial states:

```
l = 5923.639
b = 40.5566
```

sigma: 0.1986

```
      AIC      AICc      BIC
314.4934 319.4934 318.9453
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -20.83957 1163.3 714.1209 -7.223339 17.00043 0.7036693 -0.1025911
ETS(M,Ad,N)
```

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8914
```

Initial states:

```
l = 5901.7288
b = 86.4282
```

sigma: 0.2041

```
      AIC      AICc      BIC
316.0525 323.6889 321.3947
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set -3.870659 1123.903 689.8989 -6.688945 16.29797 0.6798018
```

```
ACF1
```

```
Training set -0.1499062
```

```
ETS(M,M,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 5901.6931
```

```
b = 1.0069
```

```
sigma: 0.1995
```

```
AIC AICc BIC
```

```
314.4057 319.4057 318.8576
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set 22.39246 1153.777 724.1285 -6.434332 16.97715 0.7135305
```

```
ACF1
```

```
Training set -0.09253257
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = ts_series, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 5e-04
```

```
beta = 3e-04
```

```
phi = 0.8085
```

```
Initial states:
```

```
l = 5903.1596
```

```
b = 1.0231
```

```
sigma: 0.2027
```

```
AIC AICc BIC
```

```
315.9922 323.6285 321.3344
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set -36.60832 1114.357 671.7901 -7.169238 16.0119 0.6619581
```

```
ACF1
```

```
Training set -0.1713032
```

```
Holt's method
```

```
Call:
```

```
holt(y = ts_series, h = h, initial = "optimal")
```

```
Smoothing parameters:
```

```
alpha = 0.0387
```

```
beta = 0.0387
```

```

Initial states:
  l = 6267.6634
  b = 86.3985

sigma: 1350.888

      AIC      AICc      BIC
317.0097 322.0097 321.4615

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -301.9307 1191.372 689.0329 -11.84825 17.14891 0.6789486
              ACF1
Training set -0.1798222
Damped Holt's method

Call:
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04
  phi   = 0.8001

Initial states:
  l = 6176.0539
  b = 84.6168

sigma: 1316.006

      AIC      AICc      BIC
316.7339 324.3703 322.0762

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set -115.5572 1118.39 674.0311 -8.45697 16.1675 0.6641663 -0.1776457
Holt's method with exponential trend

Call:
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)

Smoothing parameters:
  alpha = 0
  beta  = 0

Initial states:
  l = 5631
  b = 1.0105

sigma: 0.1811
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 98.86469 1191.966 761.0261 -5.320104 17.59678 0.7498881
              ACF1
Training set -0.03022133
ETS(A,N,N)

```



Call:

```
ets(y = ts_series, model = "ANN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 5489.9775
```

```
sigma: 658.3261
```

```
      AIC      AICc      BIC
289.5358 291.2501 292.2069
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 0.3849455 620.6758 416.2785 -1.569501 8.506258 0.742255
```

```
      ACF1
```

```
Training set 0.09811998
```

```
ETS(M,N,N)
```

Call:

```
ets(y = ts_series, model = "MNN")
```

Smoothing parameters:

```
alpha = 1e-04
```

Initial states:

```
l = 5490.5243
```

```
sigma: 0.1199
```

```
      AIC      AICc      BIC
289.5351 291.2494 292.2063
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -0.1623979 620.6761 416.0355 -1.579628 8.502683 0.7418218
```

```
      ACF1
```

```
Training set 0.09811978
```

```
ETS(A,A,N)
```

Call:

```
ets(y = ts_series, model = "AAN")
```

Smoothing parameters:

```
alpha = 6e-04
```

```
beta  = 6e-04
```

Initial states:

```
l = 6051.6934
```

```
b = -50.3115
```

```
sigma: 703.3941
```

```
      AIC      AICc      BIC
293.5161 298.5161 297.9679
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-77.2224	620.3353	482.3378	-2.868462	9.820872	0.8600437	0.0572451

ETS(A,Ad,N)

Call:

```
ets(y = ts_series, model = "AAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0049
beta  = 0.0049
phi   = 0.98
```

Initial states:

```
l = 6024.3371
b = -43.7392
```

sigma: 734.4489

AIC	AICc	BIC
295.7374	303.3738	301.0797

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-120.9553	624.1616	455.4053	-3.709345	9.402388	0.8120211

ACF1

Training set 0.04760233

ETS(M,A,N)

Call:

```
ets(y = ts_series, model = "MAN")
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
```

Initial states:

```
l = 6067.2481
b = -51.0175
```

sigma: 0.127

AIC	AICc	BIC
293.7447	298.7447	298.1965

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-91.01539	621.7819	477.5646	-3.122298	9.753533	0.8515328

ACF1

Training set 0.05683066

ETS(M,Ad,N)

Call:

```
ets(y = ts_series, model = "MAN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0133
beta  = 0.0133
```

```

phi    = 0.98

Initial states:
  l = 6023.9382
  b = -30.9111

sigma:  0.1333

      AIC      AICc      BIC
296.4118 304.0482 301.7540

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -128.0354 637.2434 465.3179 -3.854598 9.623755 0.8296959
              ACF1
Training set 0.06372771
ETS(M,M,N)

Call:
ets(y = ts_series, model = "MMN")

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04

Initial states:
  l = 6025.1605
  b = 0.9914

sigma:  0.1263

      AIC      AICc      BIC
293.3894 298.3894 297.8412

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -64.77513 615.2277 480.8556 -2.643393 9.769148 0.8574008
              ACF1
Training set 0.05012513
ETS(M,Md,N)

Call:
ets(y = ts_series, model = "MMN", damped = TRUE)

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04
  phi   = 0.9767

Initial states:
  l = 6025.1316
  b = 0.9898

sigma:  0.1306

      AIC      AICc      BIC
295.1906 302.8270 300.5328

```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-53.29026	611.4955	481.5142	-2.433992	9.75133	0.8585752

ACF1

Training set 0.04453638

Holt's method

Call:

```
holt(y = ts_series, h = h, initial = "optimal")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 6052.6231

b = -50.9014

sigma: 702.8219

	AIC	AICc	BIC
	293.4868	298.4868	297.9386

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Training set	-77.5583	619.8307	481.7996	-2.873687	9.81031	0.859084	0.05657073

Damped Holt's method

Call:

```
holt(y = ts_series, h = h, damped = TRUE, initial = "optimal")
```

Smoothing parameters:

alpha = 0.0049

beta = 0.0049

phi = 0.98

Initial states:

l = 6024.337

b = -43.7391

sigma: 734.4489

	AIC	AICc	BIC
	295.7374	303.3738	301.0797

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-120.8658	624.1615	455.4526	-3.707682	9.403137	0.8121054

ACF1

Training set 0.04762638

Holt's method with exponential trend

Call:

```
holt(y = ts_series, h = h, initial = "simple", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.2577

beta = 0.1786

```

Initial states:
  l = 5585.65
  b = 0.9653

sigma: 0.1386
Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE      ACF1
Training set 220.4265 746.4832 607.8428 2.298514 11.90768 1.083828 0.07450255

```

Hide

```

#micro_mase_table<- micro_mase_table %>% na.omit()
model_table_micro<- model_table_micro%>% na.omit()

```

Hide

```

model_table_micro$mase_v<- model_table_micro$mase_v %>% as.numeric()
model_table_micro$aic_v<- model_table_micro$aic_v %>% as.numeric()
model_table_micro$p_val<- model_table_micro$p_val %>% as.numeric()
model_table_micro$count<- model_table_micro$count %>% as.numeric()
micro_model_summary<-model_table_micro %>% group_by(model) %>% summarise(mase_mean =
mean(mase_v), aic_mean=mean(aic_v), p_value_mean=mean(p_val),count=sum(count))

```

Hide

```

#Best model is fit_etsM_AN
micro_model_summary<- micro_model_summary %>% arrange(desc(count))
micro_model_summary[c(1,2,3,4),]

```

model <chr>	mase_mean <dbl>	aic_mean <dbl>	p_value_mean <dbl>	count <dbl>
fit_etsM_MN	0.7041992	279.7916	0.4443697	12
fit_etsM_AN	0.7014405	271.2392	0.5073185	8
fit_etsM_AN_damp	0.8172076	299.0738	0.2859968	8
fit_etsM_MN_damp	0.7552919	286.3974	0.3517054	8

4 rows

##Forecasting

Hide

```
``r
``r
micro_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1: nrow(data_year_micro)){

  a<- read_row(data_year_micro[i,])
  starting<- read_starting_time(data_year_micro[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting)
  a_5<- subset_5(a)
  best_model_micro = ets(a_95_ts, model=\MMN\)
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_micro,a_
5)
  micro_forecast_mase_table[nrow(micro_forecast_mase_table)+1 ,]=c(forecast_mase)}
```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9995

beta = 0.1676

Initial states:

l = 3246.9931

b = 574.9184

sigma: 0.0986

AIC	AICc	BIC
293.5184	298.5184	297.9703

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-84.5237	711.8016	529.1652	-1.280663	7.064583

	MASE	ACF1
Training set	0.7857857	0.3823437

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.1111

Initial states:

l = 1004.126

b = 398.4941

sigma: 0.169

AIC	AICc	BIC
286.8684	291.8684	291.3203

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-163.9525	638.5365	486.9137	-4.741919	13.36792

	MASE	ACF1
Training set	0.9556641	0.2566367

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.2474

beta = 0.2474

Initial states:

l = -58.7407

b = 103.7112

sigma: 0.3429

AIC	AICc	BIC
263.5044	268.5044	267.9563

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	364.8123	914.1963	413.2087	5.181325	19.37891	0.7427253

ACF1

Training set 0.2708645

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.5002

Initial states:

l = -139.2538

b = -195.1436

sigma: 0.4668

AIC	AICc	BIC
259.8390	264.8390	264.2909

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	75.75261	265.7854	170.6692	33.82409	43.988	0.738247

ACF1

Training set 0.1417443

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.7575

Initial states:

l = 274.195

b = 535.5597

sigma: 0.0816

AIC	AICc	BIC
262.0903	267.0903	266.5422

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	12.81831	220.1592	155.7645	-1.099816	4.913102

MASE ACF1

Training set 0.2965464 0.1654112



ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 5038.0269

b = -28.8516

sigma: 0.068

AIC	AICc	BIC
265.6109	270.6109	270.0628

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-15.1495	283.2341	231.4224	-0.6641364	4.902678

	MASE	ACF1
Training set	0.8751922	0.06826281

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.0021

beta = 1e-04

Initial states:

l = 1333.3194

b = 185.6962

sigma: 0.0662

AIC	AICc	BIC
247.2403	252.2403	251.6922

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-1.572739	203.7193	160.2853	-0.3731013	4.985499

	MASE	ACF1
Training set	0.6496956	0.285423

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 1382.5272

b = 378.1747

```

sigma: 0.1522

      AIC      AICc      BIC
292.8699 297.8699 297.3218

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 136.7786 714.2911 532.7296 -0.7550671 10.52514
              MASE      ACF1
Training set 1.007542 0.3369132
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\

Smoothing parameters:
alpha = 0.9998
beta  = 0.0037

Initial states:
l = 2913.7986
b = 360.1705

sigma: 0.0548

      AIC      AICc      BIC
266.6551 271.6551 271.1069

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -49.771 323.0549 273.7431 -0.6217925 4.138957 0.791036
              ACF1
Training set 0.09438549
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\

Smoothing parameters:
alpha = 0.9997
beta  = 3e-04

Initial states:
l = 1457.2556
b = 310.2821

sigma: 0.1118

      AIC      AICc      BIC
276.6821 281.6821 281.1340

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -0.2739143 534.1554 329.6998 -0.8205403 6.527125
              MASE      ACF1
Training set 0.7463474 0.1547857
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.997

beta = 0.079

Initial states:

l = 769.6578

b = 316.7824

sigma: 0.215

AIC	AICc	BIC
286.6933	291.6933	291.1452

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-116.6897	830.6572	476.5994	-5.805832	15.12441

	MASE	ACF1
Training set	0.9002733	0.1446519

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.7349

beta = 1e-04

Initial states:

l = 486.1635

b = 192.8212

sigma: 0.0877

AIC	AICc	BIC
245.2761	250.2761	249.7280

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	20.33929	184.5494	131.6055	0.1026113	5.830545

	MASE	ACF1
Training set	0.5357044	0.09869112

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9991

beta = 1e-04

Initial states:

l = 1176.7327

b = 334.6676

```

sigma: 0.0491

      AIC      AICc      BIC
246.5248 251.5248 250.9766

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 15.95333 188.8574 147.716 -0.1021675 3.507943
              MASE      ACF1
Training set 0.4103691 0.2493036
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\)

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04

Initial states:
l = 1994.1978
b = 482.2394

sigma: 0.0741

      AIC      AICc      BIC
275.6903 280.6903 280.1422

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -97.944 414.3803 329.9153 -1.57121 5.654194 0.7262078
              ACF1
Training set 0.3506757
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\)

Smoothing parameters:
alpha = 0.2074
beta  = 0.2074

Initial states:
l = 730.0023
b = 130.77

sigma: 0.0809

      AIC      AICc      BIC
244.1893 249.1893 248.6411

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 57.44586 170.9954 129.8219 2.078149 5.284385 0.5551125
              ACF1
Training set 0.1683523
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.3772

beta = 0.2724

Initial states:

l = 1017.5263

b = 164.7981

sigma: 0.0736

AIC	AICc	BIC
-----	------	-----

249.0349	254.0349	253.4868
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	82.70212	235.251	162.1327	1.89044	4.880797	0.5333477

ACF1

Training set -0.05642828

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.1511

Initial states:

l = 258.5598

b = 203.6419

sigma: 0.1163

AIC	AICc	BIC
-----	------	-----

252.2103	257.2103	256.6622
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	102.7128	252.9532	198.0448	1.239485	8.617191	0.5790564

ACF1

Training set 0.257542

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.8232

beta = 0.8232

Initial states:

l = 3576.266

b = 248.2856

sigma: 0.0799

```

      AIC      AICc      BIC
277.0225 282.0225 281.4744

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -41.56513 614.202 351.5678 -0.2418625 5.384869

```

```

           MASE      ACF1
Training set 0.7889034 -0.1397322

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

Initial states:

```
l = 1990.8103
```

```
b = 101.1472
```

```
sigma: 0.1055
```

```

      AIC      AICc      BIC
261.6124 266.6124 266.0642

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 10.29354 262.9785 185.0424 -0.3894993 6.734925

```

```

           MASE      ACF1
Training set 0.8425303 0.2279972

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

Initial states:

```
l = 3659.931
```

```
b = 376.1066
```

```
sigma: 0.0607
```

```

      AIC      AICc      BIC
273.0090 278.0090 277.4608

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -39.65778 325.7647 244.7979 -0.8367382 3.931289

```

```

           MASE      ACF1
Training set 0.6388059 0.3809817

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.1757
```

```
Initial states:
```

```
l = 1077.2373
```

```
b = 305.7013
```

```
sigma: 0.0719
```

```
AIC      AICc      BIC
```

```
254.6613 259.6613 259.1132
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -62.2812 253.7083 176.25 -1.576204 5.134284 0.6398388
```

```
ACF1
```

```
Training set 0.1580997
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 0.0133
```

```
beta = 0.0133
```

```
Initial states:
```

```
l = 1316.8028
```

```
b = 98.7152
```

```
sigma: 0.2431
```

```
AIC      AICc      BIC
```

```
281.3526 286.3526 285.8044
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -105.0387 452.472 369.7862 -11.87175 21.70875 1.102359
```

```
ACF1
```

```
Training set 0.2601386
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 0.2458
```

```
beta = 0.101
```

```
Initial states:
```

```
l = 1257.9904
```

```
b = 353.0626
```

```
sigma: 0.2352
```

```

      AIC      AICc      BIC
299.5079 304.5079 303.9598

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -238.5007 807.6535 620.9178 -9.609108 19.02932

```

```

              MASE      ACF1
Training set 0.7888619 -0.02076798

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```

alpha = 0.726
beta  = 1e-04

```

Initial states:

```

l = 1363.7188
b = 121.8555

```

sigma: 0.1184

```

      AIC      AICc      BIC
258.7450 263.7450 263.1969

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -11.29984 266.7335 196.1362 -1.592275 8.430237

```

```

              MASE      ACF1
Training set 0.7682222 -0.1018784

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 1e-04

```

Initial states:

```

l = 4088.9499
b = 198.2914

```

sigma: 0.1241

```

      AIC      AICc      BIC
293.1262 298.1262 297.5781

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 67.29339 667.005 544.994 0.06356397 9.12051 0.9246406

```

```

              ACF1
Training set -0.06814321

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```



## Smoothing parameters:

alpha = 0.9999  
beta = 1e-04

## Initial states:

l = 1537.1087  
b = 83.652

sigma: 0.1994

	AIC	AICc	BIC
	266.5032	271.5032	270.9550

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-77.85377	248.9267	196.5183	-6.457845	13.29998	1.0648

ACF1

Training set 0.265669

ETS(M,A,N)

## Call:

ets(y = a\_95\_ts, model = \MAN\)

## Smoothing parameters:

alpha = 0.9999  
beta = 0.177

## Initial states:

l = -218.9369  
b = 1350.3176

sigma: 0.3305

	AIC	AICc	BIC
	320.8693	325.8693	325.3211

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-492.4509	1357.682	1071.78	-17.38331	27.91724	1.193315

ACF1

Training set -0.05506759

ETS(M,A,N)

## Call:

ets(y = a\_95\_ts, model = \MAN\)

## Smoothing parameters:

alpha = 0.8202  
beta = 0.0248

## Initial states:

l = 1375.7821  
b = 397.1652

sigma: 0.1786

	AIC	AICc	BIC
--	-----	------	-----

287.7826 292.7826 292.2345

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-223.2574	570.2256	438.7436	-8.971513	15.15671

	MASE	ACF1
Training set	0.9245981	-0.05413866

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9999  
beta = 0.2783

Initial states:

l = 1525.651  
b = 854.2761

sigma: 0.0888

	AIC	AICc	BIC
	282.4400	287.4400	286.8919

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-188.2214	512.1953	420.0893	-3.17942	6.963738	0.907597

	ACF1
Training set	-0.02944306

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.3348  
beta = 0.0017

Initial states:

l = 3206.0561  
b = 108.5762

sigma: 0.14

	AIC	AICc	BIC
	286.7342	291.7342	291.1861

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	90.829	543.5145	426.9026	0.4059407	9.667017	0.8127198

	ACF1
Training set	0.2188436

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

## Smoothing parameters:

alpha = 0.9999

beta = 0.1283

## Initial states:

l = 4507.3949

b = 1168.178

sigma: 0.3428

AIC	AICc	BIC
297.0184	302.0184	301.4703

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-494.7102	1798.931	919.3289	-39.20616	54.76805

	MASE	ACF1
Training set	1.131973	0.1292616

ETS(M,A,N)

## Call:

ets(y = a\_95\_ts, model = \MAN\)

## Smoothing parameters:

alpha = 1e-04

beta = 1e-04

## Initial states:

l = 2337.3076

b = 270.7105

sigma: 0.1662

AIC	AICc	BIC
297.2631	302.2631	301.7149

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-34.60822	911.5136	626.6136	-2.275848	11.0034

	MASE	ACF1
Training set	0.7993144	-0.1326341

ETS(M,A,N)

## Call:

ets(y = a\_95\_ts, model = \MAN\)

## Smoothing parameters:

alpha = 0.2209

beta = 0.1516

## Initial states:

l = 1437.0881

b = 943.7614

sigma: 0.2947

AIC	AICc	BIC
315.5972	320.5972	320.0491

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-783.534	1650.917	1388.135	-17.9052	28.94512	1.199341

ACF1

Training set 0.4498106

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.1315  
beta = 0.0018

Initial states:

l = 771.088  
b = 277.6596

sigma: 0.2507

AIC	AICc	BIC
297.6094	302.6094	302.0612

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-85.92439	1273.641	527.6186	-34.37611	45.37267

MASE ACF1

Training set 0.5497661 -0.1798938

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.1977  
beta = 0.0075

Initial states:

l = 5775.7764  
b = 109.5996

sigma: 0.3018

AIC	AICc	BIC
334.9600	339.9600	339.4118

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-167.2489	2269.35	1274.934	-237.0571	250.1594

MASE ACF1

Training set 0.8295776 0.1724242

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```
alpha = 0.7263
beta  = 1e-04
```

## Initial states:

```
l = 1446.357
b = 414.7223
```

```
sigma: 0.1114
```

```
      AIC      AICc      BIC
282.8323 287.8323 287.2842
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -57.18479 545.12 407.233 -2.154429 8.059201 0.7155775
```

```
      ACF1
```

```
Training set 0.1961877
```

```
ETS(M,A,N)
```

## Call:

```
ets(y = a_95_ts, model = \MAN\)
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 0.3567
```

## Initial states:

```
l = 1288.916
b = 265.9758
```

```
sigma: 0.5131
```

```
      AIC      AICc      BIC
340.6391 345.6391 345.0910
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -478.2964 4312.398 2680.521 -4.843898 27.6638
```

```
      MASE      ACF1
```

```
Training set 0.9894679 0.461016
```

```
ETS(M,A,N)
```

## Call:

```
ets(y = a_95_ts, model = \MAN\)
```

## Smoothing parameters:

```
alpha = 0.9842
beta  = 1e-04
```

## Initial states:

```
l = 477.0722
b = 178.238
```

```
sigma: 0.2632
```

```
      AIC      AICc      BIC
278.9381 283.9381 283.3899
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	169.8363	578.3329	443.064	-3.307291	22.14646	0.8125142

ACF1

Training set 0.2402385

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.9999

Initial states:

l = 57.6226

b = 182.5799

sigma: 0.1477

	AIC	AICc	BIC
	241.3673	246.3673	245.8191

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	18.01131	228.7629	131.9843	-1.010652	9.732417

MASE ACF1

Training set 0.4497288 -0.09686436

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9744

beta = 1e-04

Initial states:

l = 1237.3299

b = 307.6415

sigma: 0.3732

	AIC	AICc	BIC
	314.1639	319.1639	318.6158

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-315.4181	1387.267	971.4072	-25.00353	40.46609

MASE ACF1

Training set 0.9019885 -0.01926787

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.0097

Initial states:

l = 1491.6985

b = 309.1379

sigma: 0.1559

AIC AICc BIC

293.4211 298.4211 297.8730

Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set 189.1968 792.4627 569.5981 1.724446 10.24878 0.7888014

ACF1

Training set -0.0224304

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = \MAN\)

Smoothing parameters:

alpha = 0.0138

beta = 1e-04

Initial states:

l = 6096.2677

b = -31.3761

sigma: 0.4273

AIC AICc BIC

338.6743 343.6743 343.1261

Training set error measures:

ME RMSE MAE MPE MAPE

Training set -177.9335 2165.479 1828.298 -131.1427 152.5057

MASE ACF1

Training set 0.931441 0.3381917

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = \MAN\)

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 5569.4714

b = 17.3003

sigma: 0.218

AIC AICc BIC

314.2152 319.2152 318.6670

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -93.26406 1123.97 637.2019 -13.48322 21.96031
                MASE      ACF1
Training set 0.7015124 0.03974592
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```
alpha = 0.8181
beta  = 0.8181
```

Initial states:

```
l = 181.384
b = 144.6943
```

sigma: 0.1229

```

        AIC      AICc      BIC
262.2909 267.2909 266.7427

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -63.77057 537.2361 333.3438 1.055954 8.769139
                MASE      ACF1
Training set 0.5787131 0.2319977
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```
alpha = 0.7744
beta  = 0.4888
```

Initial states:

```
l = 1951.8219
b = 44.3016
```

sigma: 0.1075

```

        AIC      AICc      BIC
259.7150 264.7150 264.1668

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE      MASE
Training set 110.6646 309.1013 177.3073 2.38161 5.393566 0.7179219
                ACF1
Training set 0.3574504
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = \MAN\)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
```



```

Initial states:
  l = 1026.0313
  b = 472.6421

sigma: 0.1853

      AIC      AICc      BIC
300.7415 305.7415 305.1934

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -154.8223 987.3485 638.905 -3.846235 13.23388
              MASE      ACF1
Training set 0.8343776 0.2127563
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\)

Smoothing parameters:
  alpha = 0.139
  beta  = 1e-04

Initial states:
  l = 769.7266
  b = 338.7131

sigma: 0.2987

      AIC      AICc      BIC
308.5039 313.5039 312.9558

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -142.2455 1363.355 686.9693 -63.4509 76.44271
              MASE      ACF1
Training set 0.5719697 -0.1769769
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\)

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04

Initial states:
  l = 1343.9489
  b = 241.7378

sigma: 0.2046

      AIC      AICc      BIC
293.1631 298.1631 297.6149

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE

```

```
Training set 114.9214 773.8585 488.5107 -2.004417 11.849 0.7242876
```

```
ACF1
```

```
Training set 0.1585456
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 0.0016
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 3906.8563
```

```
b = -13.4205
```

```
sigma: 0.304
```

```
AIC AICc BIC
```

```
311.1645 316.1645 315.6164
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set -0.6917776 1017.972 754.5869 -9.250005 24.21315
```

```
MASE ACF1
```

```
Training set 0.7309055 0.3413591
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.0012
```

```
Initial states:
```

```
l = 952.3573
```

```
b = 174.6268
```

```
sigma: 0.1675
```

```
AIC AICc BIC
```

```
276.3778 281.3778 280.8297
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set 119.3451 501.3186 361.7115 1.584065 12.11595 0.8547176
```

```
ACF1
```

```
Training set -0.1535735
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```

Initial states:
  l = 3772.3521
  b = 135.6102

sigma: 0.3864

      AIC      AICc      BIC
329.9438 334.9438 334.3957

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -379.6983 1843.845 1298.226 -49.95431 61.04696
              MASE      ACF1
Training set 0.9118374 0.4278856
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\)

Smoothing parameters:
  alpha = 0.827
  beta  = 5e-04

Initial states:
  l = 2183.3069
  b = 298.4343

sigma: 0.3317

      AIC      AICc      BIC
316.4440 321.4440 320.8959

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -181.1366 1557.185 1086.233 -10.52218 26.10998
              MASE      ACF1
Training set 0.9817102 0.1861188
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\)

Smoothing parameters:
  alpha = 0.0299
  beta  = 0.0299

Initial states:
  l = 4397.2218
  b = 32.2363

sigma: 0.3909

      AIC      AICc      BIC
326.2705 331.2705 330.7224

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -364.7483 1563.257 1146.8 -65.58496 79.20171 0.8858009

```

```

                ACF1
Training set 0.3220946
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\ )

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04

Initial states:
  l = 2617.7386
  b = 34.1678

sigma: 0.3106

      AIC      AICc      BIC
302.8797 307.8797 307.3316

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -31.30432 860.7906 529.5549 -22.479 35.336 0.8005109
              ACF1
Training set 0.2131338
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\ )

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.9999

Initial states:
  l = 234.5373
  b = 162.2274

sigma: 0.0664

      AIC      AICc      BIC
225.7174 230.7174 230.1693

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 44.27479 107.6175 76.95648 0.8444011 4.548827
              MASE      ACF1
Training set 0.2056444 0.106669
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = \MAN\ )

Smoothing parameters:
  alpha = 0.9999
  beta  = 1e-04

Initial states:

```

l = 1781.5397  
b = 395.4387

sigma: 0.0998

AIC	AICc	BIC
281.5344	286.5344	285.9862

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.336363	404.2283	293.3085	-0.5033513	6.110044

	MASE	ACF1
Training set	0.6554294	0.04751172

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = \MAN\)

Smoothing parameters:

alpha = 0.4944  
beta = 1e-04

Initial states:

l = 3767.4658  
b = 304.2207

sigma: 0.2444

AIC	AICc	BIC
319.3894	324.3894	323.8413

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-456.0977	1618.717	800.5716	-27.73227	33.23032	0.84161

	ACF1
Training set	0.08737393

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = \MAN\)

Smoothing parameters:

alpha = 0.8994  
beta = 0.8994

Initial states:

l = 1013.2971  
b = 58.494

sigma: 0.0875

AIC	AICc	BIC
260.6143	265.6143	265.0662

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-48.2872	404.2068	307.102	0.2962913	6.65603	0.667912

	ACF1
Training set	

```
Training set -0.1011123
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 0.0263
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 5923.639
```

```
b = 40.5566
```

```
sigma: 0.1986
```

```
AIC      AICc      BIC
```

```
314.4934 319.4934 318.9453
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set -20.83957 1163.3 714.1209 -7.223339 17.00043 0.7036693
```

```
ACF1
```

```
Training set -0.1025911
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = \MAN\)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
Initial states:
```

```
l = 6067.2481
```

```
b = -51.0175
```

```
sigma: 0.127
```

```
AIC      AICc      BIC
```

```
293.7447 298.7447 298.1965
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -91.01539 621.7819 477.5646 -3.122298 9.753533
```

```
MASE      ACF1
```

```
Training set 0.8515328 0.05683066
```

Hide

```
```r
```

```
micro_forecast_mase_table$forecasting_mase<- micro_forecast_mase_table$forecasting_mase %>% as.character()
```

```
micro_forecast_mase_table$forecasting_mase<- micro_forecast_mase_table$forecasting_mase %>% as.numeric()
```

```

<!-- rnb-source-end -->

<!-- rnb-chunk-end -->

<!-- rnb-text-begin -->

<!-- rnb-text-end -->

<!-- rnb-chunk-begin -->

<!-- rnb-source-begin eyJkYXRhIjoiYGBgclxuYGBgclxubWVhbihtb2RlbF90YWJsZV9taWNybyRtYXNlX3YpXG5gYGBcbmBgYCY9 -->
```r
```r
mean(model_table_micro$mase_v)

```

```

<!-- rnb-source-end -->

<!-- rnb-output-begin eyJkYXRhIjoiWzFdIDAuNzU1NjkyNlxiIn0= -->

```

[1] 0.7556926

```

<!-- rnb-output-end -->

<!-- rnb-source-begin eyJkYXRhIjoiYGBgclxuYGBgclxuc3VtKG1vZGVsX3RhYmxiX21pY3JvJHBfdmFspDAuMDUpXG5gYGBcbmBgYCY9 -->
```r
```r
sum(model_table_micro$p_val<0.05)

```

```

<!-- rnb-source-end -->

<!-- rnb-output-begin eyJkYXRhIjoiWzFdIDhcbiJ9 -->

```

[1] 8

```
<!-- rnb-output-end -->
```

```
<!-- rnb-source-begin eyJkYXRhIjoiYGBgc1xuYGBgc1xubWVhbihtaWNYb19mb3JlY2FzdF9tYXNlX3RhYmxlJGZvcmljYXN0aW5nX2lhc2UsbmEucm09VFJVRSlcbmBgYFxuYGBgIn0= -->
```

```
`` `r
```

```
`` `r
```

```
mean(micro_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

```
<!-- rnb-source-end -->
```

```
<!-- rnb-output-begin eyJkYXRhIjoiWzFdIDIuMjU5MzU4XG4ifQ== -->
```

```
[1] 2.259358
```



```

<!-- rnb-output-end -->

<!-- rnb-chunk-end -->

<!-- rnb-text-begin -->

<!-- rnb-text-end -->

<!-- rnb-chunk-begin -->

<!-- rnb-source-begin eyJkYXRhIjoiYGBgc1xubWljcm9fZm9yZWNhcyRfbWVzZV90YWJsZTwtZGF0YS5mcmFtZSggZm9yZWNhcyRpbmdfbWVzZSA9IE5BKVxuZm9yIChpIGluIDE6IG5yb3coZGF0YV95ZWV5X21pY3JvKS17XG5cbiAgYTwtIHJlYWRfcm93KGRhdGFfeWVhcl9taWNYbl1tpLF0pXG4gIHN0YXJ0aW5nPC0gcmVhZF9zdGFydGluZ190aW1lKGRhdGFfeWVhcl9taWNYbl1tpLF0pXG4gIGFfOTU8LSBzdWJzZXRFOTUoYS1cbiAgYV85NV90czwtIHRzKGFfOTUsIHN0YXJ0ID0gc3RhcncRpbmcpXG4gIGFfNTwtIHN1YnNldF81KGEpXG4gIGJlc3RfbW9kZWxibWljcm8gPSBlbHM0YV85NV90cywgbW9kZWw9XCJNQ0U5cIilcbiAgZm9yZWNhcyRfbWVzZTwtIG1hc2VfdHJ5Y2F0Y2hfZm9yZWNhcyRpbmdfMihhcy52ZWV0b3IoYV85NV90cyksYmVzdF9tb2Rlbf9taWNYbyxhXzUpXG4gbWljcm9fZm9yZWNhcyRfbWVzZV90YWJsZVtucm93KG1pY3JvX2ZvcmlvYXN0X21hc2VfdGFibGUkZG90YyYhbm3JlY2FzdF9tYXNlKX1cbmBgYCY9 -->

```r
micro_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1: nrow(data_year_micro)){

  a<- read_row(data_year_micro[i,])
  starting<- read_starting_time(data_year_micro[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting)
  a_5<- subset_5(a)
  best_model_micro = ets(a_95_ts, model="MAN")
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_micro,a_5)
  micro_forecast_mase_table[nrow(micro_forecast_mase_table)+1 ,]=c(forecast_mase)}

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9995

beta = 0.1676

Initial states:

l = 3246.9931

b = 574.9184

sigma: 0.0986

	AIC	AICc	BIC
	293.5184	298.5184	297.9703

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-84.5237	711.8016	529.1652	-1.280663	7.064583

	MASE	ACF1
Training set	0.7857857	0.3823437

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.1111

Initial states:

l = 1004.126

b = 398.4941

sigma: 0.169

	AIC	AICc	BIC
	286.8684	291.8684	291.3203

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-163.9525	638.5365	486.9137	-4.741919	13.36792

	MASE	ACF1
Training set	0.9556641	0.2566367

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.2474

beta = 0.2474

Initial states:

l = -58.7407

b = 103.7112

sigma: 0.3429

AIC	AICc	BIC
263.5044	268.5044	267.9563

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	364.8123	914.1963	413.2087	5.181325	19.37891

	MASE	ACF1
Training set	0.7427253	0.2708645

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.5002

Initial states:

l = -139.2538

b = -195.1436

sigma: 0.4668

AIC	AICc	BIC
259.8390	264.8390	264.2909

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	75.75261	265.7854	170.6692	33.82409	43.988

	MASE	ACF1
Training set	0.738247	0.1417443

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.7575

Initial states:

l = 274.195

b = 535.5597

sigma: 0.0816

AIC	AICc	BIC
262.0903	267.0903	266.5422

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	12.81831	220.1592	155.7645	-1.099816	4.913102

	MASE	ACF1
Training set	0.2965464	0.1654112

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 5038.0269

b = -28.8516

sigma: 0.068

AIC	AICc	BIC
265.6109	270.6109	270.0628

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-15.1495	283.2341	231.4224	-0.6641364	4.902678

	MASE	ACF1
Training set	0.8751922	0.06826281

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.0021

beta = 1e-04

Initial states:

l = 1333.3194

b = 185.6962

sigma: 0.0662

AIC	AICc	BIC
247.2403	252.2403	251.6922

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-1.572739	203.7193	160.2853	-0.3731013

	MAPE	MASE	ACF1
Training set	4.985499	0.6496956	0.285423

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 1382.5272

b = 378.1747

sigma: 0.1522

	AIC	AICc	BIC
	292.8699	297.8699	297.3218

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	136.7786	714.2911	532.7296	-0.7550671	10.52514

	MASE	ACF1
Training set	1.007542	0.3369132

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9998  
beta = 0.0037

Initial states:

l = 2913.7986  
b = 360.1705

sigma: 0.0548

	AIC	AICc	BIC
	266.6551	271.6551	271.1069

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-49.771	323.0549	273.7431	-0.6217925	4.138957

	MASE	ACF1
Training set	0.791036	0.09438549

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9997  
beta = 3e-04

Initial states:

l = 1457.2556  
b = 310.2821

sigma: 0.1118

	AIC	AICc	BIC
	276.6821	281.6821	281.1340

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-0.2739143	534.1554	329.6998	-0.8205403

	MAPE	MASE	ACF1
Training set	6.527125	0.7463474	0.1547857

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.997
```

```
beta = 0.079
```

Initial states:

```
l = 769.6578
```

```
b = 316.7824
```

```
sigma: 0.215
```

AIC	AICc	BIC
286.6933	291.6933	291.1452

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-116.6897	830.6572	476.5994	-5.805832	15.12441

	MASE	ACF1
Training set	0.9002733	0.1446519

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.7349
```

```
beta = 1e-04
```

Initial states:

```
l = 486.1635
```

```
b = 192.8212
```

```
sigma: 0.0877
```

AIC	AICc	BIC
245.2761	250.2761	249.7280

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	20.33929	184.5494	131.6055	0.1026113	5.830545

	MASE	ACF1
Training set	0.5357044	0.09869112

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9991
```

```
beta = 1e-04
```

Initial states:

```
l = 1176.7327
```

```
b = 334.6676
```

```

sigma: 0.0491

      AIC      AICc      BIC
246.5248 251.5248 250.9766

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 15.95333 188.8574 147.716 -0.1021675 3.507943
              MASE      ACF1
Training set 0.4103691 0.2493036
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = "MAN")

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04

Initial states:
l = 1994.1978
b = 482.2394

sigma: 0.0741

      AIC      AICc      BIC
275.6903 280.6903 280.1422

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -97.944 414.3803 329.9153 -1.57121 5.654194
              MASE      ACF1
Training set 0.7262078 0.3506757
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = "MAN")

Smoothing parameters:
alpha = 0.2074
beta  = 0.2074

Initial states:
l = 730.0023
b = 130.77

sigma: 0.0809

      AIC      AICc      BIC
244.1893 249.1893 248.6411

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 57.44586 170.9954 129.8219 2.078149 5.284385
              MASE      ACF1
Training set 0.5551125 0.1683523
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.3772
```

```
beta = 0.2724
```

Initial states:

```
l = 1017.5263
```

```
b = 164.7981
```

```
sigma: 0.0736
```

	AIC	AICc	BIC
	249.0349	254.0349	253.4868

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	82.70212	235.251	162.1327	1.89044	4.880797

	MASE	ACF1
Training set	0.5333477	-0.05642828

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta = 0.1511
```

Initial states:

```
l = 258.5598
```

```
b = 203.6419
```

```
sigma: 0.1163
```

	AIC	AICc	BIC
	252.2103	257.2103	256.6622

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	102.7128	252.9532	198.0448	1.239485	8.617191

	MASE	ACF1
Training set	0.5790564	0.257542

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.8232
```

```
beta = 0.8232
```

Initial states:

```
l = 3576.266
```

```
b = 248.2856
```

```
sigma: 0.0799
```



```

      AIC      AICc      BIC
277.0225 282.0225 281.4744

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -41.56513 614.202 351.5678 -0.2418625 5.384869

```

```

           MASE      ACF1
Training set 0.7889034 -0.1397322

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

Initial states:

```
l = 1990.8103
```

```
b = 101.1472
```

```
sigma: 0.1055
```

```

      AIC      AICc      BIC
261.6124 266.6124 266.0642

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 10.29354 262.9785 185.0424 -0.3894993 6.734925

```

```

           MASE      ACF1
Training set 0.8425303 0.2279972

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

Initial states:

```
l = 3659.931
```

```
b = 376.1066
```

```
sigma: 0.0607
```

```

      AIC      AICc      BIC
273.0090 278.0090 277.4608

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set -39.65778 325.7647 244.7979 -0.8367382

```

```

           MAPE      MASE      ACF1
Training set 3.931289 0.6388059 0.3809817

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 0.1757
```

```
Initial states:
```

```
l = 1077.2373
```

```
b = 305.7013
```

```
sigma: 0.0719
```

```
AIC      AICc      BIC
```

```
254.6613 259.6613 259.1132
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
Training set -62.2812 253.7083 176.25 -1.576204 5.134284
```

```
MASE      ACF1
Training set 0.6398388 0.1580997
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.0133
```

```
beta = 0.0133
```

```
Initial states:
```

```
l = 1316.8028
```

```
b = 98.7152
```

```
sigma: 0.2431
```

```
AIC      AICc      BIC
```

```
281.3526 286.3526 285.8044
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
Training set -105.0387 452.472 369.7862 -11.87175 21.70875
```

```
MASE      ACF1
Training set 1.102359 0.2601386
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.2458
```

```
beta = 0.101
```

```
Initial states:
```

```
l = 1257.9904
```

```
b = 353.0626
```

```
sigma: 0.2352
```

```

      AIC      AICc      BIC
299.5079 304.5079 303.9598

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -238.5007 807.6535 620.9178 -9.609108 19.02932

```

```

              MASE      ACF1
Training set 0.7888619 -0.02076798

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```

alpha = 0.726
beta  = 1e-04

```

Initial states:

```

l = 1363.7188
b = 121.8555

```

sigma: 0.1184

```

      AIC      AICc      BIC
258.7450 263.7450 263.1969

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -11.29984 266.7335 196.1362 -1.592275 8.430237

```

```

              MASE      ACF1
Training set 0.7682222 -0.1018784

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 1e-04

```

Initial states:

```

l = 4088.9499
b = 198.2914

```

sigma: 0.1241

```

      AIC      AICc      BIC
293.1262 298.1262 297.5781

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 67.29339 667.005 544.994 0.06356397 9.12051

```

```

              MASE      ACF1
Training set 0.9246406 -0.06814321

```

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999  
beta = 1e-04

Initial states:

l = 1537.1087  
b = 83.652

sigma: 0.1994

AIC	AICc	BIC
266.5032	271.5032	270.9550

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-77.85377	248.9267	196.5183	-6.457845	13.29998

	MASE	ACF1
Training set	1.0648	0.265669

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = "MAN")

Smoothing parameters:

alpha = 0.9999  
beta = 0.177

Initial states:

l = -218.9369  
b = 1350.3176

sigma: 0.3305

AIC	AICc	BIC
320.8693	325.8693	325.3211

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-492.4509	1357.682	1071.78	-17.38331	27.91724

	MASE	ACF1
Training set	1.193315	-0.05506759

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = "MAN")

Smoothing parameters:

alpha = 0.8202  
beta = 0.0248

Initial states:

l = 1375.7821  
b = 397.1652

sigma: 0.1786

AIC	AICc	BIC
-----	------	-----

287.7826 292.7826 292.2345

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-223.2574	570.2256	438.7436	-8.971513	15.15671

  

	MASE	ACF1
Training set	0.9245981	-0.05413866

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999  
beta = 0.2783

Initial states:

l = 1525.651  
b = 854.2761

sigma: 0.0888

	AIC	AICc	BIC
	282.4400	287.4400	286.8919

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-188.2214	512.1953	420.0893	-3.17942	6.963738

  

	MASE	ACF1
Training set	0.907597	-0.02944306

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.3348  
beta = 0.0017

Initial states:

l = 3206.0561  
b = 108.5762

sigma: 0.14

	AIC	AICc	BIC
	286.7342	291.7342	291.1861

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	90.829	543.5145	426.9026	0.4059407	9.667017

  

	MASE	ACF1
Training set	0.8127198	0.2188436

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

## Smoothing parameters:

alpha = 0.9999

beta = 0.1283

## Initial states:

l = 4507.3949

b = 1168.178

sigma: 0.3428

AIC	AICc	BIC
297.0184	302.0184	301.4703

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-494.7102	1798.931	919.3289	-39.20616	54.76805

	MASE	ACF1
Training set	1.131973	0.1292616

ETS(M,A,N)

## Call:

ets(y = a\_95\_ts, model = "MAN")

## Smoothing parameters:

alpha = 1e-04

beta = 1e-04

## Initial states:

l = 2337.3076

b = 270.7105

sigma: 0.1662

AIC	AICc	BIC
297.2631	302.2631	301.7149

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-34.60822	911.5136	626.6136	-2.275848	11.0034

	MASE	ACF1
Training set	0.7993144	-0.1326341

ETS(M,A,N)

## Call:

ets(y = a\_95\_ts, model = "MAN")

## Smoothing parameters:

alpha = 0.2209

beta = 0.1516

## Initial states:

l = 1437.0881

b = 943.7614

sigma: 0.2947

AIC	AICc	BIC
315.5972	320.5972	320.0491

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-783.534	1650.917	1388.135	-17.9052	28.94512
	MASE	ACF1			
Training set	1.199341	0.4498106			

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.1315
beta  = 0.0018
```

Initial states:

```
l = 771.088
b = 277.6596
```

```
sigma: 0.2507
```

	AIC	AICc	BIC
	297.6094	302.6094	302.0612

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-85.92439	1273.641	527.6186	-34.37611	45.37267
	MASE	ACF1			
Training set	0.5497661	-0.1798938			

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.1977
beta  = 0.0075
```

Initial states:

```
l = 5775.7764
b = 109.5996
```

```
sigma: 0.3018
```

	AIC	AICc	BIC
	334.9600	339.9600	339.4118

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-167.2489	2269.35	1274.934	-237.0571	250.1594
	MASE	ACF1			
Training set	0.8295776	0.1724242			

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.7263
beta  = 1e-04
```

## Initial states:

```
l = 1446.357
b = 414.7223
```

```
sigma: 0.1114
```

```
      AIC      AICc      BIC
282.8323 287.8323 287.2842
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -57.18479 545.12 407.233 -2.154429 8.059201
```

```
           MASE      ACF1
Training set 0.7155775 0.1961877
ETS(M,A,N)
```

## Call:

```
ets(y = a_95_ts, model = "MAN")
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 0.3567
```

## Initial states:

```
l = 1288.916
b = 265.9758
```

```
sigma: 0.5131
```

```
      AIC      AICc      BIC
340.6391 345.6391 345.0910
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -478.2964 4312.398 2680.521 -4.843898 27.6638
```

```
           MASE      ACF1
Training set 0.9894679 0.461016
ETS(M,A,N)
```

## Call:

```
ets(y = a_95_ts, model = "MAN")
```

## Smoothing parameters:

```
alpha = 0.9842
beta  = 1e-04
```

## Initial states:

```
l = 477.0722
b = 178.238
```

```
sigma: 0.2632
```

```
      AIC      AICc      BIC
278.9381 283.9381 283.3899
```



Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	169.8363	578.3329	443.064	-3.307291	22.14646

  

	MASE	ACF1
Training set	0.8125142	0.2402385

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.9999

Initial states:

l = 57.6226

b = 182.5799

sigma: 0.1477

	AIC	AICc	BIC
	241.3673	246.3673	245.8191

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	18.01131	228.7629	131.9843	-1.010652	9.732417

  

	MASE	ACF1
Training set	0.4497288	-0.09686436

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9744

beta = 1e-04

Initial states:

l = 1237.3299

b = 307.6415

sigma: 0.3732

	AIC	AICc	BIC
	314.1639	319.1639	318.6158

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-315.4181	1387.267	971.4072	-25.00353	40.46609

  

	MASE	ACF1
Training set	0.9019885	-0.01926787

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

alpha = 0.9999

beta = 0.0097

Initial states:

l = 1491.6985

b = 309.1379

sigma: 0.1559

AIC AICc BIC

293.4211 298.4211 297.8730

Training set error measures:

ME RMSE MAE MPE MAPE

Training set 189.1968 792.4627 569.5981 1.724446 10.24878

MASE ACF1

Training set 0.7888014 -0.0224304

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = "MAN")

Smoothing parameters:

alpha = 0.0138

beta = 1e-04

Initial states:

l = 6096.2677

b = -31.3761

sigma: 0.4273

AIC AICc BIC

338.6743 343.6743 343.1261

Training set error measures:

ME RMSE MAE MPE MAPE

Training set -177.9335 2165.479 1828.298 -131.1427 152.5057

MASE ACF1

Training set 0.931441 0.3381917

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = "MAN")

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

Initial states:

l = 5569.4714

b = 17.3003

sigma: 0.218

AIC AICc BIC

314.2152 319.2152 318.6670

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-93.26406	1123.97	637.2019	-13.48322	21.96031

	MASE	ACF1
Training set	0.7015124	0.03974592

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.8181
beta  = 0.8181
```

Initial states:

```
l = 181.384
b = 144.6943
```

sigma: 0.1229

	AIC	AICc	BIC
	262.2909	267.2909	266.7427

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-63.77057	537.2361	333.3438	1.055954	8.769139

	MASE	ACF1
Training set	0.5787131	0.2319977

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.7744
beta  = 0.4888
```

Initial states:

```
l = 1951.8219
b = 44.3016
```

sigma: 0.1075

	AIC	AICc	BIC
	259.7150	264.7150	264.1668

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	110.6646	309.1013	177.3073	2.38161	5.393566

	MASE	ACF1
Training set	0.7179219	0.3574504

ETS(M,A,N)

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
```

```

Initial states:
  l = 1026.0313
  b = 472.6421

sigma: 0.1853

      AIC      AICc      BIC
300.7415 305.7415 305.1934

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -154.8223 987.3485 638.905 -3.846235 13.23388
              MASE      ACF1
Training set 0.8343776 0.2127563
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = "MAN")

Smoothing parameters:
  alpha = 0.139
  beta  = 1e-04

Initial states:
  l = 769.7266
  b = 338.7131

sigma: 0.2987

      AIC      AICc      BIC
308.5039 313.5039 312.9558

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -142.2455 1363.355 686.9693 -63.4509 76.44271
              MASE      ACF1
Training set 0.5719697 -0.1769769
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = "MAN")

Smoothing parameters:
  alpha = 1e-04
  beta  = 1e-04

Initial states:
  l = 1343.9489
  b = 241.7378

sigma: 0.2046

      AIC      AICc      BIC
293.1631 298.1631 297.6149

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE

```

```
Training set 114.9214 773.8585 488.5107 -2.004417 11.849
```

```
      MASE      ACF1
```

```
Training set 0.7242876 0.1585456
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.0016
```

```
beta  = 1e-04
```

```
Initial states:
```

```
l = 3906.8563
```

```
b = -13.4205
```

```
sigma: 0.304
```

```
      AIC      AICc      BIC
```

```
311.1645 316.1645 315.6164
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE
```

```
Training set -0.6917776 1017.972 754.5869 -9.250005
```

```
      MAPE      MASE      ACF1
```

```
Training set 24.21315 0.7309055 0.3413591
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 0.0012
```

```
Initial states:
```

```
l = 952.3573
```

```
b = 174.6268
```

```
sigma: 0.1675
```

```
      AIC      AICc      BIC
```

```
276.3778 281.3778 280.8297
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set 119.3451 501.3186 361.7115 1.584065 12.11595
```

```
      MASE      ACF1
```

```
Training set 0.8547176 -0.1535735
```

```
ETS(M,A,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAN")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta  = 1e-04
```

```

Initial states:
  l = 3772.3521
  b = 135.6102

sigma: 0.3864

      AIC      AICc      BIC
329.9438 334.9438 334.3957

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -379.6983 1843.845 1298.226 -49.95431 61.04696
              MASE      ACF1
Training set 0.9118374 0.4278856
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = "MAN")

Smoothing parameters:
  alpha = 0.827
  beta  = 5e-04

Initial states:
  l = 2183.3069
  b = 298.4343

sigma: 0.3317

      AIC      AICc      BIC
316.4440 321.4440 320.8959

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -181.1366 1557.185 1086.233 -10.52218 26.10998
              MASE      ACF1
Training set 0.9817102 0.1861188
ETS(M,A,N)

Call:
ets(y = a_95_ts, model = "MAN")

Smoothing parameters:
  alpha = 0.0299
  beta  = 0.0299

Initial states:
  l = 4397.2218
  b = 32.2363

sigma: 0.3909

      AIC      AICc      BIC
326.2705 331.2705 330.7224

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -364.7483 1563.257 1146.8 -65.58496 79.20171

```

```

                MASE      ACF1
Training set 0.8858009 0.3220946
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 1e-04
```

```
beta  = 1e-04
```

Initial states:

```
l = 2617.7386
```

```
b = 34.1678
```

```
sigma: 0.3106
```

```

        AIC      AICc      BIC
302.8797 307.8797 307.3316

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -31.30432 860.7906 529.5549 -22.479 35.336

```

```

                MASE      ACF1
Training set 0.8005109 0.2131338
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 0.9999
```

Initial states:

```
l = 234.5373
```

```
b = 162.2274
```

```
sigma: 0.0664
```

```

        AIC      AICc      BIC
225.7174 230.7174 230.1693

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set 44.27479 107.6175 76.95648 0.8444011 4.548827

```

```

                MASE      ACF1
Training set 0.2056444 0.106669
ETS(M,A,N)

```

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
beta  = 1e-04
```

Initial states:

l = 1781.5397  
b = 395.4387

sigma: 0.0998

AIC	AICc	BIC
281.5344	286.5344	285.9862

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.336363	404.2283	293.3085	-0.5033513	6.110044

	MASE	ACF1
Training set	0.6554294	0.04751172

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = "MAN")

Smoothing parameters:

alpha = 0.4944  
beta = 1e-04

Initial states:

l = 3767.4658  
b = 304.2207

sigma: 0.2444

AIC	AICc	BIC
319.3894	324.3894	323.8413

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-456.0977	1618.717	800.5716	-27.73227	33.23032

	MASE	ACF1
Training set	0.84161	0.08737393

ETS(M,A,N)

Call:

ets(y = a\_95\_ts, model = "MAN")

Smoothing parameters:

alpha = 0.8994  
beta = 0.8994

Initial states:

l = 1013.2971  
b = 58.494

sigma: 0.0875

AIC	AICc	BIC
260.6143	265.6143	265.0662

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-48.2872	404.2068	307.102	0.2962913	6.65603

	MASE	ACF1
--	------	------



```
Training set 0.667912 -0.1011123
ETS(M,A,N)
```

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 0.0263
beta = 1e-04
```

Initial states:

```
l = 5923.639
b = 40.5566
```

sigma: 0.1986

```
      AIC      AICc      BIC
314.4934 319.4934 318.9453
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -20.83957 1163.3 714.1209 -7.223339 17.00043
```

```
              MASE      ACF1
Training set 0.7036693 -0.1025911
ETS(M,A,N)
```

Call:

```
ets(y = a_95_ts, model = "MAN")
```

Smoothing parameters:

```
alpha = 1e-04
beta = 1e-04
```

Initial states:

```
l = 6067.2481
b = -51.0175
```

sigma: 0.127

```
      AIC      AICc      BIC
293.7447 298.7447 298.1965
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -91.01539 621.7819 477.5646 -3.122298 9.753533
```

```
              MASE      ACF1
Training set 0.8515328 0.05683066
```

Hide

```
micro_forecast_mase_table$forecasting_mase<- micro_forecast_mase_table$forecasting_mase %>% as.character()
micro_forecast_mase_table$forecasting_mase<- micro_forecast_mase_table$forecasting_mase %>% as.numeric()
```

Hide

```
mean(model_table_micro$mase_v)
```

```
[1] 0.7556926
```

Hide

```
sum(model_table_micro$p_val<0.05)
```

```
[1] 8
```

Hide

```
mean(micro_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

```
[1] 2.259358
```

```
##Best model is ETS(MAN)
```

Hide

```
Year_table[nrow(Year_table)+1 ,] =c("micro","ETS(MAN)",mean(model_table_micro$mase_v),mean(micro_forecast_mase_table$forecasting_mase,na.rm=TRUE),sum(model_table_micro$p_val<0.05))
```

Hide

```
micro_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1: nrow(data_year_micro)){

  a<- read_row(data_year_micro[i,])
  starting<- read_starting_time(data_year_micro[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting)
  a_5<- subset_5(a)
  best_model_micro = ets(a_95_ts, model="MMN",damped = TRUE)
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_micro,a_5)
  micro_forecast_mase_table[nrow(micro_forecast_mase_table)+1 ,]=c(forecast_mase)}
```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.6447
phi   = 0.8
```

Initial states:

```
l = 3548.1482
b = 1.0683
```

sigma: 0.107

AIC	AICc	BIC
296.3626	303.9990	301.7049

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	31.8729	678.0208	557.3191	0.8757797	7.574277

  

	MASE	ACF1
Training set	0.8275929	0.1394913

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.8222
```

Initial states:

```
l = 1118.4881
b = 1.4182
```

sigma: 0.1708

AIC	AICc	BIC
287.5624	295.1988	292.9046

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-109.6759	594.7386	453.8248	-3.626897	12.46941

  

	MASE	ACF1
Training set	0.8907206	0.241143

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1731
beta  = 0.1731
phi   = 0.8836
```

Initial states:

l = 48.2324

b = 2.0538

sigma: 0.371

AIC	AICc	BIC
269.4710	277.1073	274.8132

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	333.0882	870.0912	424.0322	-3.763587	27.82835

	MASE	ACF1
Training set	0.7621802	0.2621576

ETS(M,Md,N)

Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

Smoothing parameters:

alpha = 0.1407

beta = 1e-04

phi = 0.98

Initial states:

l = 76.6801

b = 1.2993

sigma: 0.232

AIC	AICc	BIC
236.7587	244.3951	242.1009

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	60.55521	255.6242	173.5373	-6.756155	18.83306

	MASE	ACF1
Training set	0.7506533	0.5838085

ETS(M,Md,N)

Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

Smoothing parameters:

alpha = 0.9879

beta = 0.8866

phi = 0.8

Initial states:

l = 244.7558

b = 4.067

sigma: 0.1489

AIC	AICc	BIC
284.8943	292.5307	290.2366

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	19.52273	312.6701	193.6436	-4.058037	8.670775
	MASE	ACF1			
Training set	0.3686612	0.06360295			

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.969
```

Initial states:

```
l = 5032.9484
b = 0.9926
```

sigma: 0.0706

AIC	AICc	BIC
267.5148	275.1512	272.8571

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-4.765769	283.2609	231.1273	-0.454849	4.891145
	MASE	ACF1			
Training set	0.874076	0.0904534			

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9467
```

Initial states:

```
l = 1412.6019
b = 1.114
```

sigma: 0.069

AIC	AICc	BIC
249.3545	256.9909	254.6968

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-0.9200181	202.7331	156.264	-0.3406456
	MAPE	MASE	ACF1	
Training set	4.770406	0.633396	0.2789328	

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

## Smoothing parameters:

alpha = 1e-04  
 beta = 1e-04  
 phi = 0.9376

## Initial states:

l = 1502.8788  
 b = 1.1887

sigma: 0.1387

	AIC	AICc	BIC
	290.3392	297.9755	295.6814

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	18.48476	571.065	392.6249	-0.9451392	8.53401

	MASE	ACF1
Training set	0.7425645	0.09702668

ETS(M,Md,N)

## Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

## Smoothing parameters:

alpha = 0.9999  
 beta = 1e-04  
 phi = 0.9278

## Initial states:

l = 3100.5316  
 b = 1.1168

sigma: 0.0587

	AIC	AICc	BIC
	269.6738	277.3101	275.0160

## Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-21.76954	319.8309	278.5798	-0.3585938

	MAPE	MASE	ACF1
Training set	4.324078	0.8050126	0.07495936

ETS(M,Md,N)

## Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

## Smoothing parameters:

alpha = 0.9999  
 beta = 1e-04  
 phi = 0.9637

## Initial states:

l = 1524.2985  
 b = 1.1335

sigma: 0.1172

```

      AIC      AICc      BIC
279.0884 286.7248 284.4306

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -39.77474 559.509 365.9666 -0.938269 7.401482

```

```

           MASE      ACF1
Training set 0.8284451 0.1657977

```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 4e-04
phi   = 0.8577

```

Initial states:

```

l = 796.4279
b = 1.3703

```

sigma: 0.2264

```

      AIC      AICc      BIC
288.7764 296.4127 294.1186

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -81.71315 812.8294 472.792 -4.484026 15.13041

```

```

           MASE      ACF1
Training set 0.8930814 0.1378913

```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.6957
beta  = 1e-04
phi   = 0.926

```

Initial states:

```

l = 603.4607
b = 1.2383

```

sigma: 0.0952

```

      AIC      AICc      BIC
249.2336 256.8700 254.5758

```

Training set error measures:

```

           ME      RMSE      MAE      MPE
Training set -9.847908 187.6122 136.0274 -0.8737433

```

```

           MAPE      MASE      ACF1
Training set 6.242786 0.5537037 0.08792745

```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.2741
phi   = 0.9125
```

Initial states:

```
l = 1220.4516
b = 1.2342
```

sigma: 0.0548

```
      AIC      AICc      BIC
251.0630 258.6994 256.4052
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 18.49989 211.5219 166.2314 0.1528439 3.864481
              MASE      ACF1
Training set 0.4618068 0.1849474
ETS(M,Md,N)
```

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9998
beta  = 0.9998
phi   = 0.8
```

Initial states:

```
l = 2149.6082
b = 1.321
```

sigma: 0.0714

```
      AIC      AICc      BIC
274.5347 282.1710 279.8769
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -25.07709 353.4614 286.765 -0.1819435 5.015574
              MASE      ACF1
Training set 0.6312256 0.2565361
ETS(M,Md,N)
```

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9363
```

Initial states:



l = 668.9372

b = 1.2091

sigma: 0.0719

AIC	AICc	BIC
241.1270	248.7633	246.4692

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	9.80367	132.2314	101.065	0.6469204	4.666919

	MASE	ACF1
Training set	0.4321495	0.1056324

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3127

beta = 1e-04

phi = 0.976

Initial states:

l = 1024.6259

b = 1.131

sigma: 0.0651

AIC	AICc	BIC
245.9487	253.5850	251.2909

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	7.996627	202.3682	149.7764	0.03290981	4.646244

	MASE	ACF1
Training set	0.4927007	0.01507879

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9697

beta = 0.9697

phi = 0.8

Initial states:

l = 169.265

b = 3.3361

sigma: 0.1728

AIC	AICc	BIC
267.9585	275.5949	273.3007

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
--	----	------	-----	-----	------

```
Training set 44.09436 261.5033 229.5293 -1.932963 12.53948
```

```
          MASE          ACF1
```

```
Training set 0.671113 -0.1097909
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.8569
```

```
beta  = 0.8569
```

```
phi   = 0.8209
```

```
Initial states:
```

```
l = 3579.3345
```

```
b = 0.9917
```

```
sigma: 0.0833
```

```
      AIC      AICc      BIC
```

```
278.8921 286.5285 284.2343
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE          MAPE
```

```
Training set -6.34015 629.5769 355.7778 0.5722363 5.20785
```

```
          MASE          ACF1
```

```
Training set 0.7983504 -0.1749733
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
phi   = 0.98
```

```
Initial states:
```

```
l = 1996.693
```

```
b = 1.0513
```

```
sigma: 0.1106
```

```
      AIC      AICc      BIC
```

```
264.1039 271.7402 269.4461
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE          MAPE
```

```
Training set -1.299984 266.4892 186.6644 -0.764727 6.812037
```

```
          MASE          ACF1
```

```
Training set 0.8499153 0.2184357
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
phi = 0.9554
```

## Initial states:

```
l = 3848.6131
b = 1.0821
```

```
sigma: 0.0701
```

```
      AIC      AICc      BIC
278.6216 286.2580 283.9638
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE
Training set -0.3741546 345.7989 247.6452 -0.2856117
```

```
              MAPE      MASE      ACF1
Training set 4.011678 0.646236 0.3783429
```

```
ETS(M,Md,N)
```

## Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
phi = 0.8622
```

## Initial states:

```
l = 1184.5147
b = 1.2783
```

```
sigma: 0.0727
```

```
      AIC      AICc      BIC
255.3853 263.0216 260.7275
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -23.68003 231.4915 166.2346 -0.71539 5.011069
```

```
              MASE      ACF1
Training set 0.6034802 0.1544672
```

```
ETS(M,Md,N)
```

## Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 3e-04
beta = 1e-04
phi = 0.979
```

## Initial states:

```
l = 1317.6008
b = 1.0511
```

```
sigma: 0.2481
```

```
      AIC      AICc      BIC
```

281.4211 289.0575 286.7634

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-33.86073	434.998	357.1447	-7.690819	19.94129

	MASE	ACF1
Training set	1.064673	0.2458291

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8
```

Initial states:

```
l = 1333.737
b = 1.3429
```

sigma: 0.213

	AIC	AICc	BIC
	294.7388	302.3752	300.0811

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	5.412865	615.1203	436.1282	-3.434434	13.4323

	MASE	ACF1
Training set	0.5540909	-0.1433576

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7365
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1399.6303
b = 1.0655
```

sigma: 0.1257

	AIC	AICc	BIC
	261.4119	269.0483	266.7541

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-5.297574	271.7427	196.5545	-1.219735	8.46914

	MASE	ACF1
Training set	0.7698606	-0.106803

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.98
```

Initial states:

```
l = 4095.6563
b = 1.0574
```

```
sigma: 0.1282
```

```
      AIC      AICc      BIC
295.3093 302.9457 300.6516
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 8.425435 671.6601 546.3569 -0.9253049 9.227156
```

```
           MASE      ACF1
Training set 0.9269529 -0.07403942
```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
phi   = 0.8138
```

Initial states:

```
l = 1688.6334
b = 0.9816
```

```
sigma: 0.2267
```

```
      AIC      AICc      BIC
269.9198 277.5562 275.2621
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 4.082061 237.0685 179.4156 -1.132841 11.94031
```

```
           MASE      ACF1
Training set 0.9721323 0.2937786
```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9253
beta  = 0.9253
phi   = 0.98
```

Initial states:

```
l = 6.9611
b = 15.4678
```

sigma: 3.443

AIC	AICc	BIC
416.9865	424.6228	422.3287

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-21262.13	61015.93	22740.89	-1413.713	1452.378

	MASE	ACF1
Training set	25.31962	0.4568882

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5521
beta  = 1e-04
phi   = 0.9294
```

Initial states:

```
l = 1989.4356
b = 1.1071
```

sigma: 0.2084

AIC	AICc	BIC
292.3546	299.9910	297.6968

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-39.1269	556.4847	446.9164	-4.696331	16.2932

	MASE	ACF1
Training set	0.9418214	0.1662195

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.8261
beta  = 1e-04
phi   = 0.8362
```

Initial states:

```
l = 2938.2665
b = 1.2413
```

sigma: 0.1348

AIC	AICc	BIC
297.8841	305.5204	303.2263

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-104.754	553.4266	421.1325	-3.005215	8.946501

	MASE	ACF1
--	------	------

Training set 0.9098509 0.159826

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3547

beta = 1e-04

phi = 0.98

Initial states:

l = 3362.5559

b = 1.0402

sigma: 0.1434

AIC	AICc	BIC
-----	------	-----

289.0987	296.7351	294.4409
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
--	----	------	-----	-----	------

Training set	-4.334594	541.4889	446.232	-1.923667	10.47434
--------------	-----------	----------	---------	-----------	----------

	MASE	ACF1
--	------	------

Training set	0.8495184	0.2080387
--------------	-----------	-----------

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.801

Initial states:

l = 5349.2111

b = 1.3752

sigma: 0.3723

AIC	AICc	BIC
-----	------	-----

300.8348	308.4712	306.1770
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
--	----	------	-----	-----	------

Training set	-485.7865	1916.028	996.2466	-41.44136	57.64695
--------------	-----------	----------	----------	-----------	----------

	MASE	ACF1
--	------	------

Training set	1.226682	0.07863623
--------------	----------	------------

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.9391

Initial states:

l = 2326.4668

b = 1.1139

sigma: 0.1722

AIC	AICc	BIC
299.0649	306.7012	304.4071

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-24.13328	910.1428	624.3422	-1.875847	10.90455

	MASE	ACF1
Training set	0.796417	-0.1314989

ETS(M,Md,N)

Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

Smoothing parameters:

alpha = 0.4301

beta = 0.4301

phi = 0.879

Initial states:

l = 2209.2473

b = 1.0402

sigma: 0.377

AIC	AICc	BIC
325.5390	333.1753	330.8812

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-488.5192	1716.228	1216.109	-31.67404	46.08104

	MASE	ACF1
Training set	1.050711	0.2818969

ETS(M,Md,N)

Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

Smoothing parameters:

alpha = 1e-04

beta = 1e-04

phi = 0.8964

Initial states:

l = 823.8653

b = 1.3012

sigma: 0.2584

AIC	AICc	BIC
299.2623	306.8986	304.6045



Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-85.1399	1199.31	483.7341	-31.92096	42.3475
	MASE	ACF1			
Training set	0.5040395	-0.1638209			

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.219
beta = 1e-04
phi = 0.98
```

Initial states:

```
l = 5689.0666
b = 1.022
```

sigma: 0.3128

AIC	AICc	BIC
336.9162	344.5526	342.2585

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-169.5425	2259.094	1283.084	-235.9521	249.2269
	MASE	ACF1			
Training set	0.8348808	0.1504606			

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5941
beta = 1e-04
phi = 0.925
```

Initial states:

```
l = 1592.4837
b = 1.2036
```

sigma: 0.1221

AIC	AICc	BIC
286.5494	294.1857	291.8916

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-40.32692	572.3064	431.0025	-1.584708	8.59492
	MASE	ACF1			
Training set	0.7573445	0.2861214			

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.9998  
 beta = 1e-04  
 phi = 0.9794

## Initial states:

l = 1328.3534  
 b = 1.1669

sigma: 0.4953

	AIC	AICc	BIC
	341.6241	349.2604	346.9663

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-583.6373	4515.969	2903.307	-9.888701	31.15674

	MASE	ACF1
Training set	1.071705	0.557242

ETS(M,Md,N)

## Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

## Smoothing parameters:

alpha = 0.8997  
 beta = 1e-04  
 phi = 0.98

## Initial states:

l = 512.7264  
 b = 1.2089

sigma: 0.2453

	AIC	AICc	BIC
	278.1423	285.7786	283.4845

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	10.5878	548.4235	378.0776	-6.342678	20.7568

	MASE	ACF1
Training set	0.6933387	0.04774063

ETS(M,Md,N)

## Call:

ets(y = a\_95\_ts, model = "MMN", damped = TRUE)

## Smoothing parameters:

alpha = 0.9999  
 beta = 1e-04  
 phi = 0.8001

## Initial states:

l = 21.8126  
 b = 7.49

sigma: 0.4418

```

      AIC      AICc      BIC
286.4235 294.0598 291.7657

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 14.03175 346.7475 258.7017 -26.72489 39.50209

```

```

           MASE      ACF1
Training set 0.8815109 0.626193

```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.7323
beta  = 1e-04
phi   = 0.8091

```

Initial states:

```

l = 1291.6874
b = 1.2864

```

sigma: 0.3914

```

      AIC      AICc      BIC
316.2225 323.8588 321.5647

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -230.9224 1332.533 930.6539 -24.56263 40.60198

```

```

           MASE      ACF1
Training set 0.8641476 0.07702716

```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.001
beta  = 1e-04
phi   = 0.9647

```

Initial states:

```

l = 1673.1746
b = 1.1449

```

sigma: 0.1436

```

      AIC      AICc      BIC
292.3658 300.0022 297.7081

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 5.484781 638.9006 526.8514 -1.616865 10.92549

```

```

           MASE      ACF1
Training set 0.729604 0.266973

```

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.8995
```

Initial states:

```
l = 6012.1139
b = 0.9891
```

sigma: 0.4471

```
      AIC      AICc      BIC
340.4022 348.0385 345.7444
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -86.12753 2144.982 1810.541 -127.275 149.6051
              MASE      ACF1
Training set 0.9223947 0.3390265
ETS(M,Md,N)
```

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
phi   = 0.9755
```

Initial states:

```
l = 5568.5958
b = 1.0023
```

sigma: 0.2282

```
      AIC      AICc      BIC
316.1287 323.7651 321.4710
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -30.77201 1111.751 642.3947 -12.11755 21.66239
              MASE      ACF1
Training set 0.7072293 0.02461251
ETS(M,Md,N)
```

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7854
beta  = 0.7854
phi   = 0.8
```

Initial states:

l = 155.505

b = 2.5206

sigma: 0.1369

AIC	AICc	BIC
267.4906	275.1270	272.8329

Training set error measures:

	ME	RMSE	MAE	MPE
Training set	-66.96298	532.6575	338.4916	-0.9789681

	MAPE	MASE	ACF1
Training set	9.610223	0.58765	0.2601755

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7535

beta = 0.4949

phi = 0.98

Initial states:

l = 1968.8128

b = 1.0099

sigma: 0.1054

AIC	AICc	BIC
259.7647	267.4011	265.1070

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	99.0159	284.8741	164.6606	2.16486	5.100137

	MASE	ACF1
Training set	0.6667153	0.3149852

ETS(M,Md,N)

Call:

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

phi = 0.8344

Initial states:

l = 1159.6923

b = 1.4549

sigma: 0.202

AIC	AICc	BIC
303.8291	311.4654	309.1713

Training set error measures:

ME	RMSE	MAE	MPE	MAPE
----	------	-----	-----	------

```
Training set -18.91461 962.364 650.3805 -1.874342 13.37126
```

```
      MASE      ACF1
```

```
Training set 0.849364 0.151927
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta  = 1e-04
```

```
phi   = 0.8642
```

```
Initial states:
```

```
l = 885.0671
```

```
b = 1.3772
```

```
sigma: 0.3118
```

```
      AIC      AICc      BIC
```

```
309.7805 317.4168 315.1227
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set 4.217472 1273.668 708.3248 -55.00306 70.55246
```

```
      MASE      ACF1
```

```
Training set 0.5897503 -0.2009464
```

```
ETS(M,Md,N)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMN", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 2e-04
```

```
beta  = 2e-04
```

```
phi   = 0.9596
```

```
Initial states:
```

```
l = 1366.9856
```

```
b = 1.1346
```

```
sigma: 0.1884
```

```
      AIC      AICc      BIC
```

```
291.3291 298.9654 296.6713
```

```
Training set error measures:
```

[Hide](#)

```
mean(model_table_micro$mase_v)
sum(model_table_micro$p_val<0.05)
mean(micro_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

[Hide](#)

```
micro_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1: nrow(data_year_micro)){

  a<- read_row(data_year_micro[i,])
  starting<- read_starting_time(data_year_micro[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting)
  a_5<- subset_5(a)
  best_model_micro = ets(a_95_ts, model="MAN",damped = TRUE)
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_micro,a_
5)
  micro_forecast_mase_table[nrow(micro_forecast_mase_table)+1 ,]=c(forecast_mase)}
micro_forecast_mase_table$forecasting_mase<- micro_forecast_mase_table$forecasting_mase %>% as.character()
micro_forecast_mase_table$forecasting_mase<- micro_forecast_mase_table$forecasting_mase %>% as.numeric()
```

[Hide](#)

```
mean(model_table_micro$mase_v)
sum(model_table_micro$p_val<0.05)
mean(micro_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

Code ▾

# Appendix 3: An example of models fitting and model selection for QUARTERLY data: Industry

## b. quaterly\_industry

Hide

```
#Fitting best model base on lowest Training MASE
#For loop for all

model_table_quaterly_industry<-data.frame(model = NA, mase_v = NA, aic_v= NA, p_val=NA, count=NA)
for (i in 1: nrow(data_quater_industry)){

  a<- read_row(data_quater_industry[i,])
  starting<- read_starting_time_quater(data_quater_industry[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting,frequency = 4)
  a_5<- subset_5(a)
  best_model<- state_model_fitting_quater_month(a_95_ts,a_5)
  best_model<- best_model%>% as.data.frame()
# training_mase<- mase_try_catch_training(best_model)
#forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model,a_5)
# quaterly_industry_mase_table[nrow(quaterly_industry_mase_table)+1 ,]=c(training_mase,forecast_mase)
  model_table_quaterly_industry[nrow(model_table_quaterly_industry)+1 ,] = c(best_model[1,1],best_model[1,2],best_model[1,3], best_model[1,4], 1)
}
```



Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.4116
beta  = 1e-04
gamma = 0.2934
```

Initial states:

```
l = 5201.1519
b = 30.2924
s = -225.7925 504.6517 -356.5927 77.7335
```

sigma: 143.7651

```
      AIC      AICc      BIC
791.2235 795.1365 809.4516
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -0.2911946 133.1006 99.75767 -0.06514556 1.661094
              MASE      ACF1
Training set 0.6097127 0.04007502
```

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4489
beta  = 0.0181
gamma = 0.2931
phi   = 0.9778
```

Initial states:

```
l = 5169.1383
b = 31.3348
s = -253.0484 502.9872 -304.8241 54.8853
```

sigma: 148.6083

```
      AIC      AICc      BIC
795.7554 800.6443 816.0089
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 16.7438 136.1438 102.3874 0.2287286 1.705917 0.6257855
              ACF1
Training set 0.01767224
```

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.5045
beta  = 1e-04
gamma = 0.254
```

## Initial states:

```
l = 5189.5943
b = 26.7729
s = 0.9583 1.0689 0.9497 1.0231
```

```
sigma: 0.0227
```

```
      AIC      AICc      BIC
783.0665 786.9796 801.2947
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 6.834707 124.6345 95.65767 0.06070439 1.589464
```

```
              MASE      ACF1
Training set 0.5846538 -0.009402511
```

```
Damped Holt-Winters' multiplicative method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.5189
beta  = 0.0161
gamma = 0.2632
phi   = 0.98
```

## Initial states:

```
l = 5190.249
b = 30.4984
s = 0.9581 1.0681 0.9485 1.0254
```

```
sigma: 0.0235
```

```
      AIC      AICc      BIC
787.6400 792.5289 807.8936
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 15.71613 127.3579 96.54664 0.2136883 1.602793
```

```
              MASE      ACF1
Training set 0.5900871 -0.01224264
```

```
Holt-Winters' multiplicative method with exponential trend
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

## Smoothing parameters:

```
alpha = 0.4732
beta  = 1e-04
gamma = 0.2869
```

## Initial states:

```
l = 5190.9128
b = 1.0043
```

```
s = 0.9509 1.0717 0.9519 1.0255
```

```
sigma: 0.0229
```

```
      AIC      AICc      BIC
784.1618 788.0748 802.3899
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 9.127469 125.4275 97.11176 0.1094583 1.617729 0.593541
```

```
      ACF1
```

```
Training set 0.00172864
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.6248
```

```
gamma = 0.3223
```

```
Initial states:
```

```
l = 5495.6021
```

```
s = -146.6395 357.6302 -257.7494 46.7587
```

```
sigma: 151.2614
```

```
      AIC      AICc      BIC
795.2023 797.5356 809.3798
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set 35.80868 142.9285 108.4602 0.5252557 1.812307
```

```
      MASE      ACF1
```

```
Training set 0.6629022 -0.06111241
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.5917
```

```
gamma = 0.2956
```

```
Initial states:
```

```
l = 5253.1536
```

```
s = -159.7523 352.2229 -282.7956 90.3251
```

```
sigma: 0.0243
```

```
      AIC      AICc      BIC
788.7150 791.0483 802.8924
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set 44.25517 137.0049 101.4368 0.6805008 1.673875
```

```
      MASE      ACF1
```

```
Training set 0.6199753 -0.09008826
```

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.5917

gamma = 0.2956

Initial states:

l = 5253.1536

s = -159.7523 352.2229 -282.7956 90.3251

sigma: 0.0243

AIC	AICc	BIC
788.7150	791.0483	802.8924

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	44.25517	137.0049	101.4368	0.6805008	1.673875

	MASE	ACF1
Training set	0.6199753	-0.09008826

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

alpha = 0.4116

beta = 1e-04

gamma = 0.2934

Initial states:

l = 5201.2291

b = 30.3094

s = -225.841 504.6506 -356.6637 77.8542

sigma: 143.7651

AIC	AICc	BIC
791.2235	795.1365	809.4517

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.327992	133.1006	99.75987	-0.06576443	1.661135

	MASE	ACF1
Training set	0.6097261	0.03996159

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4413

beta = 0.0163

gamma = 0.2965

phi = 0.98

Initial states:

l = 5182.9019  
 b = 30.1893  
 s = -214.9988 505.2378 -340.1425 49.9034

sigma: 149.1457

	AIC	AICc	BIC
	796.1597	801.0486	816.4133

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	16.75288	136.6362	101.1548	0.2285061	1.680889

	MASE	ACF1
Training set	0.6182516	0.03522671

ETS(M,M,M)

Call:

ets(y = ts\_series, model = "MMM")

Smoothing parameters:

alpha = 0.3759  
 beta = 3e-04  
 gamma = 1e-04

Initial states:

l = 5191.9701  
 b = 1.0051  
 s = 0.9629 1.084 0.9428 1.0103

sigma: 0.0227

	AIC	AICc	BIC
	783.5200	787.4331	801.7482

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.611801	126.1733	94.64417	-0.02822298	1.580818

	MASE	ACF1
Training set	0.5784593	0.1715611

ETS(M,Md,M)

Call:

ets(y = ts\_series, model = "MMM", damped = TRUE)

Smoothing parameters:

alpha = 0.5604  
 beta = 4e-04  
 gamma = 1e-04  
 phi = 0.98

Initial states:

l = 5191.4801  
 b = 1.0073  
 s = 0.9638 1.0836 0.9422 1.0105

sigma: 0.0232

```

      AIC      AICc      BIC
786.4287 791.3176 806.6823

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 10.38725 127.7564 95.91157 0.1085119 1.592771

```

```

           MASE      ACF1
Training set 0.5862055 0.04786075

```

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```

alpha = 0.4293
beta  = 1e-04
gamma = 0.2352

```

Initial states:

```

l = 5181.6103
b = 31.0346
s = -226.9603 502.5693 -325.7591 50.1501

```

sigma: 0.024

```

      AIC      AICc      BIC
789.7049 793.6179 807.9331

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -0.8029434 133.3171 101.3983 -0.07705353 1.685795

```

```

           MASE      ACF1
Training set 0.6197399 0.04301184

```

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.4713
beta  = 1e-04
gamma = 0.2471
phi   = 0.98

```

Initial states:

```

l = 5172.9294
b = 37.8946
s = -218.6019 504.4009 -329.0503 43.2513

```

sigma: 0.0249

```

      AIC      AICc      BIC
794.4790 799.3679 814.7325

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 15.26378 136.9995 101.8908 0.1786503 1.691453 0.62275

```

```

                ACF1
Training set 0.03558567
ETS(M,A,M)

Call:
ets(y = ts_series, model = "MAM")

Smoothing parameters:
  alpha = 0.5235
  beta  = 1e-04
  gamma = 0.2247

Initial states:
  l = 5192.0476
  b = 24.4042
  s = 0.9592 1.0709 0.947 1.0229

sigma: 0.0227

      AIC      AICc      BIC
783.1140 787.0270 801.3421

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 10.80491 125.1207 95.44702 0.1283303 1.583382
              MASE      ACF1
Training set 0.5833662 -0.01762298
ETS(M,Ad,M)

Call:
ets(y = ts_series, model = "MAM", damped = TRUE)

Smoothing parameters:
  alpha = 0.5991
  beta  = 0.0089
  gamma = 1e-04
  phi   = 0.98

Initial states:
  l = 5191.4405
  b = 28.5075
  s = 0.9627 1.0839 0.9428 1.0106

sigma: 0.0233

      AIC      AICc      BIC
786.9155 791.8043 807.1690

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 19.5709 128.3417 96.14522 0.2771793 1.59363 0.5876336
              ACF1
Training set 0.003514186
Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive")

```

## Smoothing parameters:

alpha = 0.4253  
 beta = 1e-04  
 gamma = 0.4087

## Initial states:

l = 6148.1323  
 b = 56.6057  
 s = -308.6122 903.3889 -343.0363 -251.7404

sigma: 191.5822

AIC	AICc	BIC
823.3828	827.2958	841.6109

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	7.596552	177.3707	134.4775	0.03736735	1.76845	0.478507

ACF1

Training set 0.057703

Damped Holt-Winters' additive method

## Call:

hw(y = ts\_series, h = h, seasonal = "additive", damped = TRUE)

## Smoothing parameters:

alpha = 0.4339  
 beta = 0.0331  
 gamma = 0.4087  
 phi = 0.98

## Initial states:

l = 6205.7332  
 b = 68.4649  
 s = -354.7697 912.8475 -342.9593 -215.1185

sigma: 198.594

AIC	AICc	BIC
828.2297	833.1186	848.4832

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	15.91586	181.937	138.7658	0.159799	1.828081	0.4937659

ACF1

Training set 0.05513108

Holt-Winters' multiplicative method

## Call:

hw(y = ts\_series, h = h, seasonal = "multiplicative")

## Smoothing parameters:

alpha = 0.4951  
 beta = 1e-04  
 gamma = 0.2866

## Initial states:

l = 6152.7541



```
b = 60.5724
s = 0.954 1.1067 0.9536 0.9857
```

```
sigma: 0.0221
```

```
      AIC      AICc      BIC
810.2466 814.1596 828.4747
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 0.7856548 156.595 122.0051 -0.04439429 1.576678
```

```
           MASE      ACF1
Training set 0.4341268 -0.01118866
```

```
Damped Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.5213
```

```
beta = 0.0426
```

```
gamma = 0.2769
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 6153.3354
```

```
b = 71.8079
```

```
s = 0.9548 1.1039 0.9548 0.9865
```

```
sigma: 0.023
```

```
      AIC      AICc      BIC
815.3761 820.2650 835.6296
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 12.78552 160.3579 126.3549 0.1262178 1.637377
```

```
           MASE      ACF1
Training set 0.4496048 -0.03803965
```

```
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.5026
```

```
beta = 0.1233
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 6150.3698
```

```
b = 0.9868
```

```
s = 0.9608 1.1157 0.9579 0.9656
```

```
sigma: 0.0255
```

```
      AIC      AICc      BIC
825.6231 829.5362 843.8513
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	10.97784	166.4564	127.7528	0.1941161	1.705116

  

	MASE	ACF1
Training set	0.4545787	0.007174438

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.6385
gamma = 0.3615
```

Initial states:

```
l = 6892.0955
s = -278.7616 904.9657 -338.3361 -287.8679
```

sigma: 238.1084

	AIC	AICc	BIC
	846.0186	848.3519	860.1961

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	65.57353	224.9913	171.9401	0.7527819	2.292038

  

	MASE	ACF1
Training set	0.6118092	0.1145787

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.6563
gamma = 0.3437
```

Initial states:

```
l = 6734.0247
s = -284.2403 779.9684 -180.305 -315.4231
```

sigma: 0.0311

	AIC	AICc	BIC
	845.6648	847.9982	859.8423

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	68.39872	212.0955	167.2235	0.7858829	2.213358	0.595026

  

	ACF1
Training set	0.05187422

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.6563
gamma = 0.3437
```

## Initial states:

```
l = 6734.0247
s = -284.2403 779.9684 -180.305 -315.4231
```

```
sigma: 0.0311
```

```
      AIC      AICc      BIC
845.6648 847.9982 859.8423
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 68.39872 212.0955 167.2235 0.7858829 2.213358 0.595026
```

```
      ACF1
```

```
Training set 0.05187422
```

```
ETS(A,A,A)
```

## Call:

```
ets(y = ts_series, model = "AAA")
```

## Smoothing parameters:

```
alpha = 0.4242
beta  = 1e-04
gamma = 0.4098
```

## Initial states:

```
l = 6148.1487
b = 56.5415
s = -308.5954 903.3873 -343.0596 -251.7323
```

```
sigma: 191.5825
```

```
      AIC      AICc      BIC
823.3829 827.2960 841.6111
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 7.721963 177.371 134.4637 0.03899971 1.768387
```

```
      MASE      ACF1
```

```
Training set 0.4784579 0.05870049
```

```
ETS(A,Ad,A)
```

## Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.434
beta  = 0.0331
gamma = 0.4086
phi   = 0.98
```

## Initial states:

```
l = 6205.7354
b = 68.465
s = -354.7715 912.8481 -342.9598 -215.1168
```

```

sigma: 198.5941

      AIC      AICc      BIC
828.2297 833.1186 848.4832

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 15.91872 181.9371 138.7652 0.1598263 1.828073
              MASE      ACF1
Training set 0.4937638 0.05508986
ETS(M,Md,M)

Call:
ets(y = ts_series, model = "MMM")

Smoothing parameters:
alpha = 0.5818
beta  = 1e-04
gamma = 0.2496
phi   = 0.98

Initial states:
l = 6152.1193
b = 1.0112
s = 0.9566 1.1032 0.9514 0.9888

sigma: 0.0228

      AIC      AICc      BIC
814.2057 819.0946 834.4592

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 18.88432 160.1649 124.2325 0.1655791 1.597432
              MASE      ACF1
Training set 0.4420527 -0.06868068
ETS(M,Md,M)

Call:
ets(y = ts_series, model = "MMM", damped = TRUE)

Smoothing parameters:
alpha = 0.5818
beta  = 1e-04
gamma = 0.2496
phi   = 0.98

Initial states:
l = 6152.1193
b = 1.0112
s = 0.9566 1.1032 0.9514 0.9888

sigma: 0.0228

      AIC      AICc      BIC
814.2057 819.0946 834.4592

Training set error measures:

```

	ME	RMSE	MAE	MPE	MAPE
Training set	18.88432	160.1649	124.2325	0.1655791	1.597432

	MASE	ACF1
Training set	0.4420527	-0.06868068

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.4711
beta  = 0.0421
gamma = 0.3709
phi   = 0.9759
```

Initial states:

```
l = 6124.5771
b = 30.843
s = -249.9786 660.3745 -228.2206 -182.1753
```

sigma: 0.025

AIC	AICc	BIC
824.2371	829.1260	844.4906

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	29.05418	172.2371	137.7212	0.340574	1.796792	0.490049

	ACF1
Training set	0.003675199

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4711
beta  = 0.0421
gamma = 0.3709
phi   = 0.9759
```

Initial states:

```
l = 6124.5771
b = 30.843
s = -249.9786 660.3745 -228.2206 -182.1753
```

sigma: 0.025

AIC	AICc	BIC
824.2371	829.1260	844.4906

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	29.05418	172.2371	137.7212	0.340574	1.796792	0.490049

	ACF1
Training set	0.003675199

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.5774
beta  = 0.0034
gamma = 0.1739
```

Initial states:

```
l = 6150.4132
b = 57.1754
s = 0.9591 1.1122 0.9493 0.9794
```

sigma: 0.0224

```
      AIC      AICc      BIC
811.4752 815.3882 829.7034
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 6.628793 159.7364 124.8488 0.03727212 1.609844
```

```
              MASE      ACF1
Training set 0.4442457 -0.08056423
ETS(M,Ad,M)
```

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5745
beta  = 0.0312
gamma = 0.2477
phi   = 0.98
```

Initial states:

```
l = 6151.579
b = 67.538
s = 0.9553 1.1046 0.9525 0.9875
```

sigma: 0.023

```
      AIC      AICc      BIC
814.9171 819.8060 835.1706
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 17.87378 160.7402 126.6012 0.1849074 1.63549 0.4504812
```

```
              ACF1
Training set -0.08025553
```

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.7648
beta  = 1e-04
gamma = 0.211
```

```

Initial states:
  l = 6121.7621
  b = 4.9289
  s = -43.064 176.5869 43.1968 -176.7197

sigma: 144.6588

      AIC      AICc      BIC
791.9176 795.8307 810.1458

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 15.32064 133.9281 101.982 0.1945002 1.623245 0.5038198
              ACF1
Training set 0.2046361
Damped Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)

Smoothing parameters:
  alpha = 0.7741
  beta  = 9e-04
  gamma = 0.2259
  phi   = 0.8048

Initial states:
  l = 6117.0713
  b = 2.4877
  s = -39.8973 213.6423 -1.4814 -172.2635

sigma: 148.7181

      AIC      AICc      BIC
795.8381 800.7270 816.0917

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 20.79888 136.2444 106.3198 0.2824182 1.692263
              MASE      ACF1
Training set 0.5252499 0.1972098
Holt-Winters' multiplicative method

Call:
hw(y = ts_series, h = h, seasonal = "multiplicative")

Smoothing parameters:
  alpha = 0.7371
  beta  = 1e-04
  gamma = 0.2106

Initial states:
  l = 6110.8946
  b = 10.6142
  s = 0.9837 1.023 1.0052 0.988

sigma: 0.0227

```

```

      AIC      AICc      BIC
791.4554 795.3685 809.6836

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 9.191624 129.0591 100.5626 0.09592977 1.608653

```

```

           MASE      ACF1
Training set 0.4968078 0.2569255

```

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.8109
beta  = 0.0128
gamma = 0.1891
phi   = 0.98

```

Initial states:

```

l = 6116.4944
b = 1.6858
s = 0.9837 1.0246 1.0083 0.9834

```

sigma: 0.0228

```

      AIC      AICc      BIC
792.4409 797.3298 812.6944

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 16.70112 128.1644 96.76267 0.2222927 1.540475

```

```

           MASE      ACF1
Training set 0.4780351 0.1860042

```

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```

alpha = 0.7366
beta  = 0.0667
gamma = 2e-04

```

Initial states:

```

l = 6116.2224
b = 0.9696
s = 0.9925 1.0351 0.9997 0.9727

```

sigma: 0.0278

```

      AIC      AICc      BIC
813.0835 816.9965 831.3117

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 53.9417 153.104 116.0149 0.8688096 1.85095 0.5731467

```



```

                ACF1
Training set 0.3378639
ETS(A,N,A)

Call:
ets(y = ts_series, model = "ANA")

Smoothing parameters:
  alpha = 0.9999
  gamma = 1e-04

Initial states:
  l = 6123.0287
  s = -42.1216 221.7996 -4.2397 -175.4383

sigma: 140.3282

      AIC      AICc      BIC
786.7995 789.1328 800.9769

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 16.59264 132.5976 103.1747 0.233311 1.62676 0.5097123
                ACF1
Training set 0.04099256
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.9998
  gamma = 2e-04

Initial states:
  l = 6111.4918
  s = -47.9295 214.84 -1.9028 -165.0076

sigma: 0.0224

      AIC      AICc      BIC
788.1669 790.5002 802.3443

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 16.90324 132.784 103.2804 0.2352878 1.624066 0.5102348
                ACF1
Training set 0.03945674
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.9998
  gamma = 2e-04

Initial states:

```

```
l = 6111.4918
s = -47.9295 214.84 -1.9028 -165.0076
```

```
sigma: 0.0224
```

```
      AIC      AICc      BIC
788.1669 790.5002 802.3443
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 16.90324 132.784 103.2804 0.2352878 1.624066 0.5102348
      ACF1
```

```
Training set 0.03945674
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.7648
beta  = 1e-04
gamma = 0.211
```

```
Initial states:
```

```
l = 6121.7632
b = 4.9282
s = -43.0641 176.5721 43.215 -176.723
```

```
sigma: 144.6588
```

```
      AIC      AICc      BIC
791.9176 795.8307 810.1458
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set 15.32121 133.9281 101.9811 0.1945087 1.623228
      MASE      ACF1
```

```
Training set 0.5038155 0.2046091
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.7741
beta  = 0.0011
gamma = 0.2259
phi   = 0.8048
```

```
Initial states:
```

```
l = 6117.0712
b = 2.4866
s = -39.9037 213.6479 -1.4894 -172.2549
```

```
sigma: 148.7181
```

```
      AIC      AICc      BIC
795.8382 800.7270 816.0917
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	20.78571	136.2444	106.3135	0.2822317	1.692171

  

	MASE	ACF1
Training set	0.5252191	0.1971594

ETS(M,Md,M)

## Call:

```
ets(y = ts_series, model = "MMM")
```

## Smoothing parameters:

```
alpha = 0.8663
beta  = 1e-04
gamma = 0.1337
phi   = 0.9567
```

## Initial states:

```
l = 6116.647
b = 1.0022
s = 0.9848 1.0279 1.0079 0.9794
```

```
sigma: 0.0227
```

AIC	AICc	BIC
792.1253	797.0142	812.3788

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	14.64184	128.925	96.37655	0.1827013	1.52866	0.4761276

  

	ACF1
Training set	0.1516026

ETS(M,Md,M)

## Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8663
beta  = 1e-04
gamma = 0.1337
phi   = 0.9567
```

## Initial states:

```
l = 6116.647
b = 1.0022
s = 0.9848 1.0279 1.0079 0.9794
```

```
sigma: 0.0227
```

AIC	AICc	BIC
792.1253	797.0142	812.3788

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	14.64184	128.925	96.37655	0.1827013	1.52866	0.4761276

  

	ACF1
Training set	0.1516026

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

alpha = 0.9994

beta = 1e-04

gamma = 1e-04

Initial states:

l = 6111.9105

b = 7.8125

s = -50.3068 221.8548 -1.4025 -170.1455

sigma: 0.0227

AIC	AICc	BIC
-----	------	-----

791.5407	795.4538	809.7689
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
--	----	------	-----	-----	------

Training set	9.127701	131.7667	101.9195	0.1139275	1.607321
--------------	----------	----------	----------	-----------	----------

	MASE	ACF1
--	------	------

Training set	0.5035115	0.04048266
--------------	-----------	------------

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

gamma = 1e-04

phi = 0.8393

Initial states:

l = 6116.8489

b = 2.7536

s = -42.1999 215.8144 -4.1527 -169.4618

sigma: 0.0231

AIC	AICc	BIC
-----	------	-----

794.2264	799.1152	814.4799
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
--	----	------	-----	-----	------

Training set	16.43986	132.7822	103.0754	0.2292039	1.621865
--------------	----------	----------	----------	-----------	----------

	MASE	ACF1
--	------	------

Training set	0.5092218	0.04074459
--------------	-----------	------------

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

alpha = 0.8424

```
beta = 1e-04
gamma = 0.1576
```

## Initial states:

```
l = 6116.485
b = 7.5941
s = 0.9874 1.0243 1.0087 0.9797
```

```
sigma: 0.0223
```

```
      AIC      AICc      BIC
789.4731 793.3862 807.7013
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 11.87938 127.8739 94.61035 0.1405856 1.503766 0.467402
```

## ACF1

```
Training set 0.1583187
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8324
beta = 0.0129
gamma = 0.1676
phi = 0.98
```

## Initial states:

```
l = 6116.7401
b = 2.553
s = 0.9863 1.0246 1.0073 0.9819
```

```
sigma: 0.0227
```

```
      AIC      AICc      BIC
792.2643 797.1531 812.5178
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 16.16706 128.3673 96.0032 0.2127587 1.526012 0.4742831
```

## ACF1

```
Training set 0.1653258
```

```
Holt-Winters' additive method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

## Smoothing parameters:

```
alpha = 0.3601
beta = 1e-04
gamma = 1e-04
```

## Initial states:

```
l = 5346.7725
b = 26.3702
s = 28.5384 -123.6584 -267.6186 362.7386
```

sigma: 203.2358

AIC	AICc	BIC
829.9963	833.9094	848.2245

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-15.19459	188.1598	131.7562	-0.3526173	2.26858

	MASE	ACF1
Training set	0.6786849	-0.01286047

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1269
beta = 0.1269
gamma = 1e-04
phi = 0.8894
```

Initial states:

```
l = 5351.1272
b = 26.9222
s = 27.1901 -124.8312 -266.5965 364.2376
```

sigma: 198.8019

AIC	AICc	BIC
828.3469	833.2357	848.6004

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	6.240919	182.1275	132.257	0.05708006	2.274326

	MASE	ACF1
Training set	0.6812642	0.04626459

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.1616
beta = 0.1179
gamma = 3e-04
```

Initial states:

```
l = 5357.1605
b = 26.7925
s = 1.0057 0.9764 0.9559 1.0619
```

sigma: 0.0354

AIC	AICc	BIC
833.1099	837.0229	851.3381

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -13.86434 183.132 133.6142 -0.2733779 2.282785
                MASE      ACF1
Training set 0.6882554 0.03154767
Damped Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1193
beta  = 0.1193
gamma = 1e-04
phi   = 0.9647

```

Initial states:

```
l = 5357.3823
b = 26.141
s = 1.0073 0.9763 0.9547 1.0617

```

sigma: 0.0355

```

      AIC      AICc      BIC
833.8524 838.7413 854.1059

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -8.046476 181.1044 131.9913 -0.1739406 2.254315
                MASE      ACF1
Training set 0.6798957 0.05726704
Holt-Winters' multiplicative method with exponential trend

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.1401
beta  = 0.1231
gamma = 1e-04

```

Initial states:

```
l = 5357.319
b = 1.0017
s = 1.0075 0.9764 0.9552 1.0609

```

sigma: 0.0353

```

      AIC      AICc      BIC
832.7344 836.6474 850.9625

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -13.7318 183.0703 135.6393 -0.2662329 2.315826
                MASE      ACF1
Training set 0.6986868 0.04456334
ETS(A,N,A)

```

Call:

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.4564
```

```
gamma = 2e-04
```

```
Initial states:
```

```
l = 5504.4743
```

```
s = 29.9427 -122.0052 -270.0561 362.1186
```

```
sigma: 207.07
```

```
AIC      AICc      BIC
```

```
830.3756 832.7090 844.5531
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 37.1022 195.6627 136.8642 0.5368253 2.353452 0.7049966
```

```
ACF1
```

```
Training set -0.07365866
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.4322
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 5478.7637
```

```
s = 22.1115 -120.4232 -255.5482 353.8599
```

```
sigma: 0.0367
```

```
AIC      AICc      BIC
```

```
834.4191 836.7524 848.5965
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set 40.43384 195.4688 137.6417 0.5876675 2.356652
```

```
MASE      ACF1
```

```
Training set 0.7090014 -0.05502311
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.4322
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 5478.7637
```

```
s = 22.1115 -120.4232 -255.5482 353.8599
```

```
sigma: 0.0367
```



```

      AIC      AICc      BIC
834.4191 836.7524 848.5965

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 40.43384 195.4688 137.6417 0.5876675 2.356652

```

```

              MASE      ACF1
Training set 0.7090014 -0.05502311
ETS(A,Ad,A)

```

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

```

alpha = 0.127
beta  = 0.127
gamma = 1e-04
phi   = 0.8896

```

Initial states:

```

l = 5351.1259
b = 26.9194
s = 27.1928 -124.8292 -266.5972 364.2336

```

sigma: 198.802

```

      AIC      AICc      BIC
828.3469 833.2358 848.6004

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 6.203932 182.1275 132.2655 0.05646416 2.274502

```

```

              MASE      ACF1
Training set 0.681308 0.04615471
ETS(A,Ad,A)

```

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.127
beta  = 0.127
gamma = 1e-04
phi   = 0.8896

```

Initial states:

```

l = 5351.1259
b = 26.9194
s = 27.1928 -124.8292 -266.5972 364.2336

```

sigma: 198.802

```

      AIC      AICc      BIC
828.3469 833.2358 848.6004

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 6.203932 182.1275 132.2655 0.05646416 2.274502

```

```

                MASE      ACF1
Training set 0.681308 0.04615471
ETS(M,M,M)

Call:
ets(y = ts_series, model = "MMM")

Smoothing parameters:
  alpha = 0.165
  beta  = 0.0957
  gamma = 1e-04

Initial states:
  l = 5357.4588
  b = 0.9971
  s = 1.0043 0.9798 0.9549 1.061

sigma: 0.0349

      AIC      AICc      BIC
831.2724 835.1855 849.5006

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -13.0731 182.6702 137.9267 -0.2389825 2.346973
              MASE      ACF1
Training set 0.7104694 0.04044652
ETS(M,Md,M)

Call:
ets(y = ts_series, model = "MMM", damped = TRUE)

Smoothing parameters:
  alpha = 0.1573
  beta  = 0.0965
  gamma = 1e-04
  phi   = 0.9668

Initial states:
  l = 5357.5277
  b = 0.9973
  s = 1.0042 0.9791 0.9547 1.062

sigma: 0.0349

      AIC      AICc      BIC
832.0294 836.9183 852.2829

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -4.851217 180.1866 133.5882 -0.1045281 2.274985
              MASE      ACF1
Training set 0.6881212 0.03019364
ETS(M,A,A)

Call:
ets(y = ts_series, model = "MAA")

```

## Smoothing parameters:

alpha = 0.3238  
 beta = 1e-04  
 gamma = 1e-04

## Initial states:

l = 5353.0396  
 b = 22.319  
 s = 27.5155 -124.3528 -271.7507 368.588

sigma: 0.0356

	AIC	AICc	BIC
	833.3448	837.2579	851.5730

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-4.385716	188.0159	131.7221	-0.1702399	2.261704

	MASE	ACF1
Training set	0.6785089	0.02622565

ETS(M,Ad,A)

## Call:

ets(y = ts\_series, model = "MAA", damped = TRUE)

## Smoothing parameters:

alpha = 0.3524  
 beta = 1e-04  
 gamma = 2e-04  
 phi = 0.98

## Initial states:

l = 5350.9344  
 b = 25.7834  
 s = 27.3734 -124.2075 -263.5643 360.3984

sigma: 0.0364

	AIC	AICc	BIC
	836.3668	841.2556	856.6203

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	14.05242	189.5712	131.2401	0.1245183	2.249152

	MASE	ACF1
Training set	0.6760262	0.01142736

ETS(M,A,M)

## Call:

ets(y = ts\_series, model = "MAM")

## Smoothing parameters:

alpha = 0.1363  
 beta = 0.1164  
 gamma = 1e-04

## Initial states:

l = 5357.9797

```
b = 24.2579
s = 1.0037 0.9797 0.9544 1.0622
```

```
sigma: 0.0353
```

```
      AIC      AICc      BIC
832.7194 836.6325 850.9476
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -14.28584 183.6428 138.7984 -0.2769027 2.366337
      MASE      ACF1
Training set 0.7149597 0.0517437
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.1231
beta  = 0.1198
gamma = 1e-04
phi   = 0.9666
```

```
Initial states:
```

```
l = 5357.3888
b = 25.7388
s = 1.0037 0.979 0.9543 1.0629
```

```
sigma: 0.0353
```

```
      AIC      AICc      BIC
833.5212 838.4101 853.7747
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -8.021969 181.4587 135.8415 -0.1733267 2.317458
      MASE      ACF1
Training set 0.6997283 0.04845184
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

```
Smoothing parameters:
```

```
alpha = 0.117
beta  = 6e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 5179.9525
b = 36.7788
s = -421.4811 749.844 -793.4629 465.1001
```

```
sigma: 219.8988
```

```
      AIC      AICc      BIC
838.8220 842.7350 857.0502
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-10.7847	203.5867	156.0958	-0.2828737	2.490214
	MASE	ACF1			
Training set	0.7133019	0.008361769			

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0511
beta  = 0.051
gamma = 1e-04
phi   = 0.9553
```

Initial states:

```
l = 5180.2749
b = 41.3251
s = -421.4878 749.7057 -794.1923 465.9743
```

sigma: 225.8798

AIC	AICc	BIC
842.6486	847.5375	862.9021

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	17.74504	206.9343	160.2681	0.2531088	2.568826
	MASE	ACF1			
Training set	0.7323675	0.05263873			

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.0574
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 5204.3824
b = 33.6102
s = 0.932 1.1213 0.8728 1.0739
```

sigma: 0.0335

AIC	AICc	BIC
830.0763	833.9893	848.3045

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	9.38249	198.9934	156.6959	-0.02499575	2.496162
	MASE	ACF1			
Training set	0.7160442	0.1554412			

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2146
beta  = 0.0241
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 5204.6917
b = 40.7681
s = 0.9326 1.1199 0.8702 1.0773
```

sigma: 0.0342

```
      AIC      AICc      BIC
833.1266 838.0155 853.3801
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 13.63324 202.5384 154.5834 0.1386022 2.422987
```

```
              MASE      ACF1
Training set 0.7063907 0.02424971
```

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.0563
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 5204.7338
b = 1.0059
s = 0.9315 1.1204 0.8714 1.0767
```

sigma: 0.0322

```
      AIC      AICc      BIC
826.0197 829.9327 844.2479
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -8.375929 193.339 150.5859 -0.2613047 2.393227
```

```
              MASE      ACF1
Training set 0.6881236 0.1083545
```

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.449
gamma = 1e-04
```

Initial states:

l = 5645.9706

s = -410.1855 748.7788 -793.8361 455.2428

sigma: 248.9966

AIC AICc BIC

851.0265 853.3598 865.2040

Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set 55.59569 235.2797 188.9882 0.8078074 3.053139 0.863608

ACF1

Training set -0.09075161

ETS(M,N,A)

Call:

ets(y = ts\_series, model = "MNA")

Smoothing parameters:

alpha = 0.4082

gamma = 1e-04

Initial states:

l = 5611.7902

s = -422.0567 749.7441 -768.2376 440.5502

sigma: 0.0395

AIC AICc BIC

845.8632 848.1966 860.0407

Training set error measures:

ME RMSE MAE MPE MAPE

Training set 62.39826 235.2881 187.1558 0.8959059 3.012693

MASE ACF1

Training set 0.8552348 -0.06996634

ETS(M,N,A)

Call:

ets(y = ts\_series, model = "MNA")

Smoothing parameters:

alpha = 0.4082

gamma = 1e-04

Initial states:

l = 5611.7902

s = -422.0567 749.7441 -768.2376 440.5502

sigma: 0.0395

AIC AICc BIC

845.8632 848.1966 860.0407

Training set error measures:

ME RMSE MAE MPE MAPE

```
Training set 62.39826 235.2881 187.1558 0.8959059 3.012693
```

```
          MASE          ACF1
```

```
Training set 0.8552348 -0.06996634
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.1193
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 5180.938
```

```
b = 37.799
```

```
s = -422.5578 749.4827 -794.0867 467.1618
```

```
sigma: 220.1515
```

```
      AIC      AICc      BIC
```

```
838.9506 842.8637 857.1788
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE
```

```
Training set -20.23253 203.8207 156.6407 -0.434814 2.504293
```

```
          MASE      ACF1
```

```
Training set 0.715792 0.001106793
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0512
```

```
beta  = 0.051
```

```
gamma = 1e-04
```

```
phi   = 0.9553
```

```
Initial states:
```

```
l = 5180.2743
```

```
b = 41.3251
```

```
s = -421.4867 749.706 -794.1923 465.973
```

```
sigma: 225.8804
```

```
      AIC      AICc      BIC
```

```
842.6489 847.5378 862.9024
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE
```

```
Training set 17.73735 206.9347 160.2661 0.2529674 2.568794
```

```
          MASE      ACF1
```

```
Training set 0.7323585 0.05259998
```

```
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```



## Smoothing parameters:

```
alpha = 0.0539
beta  = 1e-04
gamma = 1e-04
```

## Initial states:

```
l = 5204.8785
b = 1.0059
s = 0.9298 1.1201 0.8704 1.0797
```

```
sigma: 0.0322
```

```
      AIC      AICc      BIC
825.7747 829.6877 844.0028
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -5.173105 193.6654 150.4929 -0.2003664 2.383823
              MASE      ACF1
Training set 0.6876983 0.1092558
ETS(M,Md,M)
```

## Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.0465
beta  = 0.0465
gamma = 1e-04
phi   = 0.9601
```

## Initial states:

```
l = 5204.7026
b = 1.0049
s = 0.9297 1.1203 0.8701 1.0799
```

```
sigma: 0.0337
```

```
      AIC      AICc      BIC
831.3397 836.2286 851.5932
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 15.89581 198.3803 154.0767 0.2325883 2.42473 0.7040752
              ACF1
Training set 0.1016187
ETS(M,A,A)
```

## Call:

```
ets(y = ts_series, model = "MAA")
```

## Smoothing parameters:

```
alpha = 0.1135
beta  = 1e-04
gamma = 0.002
```

## Initial states:

```

l = 5184.2651
b = 35.1994
s = -422.3814 753.4679 -797.8967 466.8102

```

```
sigma: 0.034
```

```

      AIC      AICc      BIC
831.8133 835.7263 850.0414

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set -2.088376 203.2687 154.7755 -0.1378626 2.465295

```

```

              MASE      ACF1
Training set 0.7072687 0.009868546

```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.0511
beta  = 0.0511
gamma = 1e-04
phi   = 0.9509

```

```
Initial states:
```

```

l = 5181.3003
b = 41.8362
s = -422.4815 748.9419 -773.8676 447.4072

```

```
sigma: 0.0359
```

```

      AIC      AICc      BIC
838.2985 843.1874 858.5520

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 20.45512 207.5454 158.6573 0.2777251 2.533607 0.725007

```

```

              ACF1
Training set 0.04900031

```

```
ETS(M,A,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```

alpha = 0.1594
beta  = 4e-04
gamma = 1e-04

```

```
Initial states:
```

```

l = 5204.6186
b = 32.9742
s = 0.9304 1.1186 0.8713 1.0796

```

```
sigma: 0.0326
```

```

      AIC      AICc      BIC

```

826.9728 830.8859 845.2010

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	9.409575	196.2264	152.566	0.03779557	2.402238

	MASE	ACF1
Training set	0.6971717	0.03959643

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0498
beta  = 0.0498
gamma = 1e-04
phi   = 0.9647
```

Initial states:

```
l = 5205.0585
b = 39.0041
s = 0.9304 1.1179 0.8708 1.0809
```

sigma: 0.0339

	AIC	AICc	BIC
	831.9334	836.8223	852.1869

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	13.13006	199.3933	154.8764	0.1618215	2.436779

	MASE	ACF1
Training set	0.7077298	0.1040908

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.4226
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 7412.1283
b = 6.7462
s = 453.9226 -379.5543 -472.6512 398.2829
```

sigma: 208.3339

	AIC	AICc	BIC
	832.7712	836.6842	850.9994

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	3.122625	192.8797	149.8259	-0.01445435	2.060577

	MASE	ACF1
Training set	0.7715338	0.0581955

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4325
beta  = 1e-04
gamma = 1e-04
phi   = 0.9361
```

Initial states:

```
l = 7412.6825
b = -1.359
s = 452.8552 -371.3199 -470.588 389.0528
```

sigma: 211.2094

	AIC	AICc	BIC
	835.1275	840.0164	855.3810

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	18.87583	193.4943	151.6741	0.1961418	2.080594

	MASE	ACF1
Training set	0.7810513	0.04857154

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.3951
beta  = 0.0094
gamma = 1e-04
```

Initial states:

```
l = 7419.0926
b = -3.4279
s = 1.0612 0.9495 0.9355 1.0538
```

sigma: 0.0287

	AIC	AICc	BIC
	833.4957	837.4087	851.7238

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	26.23535	192.1243	152.5001	0.2995242	2.087705

	MASE	ACF1
Training set	0.7853048	0.0771304

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4337
```

```
beta = 1e-04
gamma = 1e-04
phi = 0.9768
```

Initial states:

```
l = 7418.083
b = -2.1554
s = 1.0611 0.9497 0.9354 1.0538
```

sigma: 0.0288

```
      AIC      AICc      BIC
834.7166 839.6054 854.9701
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 20.27023 191.0744 151.8061 0.2162307 2.081281
```

```
           MASE      ACF1
Training set 0.7817307 0.05089017
```

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.1931
beta = 1e-04
gamma = 0.007
```

Initial states:

```
l = 7417.9728
b = 1.0004
s = 1.0607 0.9441 0.9435 1.0516
```

sigma: 0.0312

```
      AIC      AICc      BIC
842.9087 846.8217 861.1368
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 18.23083 210.1541 166.3385 0.1573279 2.268021
```

```
           MASE      ACF1
Training set 0.8565657 0.3195621
```

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.4339
gamma = 1e-04
```

Initial states:

```
l = 7404.9925
s = 452.6739 -367.2879 -470.4326 385.0467
```

sigma: 204.8059

```

      AIC      AICc      BIC
829.1443 831.4777 843.3218

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 18.32018 193.5234 151.918 0.186171 2.08419 0.7823068

```

```

      ACF1

```

```

Training set 0.04874608

```

```

ETS(M,N,A)

```

Call:

```

ets(y = ts_series, model = "MNA")

```

Smoothing parameters:

```

alpha = 0.4311

```

```

gamma = 1e-04

```

Initial states:

```

l = 7403.9207

```

```

s = 450.2415 -369.7091 -462.7801 382.2477

```

```

sigma: 0.0283

```

```

      AIC      AICc      BIC
830.3380 832.6714 844.5155

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 18.50474 193.6016 151.5764 0.1863183 2.078938

```

```

      MASE      ACF1

```

```

Training set 0.7805479 0.05049918

```

```

ETS(M,N,A)

```

Call:

```

ets(y = ts_series, model = "MNA")

```

Smoothing parameters:

```

alpha = 0.4311

```

```

gamma = 1e-04

```

Initial states:

```

l = 7403.9207

```

```

s = 450.2415 -369.7091 -462.7801 382.2477

```

```

sigma: 0.0283

```

```

      AIC      AICc      BIC
830.3380 832.6714 844.5155

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 18.50474 193.6016 151.5764 0.1863183 2.078938

```

```

      MASE      ACF1

```

```

Training set 0.7805479 0.05049918

```

```

ETS(A,A,A)

```

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

```
alpha = 0.4183
beta  = 1e-04
gamma = 0.0021
```

Initial states:

```
l = 7412.3021
b = 5.4812
s = 453.3762 -378.1032 -472.1153 396.8423
```

```
sigma: 208.5728
```

```
      AIC      AICc      BIC
832.8995 836.8126 851.1277
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 6.01128 193.1009 150.4577 0.02382116 2.067973
```

```
              MASE      ACF1
Training set 0.7747874 0.06170406
```

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4325
beta  = 1e-04
gamma = 1e-04
phi   = 0.9364
```

Initial states:

```
l = 7412.685
b = -1.3579
s = 452.8422 -371.3123 -470.5841 389.0542
```

```
sigma: 211.2094
```

```
      AIC      AICc      BIC
835.1275 840.0164 855.3810
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 18.88209 193.4943 151.6764 0.1962196 2.080621
```

```
              MASE      ACF1
Training set 0.7810631 0.04862876
```

ETS(M,M,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```
alpha = 0.3276
beta  = 0.0287
gamma = 1e-04
```

```

Initial states:
  l = 7422.8803
  b = 0.9971
  s = 1.0585 0.9509 0.9374 1.0532

sigma: 0.0291

      AIC      AICc      BIC
835.0254 838.9385 853.2536

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 33.63119 195.5426 156.5713 0.3941417 2.134351
              MASE      ACF1
Training set 0.8062692 0.1241517
ETS(M,Md,M)

Call:
ets(y = ts_series, model = "MMM", damped = TRUE)

Smoothing parameters:
  alpha = 0.4202
  beta  = 0.0118
  gamma = 1e-04
  phi   = 0.9748

Initial states:
  l = 7418.1791
  b = 0.9989
  s = 1.0605 0.9496 0.9365 1.0535

sigma: 0.0288

      AIC      AICc      BIC
834.7803 839.6692 855.0338

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 23.94276 191.2316 151.1452 0.2668341 2.069777
              MASE      ACF1
Training set 0.7783272 0.04660703
ETS(M,A,A)

Call:
ets(y = ts_series, model = "MAA")

Smoothing parameters:
  alpha = 0.4173
  beta  = 1e-04
  gamma = 1e-04

Initial states:
  l = 7410.5233
  b = 8.9187
  s = 452.0964 -373.8843 -461.3302 383.1182

sigma: 0.0287

```



```

      AIC      AICc      BIC
833.8104 837.7235 852.0386

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -1.930868 192.7762 150.9043 -0.09232313 2.076835

```

```

              MASE      ACF1
Training set 0.777087 0.061946

```

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.4278
beta  = 1e-04
gamma = 1e-04
phi   = 0.9728

```

Initial states:

```

l = 7413.064
b = -1.0253
s = 451.5992 -369.9927 -458.6397 377.0332

```

sigma: 0.0292

```

      AIC      AICc      BIC
836.4413 841.3302 856.6948

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 19.40986 193.8476 152.1437 0.1967223 2.085737

```

```

              MASE      ACF1
Training set 0.7834691 0.05114013

```

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.3705
beta  = 1e-04
gamma = 1e-04

```

Initial states:

```

l = 7418.0744
b = -2.5717
s = 1.06 0.9514 0.936 1.0526

```

sigma: 0.0287

```

      AIC      AICc      BIC
833.6848 837.5978 851.9129

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 27.34571 193.0019 155.7914 0.3008909 2.130034 0.802253

```

```

              ACF1

```

Training set 0.1136951

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4329

beta = 1e-04

gamma = 1e-04

phi = 0.977

Initial states:

l = 7417.6955

b = -2.5017

s = 1.0608 0.9493 0.9352 1.0547

sigma: 0.0288

AIC AICc BIC

834.8100 839.6989 855.0635

Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set 20.6452 191.2052 151.7742 0.2238277 2.080936 0.7815663

ACF1

Training set 0.05037667

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

alpha = 0.3219

beta = 1e-04

gamma = 1e-04

Initial states:

l = 6026.7991

b = 66.7183

s = -37.3187 177.6112 -164.9703 24.6778

sigma: 322.8483

AIC AICc BIC

881.8317 885.7447 900.0599

Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set 8.2508 298.8994 225.2577 -0.09855557 2.908827

MASE ACF1

Training set 0.5688187 0.1148908

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3757
beta  = 0.0215
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 6012.8447
b = 81.397
s = -32.0556 187.9773 -159.9664 4.0447
```

sigma: 337.1284

```
      AIC      AICc      BIC
887.5002 892.3891 907.7537
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 40.99486 308.8519 227.133 0.3220086 2.92541 0.5735543
```

ACF1

Training set 0.09258075

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.3955
beta  = 0.007
gamma = 1e-04
```

Initial states:

```
l = 6010.6045
b = 58.0435
s = 0.9958 1.0247 0.9788 1.0007
```

sigma: 0.0432

```
      AIC      AICc      BIC
884.7954 888.7084 903.0235
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 26.61644 302.5835 224.7089 0.1687583 2.902152
```

MASE ACF1

Training set 0.5674328 0.04599648

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3669
beta  = 0.0199
gamma = 2e-04
phi   = 0.98
```

Initial states:

```
l = 6010.3
```

```
b = 81.0362
s = 0.9957 1.0259 0.9788 0.9996
```

```
sigma: 0.0447
```

```
      AIC      AICc      BIC
889.1581 894.0470 909.4116
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set 42.62085 309.0215 225.3824 0.3413204 2.916225
      MASE      ACF1
```

```
Training set 0.5691336 0.08645761
```

```
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0508
beta  = 1e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 6052.7985
b = 1.0087
s = 0.9965 1.0251 0.9788 0.9996
```

```
sigma: 0.0431
```

```
      AIC      AICc      BIC
885.1357 889.0488 903.3639
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -10.5701 310.2661 242.7294 -0.3370171 3.15931
      MASE      ACF1
```

```
Training set 0.6129382 0.3471049
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.6472
gamma = 1e-04
```

```
Initial states:
```

```
l = 6823.9558
s = -21.5204 195.1898 -160.1386 -13.5308
```

```
sigma: 364.0885
```

```
      AIC      AICc      BIC
893.5817 895.9151 907.7592
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 85.66304 344.0313 244.4137 0.894083 3.145172 0.6171914
```

```
ACF1
```

```
Training set -0.03256585
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.6281
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 6799.2141
```

```
s = 18.3486 190.1626 -185.2344 -23.2768
```

```
sigma: 0.0492
```

```
AIC AICc BIC
```

```
896.6807 899.0140 910.8582
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set 88.16698 344.6142 252.7304 0.9289955 3.250109
```

```
MASE ACF1
```

```
Training set 0.6381925 -0.02758628
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.6281
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 6799.2141
```

```
s = 18.3486 190.1626 -185.2344 -23.2768
```

```
sigma: 0.0492
```

```
AIC AICc BIC
```

```
896.6807 899.0140 910.8582
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set 88.16698 344.6142 252.7304 0.9289955 3.250109
```

```
MASE ACF1
```

```
Training set 0.6381925 -0.02758628
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.3215
```

```
beta = 1e-04
```

```
gamma = 7e-04
```

Initial states:

l = 6028.0988  
 b = 67.3285  
 s = -37.4478 176.6906 -165.2951 26.0523

sigma: 322.9185

	AIC	AICc	BIC
	881.8561	885.7691	900.0842

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	6.380824	298.9645	225.4705	-0.1232564	2.912024

	MASE	ACF1
Training set	0.5693561	0.1150442

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3756  
 beta = 0.0215  
 gamma = 1e-04  
 phi = 0.98

Initial states:

l = 6012.8447  
 b = 81.3971  
 s = -32.0555 187.9773 -159.9664 4.0447

sigma: 337.1284

	AIC	AICc	BIC
	887.5002	892.3891	907.7537

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	40.99686	308.8519	227.134	0.322031	2.925427	0.5735567

	ACF1
Training set	0.09264012

ETS(M,M,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

alpha = 0.0762  
 beta = 1e-04  
 gamma = 1e-04

Initial states:

l = 6053.0544  
 b = 1.0087  
 s = 0.9959 1.0248 0.9769 1.0024

sigma: 0.0431

```

      AIC      AICc      BIC
884.8940 888.8071 903.1222

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -4.655767 309.4629 241.5629 -0.2652628 3.140746

```

```

           MASE      ACF1
Training set 0.6099925 0.3288571

```

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.3195
beta  = 0.0198
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 6010.8027
b = 1.0108
s = 0.9932 1.0234 0.9789 1.0045

```

sigma: 0.0445

```

      AIC      AICc      BIC
888.7249 893.6138 908.9784

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 43.39485 308.6921 226.1157 0.366658 2.918209 0.5709854

```

```

           ACF1
Training set 0.1182725

```

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```

alpha = 0.2894
beta  = 1e-04
gamma = 1e-04

```

Initial states:

```

l = 6013.0915
b = 60.2537
s = -40.1752 187.7825 -160.1236 12.5162

```

sigma: 0.0425

```

      AIC      AICc      BIC
882.8163 886.7294 901.0445

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 30.47431 300.4696 225.285 0.1846764 2.906267 0.5688877

```

```

                ACF1
Training set 0.1423006
ETS(M,Ad,A)

Call:
ets(y = ts_series, model = "MAA", damped = TRUE)

Smoothing parameters:
  alpha = 0.3636
  beta  = 0.0094
  gamma = 1e-04
  phi   = 0.98

Initial states:
  l = 6012.7368
  b = 79.6826
  s = -36.0996 187.5795 -159.2258 7.746

sigma: 0.0445

      AIC      AICc      BIC
888.5520 893.4409 908.8055

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 51.47789 309.8525 226.8059 0.4320843 2.913975
              MASE      ACF1
Training set 0.5727282 0.1105681
ETS(M,A,M)

Call:
ets(y = ts_series, model = "MAM")

Smoothing parameters:
  alpha = 0.1403
  beta  = 1e-04
  gamma = 8e-04

Initial states:
  l = 6005.899
  b = 62.6101
  s = 0.9959 1.0168 0.9794 1.0079

sigma: 0.0438

      AIC      AICc      BIC
886.3342 890.2473 904.5624

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 32.25641 316.2089 244.1542 0.1433816 3.13037 0.6165361
              ACF1
Training set 0.2921283
ETS(M,Ad,M)

Call:
ets(y = ts_series, model = "MAM", damped = TRUE)

```



```

Smoothing parameters:
  alpha = 0.4171
  beta  = 1e-04
  gamma = 1e-04
  phi   = 0.9797

Initial states:
  l = 6010.0403
  b = 79.9741
  s = 0.9982 1.0252 0.9757 1.0009

sigma: 0.0447

      AIC      AICc      BIC
889.0750 893.9639 909.3285

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 51.81114 311.521 228.456 0.4359504 2.939212 0.5768951
              ACF1
Training set 0.06342091
Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive")

Smoothing parameters:
  alpha = 0.5673
  beta  = 1e-04
  gamma = 1e-04

Initial states:
  l = 3984.5294
  b = -48.5384
  s = 12.379 158.5754 -44.5726 -126.3818

sigma: 234.6823

      AIC      AICc      BIC
846.1093 850.0223 864.3375

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -2.956094 217.2736 172.8067 -0.7093032 7.225079
              MASE      ACF1
Training set 0.5607805 0.01275523
Damped Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)

Smoothing parameters:
  alpha = 0.5814
  beta  = 1e-04
  gamma = 1e-04
  phi   = 0.98

Initial states:

```

```

l = 3987.776
b = -61.8395
s = 13.81 159.7571 -58.8552 -114.712

```

```
sigma: 238.1296
```

```

      AIC      AICc      BIC
848.5636 853.4524 868.8171

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set -22.80147 218.1566 175.8423 -1.820524 7.54727

```

```

              MASE      ACF1
Training set 0.5706315 -0.004309553
Holt-Winters' multiplicative method

```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

```
Smoothing parameters:
```

```

alpha = 0.544
beta  = 1e-04
gamma = 5e-04

```

```
Initial states:
```

```

l = 4021.3539
b = -36.2668
s = 0.9978 1.0574 0.9887 0.9561

```

```
sigma: 0.0993
```

```

      AIC      AICc      BIC
848.2696 852.1826 866.4977

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set -25.14935 223.3165 181.2788 -1.713064 7.773396

```

```

              MASE      ACF1
Training set 0.5882736 0.0396701
Damped Holt-Winters' multiplicative method

```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.6339
beta  = 1e-04
gamma = 8e-04
phi   = 0.98

```

```
Initial states:
```

```

l = 4021.6143
b = -63.4079
s = 0.9969 1.0601 0.9835 0.9595

```

```
sigma: 0.1008
```

```

      AIC      AICc      BIC

```

850.6756 855.5645 870.9291

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-19.53929	222.6298	179.8665	-1.653717	7.792862

  

	MASE	ACF1
Training set	0.5836905	-0.05123694

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.5747  
beta = 0.0129  
gamma = 1e-04

Initial states:

l = 4025.7971  
b = 0.9784  
s = 1.003 1.0588 0.9844 0.9538

sigma: 0.0998

AIC	AICc	BIC
847.9364	851.8495	866.1646

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.6067874	221.201	179.5494	-0.9315428	7.711963

  

	MASE	ACF1
Training set	0.5826616	0.0004119006

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

alpha = 0.699  
gamma = 1e-04

Initial states:

l = 3348.7055  
s = 13.6639 152.289 -68.4054 -97.5475

sigma: 259.8959

AIC	AICc	BIC
855.8248	858.1581	870.0022

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-55.17076	245.5785	201.2482	-3.288478	8.493408

  

	MASE	ACF1
Training set	0.653077	-0.03494735

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.7115
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 3340.4368
```

```
s = 36.8509 149.5185 -61.4866 -124.8828
```

```
sigma: 0.1013
```

```
AIC      AICc      BIC
```

```
850.4950 852.8283 864.6724
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set -54.4439 247.7038 203.0968 -3.24854 8.540863 0.6590759
```

```
ACF1
```

```
Training set -0.04871641
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.7115
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 3340.4368
```

```
s = 36.8509 149.5185 -61.4866 -124.8828
```

```
sigma: 0.1013
```

```
AIC      AICc      BIC
```

```
850.4950 852.8283 864.6724
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set -54.4439 247.7038 203.0968 -3.24854 8.540863 0.6590759
```

```
ACF1
```

```
Training set -0.04871641
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.5673
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 3984.5189
```

```
b = -48.5729
```

```
s = 12.3738 158.5743 -44.5313 -126.4168
```

sigma: 234.6823

	AIC	AICc	BIC
	846.1093	850.0224	864.3375

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-2.895696	217.2736	172.8007	-0.7066146	7.224561

	MASE	ACF1
Training set	0.5607611	0.01269145

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5813
beta = 1e-04
gamma = 1e-04
phi = 0.98
```

Initial states:

```
l = 3987.776
b = -61.8394
s = 13.8101 159.7571 -58.8554 -114.7118
```

sigma: 238.1297

	AIC	AICc	BIC
	848.5636	853.4525	868.8171

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-22.80376	218.1566	175.8422	-1.820671	7.547291

	MASE	ACF1
Training set	0.5706313	-0.004255081

ETS(M,M,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```
alpha = 0.5348
beta = 2e-04
gamma = 1e-04
```

Initial states:

```
l = 4025.5478
b = 0.9791
s = 1.0017 1.0727 0.9798 0.9457
```

sigma: 0.0984

	AIC	AICc	BIC
	846.1882	850.1012	864.4163

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
--	----	------	-----	-----	------

```
Training set 3.722147 221.6347 177.0171 -0.7062526 7.560794
```

```
      MASE      ACF1
```

```
Training set 0.5744438 0.03846123
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.6085
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
phi   = 0.98
```

```
Initial states:
```

```
l = 4025.8049
```

```
b = 0.9707
```

```
s = 1.0048 1.0713 0.9753 0.9487
```

```
sigma: 0.0999
```

```
      AIC      AICc      BIC
```

```
849.2707 854.1596 869.5242
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -5.204963 222.0666 179.4134 -1.24504 7.754725
```

```
      MASE      ACF1
```

```
Training set 0.5822202 -0.03258398
```

```
ETS(M,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA")
```

```
Smoothing parameters:
```

```
alpha = 0.5184
```

```
beta  = 2e-04
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 3952.8309
```

```
b = -42.8905
```

```
s = 9.2628 158.8906 -60.7739 -107.3795
```

```
sigma: 0.0959
```

```
      AIC      AICc      BIC
```

```
843.8464 847.7595 862.0746
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -12.65772 217.9587 174.9971 -1.180705 7.370388
```

```
      MASE      ACF1
```

```
Training set 0.5678886 0.05986838
```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.5783  
 beta = 0.0051  
 gamma = 1e-04  
 phi = 0.98

## Initial states:

l = 3987.9407  
 b = -53.4084  
 s = 14.0508 160.0688 -55.182 -118.9376

sigma: 0.0976

AIC	AICc	BIC
847.5408	852.4297	867.7943

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-28.14221	219.3445	176.2099	-2.006006	7.564925

	MASE	ACF1
Training set	0.5718244	-1.179614e-05

ETS(M,A,M)

## Call:

ets(y = ts\_series, model = "MAM")

## Smoothing parameters:

alpha = 0.5921  
 beta = 0.0057  
 gamma = 1e-04

## Initial states:

l = 4022.5241  
 b = -22.1187  
 s = 1.0055 1.0717 0.9747 0.9482

sigma: 0.0986

AIC	AICc	BIC
847.9562	851.8692	866.1843

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-37.32217	229.8929	179.3306	-2.12487	7.689088

	MASE	ACF1
Training set	0.5819514	0.004531355

ETS(M,Ad,M)

## Call:

ets(y = ts\_series, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.6188  
 beta = 0.0046  
 gamma = 2e-04  
 phi = 0.98

```

Initial states:
  l = 4021.9421
  b = -54.7317
  s = 1.0027 1.0738 0.9722 0.9513

sigma: 0.1

      AIC      AICc      BIC
850.0226 854.9115 870.2761

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -27.06454 227.4859 178.2081 -1.88888 7.696907
              MASE      ACF1
Training set 0.5783088 -0.03631197
Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive")

Smoothing parameters:
  alpha = 0.3884
  beta  = 0.0465
  gamma = 0.5347

Initial states:
  l = 1824.8699
  b = 66.7392
  s = -151.5554 274.5971 -222.3549 99.3132

sigma: 113.4177

      AIC      AICc      BIC
764.6679 768.5810 782.8961

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -12.41233 105.0044 87.42492 -0.3278851 2.6322
              MASE      ACF1
Training set 0.4157495 -0.009367651
Damped Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)

Smoothing parameters:
  alpha = 0.2719
  beta  = 1e-04
  gamma = 0.5078
  phi   = 0.9727

Initial states:
  l = 1869.1139
  b = 102.8535
  s = -184.9442 474.8353 -214.3832 -75.5079

sigma: 120.5519

```



```

      AIC      AICc      BIC
772.3212 777.2101 792.5748

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -2.740619 110.4406 77.8052 -0.2386648 2.355166
              MASE      ACF1
Training set 0.3700029 0.05081785
Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```

alpha = 0.6028
beta  = 0.0551
gamma = 0.2895

```

Initial states:

```

l = 1939.3836
b = 95.8655
s = 0.932 1.1078 0.9575 1.0027

```

sigma: 0.0298

```

      AIC      AICc      BIC
755.6294 759.5424 773.8575

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -17.44662 93.24472 76.30524 -0.6232055 2.257259
              MASE      ACF1
Training set 0.3628698 -0.02704367
Damped Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.4973
beta  = 1e-04
gamma = 0.3014
phi   = 0.9756

```

Initial states:

```

l = 1871.4125
b = 96.2126
s = 0.9317 1.1125 0.9598 0.996

```

sigma: 0.0279

```

      AIC      AICc      BIC
748.3205 753.2094 768.5740

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -0.1690988 87.12606 69.2723 -0.1171782 2.023692
              MASE      ACF1

```

```
Training set 0.3294246 0.02208814
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.6467
```

```
beta = 0.085
```

```
gamma = 0.2784
```

```
Initial states:
```

```
l = 1941.5239
```

```
b = 1.0244
```

```
s = 0.9332 1.1114 0.9553 1.0001
```

```
sigma: 0.0305
```

```
AIC      AICc      BIC
```

```
757.7905 761.7035 776.0186
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -14.22775 96.18923 79.55388 -0.4049347 2.322325
```

```
MASE      ACF1
```

```
Training set 0.3783187 -0.02195386
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.6367
```

```
gamma = 0.3633
```

```
Initial states:
```

```
l = 2356.3225
```

```
s = -318.8882 313.5256 -132.6508 138.0135
```

```
sigma: 159.2682
```

```
AIC      AICc      BIC
```

```
800.9793 803.3127 815.1568
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 58.2453 150.4943 104.6282 1.544727 3.389595 0.4975599
```

```
ACF1
```

```
Training set -0.04387447
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.7474
```

```
gamma = 0.2509
```

```

Initial states:
  l = 2564.6654
  s = -136.9574 222.4906 -169.0228 83.4897

sigma: 0.0583

      AIC      AICc      BIC
826.8683 829.2016 841.0457

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 48.33707 164.0596 112.3866 1.091609 3.518561 0.534455
              ACF1
Training set -0.06508562
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.7474
  gamma = 0.2509

Initial states:
  l = 2564.6654
  s = -136.9574 222.4906 -169.0228 83.4897

sigma: 0.0583

      AIC      AICc      BIC
826.8683 829.2016 841.0457

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 48.33707 164.0596 112.3866 1.091609 3.518561 0.534455
              ACF1
Training set -0.06508562
ETS(A,A,A)

Call:
ets(y = ts_series, model = "AAA")

Smoothing parameters:
  alpha = 0.3884
  beta  = 0.0465
  gamma = 0.5347

Initial states:
  l = 1824.8699
  b = 66.7392
  s = -151.5554 274.5971 -222.3549 99.3132

sigma: 113.4177

      AIC      AICc      BIC
764.6679 768.5810 782.8961

Training set error measures:

```

	ME	RMSE	MAE	MPE	MAPE
Training set	-12.41233	105.0044	87.42492	-0.3278851	2.6322

	MASE	ACF1
Training set	0.4157495	-0.009367651

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2711
beta = 1e-04
gamma = 0.5053
phi = 0.9727
```

Initial states:

```
l = 1869.0708
b = 102.7381
s = -185.0001 474.9501 -214.4063 -75.5437
```

sigma: 120.5526

AIC	AICc	BIC
772.3219	777.2108	792.5754

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-2.730189	110.4413	77.79328	-0.2379871	2.354648

	MASE	ACF1
Training set	0.3699462	0.0513589

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```
alpha = 0.5599
beta = 1e-04
gamma = 0.2514
phi = 0.9636
```

Initial states:

```
l = 1893.8934
b = 1.0408
s = 0.9368 1.109 0.9531 1.0012
```

sigma: 0.0279

AIC	AICc	BIC
748.4356	753.3245	768.6892

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.3506947	88.74095	71.69128	-0.08210145	2.085571

	MASE	ACF1
Training set	0.3409281	0.0008097627

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5599
beta  = 1e-04
gamma = 0.2514
phi   = 0.9636
```

Initial states:

```
l = 1893.8934
b = 1.0408
s = 0.9368 1.109 0.9531 1.0012
```

sigma: 0.0279

```
      AIC      AICc      BIC
748.4356 753.3245 768.6892
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -0.3506947 88.74095 71.69128 -0.08210145 2.085571
              MASE      ACF1
Training set 0.3409281 0.0008097627
ETS(M,Ad,A)
```

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.2271
beta  = 1e-04
gamma = 0.4664
phi   = 0.9681
```

Initial states:

```
l = 1862.096
b = 110.2096
s = -186.0921 471.1894 -219.8138 -65.2835
```

sigma: 0.0378

```
      AIC      AICc      BIC
782.5600 787.4489 802.8135
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 1.629468 111.2024 76.66502 -0.1824778 2.278437
              MASE      ACF1
Training set 0.3645808 0.09943989
ETS(M,Ad,A)
```

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2271
beta  = 1e-04
```

```
gamma = 0.4664
phi   = 0.9681
```

## Initial states:

```
l = 1862.096
b = 110.2096
s = -186.0921 471.1894 -219.8138 -65.2835
```

```
sigma: 0.0378
```

```
      AIC      AICc      BIC
782.5600 787.4489 802.8135
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 1.629468 111.2024 76.66502 -0.1824778 2.278437
```

```
              MASE      ACF1
Training set 0.3645808 0.09943989
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.4974
beta  = 1e-04
gamma = 0.2855
phi   = 0.9765
```

## Initial states:

```
l = 1827.5218
b = 95.6572
s = 0.9389 1.1044 0.9521 1.0046
```

```
sigma: 0.0271
```

```
      AIC      AICc      BIC
745.0297 749.9186 765.2832
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -0.2542389 86.85188 68.54752 -0.09003932 1.960967
```

```
              MASE      ACF1
Training set 0.3259779 0.009460387
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.4974
beta  = 1e-04
gamma = 0.2855
phi   = 0.9765
```

## Initial states:

```
l = 1827.5218
b = 95.6572
```

```
s = 0.9389 1.1044 0.9521 1.0046
```

```
sigma: 0.0271
```

```
      AIC      AICc      BIC
745.0297 749.9186 765.2832
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -0.2542389 86.85188 68.54752 -0.09003932 1.960967
           MASE      ACF1
Training set 0.3259779 0.009460387
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

```
Smoothing parameters:
```

```
alpha = 0.2374
beta  = 0.2374
gamma = 1e-04
```

```
Initial states:
```

```
l = 8979.1421
b = 29.3237
s = -8.9986 -95.0918 12.2018 91.8886
```

```
sigma: 22.5863
```

```
      AIC      AICc      BIC
629.1559 632.7559 648.0050
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 0.7118257 21.02671 14.83251 0.007144836 0.1529951
           MASE      ACF1
Training set 0.1048711 -0.06194766
Damped Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2539
beta  = 0.2539
gamma = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 8979.0571
b = 39.4678
s = -6.9883 -95.0865 12.0217 90.0531
```

```
sigma: 23.8678
```

```
      AIC      AICc      BIC
636.6134 641.1032 657.5568
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.761129	22.00507	14.93829	0.02676367	0.1539584
	MASE	ACF1			
Training set	0.1056189	-0.04061675			

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.2135
beta  = 0.2135
gamma = 0.2038
```

Initial states:

```
l = 8980.1976
b = 29.114
s = 1 0.9896 1 1.0104
```

sigma: 0.0025

AIC	AICc	BIC
639.6417	643.2417	658.4908

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.029575	21.72496	16.55508	0.0103709	0.1713874
	MASE	ACF1			
Training set	0.1170502	-0.04325707			

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.238
beta  = 0.238
gamma = 0.214
phi   = 0.976
```

Initial states:

```
l = 8980.0835
b = 38.5289
s = 1 0.989 1.0003 1.0107
```

sigma: 0.0026

AIC	AICc	BIC
646.4648	650.9546	667.4083

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	3.80218	22.5661	16.79323	0.03730156	0.1740423	0.118734
	ACF1					
Training set	-0.03968415					

Holt-Winters' multiplicative method with exponential trend



Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.216
beta  = 0.2069
gamma = 0.2533
```

Initial states:

```
l = 8980.1432
b = 1.0027
s = 1.0004 0.9893 0.9997 1.0105
```

sigma: 0.0025

```
      AIC      AICc      BIC
639.0793 642.6793 657.9284
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 0.845938 21.62721 16.67375 0.009048979 0.1726774
              MASE      ACF1
Training set 0.1178892 -0.05091115
ETS(A,N,A)
```

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.9999
gamma = 1e-04
```

Initial states:

```
l = 9449.3965
s = 5.9574 -100.425 6.9839 87.4838
```

sigma: 71.8484

```
      AIC      AICc      BIC
766.2861 768.4399 780.9465
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 27.08978 68.16141 43.83076 0.2624873 0.4457376
              MASE      ACF1
Training set 0.3098988 0.08641842
ETS(M,N,A)
```

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9997
gamma = 1e-04
```

Initial states:

```
l = 9420.5742
s = 6.3533 -89.1897 0.8951 81.9413
```

sigma: 0.0071

AIC	AICc	BIC
763.2998	765.4536	777.9602

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	27.56837	65.04283	42.62613	0.2671878	0.4320771

	MASE	ACF1
Training set	0.3013817	0.1143727

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.9997  
gamma = 1e-04

Initial states:

l = 9420.5742  
s = 6.3533 -89.1897 0.8951 81.9413

sigma: 0.0071

AIC	AICc	BIC
763.2998	765.4536	777.9602

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	27.56837	65.04283	42.62613	0.2671878	0.4320771

	MASE	ACF1
Training set	0.3013817	0.1143727

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

alpha = 0.2374  
beta = 0.2374  
gamma = 1e-04

Initial states:

l = 8979.1421  
b = 29.3237  
s = -8.9986 -95.0918 12.2018 91.8886

sigma: 22.5863

AIC	AICc	BIC
629.1559	632.7559	648.0050

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.7118257	21.02671	14.83251	0.007144836	0.1529951

	MASE	ACF1
--	------	------

```
Training set 0.1048711 -0.06194766
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2539
beta  = 0.2539
gamma = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 8979.057
b = 39.4677
s = -6.9884 -95.0863 12.0216 90.0532
```

```
sigma: 23.8678
```

```
      AIC      AICc      BIC
636.6133 641.1031 657.5568
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 2.761455 22.00505 14.93859 0.02676689 0.1539614
```

```
           MASE      ACF1
Training set 0.105621 -0.0405562
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.2087
beta  = 0.2087
gamma = 0.1971
```

```
Initial states:
```

```
l = 8980.4739
b = 1.0024
s = 1.0005 0.9893 1 1.0101
```

```
sigma: 0.0025
```

```
      AIC      AICc      BIC
638.6180 642.2180 657.4671
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 1.050708 21.60715 16.64214 0.01137275 0.1719375
```

```
           MASE      ACF1
Training set 0.1176658 -0.02848428
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2198
beta  = 0.2198
gamma = 0.2031
phi   = 0.9757
```

Initial states:

```
l = 8980.2648
b = 1.0026
s = 1.0006 0.9892 1.0001 1.0101
```

sigma: 0.0025

```
      AIC      AICc      BIC
642.1358 646.6256 663.0792
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 4.7207 21.86514 16.73183 0.04769009 0.1730296
           MASE      ACF1
Training set 0.1182999 -0.06221466
ETS(M,A,A)
```

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.2324
beta  = 0.2323
gamma = 1e-04
```

Initial states:

```
l = 8979.162
b = 29.3763
s = -5.1406 -96.5282 10.2221 91.4466
```

sigma: 0.0024

```
      AIC      AICc      BIC
636.2843 639.8843 655.1334
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 0.6854398 21.2023 15.12696 0.006914041 0.1553943
           MASE      ACF1
Training set 0.1069529 -0.05315665
ETS(M,Ad,A)
```

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2514
beta  = 0.2514
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 8978.8642
```

```
b = 38.945
s = -6.3299 -94.8975 11.1822 90.0452
```

```
sigma: 0.0025
```

```
      AIC      AICc      BIC
643.0851 647.5749 664.0286
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE
Training set 2.815368 21.96788 15.00573 0.02733141 0.1545426
           MASE      ACF1
Training set 0.1060957 -0.03697385
ETS(M,A,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.2151
beta  = 0.2151
gamma = 0.167
```

```
Initial states:
```

```
l = 8980.1571
b = 28.9181
s = 1 0.9895 1.0003 1.0102
```

```
sigma: 0.0025
```

```
      AIC      AICc      BIC
639.3755 642.9755 658.2246
```

```
Training set error measures:
```

```

           ME      RMSE      MAE      MPE      MAPE
Training set 1.026383 21.71539 16.52947 0.01038254 0.170781
           MASE      ACF1
Training set 0.1168692 -0.03604119
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2404
beta  = 0.2404
gamma = 1e-04
phi   = 0.9786
```

```
Initial states:
```

```
l = 8978.8608
b = 38.523
s = 0.9991 0.9904 1.001 1.0096
```

```
sigma: 0.0026
```

```
      AIC      AICc      BIC
643.8773 648.3670 664.8207
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	3.344528	22.09451	15.1477	0.0326308	0.1559364

  

	MASE	ACF1
Training set	0.1070996	-0.009600656

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.2473
beta  = 0.243
gamma = 1e-04
```

Initial states:

```
l = 8265.248
b = 27.7212
s = -6.8422 -79.819 9.096 77.5653
```

sigma: 19.9336

AIC	AICc	BIC
614.1635	617.7635	633.0126

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.6067292	18.55718	12.80672	0.006509061	0.1435148

  

	MASE	ACF1
Training set	0.1001419	-0.0503315

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2594
beta  = 0.2593
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 8265.0314
b = 35.9191
s = -6.5382 -79.9154 9.2034 77.2502
```

sigma: 20.7037

AIC	AICc	BIC
619.5473	624.0371	640.4907

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.513337	19.08791	12.86221	0.02654975	0.1443315

  

	MASE	ACF1
Training set	0.1005758	-0.04122836

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

alpha = 0.2248

beta = 0.2086

gamma = 0.2814

Initial states:

l = 8264.8732

b = 26.1972

s = 1.0009 0.9896 0.9996 1.0099

sigma: 0.0024

AIC	AICc	BIC
624.3440	627.9440	643.1931

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.035338	19.15011	14.7483	0.01133912	0.1661997

	MASE	ACF1
Training set	0.1153241	-0.03485454

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2516

beta = 0.2516

gamma = 1e-04

phi = 0.976

Initial states:

l = 8265.7885

b = 35.8248

s = 0.9993 0.9912 1.0009 1.0087

sigma: 0.0025

AIC	AICc	BIC
629.0107	633.5005	649.9541

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	3.209953	19.55514	13.27064	0.03403677	0.1482446

	MASE	ACF1
Training set	0.1037695	-0.01731421

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.2262

beta = 0.212

gamma = 0.2655

Initial states:

l = 8269.9249

b = 1.0027

s = 1.001 0.9897 0.9997 1.0096

sigma: 0.0024

AIC AICc BIC

624.0699 627.6699 642.9190

Training set error measures:

ME RMSE MAE MPE MAPE

Training set 0.7647628 19.11984 14.7891 0.008774504 0.1664642

MASE ACF1

Training set 0.1156431 -0.02326398

ETS(A,N,A)

Call:

ets(y = ts\_series, model = "ANA")

Smoothing parameters:

alpha = 0.9999

gamma = 1e-04

Initial states:

l = 8683.8143

s = 6.9633 -79.365 0.5912 71.8105

sigma: 63.9406

AIC AICc BIC

752.2935 754.4474 766.9539

Training set error measures:

ME RMSE MAE MPE MAPE

Training set 24.6624 60.65934 38.88144 0.2600137 0.4292911

MASE ACF1

Training set 0.3040327 0.09558917

ETS(M,N,A)

Call:

ets(y = ts\_series, model = "MNA")

Smoothing parameters:

alpha = 0.9999

gamma = 1e-04

Initial states:

l = 8678.838

s = 8.8078 -73.5671 -0.9161 65.6755

sigma: 0.0071

AIC AICc BIC

754.4206 756.5744 769.0810



Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	24.71449	60.42886	38.48461	0.2603533	0.424258
	MASE	ACF1			
Training set	0.3009297	0.1039052			

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9999
gamma = 1e-04
```

Initial states:

```
l = 8678.838
s = 8.8078 -73.5671 -0.9161 65.6755
```

sigma: 0.0071

	AIC	AICc	BIC
	754.4206	756.5744	769.0810

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	24.71449	60.42886	38.48461	0.2603533	0.424258
	MASE	ACF1			
Training set	0.3009297	0.1039052			

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

```
alpha = 0.2473
beta = 0.243
gamma = 1e-04
```

Initial states:

```
l = 8265.248
b = 27.7212
s = -6.8422 -79.819 9.096 77.5653
```

sigma: 19.9336

	AIC	AICc	BIC
	614.1635	617.7635	633.0126

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.6067292	18.55718	12.80672	0.006509061	0.1435148
	MASE	ACF1			
Training set	0.1001419	-0.0503315			

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.2595
beta  = 0.2595
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 8265.0291
b = 35.9197
s = -6.5374 -79.916 9.202 77.2513
```

```
sigma: 20.7036
```

```
      AIC      AICc      BIC
619.5467 624.0365 640.4901
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 2.511297 19.08782 12.86023 0.02652781 0.1443095
```

```
              MASE      ACF1
Training set 0.1005604 -0.04153764
ETS(M,M,M)
```

## Call:

```
ets(y = ts_series, model = "MMM")
```

## Smoothing parameters:

```
alpha = 0.2177
beta  = 0.2098
gamma = 0.2454
```

## Initial states:

```
l = 8273.0402
b = 1.0026
s = 1.001 0.9898 0.9997 1.0095
```

```
sigma: 0.0024
```

```
      AIC      AICc      BIC
624.1137 627.7137 642.9628
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 0.8093805 19.14978 14.89184 0.009326451 0.167512
```

```
              MASE      ACF1
Training set 0.1164465 0.002398763
ETS(M,Md,M)
```

## Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.2309
beta  = 0.2294
gamma = 1e-04
phi   = 0.9791
```

## Initial states:

```

l = 8266.1191
b = 1.0029
s = 0.9992 0.9913 1.0008 1.0087

```

```
sigma: 0.0024
```

```

      AIC      AICc      BIC
625.1316 629.6214 646.0750

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 3.425428 18.97449 12.90695 0.03737392 0.1438938

```

```

              MASE      ACF1
Training set 0.1009257 -0.03013089
ETS(M,A,A)

```

```
Call:
```

```
ets(y = ts_series, model = "MAA")
```

```
Smoothing parameters:
```

```

alpha = 0.236
beta  = 0.2359
gamma = 0.0042

```

```
Initial states:
```

```

l = 8267.2597
b = 26.868
s = -4.7294 -80.4084 7.6907 77.4471

```

```
sigma: 0.0023
```

```

      AIC      AICc      BIC
620.8156 624.4156 639.6647

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 0.6624897 18.63595 13.25687 0.00720615 0.1481441

```

```

              MASE      ACF1
Training set 0.1036619 -0.02716016
ETS(M,Ad,A)

```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.2501
beta  = 0.2501
gamma = 1e-04
phi   = 0.98

```

```
Initial states:
```

```

l = 8265.0896
b = 35.8092
s = -6.8173 -79.7449 9.2497 77.3126

```

```
sigma: 0.0024
```

```

      AIC      AICc      BIC

```

626.4198 630.9096 647.3632

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.614505	19.08114	12.94114	0.02764038	0.1452549
	MASE	ACF1			
Training set	0.101193	-0.02324026			

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

alpha = 0.2148  
beta = 0.2148  
gamma = 0.2159

Initial states:

l = 8265.934  
b = 26.8625  
s = 1.0005 0.99 0.9999 1.0096

sigma: 0.0024

AIC	AICc	BIC
624.2683	627.8683	643.1174

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.9377135	19.17262	14.89698	0.01022492	0.1675809
	MASE	ACF1			
Training set	0.1164866	-0.01793232			

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2423  
beta = 0.2401  
gamma = 1e-04  
phi = 0.9777

Initial states:

l = 8265.3562  
b = 36.585  
s = 0.9992 0.9912 1.0008 1.0088

sigma: 0.0025

AIC	AICc	BIC
629.1573	633.6471	650.1007

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	3.087515	19.5865	13.39878	0.03263821	0.1497442
	MASE	ACF1			
Training set	0.1047715	0.009185694			

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.58
beta  = 0.068
gamma = 1e-04
```

Initial states:

```
l = 6705.6804
b = 28.205
s = -18.6256 -149.6647 23.2117 145.0786
```

sigma: 36.4509

AIC	AICc	BIC
686.5906	690.1906	705.4397

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.582276	33.93395	23.11609	0.03210705	0.3166342

	MASE	ACF1
Training set	0.1644437	-0.010508

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4776
beta  = 0.1902
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 6705.5493
b = 31.7692
s = -18.3591 -147.921 23.6428 142.6373
```

sigma: 37.5284

AIC	AICc	BIC
690.9214	695.4112	711.8649

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	3.149888	34.59951	23.61987	0.04074553	0.3240901

	MASE	ACF1
Training set	0.1680275	0.0008876634

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.3607
```

```
beta = 0.3502
gamma = 1e-04
```

## Initial states:

```
l = 6705.6894
b = 25.6505
s = 0.9972 0.9803 1.0027 1.0198
```

```
sigma: 0.0052
```

```
      AIC      AICc      BIC
694.4318 698.0318 713.2809
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 0.06314918 33.82794 24.81872 0.001458696 0.3400239
```

```
              MASE      ACF1
Training set 0.1765559 -0.005390828
```

```
Damped Holt-Winters' multiplicative method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.4773
beta = 0.2353
gamma = 1e-04
phi = 0.9799
```

## Initial states:

```
l = 6707.5688
b = 33.1871
s = 0.997 0.9803 1.0028 1.0198
```

```
sigma: 0.0052
```

```
      AIC      AICc      BIC
695.7525 700.2423 716.6959
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 2.61016 33.49811 23.0805 0.03369257 0.3168791
```

```
              MASE      ACF1
Training set 0.1641905 -0.03139961
```

```
Holt-Winters' multiplicative method with exponential trend
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

## Smoothing parameters:

```
alpha = 0.114
beta = 0.0423
gamma = 0.886
```

## Initial states:

```
l = 6706.7194
b = 1.0014
s = 1.0084 0.9728 0.9934 1.0255
```

```

sigma: 0.0061

      AIC      AICc      BIC
715.0045 718.6045 733.8536

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 8.779351 40.67239 28.96621 0.1259253 0.3950113
              MASE      ACF1
Training set 0.2060604 0.4141619
ETS(A,N,A)

Call:
ets(y = ts_series, model = "ANA")

Smoothing parameters:
alpha = 0.9999
gamma = 1e-04

Initial states:
l = 7061.2107
s = -13.8717 -139.1875 18.3271 134.7322

sigma: 65.3142

      AIC      AICc      BIC
754.8443 756.9981 769.5047

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 26.87943 61.96253 45.11225 0.3395794 0.6048309
              MASE      ACF1
Training set 0.3209204 0.1455949
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
alpha = 0.9999
gamma = 1e-04

Initial states:
l = 7023.2513
s = -10.5881 -132.8166 17.3014 126.1033

sigma: 0.0086

      AIC      AICc      BIC
754.1908 756.3447 768.8512

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 27.45745 60.56997 44.39755 0.3469516 0.592847
              MASE      ACF1
Training set 0.3158362 0.1362423
ETS(M,N,A)

```

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9999
gamma = 1e-04
```

Initial states:

```
l = 7023.2513
s = -10.5881 -132.8166 17.3014 126.1033
```

sigma: 0.0086

AIC	AICc	BIC
754.1908	756.3447	768.8512

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	27.45745	60.56997	44.39755	0.3469516	0.592847

	MASE	ACF1
Training set	0.3158362	0.1362423

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

```
alpha = 0.58
beta = 0.068
gamma = 1e-04
```

Initial states:

```
l = 6705.6804
b = 28.205
s = -18.6256 -149.6647 23.2117 145.0786
```

sigma: 36.4509

AIC	AICc	BIC
686.5906	690.1906	705.4397

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.582276	33.93395	23.11609	0.03210705	0.3166342

	MASE	ACF1
Training set	0.1644437	-0.010508

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4778
beta = 0.1901
gamma = 1e-04
phi = 0.98
```



Initial states:

l = 6705.5487  
 b = 31.7751  
 s = -18.3609 -147.9233 23.6425 142.6418

sigma: 37.5284

AIC	AICc	BIC
690.9214	695.4112	711.8649

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	3.15154	34.59951	23.6182	0.04076561	0.3240678

  

	MASE	ACF1
Training set	0.1680156	0.0008153998

ETS(M,M,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

alpha = 0.4074  
 beta = 0.2289  
 gamma = 1e-04

Initial states:

l = 6708.0273  
 b = 0.9999  
 s = 0.9974 0.9801 1.0027 1.0198

sigma: 0.0049

AIC	AICc	BIC
687.3954	690.9954	706.2445

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.557708	31.94879	23.01889	0.02490266	0.3139624

  

	MASE	ACF1
Training set	0.1637523	-0.04520195

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3983  
 beta = 0.1777  
 gamma = 1e-04  
 phi = 0.98

Initial states:

l = 6707.5501  
 b = 0.9998  
 s = 0.9974 0.9803 1.0026 1.0197

sigma: 0.0049

```

      AIC      AICc      BIC
688.5078 692.9976 709.4513

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 5.763451 31.68823 23.01547 0.08038675 0.3139077
              MASE      ACF1
Training set 0.163728 -0.02496557
ETS(M,A,A)

```

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```

alpha = 0.5715
beta  = 0.06
gamma = 1e-04

```

Initial states:

```

l = 6707.6227
b = 26.5021
s = -20.9074 -147.2788 21.4504 146.7358

```

sigma: 0.0051

```

      AIC      AICc      BIC
693.7039 697.3039 712.5530

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 3.513118 33.75497 23.33783 0.04436312 0.3198466
              MASE      ACF1
Training set 0.1660212 0.0007172351
ETS(M,Ad,A)

```

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.497
beta  = 0.1813
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 6705.3429
b = 33.6393
s = -18.9257 -149.1934 23.634 144.4852

```

sigma: 0.0053

```

      AIC      AICc      BIC
699.3363 703.8260 720.2797

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 3.18945 34.59655 23.23552 0.04110982 0.3193471
              MASE      ACF1

```

```
Training set 0.1652933 -0.001999844
ETS(M,A,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.4671
beta  = 0.2153
gamma = 1e-04
```

```
Initial states:
```

```
l = 6704.3962
b = 29.264
s = 0.9974 0.9802 1.0026 1.0198
```

```
sigma: 0.0051
```

```
      AIC      AICc      BIC
692.6224 696.2224 711.4715
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 0.1862193 33.30906 23.44483 0.002729789 0.3210638
```

```
              MASE      ACF1
Training set 0.1667823 -0.01268666
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.4859
beta  = 0.2068
gamma = 1e-04
phi   = 0.9783
```

```
Initial states:
```

```
l = 6707.5982
b = 32.8407
s = 0.9974 0.9802 1.0026 1.0198
```

```
sigma: 0.0052
```

```
      AIC      AICc      BIC
695.2093 699.6991 716.1528
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 3.240166 33.4701 23.5502 0.04175264 0.3223614
```

```
              MASE      ACF1
Training set 0.1675319 -0.01236664
```

```
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 0.0797
gamma = 1e-04
```

## Initial states:

```
l = 9344.2407
b = 117.4445
s = -7.3483 -65.5772 14.851 58.0744
```

```
sigma: 180.5667
```

```
      AIC      AICc      BIC
878.6066 882.2066 897.4557
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -24.78804 168.0984 88.09168 -0.2774997 0.9887396
```

```
           MASE      ACF1
Training set 0.5112056 0.1031473
```

```
Damped Holt-Winters' additive method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9984
beta  = 1e-04
gamma = 5e-04
phi   = 0.8535
```

## Initial states:

```
l = 8947.7755
b = 117.8599
s = -6.9843 -65.2627 14.8638 57.3832
```

```
sigma: 149.8005
```

```
      AIC      AICc      BIC
857.0261 861.5159 877.9695
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -18.80474 138.1092 72.82039 -0.2220496 0.8202104
```

```
           MASE      ACF1
Training set 0.4225847 0.1109283
```

```
Holt-Winters' multiplicative method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 0.08
gamma = 1e-04
```

## Initial states:

```
l = 9344.4835
b = 117.7105
```

```
s = 0.9996 0.994 1.0016 1.0048
```

```
sigma: 0.0199
```

```
      AIC      AICc      BIC
876.8084 880.4084 895.6575
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -24.80695 167.7743 91.30723 -0.2784206 1.024714
           MASE      ACF1
Training set 0.5298658 0.1114323
Damped Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9648
beta  = 0.009
gamma = 0.0162
phi   = 0.8979
```

```
Initial states:
```

```
l = 8956.7587
b = 119.785
s = 0.9979 0.9946 1.0022 1.0052
```

```
sigma: 0.0172
```

```
      AIC      AICc      BIC
860.0414 864.5312 880.9849
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -23.81457 140.8838 77.84583 -0.2762468 0.8770051
           MASE      ACF1
Training set 0.4517478 0.1335365
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9835
beta  = 1e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 9346.3357
b = 0.9984
s = 0.9994 0.9934 1.0019 1.0053
```

```
sigma: 0.0189
```

```
      AIC      AICc      BIC
870.2736 873.8736 889.1227
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.6320314	157.0682	74.03531	-0.008352409	0.8338872
	MASE	ACF1			
Training set	0.429635	0.1445068			

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.9971
gamma = 1e-04
```

Initial states:

```
l = 9142.1949
s = 0.2496 -61.8766 11.0811 50.5459
```

sigma: 153.0093

	AIC	AICc	BIC
	856.9989	859.1528	871.6593

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-10.73969	145.1574	72.39099	-0.1346751	0.8144741
	MASE	ACF1			
Training set	0.4200928	0.1365333			

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9996
gamma = 1e-04
```

Initial states:

```
l = 9143.1426
s = -6.04 -63.9614 15.0483 54.9532
```

sigma: 0.0172

	AIC	AICc	BIC
	857.8062	859.9600	872.4666

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-10.62255	145.2319	72.13011	-0.1329578	0.8119333
	MASE	ACF1			
Training set	0.4185789	0.1351496			

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9996
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 9143.1426
```

```
s = -6.04 -63.9614 15.0483 54.9532
```

```
sigma: 0.0172
```

```
AIC      AICc      BIC
```

```
857.8062 859.9600 872.4666
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -10.62255 145.2319 72.13011 -0.1329578 0.8119333
```

```
MASE      ACF1
```

```
Training set 0.4185789 0.1351496
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.9984
```

```
beta = 1e-04
```

```
gamma = 5e-04
```

```
phi = 0.8535
```

```
Initial states:
```

```
l = 8947.7755
```

```
b = 117.8599
```

```
s = -6.9843 -65.2627 14.8638 57.3832
```

```
sigma: 149.8005
```

```
AIC      AICc      BIC
```

```
857.0261 861.5159 877.9695
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -18.80474 138.1092 72.82039 -0.2220496 0.8202104
```

```
MASE      ACF1
```

```
Training set 0.4225847 0.1109283
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9984
```

```
beta = 1e-04
```

```
gamma = 5e-04
```

```
phi = 0.8535
```

```
Initial states:
```

```
l = 8947.7755
```

```
b = 117.8599
```

```
s = -6.9843 -65.2627 14.8638 57.3832
```

```

sigma: 149.8005

      AIC      AICc      BIC
857.0261 861.5159 877.9695

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -18.80474 138.1092 72.82039 -0.2220496 0.8202104
              MASE      ACF1
Training set 0.4225847 0.1109283
ETS(M,Md,M)

Call:
ets(y = ts_series, model = "MMM")

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04
phi   = 0.9404

Initial states:
l = 8922.231
b = 1.004
s = 0.9985 0.9937 1.0013 1.0066

sigma: 0.0167

      AIC      AICc      BIC
856.7122 861.2020 877.6556

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -16.15066 136.6911 71.87999 -0.1918326 0.809126
              MASE      ACF1
Training set 0.4171274 0.1234965
ETS(M,Md,M)

Call:
ets(y = ts_series, model = "MMM", damped = TRUE)

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04
phi   = 0.9404

Initial states:
l = 8922.231
b = 1.004
s = 0.9985 0.9937 1.0013 1.0066

sigma: 0.0167

      AIC      AICc      BIC
856.7122 861.2020 877.6556

Training set error measures:

```



	ME	RMSE	MAE	MPE	MAPE
Training set	-16.15066	136.6911	71.87999	-0.1918326	0.809126

  

	MASE	ACF1
Training set	0.4171274	0.1234965

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
gamma = 1e-04
phi = 0.8669
```

Initial states:

```
l = 8921.8696
b = 117.5023
s = -7.5605 -65.41 14.9962 57.9744
```

sigma: 0.0167

AIC	AICc	BIC
856.8706	861.3604	877.8141

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-19.64319	137.0034	72.83582	-0.2307833	0.8201474

  

	MASE	ACF1
Training set	0.4226742	0.1063869

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
gamma = 1e-04
phi = 0.8669
```

Initial states:

```
l = 8921.8696
b = 117.5023
s = -7.5605 -65.41 14.9962 57.9744
```

sigma: 0.0167

AIC	AICc	BIC
856.8706	861.3604	877.8141

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-19.64319	137.0034	72.83582	-0.2307833	0.8201474

  

	MASE	ACF1
Training set	0.4226742	0.1063869

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.046
gamma = 1e-04
phi   = 0.9563
```

Initial states:

```
l = 8930.3573
b = 117.5856
s = 0.9991 0.9934 1.0013 1.0062
```

sigma: 0.0171

```
      AIC      AICc      BIC
859.4531 863.9429 880.3966
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -24.77054 140.4351 80.1659 -0.2801461 0.8989221
              MASE      ACF1
Training set 0.4652114 0.1029862
ETS(M,Ad,M)
```

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.046
gamma = 1e-04
phi   = 0.9563
```

Initial states:

```
l = 8930.3573
b = 117.5856
s = 0.9991 0.9934 1.0013 1.0062
```

sigma: 0.0171

```
      AIC      AICc      BIC
859.4531 863.9429 880.3966
```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -24.77054 140.4351 80.1659 -0.2801461 0.8989221
              MASE      ACF1
Training set 0.4652114 0.1029862
Holt-Winters' additive method
```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.4221
beta  = 1e-04
```

```
gamma = 0.2342
```

```
Initial states:
```

```
l = 3917.0121
```

```
b = -20.9526
```

```
s = 18.8668 -1011.955 -494.2312 1487.32
```

```
sigma: 195.2183
```

```
AIC      AICc      BIC
```

```
887.9689 891.5689 906.8180
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -9.315576 181.7384 133.7716 -0.448638 4.183293
```

```
MASE      ACF1
```

```
Training set 0.726033 -0.01212407
```

```
Damped Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.4239
```

```
beta = 1e-04
```

```
gamma = 0.2316
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 3938.0211
```

```
b = -26.7751
```

```
s = 136.4682 -1071.396 -553.2595 1488.187
```

```
sigma: 202.3412
```

```
AIC      AICc      BIC
```

```
893.1042 897.5940 914.0476
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -21.17581 186.5494 135.6443 -0.8635552 4.235857
```

```
MASE      ACF1
```

```
Training set 0.7361968 -0.02854773
```

```
Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

```
Smoothing parameters:
```

```
alpha = 0.4173
```

```
beta = 2e-04
```

```
gamma = 0.3603
```

```
Initial states:
```

```
l = 3910.2389
```

```
b = 5.5692
```

```
s = 1.0096 0.7203 0.8771 1.3931
```

sigma: 0.0667

AIC	AICc	BIC
892.9255	896.5255	911.7746

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-47.93797	200.8171	154.3455	-2.43429	5.108572

	MASE	ACF1
Training set	0.8376963	0.009297634

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3949
beta = 1e-04
gamma = 0.3982
phi = 0.8423
```

Initial states:

```
l = 3769.56
b = 35.6055
s = 0.9986 0.7157 0.8696 1.4161
```

sigma: 0.0641

AIC	AICc	BIC
888.7939	893.2837	909.7373

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-43.38968	189.5184	145.7987	-2.177581	4.809736

	MASE	ACF1
Training set	0.7913089	-0.01615265

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.324
beta = 1e-04
gamma = 0.4633
```

Initial states:

```
l = 3897.6136
b = 0.9952
s = 1.0045 0.7129 0.8681 1.4145
```

sigma: 0.0624

AIC	AICc	BIC
883.6478	887.2478	902.4969

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
--	----	------	-----	-----	------

```
Training set -15.39481 195.8815 145.7631 -1.239933 4.635565
```

```
          MASE          ACF1
```

```
Training set 0.791116 0.0639222
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.4783
```

```
gamma = 0.2655
```

```
Initial states:
```

```
l = 3689.2602
```

```
s = 11.5615 -988.8678 -513.3382 1490.644
```

```
sigma: 188.5485
```

```
          AIC          AICc          BIC
```

```
882.0617 884.2155 896.7221
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE          MAPE          MASE
```

```
Training set -39.47393 178.8728 128.325 -1.573179 4.128786 0.696472
```

```
          ACF1
```

```
Training set -0.1021226
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.4263
```

```
gamma = 0.2696
```

```
Initial states:
```

```
l = 3699.0247
```

```
s = 144.8426 -1063.879 -534.8742 1453.911
```

```
sigma: 0.0557
```

```
          AIC          AICc          BIC
```

```
868.7454 870.8993 883.4059
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE          MAPE
```

```
Training set -43.82844 182.1479 131.1182 -1.704187 4.18851
```

```
          MASE          ACF1
```

```
Training set 0.7116319 -0.07809808
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.4263
```

```
gamma = 0.2696
```

```

Initial states:
  l = 3699.0247
  s = 144.8426 -1063.879 -534.8742 1453.911

sigma: 0.0557

      AIC      AICc      BIC
868.7454 870.8993 883.4059

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -43.82844 182.1479 131.1182 -1.704187 4.18851
              MASE      ACF1
Training set 0.7116319 -0.07809808
ETS(A,A,A)

Call:
ets(y = ts_series, model = "AAA")

Smoothing parameters:
alpha = 0.422
beta  = 1e-04
gamma = 0.2341

Initial states:
  l = 3917.0216
  b = -20.957
  s = 18.9084 -1011.972 -494.2458 1487.309

sigma: 195.2183

      AIC      AICc      BIC
887.9689 891.5689 906.8180

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -9.309071 181.7384 133.7709 -0.4484178 4.183215
              MASE      ACF1
Training set 0.7260294 -0.01202002
ETS(A,Ad,A)

Call:
ets(y = ts_series, model = "AAA", damped = TRUE)

Smoothing parameters:
alpha = 0.424
beta  = 1e-04
gamma = 0.2319
phi   = 0.98

Initial states:
  l = 3937.9897
  b = -26.7548
  s = 136.4744 -1071.386 -553.2673 1488.179

sigma: 202.3413

      AIC      AICc      BIC

```

893.1042 897.5940 914.0477

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-21.19701	186.5494	135.6419	-0.8644018	4.235819

  

	MASE	ACF1
Training set	0.7361838	-0.028643

ETS(M,M,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

alpha = 0.3165  
beta = 1e-04  
gamma = 0.5545

Initial states:

l = 3897.3409  
b = 0.9916  
s = 1.0003 0.7115 0.838 1.4502

sigma: 0.0622

AIC	AICc	BIC
882.2472	885.8472	901.0963

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	6.165778	201.2414	147.9669	-0.4218508	4.566497

  

	MASE	ACF1
Training set	0.8030767	0.03002443

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4011  
beta = 1e-04  
gamma = 0.4746  
phi = 0.98

Initial states:

l = 3897.2856  
b = 0.9885  
s = 0.9965 0.6986 0.8615 1.4434

sigma: 0.0635

AIC	AICc	BIC
885.8284	890.3182	906.7718

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.6698829	199.1351	150.6528	-0.741061	4.746906

  

	MASE	ACF1
Training set	0.817654	0.0008694945

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

alpha = 0.3223

beta = 1e-04

gamma = 0.2807

Initial states:

l = 3847.8561

b = -22.2638

s = 150.5858 -1015.558 -550.9198 1415.892

sigma: 0.0558

AIC	AICc	BIC
-----	------	-----

869.1374	872.7374	887.9865
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-5.689301	183.1607	133.3763	-0.3902428	4.120807

	MASE	ACF1
Training set	0.7238877	0.04948898

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3342

beta = 0.0304

gamma = 0.2798

phi = 0.9403

Initial states:

l = 3860.3834

b = 35.1876

s = 145.9487 -1046.486 -569.9408 1470.479

sigma: 0.0581

AIC	AICc	BIC
-----	------	-----

876.1008	880.5906	897.0443
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-41.77858	188.3616	138.993	-1.454182	4.370292

	MASE	ACF1
Training set	0.7543716	0.01897165

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

alpha = 0.3683



```
beta = 0.0307
gamma = 0.5001
```

## Initial states:

```
l = 3897.0579
b = 37.6395
s = 0.9933 0.7011 0.8523 1.4533
```

```
sigma: 0.0639
```

```
      AIC      AICc      BIC
886.3726 889.9726 905.2217
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -26.8644 210.2981 154.0974 -1.237004 4.731641
```

```
           MASE      ACF1
Training set 0.8363497 0.02509227
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.3563
beta = 0.0316
gamma = 0.4976
phi = 0.9523
```

## Initial states:

```
l = 3898.0259
b = 34.7806
s = 0.993 0.7025 0.8526 1.452
```

```
sigma: 0.0638
```

```
      AIC      AICc      BIC
887.4394 891.9292 908.3828
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -31.5127 206.828 151.2583 -1.490264 4.694183 0.8209405
```

```
           ACF1
Training set 0.01426832
```

```
Holt-Winters' additive method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

## Smoothing parameters:

```
alpha = 0.0063
beta = 1e-04
gamma = 0.4062
```

## Initial states:

```
l = 2507.3934
b = -4.3816
s = 199.3037 -1537.676 -659.0745 1997.447
```

sigma: 190.2654

	AIC	AICc	BIC
	884.8850	888.4850	903.7341

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.737907	177.1274	123.0436	0.05586028	5.149178

	MASE	ACF1
Training set	0.959939	0.01257572

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0014
beta  = 3e-04
gamma = 0.331
phi   = 0.9436
```

Initial states:

```
l = 2606.5712
b = -23.2051
s = 188.296 -1622.067 -650.9964 2084.767
```

sigma: 183.1352

	AIC	AICc	BIC
	881.1365	885.6263	902.0799

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	8.258279	168.8423	121.1174	0.8463034	5.308945

	MASE	ACF1
Training set	0.9449111	-0.03315092

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.0278
beta  = 0.0278
gamma = 0.2507
```

Initial states:

```
l = 2537.381
b = 15.53
s = 1.019 0.3803 0.7362 1.8646
```

sigma: 0.0703

	AIC	AICc	BIC
	846.1955	849.7955	865.0446

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set 4.78092 173.2069 125.2941 -0.6178488 5.189087
                MASE      ACF1
Training set 0.9774963 0.04771568
Damped Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0225
beta  = 0.0225
gamma = 0.2578
phi   = 0.9119

```

Initial states:

```
l = 2515.7422
b = 15.8547
s = 1.0149 0.396 0.7292 1.8599

```

sigma: 0.0715

```

      AIC      AICc      BIC
849.7680 854.2578 870.7115

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -5.753498 169.2866 120.984 -1.257541 5.249335
                MASE      ACF1
Training set 0.9438705 0.007570972
Holt-Winters' multiplicative method with exponential trend

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta  = 1e-04
gamma = 0.3602

```

Initial states:

```
l = 2536.9177
b = 0.9976
s = 1.017 0.3468 0.7281 1.9082

```

sigma: 0.0633

```

      AIC      AICc      BIC
832.7495 836.3495 851.5986

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set 6.115376 164.7072 108.2576 0.04902702 4.338435
                MASE      ACF1
Training set 0.8445842 0.04574407
ETS(A,N,A)

```

Call:

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.0519
```

```
gamma = 0.4075
```

```
Initial states:
```

```
l = 2492.7735
```

```
s = 28.4363 -1626.616 -678.3951 2276.574
```

```
sigma: 180.4623
```

```
AIC      AICc      BIC
```

```
876.8017 878.9555 891.4621
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -22.76767 171.2016 105.1399 -0.9686202 4.112122
```

```
MASE      ACF1
```

```
Training set 0.8202611 -0.01362239
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.0484
```

```
gamma = 0.4363
```

```
Initial states:
```

```
l = 2454.0498
```

```
s = 41.8543 -1617.26 -566.1517 2141.557
```

```
sigma: 0.0601
```

```
AIC      AICc      BIC
```

```
826.0421 828.1960 840.7026
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -18.24028 174.1953 110.712 -0.9324994 4.244008
```

```
MASE      ACF1
```

```
Training set 0.8637326 -0.01935071
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.0484
```

```
gamma = 0.4363
```

```
Initial states:
```

```
l = 2454.0498
```

```
s = 41.8543 -1617.26 -566.1517 2141.557
```

```
sigma: 0.0601
```

```

      AIC      AICc      BIC
826.0421 828.1960 840.7026

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -18.24028 174.1953 110.712 -0.9324994 4.244008

```

```

              MASE      ACF1
Training set 0.8637326 -0.01935071

```

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

```

alpha = 0.0014
beta  = 3e-04
gamma = 0.331
phi   = 0.9436

```

Initial states:

```

l = 2606.5712
b = -23.2051
s = 188.296 -1622.067 -650.9964 2084.767

```

sigma: 183.1352

```

      AIC      AICc      BIC
881.1365 885.6263 902.0799

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 8.258279 168.8423 121.1174 0.8463034 5.308945

```

```

              MASE      ACF1
Training set 0.9449111 -0.03315092

```

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.0014
beta  = 3e-04
gamma = 0.331
phi   = 0.9436

```

Initial states:

```

l = 2606.5712
b = -23.2051
s = 188.296 -1622.067 -650.9964 2084.767

```

sigma: 183.1352

```

      AIC      AICc      BIC
881.1365 885.6263 902.0799

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 8.258279 168.8423 121.1174 0.8463034 5.308945

```

```

                MASE          ACF1
Training set 0.9449111 -0.03315092
ETS(M,M,M)

```

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```

alpha = 0.0518
beta  = 1e-04
gamma = 0.5008

```

Initial states:

```

l = 2491.1289
b = 0.9986
s = 1.0076 0.3406 0.724 1.9278

```

sigma: 0.0614

```

        AIC      AICc      BIC
829.5596 833.1596 848.4087

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -3.925558 170.1628 108.9209 -0.2845932 4.260372

```

```

                MASE      ACF1
Training set 0.8497593 0.00281982
ETS(M,Md,M)

```

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.1148
beta  = 1e-04
gamma = 0.4109
phi   = 0.9689

```

Initial states:

```

l = 2459.543
b = 0.9971
s = 1.009 0.3398 0.7343 1.9168

```

sigma: 0.0621

```

        AIC      AICc      BIC
831.6123 836.1021 852.5558

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -2.140248 171.3523 111.9797 -0.2463094 4.340244

```

```

                MASE      ACF1
Training set 0.8736223 -0.01917447
ETS(M,A,A)

```

Call:

```
ets(y = ts_series, model = "MAA")
```

## Smoothing parameters:

alpha = 0.0265  
 beta = 1e-04  
 gamma = 0.554

## Initial states:

l = 2535.4492  
 b = -2.266  
 s = 182.8713 -1533.781 -662.4808 2013.39

sigma: 0.067

AIC	AICc	BIC
840.6638	844.2638	859.5129

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-12.69821	179.61	122.5164	-0.8393636	4.951459

  

	MASE	ACF1
Training set	0.9558256	-0.01433981

ETS(M,Ad,A)

## Call:

ets(y = ts\_series, model = "MAA", damped = TRUE)

## Smoothing parameters:

alpha = 0.0142  
 beta = 0.0142  
 gamma = 0.5738  
 phi = 0.8

## Initial states:

l = 2508.3088  
 b = 9.6177  
 s = 191.2839 -1543.094 -658.3146 2010.125

sigma: 0.0672

AIC	AICc	BIC
842.4359	846.9257	863.3794

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-21.33878	181.7551	123.315	-1.358247	4.963927

  

	MASE	ACF1
Training set	0.9620566	-0.01212804

ETS(M,A,M)

## Call:

ets(y = ts\_series, model = "MAM")

## Smoothing parameters:

alpha = 0.0632  
 beta = 1e-04  
 gamma = 0.44

## Initial states:

l = 2487.6301

```
b = -3.0356
s = 1.0103 0.3409 0.7302 1.9187
```

```
sigma: 0.0613
```

```
      AIC      AICc      BIC
829.3479 832.9479 848.1970
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -4.938526 169.453 108.7128 -0.355422 4.24951 0.8481358
```

```
      ACF1
```

```
Training set 0.001939027
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0482
```

```
beta = 0.0272
```

```
gamma = 0.4412
```

```
phi = 0.8
```

```
Initial states:
```

```
l = 2461.8484
```

```
b = 15.5025
```

```
s = 1.0111 0.341 0.7286 1.9193
```

```
sigma: 0.0617
```

```
      AIC      AICc      BIC
831.7521 836.2419 852.6956
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -17.79902 174.1698 109.9362 -0.892015 4.279828 0.85768
```

```
      ACF1
```

```
Training set 0.003539387
```

```
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
gamma = 2e-04
```

```
Initial states:
```

```
l = 3111.7809
```

```
b = -6.1439
```

```
s = 241.8517 -1545.001 -752.5388 2055.688
```

```
sigma: 178.0291
```

```
      AIC      AICc      BIC
876.9083 880.5083 895.7574
```



## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	3.483968	165.7361	122.4954	-0.1783401	4.029439

  

	MASE	ACF1
Training set	0.8239934	-0.1008619

Damped Holt-Winters' additive method

## Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.0229
beta  = 0.0229
gamma = 0.2001
phi   = 0.8428
```

## Initial states:

```
l = 3062.8852
b = 18.9982
s = 224.1673 -1548.234 -762.0318 2086.099
```

```
sigma: 191.4543
```

AIC	AICc	BIC
886.4675	890.9573	907.4109

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-33.46488	176.5122	126.476	-1.451607	4.181593

  

	MASE	ACF1
Training set	0.8507692	-0.06534307

Holt-Winters' multiplicative method

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

## Smoothing parameters:

```
alpha = 0.0166
beta  = 0.0157
gamma = 0.2993
```

## Initial states:

```
l = 3106.9338
b = 13.7819
s = 1.0252 0.5184 0.7666 1.6898
```

```
sigma: 0.0593
```

AIC	AICc	BIC
860.9151	864.5151	879.7642

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.1883443	179.252	132.8465	-0.6202875	4.493021

  

	MASE	ACF1
Training set	0.8936222	0.06010898

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0153
beta  = 0.0153
gamma = 0.203
phi   = 0.8704
```

Initial states:

```
l = 3062.1435
b = 13.9348
s = 1.0382 0.5033 0.7619 1.6967
```

sigma: 0.0577

```
      AIC      AICc      BIC
859.8484 864.3382 880.7919
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -28.30877 170.9132 124.6094 -1.697834 4.29855
```

```
           MASE      ACF1
Training set 0.8382135 -0.02705047
```

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.0031
beta  = 1e-04
gamma = 0.1552
```

Initial states:

```
l = 3108.0114
b = 0.998
s = 1.0493 0.4782 0.7547 1.7179
```

sigma: 0.055

```
      AIC      AICc      BIC
851.8183 855.4183 870.6674
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -1.453823 164.3803 121.9362 -0.5224244 4.144696
```

```
           MASE      ACF1
Training set 0.8202314 -0.05863761
```

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.0851
gamma = 0.2401
```

Initial states:

l = 3123.0128

s = 141.6718 -1546.065 -693.737 2098.131

sigma: 186.9927

AIC AICc BIC

881.0674 883.2212 895.7278

Training set error measures:

ME RMSE MAE MPE MAPE

Training set -39.04502 177.3969 124.5551 -1.747253 4.051639

MASE ACF1

Training set 0.837848 -0.09510547

ETS(M,N,A)

Call:

ets(y = ts\_series, model = "MNA")

Smoothing parameters:

alpha = 0.1043

gamma = 0.3169

Initial states:

l = 3069.3356

s = 166.3315 -1536.541 -691.3024 2061.512

sigma: 0.0529

AIC AICc BIC

846.3872 848.5410 861.0476

Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set -27.1564 179.117 125.1234 -1.276925 4.024127 0.8416706

ACF1

Training set -0.09882086

ETS(M,N,A)

Call:

ets(y = ts\_series, model = "MNA")

Smoothing parameters:

alpha = 0.1043

gamma = 0.3169

Initial states:

l = 3069.3356

s = 166.3315 -1536.541 -691.3024 2061.512

sigma: 0.0529

AIC AICc BIC

846.3872 848.5410 861.0476

Training set error measures:

ME RMSE MAE MPE MAPE MASE

```
Training set -27.1564 179.117 125.1234 -1.276925 4.024127 0.8416706
```

```
ACF1
```

```
Training set -0.09882086
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
```

```
beta = 1e-04
```

```
gamma = 2e-04
```

```
Initial states:
```

```
l = 3111.781
```

```
b = -6.1434
```

```
s = 241.8513 -1545.001 -752.539 2055.688
```

```
sigma: 178.0291
```

```
AIC AICc BIC
```

```
876.9083 880.5083 895.7574
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set 3.466852 165.7361 122.4951 -0.1790936 4.029382
```

```
MASE ACF1
```

```
Training set 0.8239908 -0.1008546
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0229
```

```
beta = 0.0229
```

```
gamma = 0.2001
```

```
phi = 0.8428
```

```
Initial states:
```

```
l = 3062.8852
```

```
b = 18.9982
```

```
s = 224.1673 -1548.234 -762.0318 2086.099
```

```
sigma: 191.4544
```

```
AIC AICc BIC
```

```
886.4675 890.9573 907.4109
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE MASE
```

```
Training set -33.4615 176.5122 126.4766 -1.451456 4.18161 0.8507733
```

```
ACF1
```

```
Training set -0.06533917
```

```
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

## Smoothing parameters:

alpha = 0.0636  
 beta = 1e-04  
 gamma = 0.3402

## Initial states:

l = 3156.252  
 b = 0.9977  
 s = 1.0366 0.4845 0.7691 1.7098

sigma: 0.0539

AIC	AICc	BIC
849.1597	852.7597	868.0088

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.7973853	174.9665	125.7628	-0.3627262	4.079888

	MASE	ACF1
Training set	0.8459717	-0.05310031

ETS(M,Md,M)

## Call:

ets(y = ts\_series, model = "MMM", damped = TRUE)

## Smoothing parameters:

alpha = 0.045  
 beta = 1e-04  
 gamma = 0.4003  
 phi = 0.98

## Initial states:

l = 3107.9675  
 b = 0.9966  
 s = 1.0286 0.4965 0.764 1.7109

sigma: 0.0544

AIC	AICc	BIC
851.1196	855.6094	872.0631

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	1.449642	176.0518	125.3168	-0.377054	4.04876	0.8429722

	ACF1
Training set	-0.03358331

ETS(M,A,A)

## Call:

ets(y = ts\_series, model = "MAA")

## Smoothing parameters:

alpha = 0.0463  
 beta = 1e-04  
 gamma = 0.2915

## Initial states:

```

l = 3083.4254
b = -4.9022
s = 217.1537 -1520.209 -765.2446 2068.3

```

```
sigma: 0.0532
```

```

      AIC      AICc      BIC
847.6488 851.2488 866.4979

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set -4.765028 173.8524 123.4396 -0.3145235 4.009906

```

```

              MASE      ACF1
Training set 0.8303442 -0.07984183

```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.0641
beta  = 0.0255
gamma = 0.3007
phi   = 0.8

```

```
Initial states:
```

```

l = 3035.5237
b = 18.8787
s = 223.9684 -1548.274 -761.8984 2086.204

```

```
sigma: 0.0545
```

```

      AIC      AICc      BIC
852.3432 856.8330 873.2867

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -24.63169 178.7225 127.0756 -1.075461 4.07011 0.854803

```

```

              ACF1
Training set -0.07822117

```

```
ETS(M,A,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```

alpha = 0.0906
beta  = 1e-04
gamma = 0.3753

```

```
Initial states:
```

```

l = 3173.8343
b = -6.6438
s = 1.0482 0.4892 0.7738 1.6888

```

```
sigma: 0.0547
```

```

      AIC      AICc      BIC

```

851.0322 854.6322 869.8813

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.3917562	180.5165	129.9397	-0.4412113	4.170519

  

	MASE	ACF1
Training set	0.8740685	-0.06404473

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0714
beta  = 0.0245
gamma = 0.3474
phi   = 0.8
```

Initial states:

```
l = 3113.2409
b = 14.1663
s = 1.0234 0.487 0.7583 1.7313
```

sigma: 0.055

	AIC	AICc	BIC
	853.4878	857.9776	874.4313

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-25.37549	180.4546	128.8015	-1.210332	4.173528

  

	MASE	ACF1
Training set	0.8664126	-0.04288279

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.7131
beta  = 2e-04
gamma = 0.2869
```

Initial states:

```
l = 9851.6036
b = -123.7333
s = 135.9773 -23.7278 -319.0575 206.808
```

sigma: 653.921

	AIC	AICc	BIC
	1105.445	1108.778	1124.875

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.42664	611.6871	459.6548	-0.3771456	8.427234

  

	MASE	ACF1
Training set	0.6222062	0.1591485

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7133
beta  = 0.0214
gamma = 0.2867
phi   = 0.98
```

Initial states:

```
l = 9811.8621
b = -40.8342
s = 125.329 -27.8455 -331.2907 233.8072
```

sigma: 670.7353

AIC	AICc	BIC
1109.541	1113.692	1131.130

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-77.69211	621.7883	464.4075	-1.716818	8.49562

	MASE	ACF1
Training set	0.6286396	0.151157

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.7154
beta  = 0.0086
gamma = 0.2846
```

Initial states:

```
l = 9855.8773
b = -37.7348
s = 1.0177 1.0622 0.9818 0.9383
```

sigma: 0.1074

AIC	AICc	BIC
1091.020	1094.354	1110.450

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-81.40474	577.4028	423.8561	-1.993115	7.828881

	MASE	ACF1
Training set	0.5737477	0.2110698

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6908
```



```
beta = 0.0714
gamma = 0.3092
phi = 0.8897
```

## Initial states:

```
l = 9855.7009
b = -37.4302
s = 1.0181 1.0614 0.9854 0.9352
```

```
sigma: 0.1083
```

```
      AIC      AICc      BIC
1093.348 1097.498 1114.936
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -90.87557 577.2495 420.1666 -2.234651 7.635886
```

```
           MASE      ACF1
Training set 0.5687534 0.1847162
```

```
Holt-Winters' multiplicative method with exponential trend
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

## Smoothing parameters:

```
alpha = 0.7005
beta = 1e-04
gamma = 0.2995
```

## Initial states:

```
l = 9855.5005
b = 0.9825
s = 1.0097 1.0564 0.9844 0.9495
```

```
sigma: 0.1048
```

```
      AIC      AICc      BIC
1087.512 1090.845 1106.941
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -12.51784 568.9668 409.516 -1.659159 7.510971
```

```
           MASE      ACF1
Training set 0.5543364 0.2371109
```

```
ETS(A,N,A)
```

## Call:

```
ets(y = ts_series, model = "ANA")
```

## Smoothing parameters:

```
alpha = 0.7404
gamma = 0.2596
```

## Initial states:

```
l = 8696.1237
s = 124.5611 -27.9403 -286.9433 190.3224
```

```
sigma: 652.4798
```

```

      AIC      AICc      BIC
1103.408 1105.408 1118.520

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -129.8471 621.1422 472.8174 -3.688429 9.015699

```

```

           MASE      ACF1
Training set 0.6400235 0.1997333

```

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```

alpha = 0.582
gamma = 0.3695

```

Initial states:

```

l = 8694.6671
s = 125.2087 119.3964 -330.8994 86.2943

```

sigma: 0.1065

```

      AIC      AICc      BIC
1090.685 1092.685 1105.797

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -153.3642 630.5614 459.0926 -4.032724 8.386488

```

```

           MASE      ACF1
Training set 0.6214451 0.3373917

```

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```

alpha = 0.582
gamma = 0.3695

```

Initial states:

```

l = 8694.6671
s = 125.2087 119.3964 -330.8994 86.2943

```

sigma: 0.1065

```

      AIC      AICc      BIC
1090.685 1092.685 1105.797

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -153.3642 630.5614 459.0926 -4.032724 8.386488

```

```

           MASE      ACF1
Training set 0.6214451 0.3373917

```

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.7131
beta  = 2e-04
gamma = 0.2869
```

```
Initial states:
```

```
l = 9851.6036
b = -123.7333
s = 135.9773 -23.7278 -319.0575 206.808
```

```
sigma: 653.921
```

```
      AIC      AICc      BIC
1105.445 1108.778 1124.875
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 1.42664 611.6871 459.6548 -0.3771456 8.427234
```

```
              MASE      ACF1
Training set 0.6222062 0.1591485
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.7133
beta  = 0.0214
gamma = 0.2867
phi   = 0.98
```

```
Initial states:
```

```
l = 9811.8621
b = -40.8343
s = 125.329 -27.8455 -331.2906 233.8071
```

```
sigma: 670.7353
```

```
      AIC      AICc      BIC
1109.541 1113.692 1131.130
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -77.68593 621.7883 464.4079 -1.716576 8.495628
```

```
              MASE      ACF1
Training set 0.6286402 0.1511644
```

```
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.5471
beta  = 1e-04
gamma = 0.4529
```

Initial states:

l = 9855.8583  
 b = 0.9771  
 s = 1.0189 1.0699 0.9857 0.9255

sigma: 0.1012

AIC	AICc	BIC
1082.241	1085.574	1101.671

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	30.84326	587.6426	405.5699	-0.9861332	7.076351

	MASE	ACF1
Training set	0.5489948	0.3903248

ETS(M,Md,M)

Call:

ets(y = ts\_series, model = "MMM", damped = TRUE)

Smoothing parameters:

alpha = 0.5544  
 beta = 0.0359  
 gamma = 0.4456  
 phi = 0.98

Initial states:

l = 9855.5448  
 b = 0.9798  
 s = 1.0186 1.075 0.9805 0.9259

sigma: 0.1026

AIC	AICc	BIC
1086.058	1090.209	1107.647

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-67.66903	592.5396	416.9861	-1.962599	7.29714

	MASE	ACF1
Training set	0.5644482	0.3575563

ETS(M,A,A)

Call:

ets(y = ts\_series, model = "MAA")

Smoothing parameters:

alpha = 0.5123  
 beta = 1e-04  
 gamma = 0.3631

Initial states:

l = 8915.6921  
 b = -68.5046  
 s = 557.1001 -6.2444 -112.6743 -438.1814

sigma: 0.106

```

      AIC      AICc      BIC
1089.362 1092.695 1108.792

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -63.94516 618.761 444.3049 -2.008032 7.95425 0.601428

```

ACF1

Training set 0.3673093

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4303

beta = 0.0422

gamma = 0.3473

phi = 0.9042

Initial states:

l = 9629.8663

b = -40.9313

s = 307.0937 -27.6725 -331.0479 51.6267

sigma: 0.1071

```

      AIC      AICc      BIC
1092.503 1096.654 1114.092

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -126.5537 644.9335 461.4811 -2.803463 7.976735

```

MASE ACF1

Training set 0.6246783 0.3839777

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

alpha = 0.5711

beta = 0.0059

gamma = 0.4289

Initial states:

l = 8960.4352

b = -37.5186

s = 1.0112 1.0661 0.9924 0.9303

sigma: 0.1015

```

      AIC      AICc      BIC
1084.368 1087.701 1103.798

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -95.20116 590.0911 416.7534 -2.417381 7.356416

```

MASE ACF1

```
Training set 0.5641332 0.3572704
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.5492
beta  = 0.0248
gamma = 0.4507
phi   = 0.9533
```

```
Initial states:
```

```
l = 9855.679
b = -37.7165
s = 1.0111 1.0703 0.9904 0.9282
```

```
sigma: 0.1027
```

```
      AIC      AICc      BIC
1086.858 1091.009 1108.447
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -113.9179 596.1842 422.1057 -2.462356 7.377493
```

```
           MASE      ACF1
Training set 0.5713783 0.354265
```

```
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

```
Smoothing parameters:
```

```
alpha = 2e-04
beta  = 1e-04
gamma = 2e-04
```

```
Initial states:
```

```
l = 4965.0768
b = -99.974
s = -333.9463 1527.776 -190.0393 -1003.791
```

```
sigma: 561.2084
```

```
      AIC      AICc      BIC
490.5368 499.5368 503.1476
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -78.21923 480.5902 399.5076 -2.718376 13.84687
```

```
           MASE      ACF1
Training set 0.6353027 -0.008163367
```

```
Damped Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
gamma = 1e-04
phi   = 0.9797
```

Initial states:

```
l = 4971.8358
b = -125.6705
s = -323.4509 1502.803 -194.4686 -984.884
```

sigma: 536.8516

```
      AIC      AICc      BIC
488.4790 500.0579 502.4909
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -54.86184 449.1622 364.438 -2.67299 12.30223 0.5795345
```

ACF1

Training set -0.1217016

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.2288
beta  = 1e-04
gamma = 3e-04
```

Initial states:

```
l = 5133.9545
b = -98.0024
s = 0.9152 1.4169 0.9291 0.7388
```

sigma: 0.1729

```
      AIC      AICc      BIC
487.4869 496.4869 500.0977
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 0.1141839 492.7353 378.1564 -1.385135 12.1314
```

MASE ACF1

Training set 0.6013496 -0.1761121

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1231
beta  = 1e-04
gamma = 1e-04
phi   = 0.9677
```

Initial states:

```
l = 5134.5539
```

```
b = -136.6532
s = 0.9078 1.4216 0.9335 0.7371
```

```
sigma: 0.159
```

```
      AIC      AICc      BIC
484.8501 496.4291 498.8621
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -73.10398 465.4183 361.8562 -4.203024 11.75455
      MASE      ACF1
```

```
Training set 0.5754288 -0.2140531
```

```
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0295
beta = 1e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 5139.5705
b = 0.9714
s = 0.9059 1.4546 0.9057 0.7337
```

```
sigma: 0.1515
```

```
      AIC      AICc      BIC
480.0971 489.0971 492.7079
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -28.05141 458.3752 348.2486 -2.026787 10.97868
      MASE      ACF1
```

```
Training set 0.5537898 -0.1805374
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.402
gamma = 1e-04
```

```
Initial states:
```

```
l = 4316.1405
s = -370.7766 1494.298 -262.3298 -861.1916
```

```
sigma: 624.0197
```

```
      AIC      AICc      BIC
495.5125 500.6034 505.3209
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```



```
Training set -156.1837 558.1402 439.3926 -7.499297 15.58029
```

```
      MASE      ACF1
```

```
Training set 0.6987283 -0.1824803
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.2612
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 4542.5878
```

```
s = -448.7635 1874.973 -522.237 -903.9721
```

```
sigma: 0.1889
```

```
      AIC      AICc      BIC
```

```
495.6354 500.7263 505.4437
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -255.8665 632.0126 464.3558 -9.197814 15.7298
```

```
      MASE      ACF1
```

```
Training set 0.7384251 -0.2275068
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.2612
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 4542.5878
```

```
s = -448.7635 1874.973 -522.237 -903.9721
```

```
sigma: 0.1889
```

```
      AIC      AICc      BIC
```

```
495.6354 500.7263 505.4437
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -255.8665 632.0126 464.3558 -9.197814 15.7298
```

```
      MASE      ACF1
```

```
Training set 0.7384251 -0.2275068
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.0781
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

Initial states:

l = 4971.7254  
 b = -90.669  
 s = -323.9664 1502.589 -194.1674 -984.4552

sigma: 564.5808

	AIC	AICc	BIC
	490.8963	499.8963	503.5071

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-68.07923	483.4781	397.7703	-2.689608	13.69034	0.63254

ACF1

Training set -0.05665626

ETS(A,Ad,A)

Call:

ets(y = ts\_series, model = "AAA", damped = TRUE)

Smoothing parameters:

alpha = 1e-04  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.9797

Initial states:

l = 4971.8358  
 b = -125.6709  
 s = -323.4503 1502.804 -194.4687 -984.8847

sigma: 536.8517

	AIC	AICc	BIC
	488.4790	500.0579	502.4910

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-55.01641	449.1624	364.3973	-2.679318	12.30049

MASE ACF1

Training set 0.5794698 -0.121792

ETS(M,M,M)

Call:

ets(y = ts\_series, model = "MMM")

Smoothing parameters:

alpha = 0.0346  
 beta = 1e-04  
 gamma = 1e-04

Initial states:

l = 5139.7384  
 b = 0.9721  
 s = 0.8852 1.4642 0.9073 0.7432

sigma: 0.1508

```

      AIC      AICc      BIC
480.2391 489.2391 492.8498

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -49.15914 464.9109 355.6237 -2.706554 11.23532

```

```

              MASE      ACF1
Training set 0.5655178 -0.2089567

```

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 2e-04
beta  = 1e-04
gamma = 1e-04
phi   = 0.9786

```

Initial states:

```

l = 5139.7247
b = 0.9638
s = 0.8959 1.46 0.9135 0.7306

```

sigma: 0.1508

```

      AIC      AICc      BIC
480.2555 491.8344 494.2675

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -0.9190386 441.4855 332.7435 -1.644389 10.47214

```

```

              MASE      ACF1
Training set 0.5291334 -0.2236769

```

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```

alpha = 1e-04
beta  = 1e-04
gamma = 0.282

```

Initial states:

```

l = 4980.358
b = -75.001
s = -319.7393 1507.933 -192.7978 -995.3956

```

sigma: 0.191

```

      AIC      AICc      BIC
497.2593 506.2593 509.8701

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -222.8869 556.1824 436.2441 -8.171505 14.8535

```

```

                MASE          ACF1
Training set 0.6937214 -0.07820112
ETS(M,Ad,A)

```

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.0568
beta  = 0.0118
gamma = 0.0543
phi   = 0.9479

```

Initial states:

```

l = 4971.788
b = -100.8914
s = -323.9293 1502.499 -194.1674 -984.4027

```

sigma: 0.1855

```

        AIC      AICc      BIC
496.1759 507.7548 510.1879

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE      MASE
Training set -204.5463 515.5027 400.9252 -8.148744 13.701 0.637557

```

ACF1

```
Training set -0.1184723
```

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.1734
beta  = 1e-04
gamma = 1e-04

```

Initial states:

```

l = 5134.3719
b = -79.2959
s = 0.8945 1.4445 0.9265 0.7344

```

sigma: 0.1626

```

        AIC      AICc      BIC
485.7175 494.7175 498.3283

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -109.8199 503.6459 390.1025 -4.559815 12.47608

```

MASE ACF1

```
Training set 0.6203465 -0.1538346
```

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.0565  
 beta = 1e-04  
 gamma = 6e-04  
 phi = 0.98

## Initial states:

l = 5134.5643  
 b = -125.0767  
 s = 0.8966 1.4603 0.91 0.7331

sigma: 0.1563

AIC	AICc	BIC
483.8762	495.4551	497.8881

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-101.3057	479.9297	364.2965	-4.268875	11.5627

	MASE	ACF1
Training set	0.5793095	-0.1746595

Holt-Winters' additive method

## Call:

hw(y = ts\_series, h = h, seasonal = "additive")

## Smoothing parameters:

alpha = 0.3624  
 beta = 0.0381  
 gamma = 1e-04

## Initial states:

l = 4585.5529  
 b = 87.0176  
 s = 407.5671 -1434.674 -894.1452 1921.252

sigma: 687.9946

AIC	AICc	BIC
1111.946	1115.280	1131.376

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	7.105378	643.5601	481.981	-1.108282	11.38995	0.7610226

	ACF1
Training set	0.04441772

Damped Holt-Winters' additive method

## Call:

hw(y = ts\_series, h = h, seasonal = "additive", damped = TRUE)

## Smoothing parameters:

alpha = 0.3215  
 beta = 0.0329  
 gamma = 1e-04  
 phi = 0.8612

## Initial states:

```

l = 4568.2288
b = 113.0106
s = 385.8819 -1463.309 -886.577 1964.004

```

```
sigma: 680.3706
```

```

      AIC      AICc      BIC
1111.367 1115.518 1132.956

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 16.91946 630.7204 478.9633 -1.031499 11.37868

```

```

              MASE      ACF1
Training set 0.7562579 0.05312706

```

```
Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

```
Smoothing parameters:
```

```

alpha = 0.3524
beta  = 4e-04
gamma = 2e-04

```

```
Initial states:
```

```

l = 4647.9981
b = 87.1014
s = 1.0846 0.6988 0.8044 1.4122

```

```
sigma: 0.1695
```

```

      AIC      AICc      BIC
1119.200 1122.534 1138.630

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set -161.5965 684.3203 554.9215 -7.048872 14.54754

```

```

              MASE      ACF1
Training set 0.8761918 0.09038195

```

```
Damped Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.2771
beta  = 0.009
gamma = 3e-04
phi   = 0.8

```

```
Initial states:
```

```

l = 4494.2985
b = 87.9868
s = 1.0852 0.6757 0.7961 1.443

```

```
sigma: 0.1738
```

```

      AIC      AICc      BIC

```

1116.395 1120.546 1137.984

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	39.47373	667.3384	537.1613	-1.425231	13.14416

	MASE	ACF1
Training set	0.8481494	0.1440241

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.2868  
beta = 0.0301  
gamma = 1e-04

Initial states:

l = 4851.3666  
b = 0.9907  
s = 1.0983 0.6718 0.7964 1.4335

sigma: 0.1766

AIC	AICc	BIC
1116.666	1119.999	1136.096

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	54.46177	693.0881	567.9454	-0.7197828	13.51708

	MASE	ACF1
Training set	0.8967559	0.1124922

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

alpha = 0.3895  
gamma = 1e-04

Initial states:

l = 4789.9379  
s = 416.4939 -1420.053 -879.7519 1883.311

sigma: 670.8795

AIC	AICc	BIC
1106.968	1108.968	1122.080

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	25.29414	638.6583	492.7338	-1.382357	11.82419

	MASE	ACF1
Training set	0.7780007	0.02507857

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.5462
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 4826.3807
```

```
s = 361.4968 -1346.941 -837.3576 1822.802
```

```
sigma: 0.1581
```

```
AIC      AICc      BIC
```

```
1102.498 1104.498 1117.610
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	19.41336	655.3808	497.125	-1.859312	11.85889	0.7849341

```
ACF1
```

```
Training set -0.0968072
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.5462
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 4826.3807
```

```
s = 361.4968 -1346.941 -837.3576 1822.802
```

```
sigma: 0.1581
```

```
AIC      AICc      BIC
```

```
1102.498 1104.498 1117.610
```

```
Training set error measures:
```

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	19.41336	655.3808	497.125	-1.859312	11.85889	0.7849341

```
ACF1
```

```
Training set -0.0968072
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.361
```

```
beta = 0.0386
```

```
gamma = 9e-04
```

```
Initial states:
```

```
l = 4585.3122
```

```
b = 88.5096
```

```
s = 406.6136 -1437.836 -893.119 1924.342
```



sigma: 688.2088

AIC	AICc	BIC
1111.986	1115.320	1131.416

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	6.828504	643.7604	481.8206	-1.091743	11.38407

	MASE	ACF1
Training set	0.7607694	0.0451883

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3214
beta = 0.0329
gamma = 1e-04
phi = 0.8609
```

Initial states:

```
l = 4568.2319
b = 113.008
s = 385.8821 -1463.309 -886.5774 1964.005
```

sigma: 680.3707

AIC	AICc	BIC
1111.367	1115.518	1132.956

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	16.96074	630.7205	478.9784	-1.030955	11.37926

	MASE	ACF1
Training set	0.7562816	0.05323017

ETS(M,M,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```
alpha = 0.3487
beta = 1e-04
gamma = 0.0126
```

Initial states:

```
l = 4888.9777
b = 1.0053
s = 1.0988 0.667 0.8041 1.43
```

sigma: 0.1695

AIC	AICc	BIC
1114.356	1117.689	1133.786

Training set error measures:

ME	RMSE	MAE	MPE	MAPE	MASE
----	------	-----	-----	------	------

```
Training set -29.17814 687.505 552.1011 -3.000399 13.4722 0.8717386
```

```
ACF1
```

```
Training set 0.07700417
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.4134
```

```
beta = 0.011
```

```
gamma = 1e-04
```

```
phi = 0.8
```

```
Initial states:
```

```
l = 4722.2588
```

```
b = 1.0693
```

```
s = 1.0895 0.6583 0.7958 1.4563
```

```
sigma: 0.1697
```

```
AIC AICc BIC
```

```
1114.382 1118.533 1135.971
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set -27.27646 719.1488 552.4618 -2.225481 12.97949
```

```
MASE ACF1
```

```
Training set 0.872308 0.05785595
```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA")
```

```
Smoothing parameters:
```

```
alpha = 0.5121
```

```
beta = 0.0338
```

```
gamma = 0.0108
```

```
phi = 0.9106
```

```
Initial states:
```

```
l = 4295.9509
```

```
b = 129.5668
```

```
s = 409.9667 -1412.977 -665.5287 1668.539
```

```
sigma: 0.1612
```

```
AIC AICc BIC
```

```
1107.972 1112.123 1129.561
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set 7.651509 672.5642 505.1593 -2.197092 11.92833
```

```
MASE ACF1
```

```
Training set 0.7976199 -0.1207175
```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5121
beta  = 0.0338
gamma = 0.0108
phi   = 0.9106
```

Initial states:

```
l = 4295.9509
b = 129.5668
s = 409.9667 -1412.977 -665.5287 1668.539
```

```
sigma: 0.1612
```

```
      AIC      AICc      BIC
1107.972 1112.123 1129.561
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 7.651509 672.5642 505.1593 -2.197092 11.92833
```

```
              MASE      ACF1
Training set 0.7976199 -0.1207175
ETS(M,A,M)
```

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.4675
beta  = 1e-04
gamma = 5e-04
```

Initial states:

```
l = 4529.916
b = 48.187
s = 1.0827 0.6705 0.7979 1.4488
```

```
sigma: 0.1663
```

```
      AIC      AICc      BIC
1112.581 1115.914 1132.011
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -62.05646 687.2089 544.1962 -3.555343 13.32022
```

```
              MASE      ACF1
Training set 0.8592572 0.01238461
ETS(M,Ad,M)
```

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4796
beta  = 0.0078
gamma = 1e-04
phi   = 0.98
```

Initial states:

l = 4576.0562  
b = 87.5432  
s = 1.0906 0.66 0.8006 1.4488

sigma: 0.1709

	AIC	AICc	BIC
	1115.760	1119.911	1137.349

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-36.63957	710.7313	559.7199	-2.580672	13.30705

	MASE	ACF1
Training set	0.8837683	0.0288477

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

alpha = 0.3103  
beta = 0.1218  
gamma = 0.6896

Initial states:

l = 1814.5677  
b = -44.8162  
s = -57.6091 -1219.998 -233.4519 1511.059

sigma: 348.1343

	AIC	AICc	BIC
	957.3852	960.9852	976.2343

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.354435	324.0954	243.1805	0.6529827	7.602026

	MASE	ACF1
Training set	0.6449158	0.09421858

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2462  
beta = 0.1259  
gamma = 0.7538  
phi = 0.8714

Initial states:

l = 1560.7941  
b = 328.6636  
s = -451.1581 -843.7732 -388.9898 1683.921

sigma: 330.8741

```

      AIC      AICc      BIC
952.1181 956.6079 973.0616

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -8.180062 305.0509 239.0757 -0.4689993 6.88945 0.63403

```

ACF1

Training set 0.04514801

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

alpha = 0.2078

beta = 0.2078

gamma = 0.6004

Initial states:

l = 2133.2691

b = 86.7094

s = 1.0173 0.6604 0.8478 1.4745

sigma: 0.0714

```

      AIC      AICc      BIC
914.8683 918.4683 933.7174

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 5.414443 256.8231 191.1959 -0.2700868 5.175381

```

MASE ACF1

Training set 0.5070524 0.07738811

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2071

beta = 0.2071

gamma = 0.5841

phi = 0.8409

Initial states:

l = 2095.0917

b = 125.7214

s = 1.0108 0.664 0.8461 1.4791

sigma: 0.0675

```

      AIC      AICc      BIC
908.5775 913.0673 929.5210

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 17.23562 241.336 186.8885 -0.008385868 5.05812

```

```

                MASE      ACF1
Training set 0.4956291 0.0364257
Holt-Winters' multiplicative method with exponential trend

Call:
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)

Smoothing parameters:
  alpha = 0.2013
  beta  = 0.2013
  gamma = 0.5442

Initial states:
  l = 2138.1995
  b = 1.0106
  s = 1.0359 0.6601 0.837 1.467

sigma: 0.0679

      AIC      AICc      BIC
909.1845 912.7845 928.0336

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE
Training set -7.078076 251.9441 184.7207 -0.5431705 4.941952
                MASE      ACF1
Training set 0.4898802 0.07143859
ETS(A,N,A)

Call:
ets(y = ts_series, model = "ANA")

Smoothing parameters:
  alpha = 0.3977
  gamma = 0.6023

Initial states:
  l = 2698.2982
  s = 223.529 -1101.103 -951.3316 1828.906

sigma: 409.3156

      AIC      AICc      BIC
975.0774 977.2313 989.7378

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE
Training set 17.94592 388.3109 279.397 0.3414943 7.993052 0.7409622
                ACF1
Training set 0.011497
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.1983
  gamma = 0.8017

```

```

Initial states:
  l = 2383.0617
  s = -100.9332 -1146.101 -488.903 1735.937

sigma: 0.1172

      AIC      AICc      BIC
970.6937 972.8476 985.3541

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 39.14937 384.8025 282.5035 0.9537905 7.808221
              MASE      ACF1
Training set 0.7492007 0.3635402
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.1983
  gamma = 0.8017

Initial states:
  l = 2383.0617
  s = -100.9332 -1146.101 -488.903 1735.937

sigma: 0.1172

      AIC      AICc      BIC
970.6937 972.8476 985.3541

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 39.14937 384.8025 282.5035 0.9537905 7.808221
              MASE      ACF1
Training set 0.7492007 0.3635402
ETS(A,Ad,A)

Call:
ets(y = ts_series, model = "AAA")

Smoothing parameters:
  alpha = 0.2461
  beta  = 0.1258
  gamma = 0.7539
  phi   = 0.8715

Initial states:
  l = 1560.6925
  b = 328.7209
  s = -451.3566 -843.6014 -388.8815 1683.84

sigma: 330.8742

      AIC      AICc      BIC
952.1181 956.6079 973.0616

```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-8.204607	305.0509	239.0762	-0.4700316	6.889286

  

	MASE	ACF1
Training set	0.6340312	0.04521432

ETS(A,Ad,A)

## Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.2461
beta  = 0.1258
gamma = 0.7539
phi   = 0.8715
```

## Initial states:

```
l = 1560.6925
b = 328.7209
s = -451.3566 -843.6014 -388.8815 1683.84
```

```
sigma: 330.8742
```

AIC	AICc	BIC
952.1181	956.6079	973.0616

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-8.204607	305.0509	239.0762	-0.4700316	6.889286

  

	MASE	ACF1
Training set	0.6340312	0.04521432

ETS(M,M,M)

## Call:

```
ets(y = ts_series, model = "MMM")
```

## Smoothing parameters:

```
alpha = 0.3296
beta  = 0.1599
gamma = 0.5649
```

## Initial states:

```
l = 2140.0238
b = 1.0272
s = 0.9987 0.6738 0.8326 1.4949
```

```
sigma: 0.0663
```

AIC	AICc	BIC
906.4818	910.0818	925.3309

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-15.17045	256.0205	186.9701	-0.7595641	4.899122

  

	MASE	ACF1
Training set	0.4958457	0.009073031

ETS(M,Md,M)



Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2967
beta  = 0.166
gamma = 0.5707
phi   = 0.918
```

Initial states:

```
l = 2138.2162
b = 1.0266
s = 1.0009 0.6735 0.8328 1.4929
```

sigma: 0.0656

```
      AIC      AICc      BIC
905.6781 910.1679 926.6215
```

Training set error measures:

```
      ME      RMSE      MAE      MPE      MAPE
Training set 1.295353 244.0149 181.9238 -0.3599965 4.854752
```

```
      MASE      ACF1
Training set 0.4824627 -0.01926332
```

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.105
beta  = 0.0226
gamma = 0.8557
phi   = 0.9315
```

Initial states:

```
l = 1994.8729
b = 242.2152
s = 422.4715 -1242.849 -1076.017 1896.394
```

sigma: 0.1226

```
      AIC      AICc      BIC
982.1025 986.5923 1003.0460
```

Training set error measures:

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -56.32142 386.4498 282.61 -2.029737 8.270828 0.7494832
```

```
      ACF1
Training set 0.243668
```

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.105
```

```
beta = 0.0226
gamma = 0.8557
phi = 0.9315
```

## Initial states:

```
l = 1994.8729
b = 242.2152
s = 422.4715 -1242.849 -1076.017 1896.394
```

```
sigma: 0.1226
```

```
      AIC      AICc      BIC
982.1025 986.5923 1003.0460
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -56.32142 386.4498 282.61 -2.029737 8.270828 0.7494832
```

```
      ACF1
```

```
Training set 0.243668
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.3159
beta = 0.1672
gamma = 0.5898
phi = 0.8894
```

## Initial states:

```
l = 2038.1798
b = 128.9968
s = 0.9879 0.673 0.8389 1.5002
```

```
sigma: 0.0653
```

```
      AIC      AICc      BIC
904.7476 909.2374 925.6910
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 12.85101 244.1606 183.2241 -0.1207281 4.825484
```

```
      MASE      ACF1
```

```
Training set 0.4859111 -0.02728913
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.3159
beta = 0.1672
gamma = 0.5898
phi = 0.8894
```

## Initial states:

```
l = 2038.1798
```

```
b = 128.9968
s = 0.9879 0.673 0.8389 1.5002
```

```
sigma: 0.0653
```

```
      AIC      AICc      BIC
904.7476 909.2374 925.6910
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 12.85101 244.1606 183.2241 -0.1207281 4.825484
           MASE      ACF1
Training set 0.4859111 -0.02728913
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

```
Smoothing parameters:
```

```
alpha = 0.1492
beta  = 0.0682
gamma = 0.831
```

```
Initial states:
```

```
l = 2173.0941
b = -35.2493
s = 117.6512 -2064.386 -1588.622 3535.356
```

```
sigma: 613.6201
```

```
      AIC      AICc      BIC
1025.400 1029.000 1044.249
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 12.28961 571.2492 413.8511 0.2439546 10.43632
           MASE      ACF1
Training set 0.9077103 0.04539823
Damped Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0592
beta  = 0.0592
gamma = 0.9196
phi   = 0.9186
```

```
Initial states:
```

```
l = 2529.806
b = 190.6542
s = 416.388 -3277.776 -1381.637 4243.025
```

```
sigma: 649.6467
```

```
      AIC      AICc      BIC
1033.081 1037.571 1054.024
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	33.20346	598.9447	426.4263	1.245547	10.39386	0.9352919

ACF1

Training set -0.02372051

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.1398
beta  = 0.1398
gamma = 0.2884
```

Initial states:

```
l = 2919.4482
b = 132.9984
s = 1.0318 0.3751 0.7869 1.8063
```

sigma: 0.0689

AIC	AICc	BIC
947.4548	951.0548	966.3039

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-37.48919	415.8615	291.5915	-0.4186221	5.382136

MASE ACF1

Training set 0.6395553 0.05033924

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1335
beta  = 0.1335
gamma = 0.3084
phi   = 0.886
```

Initial states:

```
l = 2825.206
b = 185.3651
s = 1.0522 0.3571 0.7776 1.8131
```

sigma: 0.0724

AIC	AICc	BIC
953.1515	957.6413	974.0950

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	1.807151	399.168	285.1988	0.4482063	5.445749	0.625534

ACF1

Training set 0.01624257

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.1398

beta = 0.1398

gamma = 0.3158

Initial states:

l = 2961.7912

b = 1.0183

s = 1.0425 0.3442 0.8074 1.8058

sigma: 0.0746

AIC	AICc	BIC
957.2510	960.8510	976.1001

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-62.92688	429.4442	298.8892	-0.6341547	5.617905

	MASE	ACF1
Training set	0.6555615	0.05356016

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

alpha = 0.2522

gamma = 0.7478

Initial states:

l = 3532.0512

s = 66.3986 -1660.098 -927.2432 2520.943

sigma: 589.8644

AIC	AICc	BIC
1018.926	1021.080	1033.587

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	109.4923	559.5945	399.6246	0.5833144	7.455116

	MASE	ACF1
Training set	0.8765071	0.01969209

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.1233

gamma = 0.8767

Initial states:

l = 3834.5087

```
s = -662.7502 -7534.719 7278.82 918.6489
```

```
sigma: 0.2254
```

```
      AIC      AICc      BIC
1089.896 1092.050 1104.557
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 126.5885 1510.834 636.0694 3.881943 21.59122 1.395108
```

```
      ACF1
```

```
Training set -0.3983723
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.1233
```

```
gamma = 0.8767
```

```
Initial states:
```

```
l = 3834.5087
```

```
s = -662.7502 -7534.719 7278.82 918.6489
```

```
sigma: 0.2254
```

```
      AIC      AICc      BIC
1089.896 1092.050 1104.557
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 126.5885 1510.834 636.0694 3.881943 21.59122 1.395108
```

```
      ACF1
```

```
Training set -0.3983723
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.1493
```

```
beta = 0.0682
```

```
gamma = 0.8312
```

```
Initial states:
```

```
l = 2172.9084
```

```
b = -35.3095
```

```
s = 117.5464 -2063.945 -1588.666 3535.065
```

```
sigma: 613.6201
```

```
      AIC      AICc      BIC
1025.400 1029.000 1044.249
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set 12.30544 571.2493 413.8634 0.2441666 10.43626
```

```

                MASE      ACF1
Training set 0.9077375 0.04536544
ETS(A,Ad,A)

```

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.0592
beta  = 0.0592
gamma = 0.9196
phi   = 0.9188

```

Initial states:

```

l = 2529.806
b = 190.6543
s = 416.3879 -3277.776 -1381.637 4243.025

```

sigma: 649.6467

```

        AIC      AICc      BIC
1033.081 1037.571 1054.024

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE      MASE
Training set 33.11325 598.9447 426.4603 1.243041 10.39533 0.9353665

```

ACF1

```
Training set -0.02366891
```

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```

alpha = 0.1609
beta  = 0.1599
gamma = 0.3133
phi   = 0.9325

```

Initial states:

```

l = 2857.4625
b = 1.0248
s = 1.0099 0.3961 0.7563 1.8377

```

sigma: 0.065

```

        AIC      AICc      BIC
940.7524 945.2422 961.6959

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -17.64407 411.2935 279.0838 0.06138794 4.868526

```

MASE ACF1

```
Training set 0.6121218 -0.01785736
```

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.1609  
 beta = 0.1599  
 gamma = 0.3133  
 phi = 0.9325

## Initial states:

l = 2857.4625  
 b = 1.0248  
 s = 1.0099 0.3961 0.7563 1.8377

sigma: 0.065

AIC	AICc	BIC
940.7524	945.2422	961.6959

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-17.64407	411.2935	279.0838	0.06138794	4.868526

	MASE	ACF1
Training set	0.6121218	-0.01785736

ETS(M,A,A)

## Call:

ets(y = ts\_series, model = "MAA")

## Smoothing parameters:

alpha = 0.0722  
 beta = 0.0257  
 gamma = 0.9278

## Initial states:

l = 2159.2631  
 b = 503.0478  
 s = 400.9013 -2967.002 -1905.092 4471.194

sigma: 0.269

AIC	AICc	BIC
1119.159	1122.759	1138.008

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-314.853	738.1868	568.8283	-9.755763	15.63225	1.247626

	ACF1
Training set	0.1706103

ETS(M,Ad,A)

## Call:

ets(y = ts\_series, model = "MAA", damped = TRUE)

## Smoothing parameters:

alpha = 0.0044  
 beta = 0.0044  
 gamma = 0.9956  
 phi = 0.98



## Initial states:

l = 2364.5484  
 b = 462.1494  
 s = 413.1058 -3298.51 -1464.154 4349.558

sigma: 0.3703

AIC	AICc	BIC
1164.180	1168.669	1185.123

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-551.0405	838.5459	697.8934	-15.46153	19.41382

	MASE	ACF1
Training set	1.530708	0.1807907

ETS(M,A,M)

## Call:

```
ets(y = ts_series, model = "MAM")
```

## Smoothing parameters:

alpha = 0.1828  
 beta = 0.1503  
 gamma = 0.3262

## Initial states:

l = 2756.587  
 b = 81.4745  
 s = 1.0055 0.3998 0.7606 1.8341

sigma: 0.0638

AIC	AICc	BIC
937.8864	941.4864	956.7355

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-25.34765	414.6417	273.9111	-0.162533	4.774853

	MASE	ACF1
Training set	0.6007763	-0.0121658

ETS(M,Ad,M)

## Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.1665  
 beta = 0.1665  
 gamma = 0.3307  
 phi = 0.9307

## Initial states:

l = 2690.4409  
 b = 161.7838  
 s = 0.9951 0.3977 0.7609 1.8463

sigma: 0.0648

```

      AIC      AICc      BIC
940.2736 944.7634 961.2171

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -6.440621 406.5586 271.7707 0.153557 4.752238
              MASE      ACF1
Training set 0.5960818 -0.03977206
Holt-Winters' additive method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```

alpha = 0.0875
beta  = 0.0875
gamma = 0.8261

```

Initial states:

```

l = 2510.9166
b = 116.0021
s = -41.3925 -2437.111 -1166.961 3645.465

```

sigma: 620.6488

```

      AIC      AICc      BIC
1026.766 1030.366 1045.616

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -25.48863 577.7925 414.498 -0.05719239 10.59238
              MASE      ACF1
Training set 0.8709249 0.05405824
Damped Holt-Winters' additive method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.0765
beta  = 0.0765
gamma = 0.8633
phi   = 0.9133

```

Initial states:

```

l = 2117.6927
b = 201.2287
s = 345.5504 -2634.634 -1267.418 3556.502

```

sigma: 613.653

```

      AIC      AICc      BIC
1026.241 1030.731 1047.185

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 14.42855 565.7601 407.2081 0.9987278 10.42605
              MASE      ACF1

```

```
Training set 0.8556076 0.03415619
Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

```
Smoothing parameters:
```

```
alpha = 0.5454
beta  = 0.0469
gamma = 0.2554
```

```
Initial states:
```

```
l = 2521.4142
b = 130.1795
s = 1.0053 0.4928 0.7963 1.7056
```

```
sigma: 0.0666
```

```
      AIC      AICc      BIC
935.4788 939.0788 954.3279
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -33.61372 363.3672 260.1462 -1.127363 5.153195
```

```
              MASE      ACF1
Training set 0.5466076 -0.03376002
```

```
Damped Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.1797
beta  = 0.1795
gamma = 0.2127
phi   = 0.8231
```

```
Initial states:
```

```
l = 2445.9641
b = 188.5437
s = 1.0564 0.4456 0.7606 1.7374
```

```
sigma: 0.0716
```

```
      AIC      AICc      BIC
943.0103 947.5001 963.9537
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 25.42297 345.9668 258.3832 0.5819491 5.458546
```

```
              MASE      ACF1
Training set 0.5429033 0.04894088
```

```
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.1629
beta  = 0.1629
gamma = 0.187
```

Initial states:

```
l = 2564.9049
b = 1.0053
s = 1.066 0.4699 0.7767 1.6874
```

sigma: 0.0679

```
      AIC      AICc      BIC
937.1178 940.7178 955.9669
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -19.33123 371.3066 259.9777 -0.4765506 5.114725
```

```
              MASE      ACF1
Training set 0.5462536 0.1145289
```

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.2379
gamma = 0.7138
```

Initial states:

```
l = 2834.5558
s = 89.3672 -2790.345 -806.0583 3507.036
```

sigma: 663.3377

```
      AIC      AICc      BIC
1033.013 1035.167 1047.674
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 98.74905 629.2974 416.8486 3.184857 9.575382 0.8758638
```

```
              ACF1
Training set 0.07274478
```

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.0226
gamma = 0.9733
```

Initial states:

```
l = 3297.8326
s = -1101.777 -2125.487 -1755.919 4983.184
```

sigma: 0.1569

```
      AIC      AICc      BIC
```

1030.260 1032.414 1044.921

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	127.5033	811.529	514.5281	3.149559	10.93393	1.081104
	ACF1					

Training set 0.2190735

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.0226

gamma = 0.9733

Initial states:

l = 3297.8326

s = -1101.777 -2125.487 -1755.919 4983.184

sigma: 0.1569

AIC	AICc	BIC
1030.260	1032.414	1044.921

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	127.5033	811.529	514.5281	3.149559	10.93393	1.081104
	ACF1					

Training set 0.2190735

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

alpha = 0.0874

beta = 0.0874

gamma = 0.8262

Initial states:

l = 2511.0678

b = 115.9939

s = -41.6159 -2436.985 -1166.88 3645.481

sigma: 620.6488

AIC	AICc	BIC
1026.766	1030.366	1045.616

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-25.49934	577.7926	414.5119	-0.05754204	10.59181
	MASE	ACF1			

Training set 0.8709539 0.05415016

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0765
beta  = 0.0765
gamma = 0.8634
phi   = 0.9132
```

Initial states:

```
l = 2117.6923
b = 201.2287
s = 345.5505 -2634.634 -1267.418 3556.502
```

```
sigma: 613.653
```

```
      AIC      AICc      BIC
1026.241 1030.731 1047.185
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 14.43835 565.7601 407.2001 0.9989632 10.42583
```

```
              MASE      ACF1
Training set 0.8555908 0.03413349
ETS(M,M,M)
```

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```
alpha = 0.3064
beta  = 0.1588
gamma = 0.2801
```

Initial states:

```
l = 2564.7676
b = 1.0291
s = 1.0139 0.4855 0.7599 1.7407
```

```
sigma: 0.0644
```

```
      AIC      AICc      BIC
930.9981 934.5981 949.8472
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -29.34808 380.5117 260.9806 -0.6907008 5.004158
```

```
              MASE      ACF1
Training set 0.5483608 0.02490944
ETS(M,Md,M)
```

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2898
beta  = 0.1578
gamma = 0.2802
phi   = 0.9454
```

Initial states:

l = 2564.8475  
 b = 1.0296  
 s = 1.0141 0.4852 0.7603 1.7404

sigma: 0.0645

	AIC	AICc	BIC
	931.5858	936.0756	952.5292

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-8.360648	364.8109	256.0948	-0.2529305	4.941439

	MASE	ACF1
Training set	0.5380949	-0.003373429

ETS(M,A,A)

Call:

ets(y = ts\_series, model = "MAA")

Smoothing parameters:

alpha = 0.0138  
 beta = 0.0138  
 gamma = 0.9862

Initial states:

l = 1986.858  
 b = 395.5725  
 s = 344.3745 -2655.192 -1308.833 3619.651

sigma: 0.3241

	AIC	AICc	BIC
	1136.403	1140.003	1155.252

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-461.4234	772.1685	614.9251	-12.95803	17.25196

	MASE	ACF1
Training set	1.292053	0.291479

ETS(M,Ad,A)

Call:

ets(y = ts\_series, model = "MAA", damped = TRUE)

Smoothing parameters:

alpha = 2e-04  
 beta = 2e-04  
 gamma = 0.9998  
 phi = 0.9661

Initial states:

l = 1986.0882  
 b = 395.0816  
 s = 345.2848 -2655.05 -1308.975 3618.74

sigma: 0.3343

```

      AIC      AICc      BIC
1140.188 1144.678 1161.132

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -423.5633 731.7422 593.6197 -12.07175 16.65911

```

```

           MASE      ACF1
Training set 1.247287 0.2565388

```

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.3266
beta  = 0.1699
gamma = 0.307

```

Initial states:

```

l = 2328.9606
b = 125.5867
s = 1.0097 0.4917 0.766 1.7326

```

sigma: 0.0618

```

      AIC      AICc      BIC
925.6529 929.2529 944.5020

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -5.913235 366.7007 248.2075 -0.3341276 4.732473

```

```

           MASE      ACF1
Training set 0.5215226 -0.01920139

```

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.2922
beta  = 0.1874
gamma = 0.3015
phi   = 0.9325

```

Initial states:

```

l = 2329.1489
b = 167.0995
s = 1.0076 0.4887 0.7654 1.7383

```

sigma: 0.0625

```

      AIC      AICc      BIC
927.3950 931.8848 948.3384

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 9.555791 357.2139 245.5802 -0.01480197 4.738342

```



```

                MASE          ACF1
Training set 0.5160022 -0.03764161
Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive")

Smoothing parameters:
  alpha = 0.6828
  beta  = 0.1506
  gamma = 1e-04

Initial states:
  l = 3324.5522
  b = 192.6057
  s = 94.1875 -103.6528 -371.0769 380.5422

sigma: 799.8313

      AIC      AICc      BIC
1131.226 1134.559 1150.656

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -22.24712 748.1737 604.4329 -1.613325 18.79715
              MASE      ACF1
Training set 0.5121445 0.04763129
Damped Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)

Smoothing parameters:
  alpha = 0.6494
  beta  = 0.1491
  gamma = 1e-04
  phi   = 0.9033

Initial states:
  l = 3196.2048
  b = 320.8981
  s = 94.0653 -103.104 -371.8933 380.9321

sigma: 789.7433

      AIC      AICc      BIC
1130.448 1134.599 1152.037

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -33.35467 732.1117 581.2811 -3.599381 18.37657
              MASE      ACF1
Training set 0.4925277 0.05327335
Holt-Winters' multiplicative method

Call:
hw(y = ts_series, h = h, seasonal = "multiplicative")

```

## Smoothing parameters:

alpha = 0.7697  
 beta = 0.1249  
 gamma = 0.0445

## Initial states:

l = 3353.9123  
 b = 197.4629  
 s = 1.0143 1.0064 0.9352 1.0441

sigma: 0.5719

AIC	AICc	BIC
1277.155	1280.488	1296.585

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-25.04526	763.7624	584.7109	-1.911077	17.94391

	MASE	ACF1
Training set	0.4954337	0.02830509

Damped Holt-Winters' multiplicative method

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.7224  
 beta = 0.1193  
 gamma = 0.0551  
 phi = 0.902

## Initial states:

l = 3217.3708  
 b = 334.8982  
 s = 1.0161 1.0081 0.9327 1.0432

sigma: 0.4045

AIC	AICc	BIC
1237.239	1241.390	1258.827

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-35.77743	746.4807	567.3428	-4.17449	17.97671

	MASE	ACF1
Training set	0.4807175	0.04432392

Holt-Winters' multiplicative method with exponential trend

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

## Smoothing parameters:

alpha = 0.6535  
 beta = 0.1662  
 gamma = 0.0598

## Initial states:

l = 3371.5637

```
b = 1.0452
s = 1.014 1.0067 0.9342 1.045
```

```
sigma: 0.3391
```

```
      AIC      AICc      BIC
1218.017 1221.350 1237.447
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -165.783 758.4601 592.766 -7.360949 18.61522 0.502259
      ACF1
```

```
Training set 0.04309179
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.9262
gamma = 2e-04
```

```
Initial states:
```

```
l = 4495.57
s = 104.3228 -128.5068 -354.9412 379.1252
```

```
sigma: 828.4648
```

```
      AIC      AICc      BIC
1133.974 1135.974 1149.086
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set -39.9449 788.675 618.6998 -5.845569 20.15802 0.524233
      ACF1
```

```
Training set -0.00270178
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.5351
gamma = 1e-04
```

```
Initial states:
```

```
l = 4504.0272
s = -20.4705 -104.5232 -366.663 491.6567
```

```
sigma: 0.2316
```

```
      AIC      AICc      BIC
1167.635 1169.635 1182.747
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -71.18611 898.3672 656.3234 -7.776606 19.92633
      MASE      ACF1
```

```
Training set 0.556112 0.4285032
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.5351
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 4504.0272
```

```
s = -20.4705 -104.5232 -366.663 491.6567
```

```
sigma: 0.2316
```

```
AIC AICc BIC
```

```
1167.635 1169.635 1182.747
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set -71.18611 898.3672 656.3234 -7.776606 19.92633
```

```
MASE ACF1
```

```
Training set 0.556112 0.4285032
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.6828
```

```
beta = 0.1506
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 3324.5522
```

```
b = 192.6057
```

```
s = 94.1875 -103.6528 -371.0769 380.5422
```

```
sigma: 799.8313
```

```
AIC AICc BIC
```

```
1131.226 1134.559 1150.656
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set -22.24712 748.1737 604.4329 -1.613325 18.79715
```

```
MASE ACF1
```

```
Training set 0.5121445 0.04763129
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.6494
```

```
beta = 0.1491
```

```
gamma = 1e-04
```

```
phi = 0.9032
```

```
Initial states:
```

```
l = 3196.2048
```

```
b = 320.8981
```

```
s = 94.0656 -103.1044 -371.8929 380.9317
```

```
sigma: 789.7433
```

```
AIC      AICc      BIC
```

```
1130.448 1134.599 1152.037
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -33.34974 732.1117 581.2775 -3.599671 18.37645
```

```
MASE      ACF1
```

```
Training set 0.4925246 0.05328978
```

```
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.4579
```

```
beta = 1e-04
```

```
gamma = 0.0031
```

```
Initial states:
```

```
l = 3371.3127
```

```
b = 0.9969
```

```
s = 1.0311 0.9892 0.9077 1.072
```

```
sigma: 0.2612
```

```
AIC      AICc      BIC
```

```
1184.066 1187.399 1203.496
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -17.77989 946.5569 713.417 -7.250482 21.01115
```

```
MASE      ACF1
```

```
Training set 0.6044882 0.5486773
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.3805
```

```
beta = 1e-04
```

```
gamma = 0.1945
```

```
phi = 0.9055
```

```
Initial states:
```

```
l = 3372.0557
```

```
b = 1.0549
```

```
s = 1.0062 1.0273 0.9775 0.989
```

```

sigma: 0.2564

      AIC      AICc      BIC
1186.362 1190.513 1207.951

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -155.5046 960.2965 649.0266 -10.474 19.9958 0.5499293
              ACF1
Training set 0.5824651
ETS(M,A,A)

Call:
ets(y = ts_series, model = "MAA")

Smoothing parameters:
alpha = 0.5218
beta  = 0.0041
gamma = 0.1048

Initial states:
l = 3023.1928
b = 190.8191
s = 395.9544 -103.7725 -370.1805 77.9986

sigma: 0.235

      AIC      AICc      BIC
1178.517 1181.851 1197.947

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -332.8775 937.5188 656.2329 -14.12338 20.86296
              MASE      ACF1
Training set 0.5560354 0.4211504
ETS(M,Ad,A)

Call:
ets(y = ts_series, model = "MAA", damped = TRUE)

Smoothing parameters:
alpha = 0.493
beta  = 0.0051
gamma = 0.0476
phi   = 0.9782

Initial states:
l = 3023.3204
b = 218.7673
s = 369.3631 -103.7562 -371.3188 105.7119

sigma: 0.2478

      AIC      AICc      BIC
1182.496 1186.647 1204.085

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE

```

```
Training set -229.9062 904.172 647.759 -10.61304 19.68966 0.5488553
```

```
ACF1
```

```
Training set 0.4345827
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.4976
```

```
beta = 0.0051
```

```
gamma = 0.0476
```

```
phi = 0.9782
```

```
Initial states:
```

```
l = 3055.3369
```

```
b = 216.8064
```

```
s = 1.0338 0.9708 0.9058 1.0897
```

```
sigma: 0.2605
```

```
AIC AICc BIC
```

```
1188.835 1192.986 1210.424
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set -231.7935 906.4738 657.4663 -10.54511 20.31959
```

```
MASE ACF1
```

```
Training set 0.5570804 0.4565395
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.4976
```

```
beta = 0.0051
```

```
gamma = 0.0476
```

```
phi = 0.9782
```

```
Initial states:
```

```
l = 3055.3369
```

```
b = 216.8064
```

```
s = 1.0338 0.9708 0.9058 1.0897
```

```
sigma: 0.2605
```

```
AIC AICc BIC
```

```
1188.835 1192.986 1210.424
```

```
Training set error measures:
```

```
ME RMSE MAE MPE MAPE
```

```
Training set -231.7935 906.4738 657.4663 -10.54511 20.31959
```

```
MASE ACF1
```

```
Training set 0.5570804 0.4565395
```

```
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.3007
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 6043.0233
b = -131.5667
s = 75.5008 805.7824 -372.442 -508.8413
```

```
sigma: 1422.806
```

```
      AIC      AICc      BIC
546.3545 555.3545 558.9652
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -72.36788 1218.418 780.9678 -9.260266 25.23932
```

```
              MASE      ACF1
Training set 0.602867 0.06372537
```

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0584
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 6042.7078
b = -190.7198
s = 105.2739 816.6034 -391.519 -530.3583
```

```
sigma: 1439.014
```

```
      AIC      AICc      BIC
547.6385 559.2174 561.6504
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -183.5187 1203.965 817.6588 -13.30246 25.96962
```

```
              MASE      ACF1
Training set 0.6311905 0.2275144
```

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.2995
beta  = 2e-04
gamma = 1e-04
```



## Initial states:

l = 6173.2886  
 b = -147.4957  
 s = 1.0726 1.2396 0.8918 0.796

sigma: 0.5878

AIC	AICc	BIC
556.1831	565.1831	568.7938

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-55.15263	1157.801	729.2153	-8.092636	23.14777

	MASE	ACF1
Training set	0.5629167	0.02378559

Damped Holt-Winters' multiplicative method

## Call:

hw(y = ts\_series, h = h, seasonal = "multiplicative", damped = TRUE)

## Smoothing parameters:

alpha = 0.2721  
 beta = 1e-04  
 gamma = 6e-04  
 phi = 0.9735

## Initial states:

l = 6173.5188  
 b = -211.4828  
 s = 1.0725 1.2517 0.8809 0.7949

sigma: 0.6019

AIC	AICc	BIC
559.2315	570.8104	573.2434

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-65.53945	1144.745	702.4445	-9.621704	22.25115

	MASE	ACF1
Training set	0.542251	0.03546314

Holt-Winters' multiplicative method with exponential trend

## Call:

hw(y = ts\_series, h = h, seasonal = "multiplicative", exponential = TRUE)

## Smoothing parameters:

alpha = 0.226  
 beta = 0.0017  
 gamma = 0.0016

## Initial states:

l = 6248.0248  
 b = 0.9418  
 s = 1.0636 1.2611 0.9081 0.7671

sigma: 0.6268

```

      AIC      AICc      BIC
558.3074 567.3074 570.9182

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 93.4936 1118.336 633.6173 -4.354883 18.59835 0.48912

```

ACF1

Training set 0.0281961

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

alpha = 0.4204

gamma = 1e-04

Initial states:

l = 4012.6826

s = 66.912 823.7544 -391.3954 -499.2711

sigma: 1428.554

```

      AIC      AICc      BIC
545.2067 550.2976 555.0151

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -184.8172 1277.738 883.5076 -17.09514 29.38853

```

MASE ACF1

Training set 0.6820225 0.01925338

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.4299

gamma = 0.0361

Initial states:

l = 3944.3342

s = 145.9106 196.6128 -507.7945 165.2712

sigma: 0.4387

```

      AIC      AICc      BIC
541.8062 546.8971 551.6146

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -178.3805 1389.399 1018.976 -20.3057 37.59955

```

MASE ACF1

Training set 0.7865974 0.0136793

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

## Smoothing parameters:

alpha = 0.4299  
gamma = 0.0361

## Initial states:

l = 3944.3342  
s = 145.9106 196.6128 -507.7945 165.2712

sigma: 0.4387

AIC	AICc	BIC
541.8062	546.8971	551.6146

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-178.3805	1389.399	1018.976	-20.3057	37.59955

	MASE	ACF1
Training set	0.7865974	0.0136793

ETS(A,A,A)

## Call:

ets(y = ts\_series, model = "AAA")

## Smoothing parameters:

alpha = 0.3008  
beta = 1e-04  
gamma = 1e-04

## Initial states:

l = 6043.0234  
b = -131.5667  
s = 75.5009 805.7822 -372.4418 -508.8413

sigma: 1422.806

AIC	AICc	BIC
546.3545	555.3545	558.9652

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-72.34335	1218.418	780.9574	-9.259269	25.23897

	MASE	ACF1
Training set	0.6028589	0.06365223

ETS(A,Ad,A)

## Call:

ets(y = ts\_series, model = "AAA", damped = TRUE)

## Smoothing parameters:

alpha = 0.0593  
beta = 1e-04  
gamma = 1e-04  
phi = 0.9799

## Initial states:

l = 6042.708  
b = -190.7267

```
s = 105.2934 816.5909 -391.5151 -530.3692
```

```
sigma: 1439.022
```

```
      AIC      AICc      BIC
547.6388 559.2177 561.6508
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -183.5105 1203.972 817.4221 -13.33317 25.9626
           MASE      ACF1
Training set 0.6310078 0.2269236
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 6821.3193
b = 0.95
s = 1.0683 1.2152 0.7847 0.9318
```

```
sigma: 0.4088
```

```
      AIC      AICc      BIC
537.5286 546.5286 550.1393
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -225.5898 1264.045 884.5328 -14.76322 29.00184
           MASE      ACF1
Training set 0.6828138 0.2684461
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta  = 1e-04
gamma = 1e-04
phi   = 0.9728
```

```
Initial states:
```

```
l = 6821.3069
b = 0.9322
s = 0.9652 1.2176 0.8506 0.9666
```

```
sigma: 0.4544
```

```
      AIC      AICc      BIC
543.1905 554.7695 557.2025
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-90.57891	1217.542	839.949	-12.12995	27.4038	0.6483974

ACF1

Training set 0.2316673

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.0376
beta  = 0.0055
gamma = 1e-04
```

Initial states:

```
l = 6038.603
b = -74.472
s = 66.4124 814.6674 -392.0004 -489.0794
```

sigma: 0.3997

AIC	AICc	BIC
541.3863	550.3863	553.9970

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-544.6558	1358.042	1038.799	-25.17644	36.37365

MASE ACF1

Training set 0.8018995 0.2962663

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0066
beta  = 0.0066
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 6047.889
b = -146.8459
s = 65.4413 805.4356 -390.2245 -480.6523
```

sigma: 0.3985

AIC	AICc	BIC
539.0425	550.6214	553.0545

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-376.013	1277.223	933.0652	-19.13785	31.25169

MASE ACF1

Training set 0.7202784 0.2935578

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.0491
beta  = 0.0062
gamma = 1e-04
```

Initial states:

```
l = 6173.2606
b = -79.6231
s = 1.0272 1.188 0.8274 0.9574
```

sigma: 0.3979

```
      AIC      AICc      BIC
539.3846 548.3846 551.9954
```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -448.7813 1366.62 1021.884 -22.59066 36.04361
           MASE      ACF1
Training set 0.7888421 0.2915168
ETS(M,Ad,M)
```

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0057
beta  = 0.0057
gamma = 1e-04
phi   = 0.979
```

Initial states:

```
l = 6267.2037
b = -173.6547
s = 1.0312 1.2476 0.7945 0.9267
```

sigma: 0.3992

```
      AIC      AICc      BIC
538.5483 550.1272 552.5603
```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -355.7286 1311.514 948.8171 -18.66909 32.23102
           MASE      ACF1
Training set 0.732438 0.2798837
Holt-Winters' additive method
```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.231
beta  = 0.0318
gamma = 0.5293
```

Initial states:

l = 826.9151  
 b = 133.4455  
 s = 612.671 -575.8997 -654.6557 617.8844

sigma: 465.8164

AIC	AICc	BIC
1062.028	1065.361	1081.458

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-48.42072	435.7314	356.6125	-4.145256	15.36932

	MASE	ACF1
Training set	0.8719133	0.1603075

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2147  
 beta = 3e-04  
 gamma = 0.5022  
 phi = 0.9255

Initial states:

l = 282.2592  
 b = 216.3221  
 s = 242.5575 -645.0691 -536.2911 938.8027

sigma: 456.6586

AIC	AICc	BIC
1060.333	1064.484	1081.922

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	17.33747	423.3339	337.2638	-0.7699521	14.46385

	MASE	ACF1
Training set	0.8246058	0.217091

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

alpha = 0.3457  
 beta = 0.0057  
 gamma = 1e-04

Initial states:

l = 1278.091  
 b = 80.7241  
 s = 1.1001 0.5896 0.7761 1.5342

sigma: 0.1595

```

      AIC      AICc      BIC
1043.787 1047.121 1063.217

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -82.82514 369.5182 295.0892 -5.396272 12.7831

```

```

           MASE      ACF1
Training set 0.7214894 0.2190534

```

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.2923
beta  = 1e-04
gamma = 1e-04
phi   = 0.9798

```

Initial states:

```

l = 1162.5878
b = 95.1587
s = 1.1003 0.5877 0.7764 1.5356

```

sigma: 0.158

```

      AIC      AICc      BIC
1041.981 1046.132 1063.570

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -51.45349 357.645 285.5983 -4.168306 12.28604

```

```

           MASE      ACF1
Training set 0.6982843 0.2490468

```

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```

alpha = 0.3167
beta  = 0.0276
gamma = 1e-04

```

Initial states:

```

l = 1283.6584
b = 1.0158
s = 1.1063 0.5761 0.7766 1.5411

```

sigma: 0.1769

```

      AIC      AICc      BIC
1053.652 1056.985 1073.082

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -35.21013 376.0733 294.1994 -2.748328 12.57555

```



```

                MASE      ACF1
Training set 0.719314 0.283167
ETS(A,N,A)

Call:
ets(y = ts_series, model = "ANA")

Smoothing parameters:
  alpha = 0.2463
  gamma = 0.5934

Initial states:
  l = 1442.2915
  s = 454.0051 -1023.094 64.4318 504.6571

sigma: 468.9359

      AIC      AICc      BIC
1061.128 1063.128 1076.240

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE
Training set 76.41719 446.4136 357.3794 1.205776 14.6402 0.8737882
                ACF1
Training set 0.06439415
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.0345
  gamma = 0.7619

Initial states:
  l = 2310.3135
  s = 438.334 -1357.013 -1238.454 2157.133

sigma: 0.228

      AIC      AICc      BIC
1078.589 1080.589 1093.701

Training set error measures:
                ME      RMSE      MAE      MPE      MAPE      MASE
Training set 67.36981 607.564 429.7551 -0.3546235 18.51557 1.050746
                ACF1
Training set 0.1888831
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.0345
  gamma = 0.7619

Initial states:

```

```

l = 2310.3135
s = 438.334 -1357.013 -1238.454 2157.133

```

```
sigma: 0.228
```

```

      AIC      AICc      BIC
1078.589 1080.589 1093.701

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 67.36981 607.564 429.7551 -0.3546235 18.51557 1.050746
              ACF1

```

```
Training set 0.1888831
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```

alpha = 0.2147
beta  = 3e-04
gamma = 0.5021
phi   = 0.9255

```

```
Initial states:
```

```

l = 281.8055
b = 216.3936
s = 242.5446 -644.746 -536.2272 938.4287

```

```
sigma: 456.6586
```

```

      AIC      AICc      BIC
1060.333 1064.484 1081.922

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 17.39224 423.3339 337.2513 -0.7675732 14.46269
              MASE      ACF1

```

```
Training set 0.8245752 0.2171722
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.2147
beta  = 3e-04
gamma = 0.5021
phi   = 0.9255

```

```
Initial states:
```

```

l = 281.8055
b = 216.3936
s = 242.5446 -644.746 -536.2272 938.4287

```

```
sigma: 456.6586
```

```

      AIC      AICc      BIC

```

1060.333 1064.484 1081.922

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	17.39224	423.3339	337.2513	-0.7675732	14.46269

	MASE	ACF1
Training set	0.8245752	0.2171722

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

alpha = 0.2487

beta = 1e-04

gamma = 0.2634

phi = 0.9468

Initial states:

l = 1283.4577

b = 1.0619

s = 1.0784 0.7043 0.7489 1.4685

sigma: 0.1565

	AIC	AICc	BIC
	1038.596	1042.747	1060.185

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	5.042015	392.0293	309.8262	-2.394988	12.29159

	MASE	ACF1
Training set	0.7575213	0.2489283

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2487

beta = 1e-04

gamma = 0.2634

phi = 0.9468

Initial states:

l = 1283.4577

b = 1.0619

s = 1.0784 0.7043 0.7489 1.4685

sigma: 0.1565

	AIC	AICc	BIC
	1038.596	1042.747	1060.185

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	5.042015	392.0293	309.8262	-2.394988	12.29159

	MASE	ACF1

```
Training set 0.7575213 0.2489283
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA")
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta = 1e-04
gamma = 0.9998
phi = 0.9654
```

```
Initial states:
```

```
l = 895.9931
b = 221.3824
s = 262.3732 -1164.657 -642.2032 1544.487
```

```
sigma: 0.3674
```

```
      AIC      AICc      BIC
1155.382 1159.533 1176.971
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -187.298 515.4807 441.2076 -10.5723 20.73242 1.078747
```

```
      ACF1
```

```
Training set 0.2754337
```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 1e-04
beta = 1e-04
gamma = 0.9998
phi = 0.9654
```

```
Initial states:
```

```
l = 895.9931
b = 221.3824
s = 262.3732 -1164.657 -642.2032 1544.487
```

```
sigma: 0.3674
```

```
      AIC      AICc      BIC
1155.382 1159.533 1176.971
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -187.298 515.4807 441.2076 -10.5723 20.73242 1.078747
```

```
      ACF1
```

```
Training set 0.2754337
```

```
ETS(M,A,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

## Smoothing parameters:

alpha = 0.3149  
 beta = 1e-04  
 gamma = 0.3344

## Initial states:

l = 1303.4331  
 b = 51.7095  
 s = 1.0602 0.7471 0.759 1.4337

sigma: 0.1545

AIC	AICc	BIC
1037.352	1040.686	1056.782

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-37.57978	414.1489	321.5015	-3.358093	12.57444

  

	MASE	ACF1
Training set	0.7860673	0.2455764

ETS(M,Ad,M)

## Call:

ets(y = ts\_series, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.2493  
 beta = 1e-04  
 gamma = 0.2729  
 phi = 0.97

## Initial states:

l = 1235.0361  
 b = 85.3273  
 s = 1.0773 0.7143 0.7586 1.4497

sigma: 0.1551

AIC	AICc	BIC
1037.512	1041.663	1059.101

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	1.937253	392.9175	310.669	-2.434634	12.23181	0.7595819

  

	ACF1
Training set	0.2542567

Holt-Winters' additive method

## Call:

hw(y = ts\_series, h = h, seasonal = "additive")

## Smoothing parameters:

alpha = 0.707  
 beta = 1e-04  
 gamma = 0.2252

## Initial states:

l = 2016.5707

```
b = 128.0444
s = -139.3144 316.4817 85.6049 -262.7721
```

```
sigma: 209.6671
```

```
      AIC      AICc      BIC
1007.495 1010.653 1027.337
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -14.59574 196.7519 142.7006 -0.5676628 2.761667
```

```
           MASE      ACF1
Training set 0.286447 0.1104551
```

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.8979
```

```
beta = 0.0522
```

```
gamma = 1e-04
```

```
phi = 0.98
```

Initial states:

```
l = 1988.5624
```

```
b = 128.7713
```

```
s = -179.086 370.9344 107.0657 -298.9141
```

```
sigma: 214.8561
```

```
      AIC      AICc      BIC
1011.625 1015.554 1033.672
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 27.09259 199.9053 160.2997 0.3792485 3.349165
```

```
           MASE      ACF1
Training set 0.3217741 0.00822443
```

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.8541
```

```
beta = 3e-04
```

```
gamma = 0.011
```

Initial states:

```
l = 1964.5688
```

```
b = 101.7872
```

```
s = 0.9691 1.063 1.0162 0.9516
```

```
sigma: 0.0292
```

```
      AIC      AICc      BIC
964.4204 967.5783 984.2627
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	17.01515	172.8092	124.0411	0.1704629	2.152389

  

	MASE	ACF1
Training set	0.2489911	0.012717

Damped Holt-Winters' multiplicative method

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.858
beta  = 0.0703
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 1969.5164
b = 126.7314
s = 0.9704 1.0621 1.0163 0.9512
```

```
sigma: 0.0308
```

AIC	AICc	BIC
972.3432	976.2718	994.3901

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	19.6067	175.7815	126.519	0.2598216	2.242464	0.2539653

  

	ACF1
Training set	-0.006408156

Holt-Winters' multiplicative method with exponential trend

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8442
beta  = 0.1452
gamma = 2e-04
```

## Initial states:

```
l = 2168.8176
b = 1.028
s = 0.9708 1.0614 1.016 0.9518
```

```
sigma: 0.0331
```

AIC	AICc	BIC
981.9728	985.1307	1001.8151

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-20.24829	184.4497	129.3443	-0.288189	2.405846

  

	MASE	ACF1
Training set	0.2596365	-0.01169235

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.9999
```

```
gamma = 1e-04
```

Initial states:

```
l = 2674.5566
```

```
s = -178.4608 370.2373 107.1112 -298.8876
```

```
sigma: 243.6419
```

```
AIC      AICc      BIC
```

```
1025.852 1027.751 1041.285
```

Training set error measures:

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 109.5851 232.4768 182.6758 1.865862 3.808163 0.3666904
```

```
ACF1
```

```
Training set 0.007972296
```

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9711
```

```
gamma = 0.0285
```

Initial states:

```
l = 2644.4025
```

```
s = -211.7308 289.3741 130.2207 -207.8639
```

```
sigma: 0.0569
```

```
AIC      AICc      BIC
```

```
1049.672 1051.570 1065.105
```

Training set error measures:

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 112.8717 244.3134 186.1763 1.85912 3.696369 0.373717
```

```
ACF1
```

```
Training set 0.006081832
```

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9711
```

```
gamma = 0.0285
```

Initial states:

```
l = 2644.4025
```

```
s = -211.7308 289.3741 130.2207 -207.8639
```



```

sigma: 0.0569

      AIC      AICc      BIC
1049.672 1051.570 1065.105

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 112.8717 244.3134 186.1763 1.85912 3.696369 0.373717
              ACF1
Training set 0.006081832
ETS(A,A,A)

Call:
ets(y = ts_series, model = "AAA")

Smoothing parameters:
alpha = 0.7071
beta  = 1e-04
gamma = 0.2251

Initial states:
l = 2016.5757
b = 128.0503
s = -139.3066 316.4703 85.6018 -262.7655

sigma: 209.6671

      AIC      AICc      BIC
1007.495 1010.653 1027.337

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -14.60161 196.7519 142.6992 -0.5677908 2.761659
              MASE      ACF1
Training set 0.2864441 0.1104052
ETS(A,Ad,A)

Call:
ets(y = ts_series, model = "AAA", damped = TRUE)

Smoothing parameters:
alpha = 0.898
beta  = 0.0522
gamma = 1e-04
phi   = 0.98

Initial states:
l = 1988.5624
b = 128.7713
s = -179.086 370.9344 107.0657 -298.914

sigma: 214.8561

      AIC      AICc      BIC
1011.625 1015.554 1033.672

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE

```

```
Training set 27.09019 199.9053 160.2982 0.3792112 3.349092
```

```
      MASE      ACF1
```

```
Training set 0.3217711 0.008133373
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.9562
```

```
beta  = 1e-04
```

```
gamma = 0.0438
```

```
phi   = 0.98
```

```
Initial states:
```

```
l = 1985.8665
```

```
b = 1.045
```

```
s = 0.9685 1.0726 1.0131 0.9458
```

```
sigma: 0.0284
```

```
      AIC      AICc      BIC
```

```
961.8915 965.8201 983.9384
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -0.901728 180.4627 127.7307 -0.05349526 2.125536
```

```
      MASE      ACF1
```

```
Training set 0.2563975 -0.1243671
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9562
```

```
beta  = 1e-04
```

```
gamma = 0.0438
```

```
phi   = 0.98
```

```
Initial states:
```

```
l = 1985.8665
```

```
b = 1.045
```

```
s = 0.9685 1.0726 1.0131 0.9458
```

```
sigma: 0.0284
```

```
      AIC      AICc      BIC
```

```
961.8915 965.8201 983.9384
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -0.901728 180.4627 127.7307 -0.05349526 2.125536
```

```
      MASE      ACF1
```

```
Training set 0.2563975 -0.1243671
```

```
ETS(M,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.5885
beta  = 0.0072
gamma = 0.2998
```

Initial states:

```
l = 1997.4277
b = 104.4246
s = -212.0642 328.5522 132.1827 -248.6707
```

```
sigma: 0.0395
```

```
      AIC      AICc      BIC
1005.062 1008.220 1024.905
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 15.45379 201.7845 152.4211 0.1034689 2.937321
```

```
              MASE      ACF1
Training set 0.3059591 0.2087314
```

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6105
beta  = 0.0369
gamma = 0.3895
phi   = 0.98
```

Initial states:

```
l = 1988.5976
b = 130.5578
s = -179.4046 370.8006 107.1842 -298.5802
```

```
sigma: 0.0421
```

```
      AIC      AICc      BIC
1013.822 1017.751 1035.869
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 31.99276 212.7549 160.727 0.4038045 3.129297 0.3226319
```

```
              ACF1
Training set 0.1633013
```

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.9876
beta  = 1e-04
gamma = 1e-04
```

```

Initial states:
  l = 1970.0036
  b = 99.9247
  s = 0.9671 1.0696 1.0167 0.9465

sigma: 0.0281

      AIC      AICc      BIC
959.4305 962.5884 979.2728

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 14.88743 177.371 127.3237 0.1810373 2.12598 0.2555805
              ACF1
Training set -0.1249475
ETS(M,Ad,M)

Call:
ets(y = ts_series, model = "MAM", damped = TRUE)

Smoothing parameters:
  alpha = 0.9999
  beta  = 0.0967
  gamma = 1e-04
  phi   = 0.9799

Initial states:
  l = 1968.756
  b = 126.0924
  s = 0.9669 1.0696 1.0168 0.9467

sigma: 0.0293

      AIC      AICc      BIC
965.7410 969.6696 987.7880

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 12.50303 183.5992 130.7721 0.1947483 2.195641
              MASE      ACF1
Training set 0.2625026 -0.1771499
Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive")

Smoothing parameters:
  alpha = 0.7287
  beta  = 1e-04
  gamma = 1e-04

Initial states:
  l = 1623.1168
  b = 85.2716
  s = -192.5402 348.9931 112.4377 -268.8906

sigma: 201.5504

```

```

      AIC      AICc      BIC
1002.204 1005.362 1022.047

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 5.484476 189.1351 155.5326 0.07618998 4.048069

```

```

              MASE      ACF1
Training set 0.3990126 0.07813896
Damped Holt-Winters' additive method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.812
beta  = 0.0178
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 1623.6148
b = 114.2825
s = -194.4356 348.9543 112.5812 -267.0999

```

sigma: 208.9117

```

      AIC      AICc      BIC
1007.866 1011.794 1029.913

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 25.57387 194.3745 158.7544 0.3666891 4.065823 0.407278

```

```

              ACF1
Training set 0.03782152
Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```

alpha = 0.7697
beta  = 0.1984
gamma = 3e-04

```

Initial states:

```

l = 1610.0008
b = 84.2416
s = 0.9588 1.0756 1.0234 0.9423

```

sigma: 0.0331

```

      AIC      AICc      BIC
953.3610 956.5189 973.2033

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -3.825815 171.2556 116.3542 -0.06045929 2.389865

```

```

              MASE      ACF1

```

```
Training set 0.2985021 -0.01314139
Damped Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.8515
beta  = 0.0205
gamma = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 1607.6683
b = 113.8092
s = 0.959 1.0755 1.0216 0.9438
```

```
sigma: 0.0333
```

```
      AIC      AICc      BIC
954.5663 958.4949 976.6132
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 21.18752 162.0037 117.3928 0.2571107 2.483627
```

```
           MASE      ACF1
Training set 0.3011665 -0.02595293
```

```
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.806
beta  = 0.2158
gamma = 1e-04
```

```
Initial states:
```

```
l = 1769.7692
b = 1.0537
s = 0.9588 1.0743 1.0219 0.9449
```

```
sigma: 0.0358
```

```
      AIC      AICc      BIC
964.3483 967.5062 984.1905
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -16.82124 175.8888 120.6349 -0.4302636 2.577169
```

```
           MASE      ACF1
Training set 0.309484 -0.04113349
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
gamma = 1e-04
```

## Initial states:

```
l = 2184.771
s = -194.1833 349.1015 112.8084 -267.7267
```

```
sigma: 224.1955
```

```
      AIC      AICc      BIC
1014.706 1016.604 1030.139
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 81.79092 213.9215 169.6052 1.778128 4.369593 0.4351153
```

## ACF1

```
Training set -0.03856086
```

```
ETS(M,N,A)
```

## Call:

```
ets(y = ts_series, model = "MNA")
```

## Smoothing parameters:

```
alpha = 0.8883
gamma = 0.1117
```

## Initial states:

```
l = 2282.7026
s = -199.0146 254.3464 56.177 -111.5088
```

```
sigma: 0.0625
```

```
      AIC      AICc      BIC
1034.241 1036.139 1049.674
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 86.38679 228.7774 170.2081 1.720091 4.113085 0.436662
```

## ACF1

```
Training set -0.01801612
```

```
ETS(M,N,A)
```

## Call:

```
ets(y = ts_series, model = "MNA")
```

## Smoothing parameters:

```
alpha = 0.8883
gamma = 0.1117
```

## Initial states:

```
l = 2282.7026
s = -199.0146 254.3464 56.177 -111.5088
```

```
sigma: 0.0625
```

```
      AIC      AICc      BIC
1034.241 1036.139 1049.674
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	86.38679	228.7774	170.2081	1.720091	4.113085	0.436662

ACF1

Training set -0.01801612

ETS(A,A,A)

## Call:

```
ets(y = ts_series, model = "AAA")
```

## Smoothing parameters:

```
alpha = 0.7288
beta  = 1e-04
gamma = 1e-04
```

## Initial states:

```
l = 1623.1167
b = 85.2715
s = -192.5401 348.9933 112.4377 -268.8909
```

```
sigma: 201.5504
```

AIC	AICc	BIC
1002.204	1005.362	1022.047

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	5.484237	189.1351	155.5329	0.07619317	4.048067

MASE            ACF1

Training set 0.3990135 0.07808726

ETS(A,Ad,A)

## Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.812
beta  = 0.0177
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 1623.6146
b = 114.2826
s = -194.4355 348.9543 112.5812 -267.0999
```

```
sigma: 208.9117
```

AIC	AICc	BIC
1007.866	1011.794	1029.913

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	25.57695	194.3745	158.7551	0.3667269	4.065843

MASE            ACF1

Training set 0.4072798 0.03785599

ETS(M,Md,M)



Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```
alpha = 0.9631
beta  = 1e-04
gamma = 1e-04
phi   = 0.9799
```

Initial states:

```
l = 1649.1945
b = 1.0422
s = 0.9559 1.0803 1.0215 0.9423
```

sigma: 0.0314

```
      AIC      AICc      BIC
947.0060 950.9346 969.0530
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-1.870549	163.0436	113.2523	-0.0402041	2.31337
	MASE	ACF1			
Training set	0.2905443	-0.1608883			

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9631
beta  = 1e-04
gamma = 1e-04
phi   = 0.9799
```

Initial states:

```
l = 1649.1945
b = 1.0422
s = 0.9559 1.0803 1.0215 0.9423
```

sigma: 0.0314

```
      AIC      AICc      BIC
947.0060 950.9346 969.0530
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-1.870549	163.0436	113.2523	-0.0402041	2.31337
	MASE	ACF1			
Training set	0.2905443	-0.1608883			

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.555
beta  = 1e-04
```

```
gamma = 0.445
```

```
Initial states:
```

```
l = 1620.434
```

```
b = 82.0739
```

```
s = -197.9211 342.1916 114.5401 -258.8105
```

```
sigma: 0.0464
```

```
      AIC      AICc      BIC
```

```
998.3855 1001.5434 1018.2277
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 6.796 200.3415 144.7126 0.09400313 3.426886 0.3712544
```

```
      ACF1
```

```
Training set 0.1597829
```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.5858
```

```
beta = 0.0058
```

```
gamma = 0.4142
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 1623.2075
```

```
b = 112.3847
```

```
s = -194.3113 348.9287 112.698 -267.3153
```

```
sigma: 0.0481
```

```
      AIC      AICc      BIC
```

```
1003.695 1007.624 1025.742
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set 32.57765 204.5061 151.4223 0.4192369 3.578684
```

```
      MASE      ACF1
```

```
Training set 0.3884679 0.1578317
```

```
ETS(M,A,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.9625
```

```
beta = 1e-04
```

```
gamma = 0.001
```

```
Initial states:
```

```
l = 1606.7633
```

```
b = 88.4407
```

```
s = 0.9562 1.0795 1.0212 0.9431
```

```

sigma: 0.0309

      AIC      AICc      BIC
944.1951 947.3530 964.0374

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -2.201728 161.4992 112.2567 -0.1046548 2.310579
              MASE      ACF1
Training set 0.28799 -0.1597983
ETS(M,Ad,M)

Call:
ets(y = ts_series, model = "MAM", damped = TRUE)

Smoothing parameters:
alpha = 0.9663
beta  = 0.0226
gamma = 1e-04
phi   = 0.98

Initial states:
l = 1607.7819
b = 109.9022
s = 0.9561 1.08 1.0218 0.9421

sigma: 0.0325

      AIC      AICc      BIC
951.4261 955.3547 973.4730

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 19.06552 165.0889 120.8322 0.2706872 2.494909
              MASE      ACF1
Training set 0.3099903 -0.1551594
Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive")

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04

Initial states:
l = 1684.3981
b = 78.3402
s = 120.9233 -102.4474 78.8367 -97.3126

sigma: 772.2887

      AIC      AICc      BIC
1182.209 1185.367 1202.051

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE

```

```
Training set 9.495012 724.7167 341.2664 -0.5694973 6.952151
```

```
      MASE      ACF1
```

```
Training set 0.3751161 0.04795817
```

```
Damped Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
phi   = 0.98
```

```
Initial states:
```

```
l = 1683.5418
```

```
b = 83.8295
```

```
s = 120.8685 -103.4941 79.6976 -97.0721
```

```
sigma: 780.435
```

```
      AIC      AICc      BIC
```

```
1184.470 1188.398 1206.517
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set 42.34889 726.1283 350.4187 0.1065265 7.042304
```

```
      MASE      ACF1
```

```
Training set 0.3851763 0.04829165
```

```
Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

```
Smoothing parameters:
```

```
alpha = 0.9428
```

```
beta  = 1e-04
```

```
gamma = 0.0559
```

```
Initial states:
```

```
l = 1666.1403
```

```
b = 77.8854
```

```
s = 1.0724 0.9135 0.9917 1.0224
```

```
sigma: 0.1484
```

```
      AIC      AICc      BIC
```

```
1153.115 1156.273 1172.958
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set 6.137148 729.0999 393.8609 -0.7161889 8.623306
```

```
      MASE      ACF1
```

```
Training set 0.4329274 0.08183192
```

```
Damped Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 0.001
gamma = 1e-04
phi   = 0.9713
```

## Initial states:

```
l = 1666.0501
b = 82.0611
s = 1.0206 0.9623 1.0238 0.9933
```

```
sigma: 0.1417
```

```
      AIC      AICc      BIC
1146.497 1150.426 1168.544
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 53.13061 705.3473 367.1061 0.3324292 7.604685
```

```
              MASE      ACF1
Training set 0.4035188 0.06476806
```

```
Holt-Winters' multiplicative method with exponential trend
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9759
beta  = 3e-04
gamma = 0.0241
```

## Initial states:

```
l = 1668.2506
b = 1.0081
s = 1.0189 0.9576 1.0161 1.0074
```

```
sigma: 0.1431
```

```
      AIC      AICc      BIC
1146.442 1149.600 1166.284
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 48.84123 719.5859 370.1329 0.6875104 7.834398
```

```
              MASE      ACF1
Training set 0.4068459 0.07611769
```

```
ETS(A,N,A)
```

## Call:

```
ets(y = ts_series, model = "ANA")
```

## Smoothing parameters:

```
alpha = 0.9999
gamma = 1e-04
```

## Initial states:

```
l = 2279.3716
```

```
s = 120.71 -103.4444 79.6084 -96.874
```

```
sigma: 767.8634
```

```
      AIC      AICc      BIC
1179.673 1181.571 1195.105
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 79.02127 732.6752 365.3598 1.024878 7.614965 0.4015993
      ACF1
```

```
Training set 0.04804214
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 2048.176
```

```
s = 134.156 -7.6593 -9.3323 -117.1643
```

```
sigma: 0.1396
```

```
      AIC      AICc      BIC
1140.755 1142.653 1156.188
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 81.04721 736.9639 332.1561 1.209131 6.41817 0.3651022
      ACF1
```

```
Training set 0.03750962
```

```
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 2048.176
```

```
s = 134.156 -7.6593 -9.3323 -117.1643
```

```
sigma: 0.1396
```

```
      AIC      AICc      BIC
1140.755 1142.653 1156.188
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 81.04721 736.9639 332.1561 1.209131 6.41817 0.3651022
      ACF1
```

```
Training set 0.03750962
```

```
ETS(A,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 1684.3981
```

```
b = 78.3402
```

```
s = 120.9233 -102.4474 78.8367 -97.3126
```

```
sigma: 772.2887
```

```
AIC      AICc      BIC
```

```
1182.209 1185.367 1202.051
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set 9.494965 724.7167 341.2664 -0.5694978 6.952151
```

```
MASE      ACF1
```

```
Training set 0.3751161 0.04795817
```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 1683.5416
```

```
b = 83.8295
```

```
s = 120.8684 -103.494 79.698 -97.0724
```

```
sigma: 780.4355
```

```
AIC      AICc      BIC
```

```
1184.470 1188.398 1206.517
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set 42.35174 726.1287 350.4192 0.1065857 7.042303
```

```
MASE      ACF1
```

```
Training set 0.3851768 0.04829892
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.9969
```

```

beta = 1e-04
gamma = 1e-04
phi = 0.9712

```

Initial states:

```

l = 1669.1345
b = 1.0456
s = 1.0149 0.997 1.0064 0.9817

```

sigma: 0.1361

```

      AIC      AICc      BIC
1142.077 1146.006 1164.124

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 17.42485 730.7146 333.1878 -0.404112 6.687929
              MASE      ACF1
Training set 0.3662362 0.04693168
ETS(M,Md,M)

```

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9969
beta = 1e-04
gamma = 1e-04
phi = 0.9712

```

Initial states:

```

l = 1669.1345
b = 1.0456
s = 1.0149 0.997 1.0064 0.9817

```

sigma: 0.1361

```

      AIC      AICc      BIC
1142.077 1146.006 1164.124

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 17.42485 730.7146 333.1878 -0.404112 6.687929
              MASE      ACF1
Training set 0.3662362 0.04693168
ETS(M,A,A)

```

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```

alpha = 0.9943
beta = 1e-04
gamma = 0.0057

```

Initial states:

```

l = 1670.6452
b = 114.565

```



```
s = 82.5071 6.3822 25.4555 -114.3448
```

```
sigma: 0.1323
```

```
      AIC      AICc      BIC
1139.065 1142.222 1158.907
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -27.94279 733.3641 316.5132 -1.606024 6.196291
      MASE      ACF1
Training set 0.3479077 0.03825114
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta = 1e-04
gamma = 1e-04
phi = 0.9797
```

```
Initial states:
```

```
l = 1683.9757
b = 70.3817
s = 120.8704 -73.2943 79.7332 -127.3092
```

```
sigma: 0.1424
```

```
      AIC      AICc      BIC
1147.170 1151.099 1169.217
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 49.44987 726.9825 341.0603 0.3450522 6.73477 0.3748897
      ACF1
Training set 0.04788969
ETS(M,A,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta = 1e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 1665.3208
b = 75.8602
s = 1.0107 0.9914 1.0119 0.986
```

```
sigma: 0.1333
```

```
      AIC      AICc      BIC
1138.631 1141.788 1158.473
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	12.62732	720.5704	342.3745	-0.5452424	6.915184

  

	MASE	ACF1
Training set	0.3763342	0.04951301

ETS(M,Ad,M)

## Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9997
beta = 1e-04
gamma = 3e-04
phi = 0.9762
```

## Initial states:

```
l = 1665.7511
b = 74.275
s = 1.0138 0.9937 1.0127 0.9798
```

```
sigma: 0.1375
```

AIC	AICc	BIC
1142.491	1146.419	1164.538

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	51.62565	723.0847	342.8294	0.3313134	6.738571

  

	MASE	ACF1
Training set	0.3768342	0.05716438

Holt-Winters' additive method

## Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

## Smoothing parameters:

```
alpha = 0.7823
beta = 1e-04
gamma = 1e-04
```

## Initial states:

```
l = 1540.5528
b = 74.817
s = 483.4773 -281.0826 -131.145 -71.2497
```

```
sigma: 263.3713
```

AIC	AICc	BIC
1038.053	1041.211	1057.895

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-13.40034	247.1479	167.0562	-0.8041769	4.958462

  

	MASE	ACF1
Training set	0.4516969	-0.003795245

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7926
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1484.6171
b = 100.4759
s = 482.8573 -274.0489 -130.4332 -78.3752
```

sigma: 266.9982

AIC	AICc	BIC
1040.740	1044.669	1062.787

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	13.08047	248.4191	164.7245	-0.2738407	4.850527

  

	MASE	ACF1
Training set	0.4453926	-0.004271132

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.6164
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 1579.8135
b = 79.8466
s = 1.1188 0.9276 0.9692 0.9845
```

sigma: 0.1065

AIC	AICc	BIC
1083.332	1086.490	1103.174

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-22.28974	273.3649	193.127	-1.451047	6.12912	0.5221889

  

	ACF1
Training set	0.09015928

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7126
beta  = 0.0194
gamma = 1e-04
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 1453.2948
```

```
b = 103.1206
```

```
s = 1.1247 0.9285 0.9708 0.976
```

```
sigma: 0.1087
```

```
AIC      AICc      BIC
```

```
1085.518 1089.447 1107.565
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set 17.63735 275.3591 180.2847 -0.3902853 5.708176
```

```
MASE      ACF1
```

```
Training set 0.4874651 0.004149809
```

```
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.7639
```

```
beta = 0.015
```

```
gamma = 0.2081
```

```
Initial states:
```

```
l = 1600.48
```

```
b = 0.993
```

```
s = 1.2089 0.7665 0.9887 1.0359
```

```
sigma: 0.1179
```

```
AIC      AICc      BIC
```

```
1093.685 1096.842 1113.527
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set 30.44714 302.2474 213.3497 0.9226838 6.718446
```

```
MASE      ACF1
```

```
Training set 0.5768683 -0.08669104
```

```
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.8714
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 1991.4502
```

```
s = 489.4588 -286.9548 -127.8614 -74.6426
```

```
sigma: 276.9989
```

```
AIC      AICc      BIC
```

1043.046 1044.945 1058.479

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	66.07399	264.3051	176.745	1.46296	5.488814	0.4778941

ACF1

Training set -0.08373349

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.8778

gamma = 1e-04

Initial states:

l = 2005.8508

s = 471.4465 -267.1656 -124.5103 -79.7707

sigma: 0.0956

AIC	AICc	BIC
1063.340	1065.238	1078.772

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	65.06791	264.8287	173.2011	1.371888	5.330305	0.4683119

ACF1

Training set -0.08878422

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.8778

gamma = 1e-04

Initial states:

l = 2005.8508

s = 471.4465 -267.1656 -124.5103 -79.7707

sigma: 0.0956

AIC	AICc	BIC
1063.340	1065.238	1078.772

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	65.06791	264.8287	173.2011	1.371888	5.330305	0.4683119

ACF1

Training set -0.08878422

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

## Smoothing parameters:

alpha = 0.7825  
 beta = 1e-04  
 gamma = 1e-04

## Initial states:

l = 1540.5533  
 b = 74.8165  
 s = 483.4773 -281.0834 -131.1447 -71.2492

sigma: 263.3713

	AIC	AICc	BIC
	1038.053	1041.211	1057.895

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-13.39614	247.1479	167.0484	-0.8039965	4.958244

  

	MASE	ACF1
Training set	0.4516758	-0.003973265

ETS(A,Ad,A)

## Call:

ets(y = ts\_series, model = "AAA", damped = TRUE)

## Smoothing parameters:

alpha = 0.7926  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.98

## Initial states:

l = 1484.6171  
 b = 100.4759  
 s = 482.8573 -274.0489 -130.4332 -78.3752

sigma: 266.9982

	AIC	AICc	BIC
	1040.740	1044.669	1062.787

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	13.08047	248.4191	164.7245	-0.2738407	4.850527

  

	MASE	ACF1
Training set	0.4453926	-0.004271132

ETS(M,M,M)

## Call:

ets(y = ts\_series, model = "MMM")

## Smoothing parameters:

alpha = 0.5686  
 beta = 1e-04  
 gamma = 0.3256

## Initial states:

l = 1601.6382

```
b = 1.0216
s = 1.3639 0.8279 0.8842 0.9239
```

```
sigma: 0.1005
```

```
      AIC      AICc      BIC
1074.685 1077.843 1094.527
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -31.9115 313.0427 227.5889 -0.8084352 6.550224
      MASE      ACF1
Training set 0.6153692 0.08589662
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.4642
beta  = 1e-04
gamma = 1e-04
phi   = 0.9723
```

```
Initial states:
```

```
l = 1512.9749
b = 1.0481
s = 1.1601 0.9058 0.9535 0.9805
```

```
sigma: 0.1037
```

```
      AIC      AICc      BIC
1079.675 1083.604 1101.722
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -4.302618 307.7539 224.8372 -0.7592123 6.468487
      MASE      ACF1
Training set 0.6079289 0.1791472
ETS(M,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA")
```

```
Smoothing parameters:
```

```
alpha = 0.7558
beta  = 1e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 1485.1719
b = 73.9315
s = 487.248 -247.2657 -130.8762 -109.1061
```

```
sigma: 0.0835
```

```
      AIC      AICc      BIC
1050.067 1053.225 1069.909
```

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-12.16849	249.5908	167.5978	-0.7738514	4.880436

  

	MASE	ACF1
Training set	0.4531615	0.02221813

ETS(M,Ad,A)

## Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.7729
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 1484.538
b = 94.6434
s = 485.2366 -246.6924 -130.8646 -107.6796
```

```
sigma: 0.0852
```

AIC	AICc	BIC
1052.704	1056.632	1074.750

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	17.02615	250.8744	166.4865	-0.1766548	4.854458

  

	MASE	ACF1
Training set	0.4501566	0.01395289

ETS(M,A,M)

## Call:

```
ets(y = ts_series, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.624
beta  = 1e-04
gamma = 0.2688
```

## Initial states:

```
l = 1455.8918
b = 84.7987
s = 1.3224 0.8316 0.9108 0.9351
```

```
sigma: 0.0972
```

AIC	AICc	BIC
1070.783	1073.941	1090.626

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-33.96423	309.6671	220.4585	-1.224302	6.355218

  

	MASE	ACF1
Training set	0.5960896	0.01896808

ETS(M,Ad,M)



Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4806
beta  = 5e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1453.5214
b = 97.6749
s = 1.1533 0.9156 0.9544 0.9766
```

sigma: 0.1026

```
      AIC      AICc      BIC
1077.641 1081.569 1099.688
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 21.28305 294.0982 212.6406 -0.2778998 6.285616
              MASE      ACF1
Training set 0.5749511 0.1867322
Holt-Winters' additive method
```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.7661
beta  = 5e-04
gamma = 1e-04
```

Initial states:

```
l = 1941.3124
b = 114.7664
s = 19.3246 108.9208 -43.5684 -84.677
```

sigma: 271.1943

```
      AIC      AICc      BIC
1041.975 1045.133 1061.817
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 12.6226 254.4891 170.2615 -0.1435311 3.03427 0.3136672
              ACF1
Training set 0.01960734
Damped Holt-Winters' additive method
```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7739
beta  = 0.048
```

```
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 1937.132
b = 127.1095
s = 9.9645 112.6904 -23.77 -98.8848
```

```
sigma: 281.145
```

```
      AIC      AICc      BIC
1047.658 1051.587 1069.705
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 35.88561 261.5814 170.4641 0.4016131 3.046681
```

```
              MASE      ACF1
Training set 0.3140404 0.006249041
Holt-Winters' multiplicative method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

## Smoothing parameters:

```
alpha = 0.7927
beta  = 0.0097
gamma = 2e-04
```

## Initial states:

```
l = 1925.2957
b = 93.6565
s = 1.0077 1.0196 0.9915 0.9812
```

```
sigma: 0.042
```

```
      AIC      AICc      BIC
1010.573 1013.730 1030.415
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 30.22348 247.7332 165.5502 0.3390501 2.834888
```

```
              MASE      ACF1
Training set 0.3049876 -0.01243133
Damped Holt-Winters' multiplicative method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.783
beta  = 0.0631
gamma = 6e-04
phi   = 0.98
```

## Initial states:

```
l = 1926.3797
b = 125.2655
s = 1.0074 1.02 0.9917 0.9809
```

```

sigma: 0.0435

      AIC      AICc      BIC
1016.119 1020.047 1038.166

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 28.85392 252.6338 165.4783 0.329239 2.859387 0.3048553
              ACF1
Training set -0.01481269
Holt-Winters' multiplicative method with exponential trend

Call:
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)

Smoothing parameters:
alpha = 0.7014
beta  = 1e-04
gamma = 0.0108

Initial states:
l = 2119.5385
b = 1.0196
s = 1.0104 1.0184 0.9911 0.9801

sigma: 0.0449

      AIC      AICc      BIC
1019.372 1022.529 1039.214

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 16.90901 251.8002 170.7495 0.4717594 3.094071
              MASE      ACF1
Training set 0.3145662 0.08534121
ETS(A,N,A)

Call:
ets(y = ts_series, model = "ANA")

Smoothing parameters:
alpha = 0.9999
gamma = 1e-04

Initial states:
l = 2547.0707
s = 9.2894 111.8163 -22.8994 -98.2062

sigma: 306.5282

      AIC      AICc      BIC
1056.620 1058.518 1072.053

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 116.0772 292.4812 205.8515 1.949548 3.826438 0.3792334
              ACF1

```

Training set -0.1452064

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.9957

gamma = 0.0011

Initial states:

l = 2534.5776

s = 6.6988 113.9708 -14.1256 -106.544

sigma: 0.0555

AIC AICc BIC

1043.788 1045.686 1059.220

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	116.6721	292.4371	206.1598	1.965724	3.826352	0.3798014

ACF1

Training set -0.1425971

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.9957

gamma = 0.0011

Initial states:

l = 2534.5776

s = 6.6988 113.9708 -14.1256 -106.544

sigma: 0.0555

AIC AICc BIC

1043.788 1045.686 1059.220

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	116.6721	292.4371	206.1598	1.965724	3.826352	0.3798014

ACF1

Training set -0.1425971

ETS(A,A,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

alpha = 0.7657

beta = 1e-04

gamma = 0.004

Initial states:

```

l = 1941.0046
b = 111.2872
s = 17.7057 109.5359 -40.3265 -86.9151

```

```
sigma: 271.8546
```

```

      AIC      AICc      BIC
1042.301 1045.459 1062.143

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 17.00898 255.1087 170.5466 -0.04864078 3.030153

```

```

              MASE      ACF1
Training set 0.3141923 0.01858295

```

```
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.774
beta  = 0.0481
gamma = 1e-04
phi   = 0.98

```

```
Initial states:
```

```

l = 1937.132
b = 127.1095
s = 9.9646 112.6903 -23.7701 -98.8849

```

```
sigma: 281.145
```

```

      AIC      AICc      BIC
1047.658 1051.587 1069.705

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 35.86015 261.5814 170.4536 0.4013401 3.046519

```

```

              MASE      ACF1
Training set 0.3140209 0.006196707

```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```

alpha = 0.7899
beta  = 1e-04
gamma = 1e-04
phi   = 0.98

```

```
Initial states:
```

```

l = 1960.3767
b = 1.0443
s = 0.9974 1.0235 0.9962 0.9829

```

```
sigma: 0.0407
```

```

      AIC      AICc      BIC
1007.735 1011.663 1029.782

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 14.51288 252.3099 153.5226 0.04847222 2.577588
              MASE      ACF1
Training set 0.2828296 -0.02010312
ETS(M,Md,M)

```

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.7899
beta  = 1e-04
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 1960.3767
b = 1.0443
s = 0.9974 1.0235 0.9962 0.9829

```

sigma: 0.0407

```

      AIC      AICc      BIC
1007.735 1011.663 1029.782

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 14.51288 252.3099 153.5226 0.04847222 2.577588
              MASE      ACF1
Training set 0.2828296 -0.02010312
ETS(M,A,A)

```

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```

alpha = 0.8672
beta  = 0.0062
gamma = 3e-04

```

Initial states:

```

l = 1951.0536
b = 83.0404
s = 5.5569 105.5606 -22.185 -88.9325

```

sigma: 0.0422

```

      AIC      AICc      BIC
1010.804 1013.962 1030.647

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 41.382 258.6604 168.2172 0.5728192 2.923673 0.309901
              ACF1

```

Training set -0.07150683

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8571

beta = 0.0671

gamma = 1e-04

phi = 0.98

Initial states:

l = 1937.2124

b = 126.3591

s = 9.9485 112.6157 -23.8351 -98.7291

sigma: 0.0439

AIC AICc BIC

1017.357 1021.285 1039.404

Training set error measures:

ME RMSE MAE MPE MAPE

Training set 28.43323 262.9544 167.4095 0.3225016 2.990721

MASE ACF1

Training set 0.3084129 -0.07456392

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

alpha = 0.8656

beta = 1e-04

gamma = 0.0025

Initial states:

l = 1926.6007

b = 101.9236

s = 0.9965 1.0226 0.9972 0.9838

sigma: 0.0405

AIC AICc BIC

1006.033 1009.191 1025.876

Training set error measures:

ME RMSE MAE MPE MAPE MASE

Training set 24.72755 254.4215 154.2808 0.1771383 2.6183 0.2842264

ACF1

Training set -0.08543788

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7556
beta  = 0.1499
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 1926.3518
b = 125.6897
s = 0.996 1.0234 0.9967 0.9839
```

```
sigma: 0.0421
```

```
      AIC      AICc      BIC
1011.927 1015.856 1033.974
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 12.98924 264.8316 157.9299 0.152583 2.675234 0.2909491
           ACF1
Training set -0.04161333
Holt-Winters' additive method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

## Smoothing parameters:

```
alpha = 0.934
beta  = 1e-04
gamma = 1e-04
```

## Initial states:

```
l = 1569.4824
b = 87.2105
s = -103.3394 137.2759 99.3313 -133.2678
```

```
sigma: 141.2842
```

```
      AIC      AICc      BIC
954.5986 957.7565 974.4409
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -2.93496 132.5813 99.64004 -0.1444012 2.466565
           MASE      ACF1
Training set 0.2623421 0.000712726
Damped Holt-Winters' additive method
```

## Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.934
beta  = 0.041
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 1566.8528
```



```
b = 108.8849
s = -102.6984 138.1485 103.1657 -138.6158
```

```
sigma: 145.9961
```

```
      AIC      AICc      BIC
959.8494 963.7780 981.8963
```

Training set error measures:

```
      ME      RMSE      MAE      MPE      MAPE
Training set 13.41131 135.8369 103.5097 0.1828412 2.571873
      MASE      ACF1
Training set 0.2725306 -0.007416629
Holt-Winters' multiplicative method
```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.8869
beta  = 1e-04
gamma = 0.0097
```

Initial states:

```
l = 1561.7745
b = 79.768
s = 0.9814 1.0254 1.0198 0.9734
```

```
sigma: 0.0315
```

```
      AIC      AICc      BIC
942.9783 946.1362 962.8206
```

Training set error measures:

```
      ME      RMSE      MAE      MPE      MAPE
Training set 4.72262 134.8399 97.73761 0.05707421 2.284032
      MASE      ACF1
Training set 0.2573332 0.02918632
Damped Holt-Winters' multiplicative method
```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9041
beta  = 0.0386
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1557.6853
b = 106.6586
s = 0.9798 1.027 1.0211 0.9721
```

```
sigma: 0.0327
```

```
      AIC      AICc      BIC
948.6634 952.5920 970.7103
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	14.13436	136.6362	99.59155	0.1979166	2.323651

  

	MASE	ACF1
Training set	0.2622145	0.008930764

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.9584
beta  = 0.0788
gamma = 2e-04
```

Initial states:

```
l = 1716.5728
b = 1.021
s = 0.979 1.0267 1.0218 0.9725
```

sigma: 0.0354

AIC	AICc	BIC
959.3463	962.5042	979.1885

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-21.35153	144.2975	100.9295	-0.311097	2.464897

  

	MASE	ACF1
Training set	0.265737	-0.03441544

ETS(A,N,A)

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.9999
gamma = 1e-04
```

Initial states:

```
l = 2116.6072
s = -102.0173 139.0755 99.7327 -136.7909
```

sigma: 173.3262

AIC	AICc	BIC
980.2220	982.1204	995.6549

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	76.33942	165.3833	132.4668	1.692062	3.488537	0.3487717

  

	ACF1
Training set	-0.005878247

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

## Smoothing parameters:

alpha = 0.9999  
gamma = 1e-04

## Initial states:

l = 2115.9022  
s = -102.598 138.2761 103.3869 -139.065

sigma: 0.0516

	AIC	AICc	BIC
	1005.268	1007.166	1020.701

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	76.36076	165.4382	132.6044	1.692821	3.509335	0.3491338

## ACF1

Training set -0.005421169

ETS(M,N,A)

## Call:

ets(y = ts\_series, model = "MNA")

## Smoothing parameters:

alpha = 0.9999  
gamma = 1e-04

## Initial states:

l = 2115.9022  
s = -102.598 138.2761 103.3869 -139.065

sigma: 0.0516

	AIC	AICc	BIC
	1005.268	1007.166	1020.701

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	76.36076	165.4382	132.6044	1.692821	3.509335	0.3491338

## ACF1

Training set -0.005421169

ETS(A,A,A)

## Call:

ets(y = ts\_series, model = "AAA")

## Smoothing parameters:

alpha = 0.9323  
beta = 1e-04  
gamma = 1e-04

## Initial states:

l = 1567.4908  
b = 82.6656  
s = -102.9769 139.3351 103.2135 -139.5717

sigma: 141.5268

```

      AIC      AICc      BIC
954.8286 957.9865 974.6708

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 1.908623 132.809 100.0237 -0.009202111 2.496061

```

```

           MASE      ACF1
Training set 0.2633524 9.360663e-05

```

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9338
beta  = 0.0411
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 1566.8532
b = 108.8846
s = -102.6984 138.1486 103.1657 -138.6159

```

sigma: 145.9961

```

      AIC      AICc      BIC
959.8494 963.7780 981.8963

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 13.39293 135.8369 103.5079 0.1826052 2.571875

```

```

           MASE      ACF1
Training set 0.2725259 -0.00730534

```

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```

alpha = 0.9897
beta  = 1e-04
gamma = 1e-04
phi   = 0.9784

```

Initial states:

```

l = 1570.3749
b = 1.0456
s = 0.9766 1.0364 1.0195 0.9675

```

sigma: 0.03

```

      AIC      AICc      BIC
937.6957 941.6242 959.7426

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE

```

```
Training set -4.70233 140.764 101.2964 -0.1024714 2.238041
```

```
          MASE          ACF1
```

```
Training set 0.2667033 -0.09843223
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9897
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
phi   = 0.9784
```

```
Initial states:
```

```
l = 1570.3749
```

```
b = 1.0456
```

```
s = 0.9766 1.0364 1.0195 0.9675
```

```
sigma: 0.03
```

```
      AIC      AICc      BIC
```

```
937.6957 941.6242 959.7426
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE
```

```
Training set -4.70233 140.764 101.2964 -0.1024714 2.238041
```

```
          MASE      ACF1
```

```
Training set 0.2667033 -0.09843223
```

```
ETS(M,A,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA")
```

```
Smoothing parameters:
```

```
alpha = 0.97
```

```
beta  = 0.0592
```

```
gamma = 0.03
```

```
Initial states:
```

```
l = 1590.8026
```

```
b = 57.9719
```

```
s = -85.7824 142.6911 52.7545 -109.6632
```

```
sigma: 0.0317
```

```
      AIC      AICc      BIC
```

```
943.8633 947.0212 963.7056
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 2.734092 140.5186 102.861 0.1746744 2.315737 0.2708226
```

```
          ACF1
```

```
Training set -0.06321792
```

```
ETS(M,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.9248  
 beta = 0.0218  
 gamma = 0.0752  
 phi = 0.98

## Initial states:

l = 1567.205  
 b = 104.1166  
 s = -102.71 138.1334 103.112 -138.5354

sigma: 0.0353

AIC	AICc	BIC
958.7301	962.6587	980.7770

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	20.28613	140.6865	105.7772	0.3144718	2.563558

	MASE	ACF1
Training set	0.2785007	-0.006580379

ETS(M,A,M)

## Call:

ets(y = ts\_series, model = "MAM")

## Smoothing parameters:

alpha = 0.904  
 beta = 3e-04  
 gamma = 0.096

## Initial states:

l = 1559.062  
 b = 80.9233  
 s = 0.9783 1.0445 1.0128 0.9644

sigma: 0.0299

AIC	AICc	BIC
936.0964	939.2543	955.9387

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	1.505908	141.952	103.964	0.02185811	2.286498	0.2737267

	ACF1
Training set	-0.02998499

ETS(M,Ad,M)

## Call:

ets(y = ts\_series, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.9474  
 beta = 0.0557  
 gamma = 0.0526  
 phi = 0.98

```

Initial states:
  l = 1558.1003
  b = 102.3594
  s = 0.9791 1.0393 1.0137 0.9678

sigma: 0.0312

      AIC      AICc      BIC
942.4099 946.3384 964.4568

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 9.429944 145.128 108.1719 0.1767644 2.383476 0.2848058
              ACF1
Training set -0.09513137
Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive")

Smoothing parameters:
  alpha = 0.8265
  beta  = 1e-04
  gamma = 1e-04

Initial states:
  l = 6021.12
  b = -87.4728
  s = -49.1753 27.9708 130.2341 -109.0295

sigma: 479.8197

      AIC      AICc      BIC
1135.999 1139.103 1155.975

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 53.64191 450.7121 315.3171 1.095116 7.890826 0.6549917
              ACF1
Training set 0.03716715
Damped Holt-Winters' additive method

Call:
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)

Smoothing parameters:
  alpha = 0.6782
  beta  = 1e-04
  gamma = 1e-04
  phi   = 0.9692

Initial states:
  l = 6020.9853
  b = -101.0127
  s = -48.4701 31.2907 130.3984 -113.219

sigma: 477.3013

```

```

      AIC      AICc      BIC
1136.141 1140.000 1158.336

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -2.655341 444.5946 304.9473 -0.6693615 7.715565
              MASE      ACF1
Training set 0.633451 0.1241103
Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```

alpha = 0.8163
beta  = 1e-04
gamma = 0.0376

```

Initial states:

```

l = 6005.4919
b = -78.0478
s = 0.972 1.0176 1.0431 0.9673

```

sigma: 0.118

```

      AIC      AICc      BIC
1122.060 1125.163 1142.036

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 41.10684 443.2061 313.1672 0.754063 7.891395 0.6505258
              ACF1
Training set 0.05588126
Damped Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.7694
beta  = 1e-04
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 6014.3888
b = -100.5359
s = 0.9803 1.0113 1.0373 0.9711

```

sigma: 0.1147

```

      AIC      AICc      BIC
1120.285 1124.145 1142.480

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 14.39306 436.458 303.0027 -0.1285053 7.646426
              MASE      ACF1

```



```
Training set 0.6294116 0.07856145
Holt-Winters' multiplicative method with exponential trend
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.8105
beta = 1e-04
gamma = 0.0018
```

```
Initial states:
```

```
l = 6015.5132
b = 0.9888
s = 0.9812 1.0158 1.0343 0.9687
```

```
sigma: 0.1122
```

```
      AIC      AICc      BIC
1116.940 1120.043 1136.915
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 0.2276487 435.4041 305.7009 -0.4457505 7.692582
```

```
              MASE      ACF1
Training set 0.6350164 0.05291435
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.8966
gamma = 1e-04
```

```
Initial states:
```

```
l = 5467.4599
s = -49.8542 30.2377 122.0444 -102.4278
```

```
sigma: 467.7083
```

```
      AIC      AICc      BIC
1130.752 1132.619 1146.289
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -38.58799 446.5977 302.1382 -1.510653 7.570738
```

```
              MASE      ACF1
Training set 0.6276159 0.02716962
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.9837
gamma = 1e-04
```

```

Initial states:
  l = 5488.748
  s = -102.0869 16.3946 175.2907 -89.5984

sigma: 0.1115

      AIC      AICc      BIC
1115.522 1117.389 1131.059

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -34.71422 449.6712 305.5015 -1.36525 7.680054
              MASE      ACF1
Training set 0.6346023 -0.02828318
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
  alpha = 0.9837
  gamma = 1e-04

Initial states:
  l = 5488.748
  s = -102.0869 16.3946 175.2907 -89.5984

sigma: 0.1115

      AIC      AICc      BIC
1115.522 1117.389 1131.059

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -34.71422 449.6712 305.5015 -1.36525 7.680054
              MASE      ACF1
Training set 0.6346023 -0.02828318
ETS(A,A,A)

Call:
ets(y = ts_series, model = "AAA")

Smoothing parameters:
  alpha = 0.8265
  beta  = 1e-04
  gamma = 1e-04

Initial states:
  l = 6021.12
  b = -87.473
  s = -49.1757 27.9712 130.2338 -109.0293

sigma: 479.8197

      AIC      AICc      BIC
1135.999 1139.103 1155.975

Training set error measures:

```

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	53.6408	450.7122	315.317	1.09508	7.890823	0.6549914

ACF1

Training set 0.03716929

ETS(A,Ad,A)

Call:

ets(y = ts\_series, model = "AAA", damped = TRUE)

Smoothing parameters:

alpha = 0.6784

beta = 1e-04

gamma = 1e-04

phi = 0.9692

Initial states:

l = 6020.9855

b = -101.0127

s = -48.4706 31.2905 130.3989 -113.2188

sigma: 477.3013

AIC	AICc	BIC
1136.141	1140.000	1158.336

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-2.649072	444.5946	304.9395	-0.6690918	7.715242

MASE ACF1

Training set 0.6334348 0.1240109

ETS(M,Md,M)

Call:

ets(y = ts\_series, model = "MMM")

Smoothing parameters:

alpha = 0.8951

beta = 1e-04

gamma = 1e-04

phi = 0.98

Initial states:

l = 6015.8089

b = 0.9899

s = 0.9922 1.0051 1.0286 0.9741

sigma: 0.111

AIC	AICc	BIC
1117.139	1120.999	1139.334

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-22.37726	439.679	301.4534	-1.068484	7.49678	0.6261933

ACF1

Training set -0.005890588

ETS(M,Md,M)

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.8951
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 6015.8089
b = 0.9899
s = 0.9922 1.0051 1.0286 0.9741
```

sigma: 0.111

```
      AIC      AICc      BIC
1117.139 1120.999 1139.334
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -22.37726 439.679 301.4534 -1.068484 7.49678 0.6261933
```

ACF1

```
Training set -0.005890588
```

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.9761
beta  = 1e-04
gamma = 0.008
phi   = 0.8
```

Initial states:

```
l = 6022.9524
b = -104.1365
s = 14.6486 31.7706 85.3218 -131.741
```

sigma: 0.1135

```
      AIC      AICc      BIC
1120.611 1124.471 1142.806
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -38.27108 456.2084 316.2759 -1.445093 7.825558
```

MASE ACF1

```
Training set 0.6569833 -0.07217653
```

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9761
beta  = 1e-04
```

```
gamma = 0.008
phi   = 0.8
```

## Initial states:

```
l = 6022.9524
b = -104.1365
s = 14.6486 31.7706 85.3218 -131.741
```

```
sigma: 0.1135
```

```
      AIC      AICc      BIC
1120.611 1124.471 1142.806
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -38.27108 456.2084 316.2759 -1.445093 7.825558
```

```
           MASE      ACF1
Training set 0.6569833 -0.07217653
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04
phi   = 0.9607
```

## Initial states:

```
l = 6014.4869
b = -100.6135
s = 0.9919 1.005 1.0292 0.974
```

```
sigma: 0.1119
```

```
      AIC      AICc      BIC
1117.684 1121.543 1139.879
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -9.09177 442.9183 301.267 -0.7040973 7.43582 0.6258062
```

```
           ACF1
Training set -0.07832734
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04
phi   = 0.9607
```

## Initial states:

```
l = 6014.4869
b = -100.6135
```

```
s = 0.9919 1.005 1.0292 0.974
```

```
sigma: 0.1119
```

```
      AIC      AICc      BIC
1117.684 1121.543 1139.879
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -9.09177 442.9183 301.267 -0.7040973 7.43582 0.6258062
           ACF1
```

```
Training set -0.07832734
```

```
Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 5491.4312
```

```
b = -38.0598
```

```
s = -141.0824 -135.4772 180.4855 96.074
```

```
sigma: 404.0969
```

```
      AIC      AICc      BIC
1112.640 1115.744 1132.616
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -2.19077 379.5829 285.6227 -0.5458791 9.231 0.5257212
           ACF1
```

```
Training set 0.01869732
```

```
Damped Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 5491.9628
```

```
b = -38.7876
```

```
s = -140.0945 -135.751 180.7829 95.0627
```

```
sigma: 407.3242
```

```
      AIC      AICc      BIC
1114.579 1118.439 1136.774
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-19.4047	379.4126	285.4742	-1.152339	9.251592
	MASE	ACF1			
Training set	0.5254479	0.0156526			

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.9917
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 5474.0242
b = -36.2853
s = 0.9583 0.9616 1.0526 1.0275
```

sigma: 0.1328

AIC	AICc	BIC
1120.948	1124.052	1140.924

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-4.095526	375.9018	281.7018	-0.6227685	9.086071
	MASE	ACF1			
Training set	0.5185043	0.01245094			

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9944
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 5475.6073
b = -38.5801
s = 0.9557 0.9624 1.0539 1.028
```

sigma: 0.1324

AIC	AICc	BIC
1122.067	1125.927	1144.262

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-19.83733	375.8603	282.701	-1.170111	9.133129
	MASE	ACF1			
Training set	0.5203435	0.006873665			

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

```
alpha = 0.0501
beta  = 0.0051
gamma = 0.0476
```

Initial states:

```
l = 5612.524
b = 0.993
s = 0.9573 0.96 1.0544 1.0282
```

sigma: 0.2063

```
      AIC      AICc      BIC
1182.140 1185.243 1202.115
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -63.52477 693.3873 526.1751 -3.331365 17.66777
              MASE      ACF1
Training set 0.9684854 0.8328778
ETS(A,N,A)
```

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.9999
gamma = 1e-04
```

Initial states:

```
l = 5281.2031
s = -139.8874 -135.8226 176.8741 98.836
```

sigma: 399.5041

```
      AIC      AICc      BIC
1109.316 1111.182 1124.852
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -37.2575 381.4719 286.8491 -1.720305 9.330671
              MASE      ACF1
Training set 0.5279786 0.02265418
ETS(M,N,A)
```

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.9291
gamma = 1e-04
```

Initial states:

```
l = 5284.5882
s = -135.3125 -145.862 207.4121 73.7624
```



```

sigma: 0.1273

      AIC      AICc      BIC
1114.952 1116.819 1130.488

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -40.2939 384.2593 280.0546 -1.829574 9.113035
              MASE      ACF1
Training set 0.5154725 0.0807521
ETS(M,N,A)

Call:
ets(y = ts_series, model = "MNA")

Smoothing parameters:
alpha = 0.9291
gamma = 1e-04

Initial states:
l = 5284.5882
s = -135.3125 -145.862 207.4121 73.7624

sigma: 0.1273

      AIC      AICc      BIC
1114.952 1116.819 1130.488

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -40.2939 384.2593 280.0546 -1.829574 9.113035
              MASE      ACF1
Training set 0.5154725 0.0807521
ETS(A,A,A)

Call:
ets(y = ts_series, model = "AAA")

Smoothing parameters:
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04

Initial states:
l = 5491.4313
b = -38.0598
s = -141.0824 -135.4772 180.4855 96.0741

sigma: 404.0969

      AIC      AICc      BIC
1112.640 1115.744 1132.616

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -2.190755 379.583 285.6227 -0.5458785 9.231002
              MASE      ACF1

```

```
Training set 0.5257213 0.01869739
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 5491.9628
b = -38.7876
s = -140.0944 -135.7513 180.7828 95.0629
```

```
sigma: 407.3244
```

```
      AIC      AICc      BIC
1114.580 1118.439 1136.775
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -19.40627 379.4128 285.4739 -1.152401 9.251583
```

```
           MASE      ACF1
Training set 0.5254473 0.01566427
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.8587
beta  = 1e-04
gamma = 1e-04
phi   = 0.9795
```

```
Initial states:
```

```
l = 5475.4879
b = 0.9924
s = 0.9653 0.9529 1.0594 1.0225
```

```
sigma: 0.1298
```

```
      AIC      AICc      BIC
1119.984 1123.843 1142.179
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -29.92478 381.0367 280.719 -1.607659 9.08882 0.5166955
```

```
           ACF1
Training set 0.118866
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8587
beta  = 1e-04
gamma = 1e-04
phi   = 0.9795
```

## Initial states:

```
l = 5475.4879
b = 0.9924
s = 0.9653 0.9529 1.0594 1.0225
```

```
sigma: 0.1298
```

```
      AIC      AICc      BIC
1119.984 1123.843 1142.179
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -29.92478 381.0367 280.719 -1.607659 9.08882 0.5166955
```

```
      ACF1
```

```
Training set 0.118866
```

```
ETS(M,A,A)
```

## Call:

```
ets(y = ts_series, model = "MAA")
```

## Smoothing parameters:

```
alpha = 0.8762
beta  = 1e-04
gamma = 1e-04
```

## Initial states:

```
l = 5491.6796
b = -38.4368
s = -84.0351 -124.5441 178.2371 30.3422
```

```
sigma: 0.1327
```

```
      AIC      AICc      BIC
1120.794 1123.897 1140.769
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -3.169986 388.0859 288.2336 -0.6644853 9.253196
```

```
      MASE      ACF1
```

```
Training set 0.5305269 0.1127249
```

```
ETS(M,Ad,A)
```

## Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8954
beta  = 1e-04
gamma = 1e-04
phi   = 0.8758
```

## Initial states:

```

l = 5492.206
b = -38.0278
s = -93.8058 -135.8533 177.1896 52.4695

```

```
sigma: 0.1299
```

```

      AIC      AICc      BIC
1120.501 1124.361 1142.696

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set -41.43958 386.9644 284.0531 -1.932827 9.200516
              MASE      ACF1
Training set 0.5228323 0.1015041
ETS(M,A,M)

```

```
Call:
```

```
ets(y = ts_series, model = "MAM")
```

```
Smoothing parameters:
```

```

alpha = 0.7912
beta  = 1e-04
gamma = 1e-04

```

```
Initial states:
```

```

l = 5474.3216
b = -34.9311
s = 0.9663 0.951 1.0569 1.0257

```

```
sigma: 0.1315
```

```

      AIC      AICc      BIC
1119.822 1122.925 1139.797

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -7.665024 385.06 286.9574 -0.847031 9.252115 0.5281779
              ACF1
Training set 0.1874302
ETS(M,Ad,M)

```

```
Call:
```

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```

alpha = 0.871
beta  = 4e-04
gamma = 1e-04
phi   = 0.98

```

```
Initial states:
```

```

l = 5475.4841
b = -38.3021
s = 0.9632 0.9548 1.0605 1.0216

```

```
sigma: 0.1309
```

```

      AIC      AICc      BIC

```

1120.823 1124.683 1143.018

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-23.30553	380.7104	279.227	-1.346173	9.027543

  

	MASE	ACF1
Training set	0.5139492	0.1105569

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

alpha = 0.9999  
beta = 0.0402  
gamma = 1e-04

Initial states:

l = 4024.7594  
b = 54.5013  
s = -34.0891 -200.3083 83.5247 150.8727

sigma: 352.1778

AIC	AICc	BIC
1093.938	1097.041	1113.914

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-27.60619	330.8135	242.5718	-1.140122	13.58102

  

	MASE	ACF1
Training set	0.4770926	0.03190187

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9172  
beta = 0.1359  
gamma = 1e-04  
phi = 0.8

Initial states:

l = 4025.1922  
b = 54.6752  
s = -34.3173 -200.2469 83.3778 151.1865

sigma: 347.9077

AIC	AICc	BIC
1093.136	1096.996	1115.331

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-32.65048	324.0676	238.6643	-2.374649	13.3164

  

	MASE	ACF1
Training set	0.4694074	-0.001156756

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

alpha = 0.9717

beta = 0.0299

gamma = 0.0283

Initial states:

l = 3841.0379

b = 53.3877

s = 1.0208 0.9277 1.0088 1.0426

sigma: 0.192

AIC	AICc	BIC
-----	------	-----

1089.079	1092.182	1109.054
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-33.6046	333.0798	255.5336	-2.048497	14.70497	0.502586

ACF1

Training set 0.08751174

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8765

beta = 0.1201

gamma = 0.0557

phi = 0.8

Initial states:

l = 4027.7612

b = 51.6649

s = 1.0286 0.9318 1.0026 1.0371

sigma: 0.1875

AIC	AICc	BIC
-----	------	-----

1087.629	1091.488	1109.824
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-32.50639	330.3139	252.8196	-2.69958	14.48014

MASE ACF1

Training set 0.4972482 0.05089676

Holt-Winters' multiplicative method with exponential trend

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)
```

Smoothing parameters:

alpha = 0.9714

```
beta = 1e-04
gamma = 0.0286
```

## Initial states:

```
l = 4027.1941
b = 0.9757
s = 1.0285 0.9229 0.9996 1.049
```

```
sigma: 0.1855
```

```
      AIC      AICc      BIC
1083.415 1086.518 1103.391
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 12.11424 327.282 260.0671 -1.248348 14.60088 0.5115025
```

```
      ACF1
```

```
Training set 0.07356356
```

```
ETS(A,N,A)
```

## Call:

```
ets(y = ts_series, model = "ANA")
```

## Smoothing parameters:

```
alpha = 0.9999
gamma = 1e-04
```

## Initial states:

```
l = 3930.4642
s = -35.6195 -184.8394 90.9375 129.5215
```

```
sigma: 339.7979
```

```
      AIC      AICc      BIC
1087.301 1089.168 1102.837
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -42.57496 324.4607 237.9885 -3.49955 13.44839
```

```
      MASE      ACF1
```

```
Training set 0.4680781 0.0438427
```

```
ETS(M,N,A)
```

## Call:

```
ets(y = ts_series, model = "MNA")
```

## Smoothing parameters:

```
alpha = 0.9574
gamma = 0.0426
```

## Initial states:

```
l = 4068.4397
s = -133.5487 -177.3735 103.9138 207.0084
```

```
sigma: 0.183
```

```
      AIC      AICc      BIC
1082.930 1084.797 1098.467
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-45.4266	343.8558	247.607	-3.51046	13.50424	0.486996

ACF1

Training set 0.04537378

ETS(M,N,A)

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

alpha = 0.9574  
gamma = 0.0426

Initial states:

l = 4068.4397  
s = -133.5487 -177.3735 103.9138 207.0084

sigma: 0.183

AIC	AICc	BIC
1082.930	1084.797	1098.467

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-45.4266	343.8558	247.607	-3.51046	13.50424	0.486996

ACF1

Training set 0.04537378

ETS(A,Ad,A)

Call:

```
ets(y = ts_series, model = "AAA")
```

Smoothing parameters:

alpha = 0.9172  
beta = 0.1358  
gamma = 1e-04  
phi = 0.8

Initial states:

l = 4025.1922  
b = 54.6753  
s = -34.3174 -200.2471 83.3777 151.1867

sigma: 347.9078

AIC	AICc	BIC
1093.136	1096.996	1115.331

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-32.65472	324.0676	238.6643	-2.374979	13.31647

MASE                      ACF1

Training set 0.4694073 -0.001121587

ETS(A,Ad,A)

Call:



```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9172
beta  = 0.1358
gamma = 1e-04
phi   = 0.8
```

```
Initial states:
```

```
l = 4025.1922
b = 54.6753
s = -34.3174 -200.2471 83.3777 151.1867
```

```
sigma: 347.9078
```

```
      AIC      AICc      BIC
1093.136 1096.996 1115.331
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -32.65472 324.0676 238.6643 -2.374979 13.31647
```

```
              MASE      ACF1
Training set 0.4694073 -0.001121587
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.844
beta  = 1e-04
gamma = 1e-04
```

```
Initial states:
```

```
l = 4027.5492
b = 0.9895
s = 0.9614 0.9157 1.0551 1.0678
```

```
sigma: 0.1727
```

```
      AIC      AICc      BIC
1075.960 1079.064 1095.936
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -27.23618 357.2868 272.396 -2.797947 14.15333
```

```
              MASE      ACF1
Training set 0.5357513 0.1967149
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9066
beta  = 0.0571
gamma = 1e-04
phi   = 0.8026
```

Initial states:

l = 4028.3922  
 b = 1.0196  
 s = 0.9563 0.9034 1.0541 1.0862

sigma: 0.1711

	AIC	AICc	BIC
	1076.758	1080.618	1098.953

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-57.08575	375.2768	282.5853	-3.644558	14.12643

	MASE	ACF1
Training set	0.5557916	0.08106465

ETS(M,A,A)

Call:

ets(y = ts\_series, model = "MAA")

Smoothing parameters:

alpha = 0.7614  
 beta = 1e-04  
 gamma = 0.0434

Initial states:

l = 3727.8515  
 b = -19.1136  
 s = -11.8582 28.2268 4.8618 -21.2304

sigma: 0.1978

	AIC	AICc	BIC
	1094.569	1097.672	1114.544

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-26.86217	371.5138	262.5693	-3.45604	15.86227	0.516424

	ACF1
Training set	0.2265997

ETS(M,Ad,A)

Call:

ets(y = ts\_series, model = "MAA", damped = TRUE)

Smoothing parameters:

alpha = 0.7395  
 beta = 1e-04  
 gamma = 0.0661  
 phi = 0.9679

Initial states:

l = 3660.1716  
 b = 54.7763  
 s = -34.5206 55.6814 83.2853 -104.4462

sigma: 0.1935

```

      AIC      AICc      BIC
1096.392 1100.251 1118.587

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -79.48067 387.283 262.0676 -6.529517 16.15675

```

```

           MASE      ACF1
Training set 0.5154372 0.2435645

```

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.9433
beta  = 0.0066
gamma = 1e-04

```

Initial states:

```

l = 3677.8792
b = 50.8324
s = 0.9593 0.8996 1.0513 1.0898

```

sigma: 0.1667

```

      AIC      AICc      BIC
1074.514 1077.618 1094.490

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -78.65293 371.9926 282.1967 -5.24399 14.3212 0.5550272

```

```

           ACF1
Training set 0.1080308

```

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.946
beta  = 0.002
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 3661.9522
b = 51.8233
s = 0.9604 0.8988 1.0494 1.0913

```

sigma: 0.1684

```

      AIC      AICc      BIC
1076.091 1079.951 1098.286

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -70.48575 368.5444 280.3175 -4.773722 14.17403

```

```

                MASE      ACF1
Training set 0.5513313 0.1017382
Holt-Winters' additive method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 0.0476
gamma = 1e-04

```

Initial states:

```

l = 6694.5081
b = 140.0511
s = -271.2203 -166.6318 189.3966 248.4556

```

sigma: 541.4549

```

        AIC      AICc      BIC
1152.435 1155.538 1172.410

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -53.62442 508.6083 362.7236 -1.170459 9.719969

```

```

                MASE      ACF1
Training set 0.4701156 -0.009520707
Damped Holt-Winters' additive method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 0.0025
gamma = 1e-04
phi   = 0.8

```

Initial states:

```

l = 6695.2349
b = 141.195
s = -273.0096 -167.2682 190.1353 250.1424

```

sigma: 534.8431

```

        AIC      AICc      BIC
1151.621 1155.481 1173.816

```

Training set error measures:

```

                ME      RMSE      MAE      MPE      MAPE
Training set -73.62819 498.1934 356.178 -2.509976 9.647345

```

```

                MASE      ACF1
Training set 0.4616321 -0.01572416
Holt-Winters' multiplicative method

```

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

## Smoothing parameters:

alpha = 0.9836  
 beta = 0.0503  
 gamma = 1e-04

## Initial states:

l = 6691.4149  
 b = 139.7802  
 s = 0.9376 0.9691 1.049 1.0443

sigma: 0.1558

	AIC	AICc	BIC
	1158.584	1161.687	1178.559

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-52.91051	504.472	359.3846	-1.269593	9.528239	0.465788

ACF1

Training set 0.01727587

Damped Holt-Winters' multiplicative method

## Call:

hw(y = ts\_series, h = h, seasonal = "multiplicative", damped = TRUE)

## Smoothing parameters:

alpha = 0.9843  
 beta = 0.0295  
 gamma = 1e-04  
 phi = 0.8782

## Initial states:

l = 6673.2609  
 b = 140.6501  
 s = 0.9389 0.9687 1.0475 1.0449

sigma: 0.1462

	AIC	AICc	BIC
	1152.313	1156.172	1174.508

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-69.56624	494.2356	360.7093	-2.383415	9.664949

MASE ACF1

Training set 0.467505 -0.007398141

Holt-Winters' multiplicative method with exponential trend

## Call:

hw(y = ts\_series, h = h, seasonal = "multiplicative", exponential = TRUE)

## Smoothing parameters:

alpha = 0.9999  
 beta = 0.0914  
 gamma = 1e-04

## Initial states:

l = 6675.221

```
b = 0.978
s = 0.948 0.964 1.0434 1.0447
```

```
sigma: 0.1532
```

```
      AIC      AICc      BIC
1156.697 1159.801 1176.673
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -30.70763 502.5637 366.0836 -1.555798 9.773519
           MASE      ACF1
Training set 0.4744705 -0.03364951
ETS(A,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "ANA")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
gamma = 1e-04
```

```
Initial states:
```

```
l = 6864.0204
s = -272.4913 -167.7288 204.0485 236.1716
```

```
sigma: 523.9973
```

```
      AIC      AICc      BIC
1146.207 1148.074 1161.744
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -68.55717 500.346 355.629 -2.447642 9.660613 0.4609206
           ACF1
Training set -0.01144139
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.9005
gamma = 1e-04
```

```
Initial states:
```

```
l = 7001.0241
s = -212.1323 -124.6297 65.6029 271.1591
```

```
sigma: 0.1381
```

```
      AIC      AICc      BIC
1142.685 1144.551 1158.221
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -79.28937 519.9093 373.3361 -2.943581 9.953337
           MASE      ACF1
```

```
Training set 0.4838702 0.06548554
ETS(M,N,A)
```

```
Call:
```

```
ets(y = ts_series, model = "MNA")
```

```
Smoothing parameters:
```

```
alpha = 0.9005
gamma = 1e-04
```

```
Initial states:
```

```
l = 7001.0241
s = -212.1323 -124.6297 65.6029 271.1591
```

```
sigma: 0.1381
```

```
      AIC      AICc      BIC
1142.685 1144.551 1158.221
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -79.28937 519.9093 373.3361 -2.943581 9.953337
```

```
              MASE      ACF1
Training set 0.4838702 0.06548554
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 0.0025
gamma = 1e-04
phi   = 0.8
```

```
Initial states:
```

```
l = 6695.2348
b = 141.1949
s = -273.0098 -167.2682 190.1355 250.1425
```

```
sigma: 534.8432
```

```
      AIC      AICc      BIC
1151.621 1155.481 1173.816
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -73.64427 498.1934 356.1784 -2.510521 9.647442
```

```
              MASE      ACF1
Training set 0.4616327 -0.01569182
ETS(A,Ad,A)
```

```
Call:
```

```
ets(y = ts_series, model = "AAA", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 0.0025
```

```
gamma = 1e-04
phi   = 0.8
```

Initial states:

```
l = 6695.2348
b = 141.1949
s = -273.0098 -167.2682 190.1355 250.1425
```

sigma: 534.8432

```
      AIC      AICc      BIC
1151.621 1155.481 1173.816
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -73.64427 498.1934 356.1784 -2.510521 9.647442
```

```
           MASE      ACF1
Training set 0.4616327 -0.01569182
ETS(M,M,M)
```

Call:

```
ets(y = ts_series, model = "MMM")
```

Smoothing parameters:

```
alpha = 0.7825
beta   = 5e-04
gamma  = 0.007
```

Initial states:

```
l = 6676.408
b = 0.9885
s = 0.9263 0.9613 1.0415 1.071
```

sigma: 0.1396

```
      AIC      AICc      BIC
1144.333 1147.436 1164.308
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -27.07687 509.6187 384.436 -1.780905 10.08965
```

```
           MASE      ACF1
Training set 0.4982565 0.2140828
ETS(M,Md,M)
```

Call:

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.8
beta   = 1e-04
gamma  = 1e-04
phi    = 0.98
```

Initial states:

```
l = 6676.6811
b = 1.0018
s = 0.9384 0.9567 1.0443 1.0607
```



```

sigma: 0.1393

      AIC      AICc      BIC
1147.030 1150.890 1169.225

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -89.93001 511.1149 379.0172 -3.363241 10.30411
              MASE      ACF1
Training set 0.4912333 0.2208503
ETS(M,A,A)

Call:
ets(y = ts_series, model = "MAA")

Smoothing parameters:
alpha = 0.9417
beta  = 0.024
gamma = 0.0146

Initial states:
l = 5991.9339
b = 287.662
s = -244.0517 48.6113 69.1194 126.3209

sigma: 0.1416

      AIC      AICc      BIC
1150.123 1153.227 1170.099

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -171.3799 561.5412 401.2912 -4.702749 10.76559
              MASE      ACF1
Training set 0.5201021 0.059949
ETS(M,Ad,A)

Call:
ets(y = ts_series, model = "MAA", damped = TRUE)

Smoothing parameters:
alpha = 0.7855
beta  = 1e-04
gamma = 0.0644
phi   = 0.8

Initial states:
l = 6086.7947
b = 141.8106
s = 30.7834 -78.5435 189.7817 -142.0216

sigma: 0.1545

      AIC      AICc      BIC
1160.891 1164.751 1183.086

Training set error measures:

```

	ME	RMSE	MAE	MPE	MAPE
Training set	-83.28411	555.644	387.2663	-3.349229	10.67393

	MASE	ACF1
Training set	0.5019248	0.1290317

ETS(M,A,M)

Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

alpha = 0.8862

beta = 0.0122

gamma = 1e-04

Initial states:

l = 6072.7623

b = 131.0464

s = 0.9281 0.9634 1.043 1.0656

sigma: 0.1376

	AIC	AICc	BIC
	1145.896	1148.999	1165.871

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-138.9339	517.8181	373.8948	-4.355985	10.14363

	MASE	ACF1
Training set	0.4845943	0.1367803

ETS(M,Ad,M)

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8748

beta = 1e-04

gamma = 1e-04

phi = 0.9459

Initial states:

l = 6066.8901

b = 140.8656

s = 0.9262 0.9636 1.0446 1.0656

sigma: 0.1377

	AIC	AICc	BIC
	1145.825	1149.685	1168.020

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-108.0061	505.1566	367.9647	-3.576783	9.90226

	MASE	ACF1
Training set	0.4769085	0.1377537

Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.3535
beta  = 1e-04
gamma = 0.369
```

Initial states:

```
l = 9554.3973
b = -102.5191
s = -1295.515 418.166 376.9839 500.3647
```

```
sigma: 640.9733
```

```
      AIC      AICc      BIC
1175.382 1178.485 1195.357
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 69.01447 602.0896 435.3235 0.9582606 7.13771 0.8703749
```

ACF1

```
Training set 0.06158333
```

Damped Holt-Winters' additive method

Call:

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2368
beta  = 1e-04
gamma = 0.3787
phi   = 0.9762
```

Initial states:

```
l = 9313.9886
b = -128.7202
s = -407.4592 132.1896 170.8757 104.3939
```

```
sigma: 653.4655
```

```
      AIC      AICc      BIC
1178.864 1182.724 1201.059
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -9.079067 608.6873 440.309 -0.6508195 7.115612
```

MASE ACF1

```
Training set 0.8803429 0.08306747
```

Holt-Winters' multiplicative method

Call:

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

Smoothing parameters:

```
alpha = 0.3268
beta  = 0.0132
gamma = 0.3279
```

```

Initial states:
  l = 9213.6905
  b = -123.0534
  s = 0.8491 1.0079 1.0253 1.1177

sigma: 0.1025

      AIC      AICc      BIC
1170.808 1173.912 1190.784

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 67.22608 567.7559 405.6633 0.7883556 6.710688
              MASE      ACF1
Training set 0.8110732 0.09814152
Damped Holt-Winters' multiplicative method

Call:
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)

Smoothing parameters:
  alpha = 0.2879
  beta  = 1e-04
  gamma = 0.3475
  phi   = 0.9792

Initial states:
  l = 9311.7994
  b = -128.8418
  s = 0.8517 1.0009 1.0282 1.1193

sigma: 0.0975

      AIC      AICc      BIC
1166.741 1170.601 1188.936

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -7.770973 556.1985 395.7519 -0.522626 6.555661
              MASE      ACF1
Training set 0.7912566 0.1136304
Holt-Winters' multiplicative method with exponential trend

Call:
hw(y = ts_series, h = h, seasonal = "multiplicative", exponential = TRUE)

Smoothing parameters:
  alpha = 0.0501
  beta  = 0.0051
  gamma = 0.0476

Initial states:
  l = 9330.5106
  b = 0.9856
  s = 0.9412 1.0251 1.0331 1.0006

sigma: 0.1465

```

```

      AIC      AICc      BIC
1216.111 1219.214 1236.087

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 199.1783 760.8159 606.4925 2.838936 9.89005 1.212606
              ACF1

```

```
Training set 0.3537237
```

```
ETS(A,N,A)
```

Call:

```
ets(y = ts_series, model = "ANA")
```

Smoothing parameters:

```
alpha = 0.3784
```

```
gamma = 0.3496
```

Initial states:

```
l = 9246.0279
```

```
s = -1031.005 3.7863 158.87 868.3486
```

```
sigma: 628.914
```

```

      AIC      AICc      BIC
1171.028 1172.895 1186.565

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -141.8254 600.5271 443.9901 -2.650994 7.383055
              MASE      ACF1

```

```
Training set 0.8877029 0.01423179
```

```
ETS(M,N,A)
```

Call:

```
ets(y = ts_series, model = "MNA")
```

Smoothing parameters:

```
alpha = 0.3015
```

```
gamma = 0.3814
```

Initial states:

```
l = 9162.2452
```

```
s = -671.6512 -51.2072 76.1357 646.7226
```

```
sigma: 0.0985
```

```

      AIC      AICc      BIC
1168.645 1170.511 1184.181

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -160.7959 613.4339 437.3828 -2.999808 7.294985
              MASE      ACF1

```

```
Training set 0.8744924 0.070309
```

```
ETS(M,N,A)
```

Call:

```
ets(y = ts_series, model = "MNA")
```

## Smoothing parameters:

alpha = 0.3015  
gamma = 0.3814

## Initial states:

l = 9162.2452  
s = -671.6512 -51.2072 76.1357 646.7226

sigma: 0.0985

	AIC	AICc	BIC
	1168.645	1170.511	1184.181

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-160.7959	613.4339	437.3828	-2.999808	7.294985

	MASE	ACF1
Training set	0.8744924	0.070309

ETS(A,A,A)

## Call:

ets(y = ts\_series, model = "AAA")

## Smoothing parameters:

alpha = 0.3536  
beta = 1e-04  
gamma = 0.3691

## Initial states:

l = 9554.368  
b = -102.5215  
s = -1295.435 418.1392 376.9655 500.3302

sigma: 640.9733

	AIC	AICc	BIC
	1175.382	1178.485	1195.357

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	69.0123	602.0896	435.3187	0.9581871	7.13764	0.8703654

	ACF1
Training set	0.0615433

ETS(A,Ad,A)

## Call:

ets(y = ts\_series, model = "AAA", damped = TRUE)

## Smoothing parameters:

alpha = 0.2367  
beta = 1e-04  
gamma = 0.3789  
phi = 0.9762

## Initial states:

l = 9313.9892  
b = -128.7223

```
s = -407.459 132.1915 170.877 104.3905
```

```
sigma: 653.4656
```

```
      AIC      AICc      BIC
1178.864 1182.724 1201.059
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -8.980927 608.6874 440.3039 -0.6490321 7.115465
```

```
      MASE      ACF1
Training set 0.8803326 0.08317874
```

```
ETS(M,M,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM")
```

```
Smoothing parameters:
```

```
alpha = 0.254
beta  = 1e-04
gamma = 0.3296
```

```
Initial states:
```

```
l = 9216.0032
b = 0.9921
s = 0.8798 1.0246 1.0223 1.0733
```

```
sigma: 0.0962
```

```
      AIC      AICc      BIC
1164.896 1167.999 1184.871
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
Training set -49.9392 567.0615 398.7125 -1.186022 6.636336
```

```
      MASE      ACF1
Training set 0.7971759 0.1496952
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = ts_series, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2569
beta  = 1e-04
gamma = 0.3399
phi   = 0.9781
```

```
Initial states:
```

```
l = 9435.0441
b = 0.9826
s = 0.8631 1.0052 1.028 1.1037
```

```
sigma: 0.0965
```

```
      AIC      AICc      BIC
1165.865 1169.725 1188.060
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-27.17408	557.448	401.4802	-0.9366354	6.641662
	MASE	ACF1			
Training set	0.8027096	0.1366712			

ETS(M,A,A)

Call:

```
ets(y = ts_series, model = "MAA")
```

Smoothing parameters:

```
alpha = 0.2668
beta = 1e-04
gamma = 0.3911
```

Initial states:

```
l = 9568.9983
b = -32.7397
s = -884.0192 578.9316 320.9725 -15.885
```

sigma: 0.1023

AIC	AICc	BIC
1174.063	1177.166	1194.038

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-100.4942	632.0603	440.7811	-1.896681	7.161355
	MASE	ACF1			
Training set	0.8812867	0.1281122			

ETS(M,Ad,A)

Call:

```
ets(y = ts_series, model = "MAA", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1949
beta = 1e-04
gamma = 0.4075
phi = 0.9655
```

Initial states:

```
l = 9214.9123
b = -128.5133
s = -38.4701 132.2002 174.5645 -268.2946
```

sigma: 0.1045

AIC	AICc	BIC
1177.238	1181.098	1199.433

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-51.04412	642.716	453.5429	-1.447732	7.288808
	MASE	ACF1			
Training set	0.9068024	0.08329296			

ETS(M,Ad,M)



Call:

```
ets(y = ts_series, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.2391
beta  = 1e-04
gamma = 0.3551
phi   = 0.9685
```

Initial states:

```
l = 9213.428
b = -130.6384
s = 0.8643 1.0045 1.0189 1.1123
```

sigma: 0.0963

```
      AIC      AICc      BIC
1165.936 1169.796 1188.131
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -46.66939 558.8596 397.933 -1.251174 6.623041
              MASE      ACF1
Training set 0.7956173 0.1544919
ETS(M,Ad,M)
```

Call:

```
ets(y = ts_series, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2391
beta  = 1e-04
gamma = 0.3551
phi   = 0.9685
```

Initial states:

```
l = 9213.428
b = -130.6384
s = 0.8643 1.0045 1.0189 1.1123
```

sigma: 0.0963

```
      AIC      AICc      BIC
1165.936 1169.796 1188.131
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -46.66939 558.8596 397.933 -1.251174 6.623041
              MASE      ACF1
Training set 0.7956173 0.1544919
Holt-Winters' additive method
```

Call:

```
hw(y = ts_series, h = h, seasonal = "additive")
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
```

```
gamma = 1e-04
```

```
Initial states:
```

```
l = 3424.9525
```

```
b = 41.1155
```

```
s = -149.9689 -78.0868 161.8073 66.2485
```

```
sigma: 289.5326
```

```
AIC      AICc      BIC
```

```
1067.300 1070.403 1087.275
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -26.23955 271.9685 200.6404 -1.064157 5.736807
```

```
MASE      ACF1
```

```
Training set 0.4734701 0.05466947
```

```
Damped Holt-Winters' additive method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "additive", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
phi = 0.9741
```

```
Initial states:
```

```
l = 3350.1854
```

```
b = 43.5185
```

```
s = -150.3897 -81.345 158.7818 72.9529
```

```
sigma: 290.0652
```

```
AIC      AICc      BIC
```

```
1068.407 1072.267 1090.602
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -4.13957 270.1887 200.2493 -0.4727466 5.690983
```

```
MASE      ACF1
```

```
Training set 0.4725474 0.06204719
```

```
Holt-Winters' multiplicative method
```

```
Call:
```

```
hw(y = ts_series, h = h, seasonal = "multiplicative")
```

```
Smoothing parameters:
```

```
alpha = 0.9557
```

```
beta = 1e-04
```

```
gamma = 0.0219
```

```
Initial states:
```

```
l = 3445.9412
```

```
b = 44.3965
```

```
s = 0.9635 0.9811 1.0481 1.0073
```

```

sigma: 0.0864

      AIC      AICc      BIC
1081.905 1085.008 1101.880

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -31.33754 285.0871 209.7117 -1.224707 6.034845
              MASE      ACF1
Training set 0.4948766 0.07514691
Damped Holt-Winters' multiplicative method

Call:
hw(y = ts_series, h = h, seasonal = "multiplicative", damped = TRUE)

Smoothing parameters:
alpha = 0.9999
beta  = 0.0015
gamma = 1e-04
phi   = 0.98

Initial states:
l = 3379.8961
b = 43.0436
s = 0.9641 0.9843 1.039 1.0126

sigma: 0.0874

      AIC      AICc      BIC
1083.442 1087.302 1105.637

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -7.029645 279.1706 209.7503 -0.5653386 6.013599
              MASE      ACF1
Training set 0.4949678 0.05209754

```

Hide

```

model_table_quaterly_industry$mase_v<- model_table_quaterly_industry$mase_v %>% as.nu
meric()
model_table_quaterly_industry$aic_v<- model_table_quaterly_industry$aic_v %>% as.ume
ric()
model_table_quaterly_industry$p_val<- model_table_quaterly_industry$p_val %>% as.ume
ric()
model_table_quaterly_industry$count<- model_table_quaterly_industry$count %>% as.ume
ric()
quaterly_industry_model_summary<-model_table_quaterly_industry %>% group_by(model) %
>% summarise(mase_mean = mean(mase_v), aic_mean=mean(aic_v), p_value_mean=mean(p_va
l),count=sum(count))

```

Hide

```

quaterly_industry_model_summary<- quaterly_industry_model_summary %>% arrange(desc(co
unt))
quaterly_industry_model_summary[c(1,2,3,4),]

```

model <chr>	mase_mean <dbl>	aic_mean <dbl>	p_value_mean <dbl>	count <dbl>
fit.hw.mult	0.3756937	845.9007	0.2718118	8
fit.MAM	0.4621698	896.7287	0.2120691	8
fit.MAdM	0.4709834	840.3078	0.3994983	5
fit.MMdM	0.3985532	666.3840	0.3350337	5

4 rows

Hide

```
#best_model_quaterly_industry = ets(ts_series, model="MAM")
```

## ##Forecasting

Hide

```
quaterly_industry_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1: nrow(data_quater_industry)){

  a<- read_row(data_quater_industry[i,])
  starting<- read_starting_time_quater(data_quater_industry[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting,frequency = 4)
  a_5<- subset_5(a)
  best_model_quaterly_industry = ets(a_95_ts, model="MAM")
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_quaterly_
industry,a_5)
  quaterly_industry_forecast_mase_table[nrow(quaterly_industry_forecast_mase_table)+1
,]=c(forecast_mase)}
```

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.5235

beta = 1e-04

gamma = 0.2247

Initial states:

l = 5192.0476

b = 24.4042

s = 0.9592 1.0709 0.947 1.0229

sigma: 0.0227

AIC	AICc	BIC
783.1140	787.0270	801.3421

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	10.80491	125.1207	95.44702	0.1283303	1.583382

	MASE	ACF1
Training set	0.5833662	-0.01762298

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.5774

beta = 0.0034

gamma = 0.1739

Initial states:

l = 6150.4132

b = 57.1754

s = 0.9591 1.1122 0.9493 0.9794

sigma: 0.0224

AIC	AICc	BIC
811.4752	815.3882	829.7034

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	6.628793	159.7364	124.8488	0.03727212	1.609844

	MASE	ACF1
Training set	0.4442457	-0.08056423

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.8424

```
beta = 1e-04
gamma = 0.1576
```

## Initial states:

```
l = 6116.485
b = 7.5941
s = 0.9874 1.0243 1.0087 0.9797
```

```
sigma: 0.0223
```

```
      AIC      AICc      BIC
789.4731 793.3862 807.7013
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 11.87938 127.8739 94.61035 0.1405856 1.503766 0.467402
```

## ACF1

```
Training set 0.1583187
```

```
ETS(M,A,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.1363
beta = 0.1164
gamma = 1e-04
```

## Initial states:

```
l = 5357.9797
b = 24.2579
s = 1.0037 0.9797 0.9544 1.0622
```

```
sigma: 0.0353
```

```
      AIC      AICc      BIC
832.7194 836.6325 850.9476
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -14.28584 183.6428 138.7984 -0.2769027 2.366337
```

## MASE ACF1

```
Training set 0.7149597 0.0517437
```

```
ETS(M,A,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.1594
beta = 4e-04
gamma = 1e-04
```

## Initial states:

```
l = 5204.6186
b = 32.9742
s = 0.9304 1.1186 0.8713 1.0796
```

```

sigma: 0.0326

      AIC      AICc      BIC
826.9728 830.8859 845.2010

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set 9.409575 196.2264 152.566 0.03779557 2.402238
              MASE      ACF1
Training set 0.6971717 0.03959643
ETS(M,A,M)

Call:
ets(y = a_95_ts, model = "MAM")

Smoothing parameters:
alpha = 0.3705
beta  = 1e-04
gamma = 1e-04

Initial states:
l = 7418.0744
b = -2.5717
s = 1.06 0.9514 0.936 1.0526

sigma: 0.0287

      AIC      AICc      BIC
833.6848 837.5978 851.9129

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 27.34571 193.0019 155.7914 0.3008909 2.130034 0.802253
              ACF1
Training set 0.1136951
ETS(M,A,M)

Call:
ets(y = a_95_ts, model = "MAM")

Smoothing parameters:
alpha = 0.1403
beta  = 1e-04
gamma = 8e-04

Initial states:
l = 6005.899
b = 62.6101
s = 0.9959 1.0168 0.9794 1.0079

sigma: 0.0438

      AIC      AICc      BIC
886.3342 890.2473 904.5624

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 32.25641 316.2089 244.1542 0.1433816 3.13037 0.6165361

```

```

                ACF1
Training set 0.2921283
ETS(M,A,M)

Call:
ets(y = a_95_ts, model = "MAM")

Smoothing parameters:
  alpha = 0.5921
  beta  = 0.0057
  gamma = 1e-04

Initial states:
  l = 4022.5241
  b = -22.1187
  s = 1.0055 1.0717 0.9747 0.9482

sigma: 0.0986

      AIC      AICc      BIC
847.9562 851.8692 866.1843

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -37.32217 229.8929 179.3306 -2.12487 7.689088
              MASE      ACF1
Training set 0.5819514 0.004531355
ETS(M,Ad,M)

Call:
ets(y = a_95_ts, model = "MAM")

Smoothing parameters:
  alpha = 0.4974
  beta  = 1e-04
  gamma = 0.2855
  phi   = 0.9765

Initial states:
  l = 1827.5218
  b = 95.6572
  s = 0.9389 1.1044 0.9521 1.0046

sigma: 0.0271

      AIC      AICc      BIC
745.0297 749.9186 765.2832

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -0.2542389 86.85188 68.54752 -0.09003932 1.960967
              MASE      ACF1
Training set 0.3259779 0.009460387
ETS(M,A,M)

Call:
ets(y = a_95_ts, model = "MAM")

```



## Smoothing parameters:

alpha = 0.2151  
 beta = 0.2151  
 gamma = 0.167

## Initial states:

l = 8980.1571  
 b = 28.9181  
 s = 1 0.9895 1.0003 1.0102

sigma: 0.0025

AIC	AICc	BIC
639.3755	642.9755	658.2246

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.026383	21.71539	16.52947	0.01038254	0.170781

	MASE	ACF1
Training set	0.1168692	-0.03604119

ETS(M,A,M)

## Call:

ets(y = a\_95\_ts, model = "MAM")

## Smoothing parameters:

alpha = 0.2148  
 beta = 0.2148  
 gamma = 0.2159

## Initial states:

l = 8265.934  
 b = 26.8625  
 s = 1.0005 0.99 0.9999 1.0096

sigma: 0.0024

AIC	AICc	BIC
624.2683	627.8683	643.1174

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	0.9377135	19.17262	14.89698	0.01022492	0.1675809

	MASE	ACF1
Training set	0.1164866	-0.01793232

ETS(M,A,M)

## Call:

ets(y = a\_95\_ts, model = "MAM")

## Smoothing parameters:

alpha = 0.4671  
 beta = 0.2153  
 gamma = 1e-04

## Initial states:

l = 6704.3962  
 b = 29.264

```
s = 0.9974 0.9802 1.0026 1.0198
```

```
sigma: 0.0051
```

```
      AIC      AICc      BIC
692.6224 696.2224 711.4715
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 0.1862193 33.30906 23.44483 0.002729789 0.3210638
```

```
           MASE      ACF1
Training set 0.1667823 -0.01268666
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 0.046
gamma = 1e-04
phi   = 0.9563
```

```
Initial states:
```

```
l = 8930.3573
b = 117.5856
s = 0.9991 0.9934 1.0013 1.0062
```

```
sigma: 0.0171
```

```
      AIC      AICc      BIC
859.4531 863.9429 880.3966
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -24.77054 140.4351 80.1659 -0.2801461 0.8989221
```

```
           MASE      ACF1
Training set 0.4652114 0.1029862
ETS(M,A,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.3683
beta  = 0.0307
gamma = 0.5001
```

```
Initial states:
```

```
l = 3897.0579
b = 37.6395
s = 0.9933 0.7011 0.8523 1.4533
```

```
sigma: 0.0639
```

```
      AIC      AICc      BIC
886.3726 889.9726 905.2217
```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-26.8644	210.2981	154.0974	-1.237004	4.731641

  

	MASE	ACF1
Training set	0.8363497	0.02509227

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.0632
beta = 1e-04
gamma = 0.44
```

Initial states:

```
l = 2487.6301
b = -3.0356
s = 1.0103 0.3409 0.7302 1.9187
```

sigma: 0.0613

	AIC	AICc	BIC
	829.3479	832.9479	848.1970

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-4.938526	169.453	108.7128	-0.355422	4.24951	0.8481358

  

	ACF1
Training set	0.001939027

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.0906
beta = 1e-04
gamma = 0.3753
```

Initial states:

```
l = 3173.8343
b = -6.6438
s = 1.0482 0.4892 0.7738 1.6888
```

sigma: 0.0547

	AIC	AICc	BIC
	851.0322	854.6322	869.8813

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.3917562	180.5165	129.9397	-0.4412113	4.170519

  

	MASE	ACF1
Training set	0.8740685	-0.06404473

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.5711
beta  = 0.0059
gamma = 0.4289
```

Initial states:

```
l = 8960.4352
b = -37.5186
s = 1.0112 1.0661 0.9924 0.9303
```

```
sigma: 0.1015
```

```
      AIC      AICc      BIC
1084.368 1087.701 1103.798
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -95.20116 590.0911 416.7534 -2.417381 7.356416
```

```
              MASE      ACF1
Training set 0.5641332 0.3572704
```

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.1734
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 5134.3719
b = -79.2959
s = 0.8945 1.4445 0.9265 0.7344
```

```
sigma: 0.1626
```

```
      AIC      AICc      BIC
485.7175 494.7175 498.3283
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -109.8199 503.6459 390.1025 -4.559815 12.47608
```

```
              MASE      ACF1
Training set 0.6203465 -0.1538346
```

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.4675
beta  = 1e-04
gamma = 5e-04
```

Initial states:

```

l = 4529.916
b = 48.187
s = 1.0827 0.6705 0.7979 1.4488

```

```
sigma: 0.1663
```

```

      AIC      AICc      BIC
1112.581 1115.914 1132.011

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set -62.05646 687.2089 544.1962 -3.555343 13.32022

```

```

              MASE      ACF1
Training set 0.8592572 0.01238461

```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM")
```

```
Smoothing parameters:
```

```

alpha = 0.3159
beta  = 0.1672
gamma = 0.5898
phi   = 0.8894

```

```
Initial states:
```

```

l = 2038.1798
b = 128.9968
s = 0.9879 0.673 0.8389 1.5002

```

```
sigma: 0.0653
```

```

      AIC      AICc      BIC
904.7476 909.2374 925.6910

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 12.85101 244.1606 183.2241 -0.1207281 4.825484

```

```

              MASE      ACF1
Training set 0.4859111 -0.02728913

```

```
ETS(M,A,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM")
```

```
Smoothing parameters:
```

```

alpha = 0.1828
beta  = 0.1503
gamma = 0.3262

```

```
Initial states:
```

```

l = 2756.587
b = 81.4745
s = 1.0055 0.3998 0.7606 1.8341

```

```
sigma: 0.0638
```

```

      AIC      AICc      BIC

```

937.8864 941.4864 956.7355

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-25.34765	414.6417	273.9111	-0.162533	4.774853
	MASE	ACF1			
Training set	0.6007763	-0.0121658			

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.3266
beta  = 0.1699
gamma = 0.307
```

Initial states:

```
l = 2328.9606
b = 125.5867
s = 1.0097 0.4917 0.766 1.7326
```

sigma: 0.0618

AIC	AICc	BIC
925.6529	929.2529	944.5020

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-5.913235	366.7007	248.2075	-0.3341276	4.732473
	MASE	ACF1			
Training set	0.5215226	-0.01920139			

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.4976
beta  = 0.0051
gamma = 0.0476
phi   = 0.9782
```

Initial states:

```
l = 3055.3369
b = 216.8064
s = 1.0338 0.9708 0.9058 1.0897
```

sigma: 0.2605

AIC	AICc	BIC
1188.835	1192.986	1210.424

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-231.7935	906.4738	657.4663	-10.54511	20.31959
	MASE	ACF1			
Training set	0.5570804	0.4565395			

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.0491
beta  = 0.0062
gamma = 1e-04
```

Initial states:

```
l = 6173.2606
b = -79.6231
s = 1.0272 1.188 0.8274 0.9574
```

sigma: 0.3979

	AIC	AICc	BIC
	539.3846	548.3846	551.9954

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-448.7813	1366.62	1021.884	-22.59066	36.04361

  

	MASE	ACF1
Training set	0.7888421	0.2915168

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.3149
beta  = 1e-04
gamma = 0.3344
```

Initial states:

```
l = 1303.4331
b = 51.7095
s = 1.0602 0.7471 0.759 1.4337
```

sigma: 0.1545

	AIC	AICc	BIC
	1037.352	1040.686	1056.782

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-37.57978	414.1489	321.5015	-3.358093	12.57444

  

	MASE	ACF1
Training set	0.7860673	0.2455764

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.9876
beta  = 1e-04
```

```

gamma = 1e-04

Initial states:
l = 1970.0036
b = 99.9247
s = 0.9671 1.0696 1.0167 0.9465

sigma: 0.0281

      AIC      AICc      BIC
959.4305 962.5884 979.2728

Training set error measures:
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 14.88743 177.371 127.3237 0.1810373 2.12598 0.2555805
      ACF1
Training set -0.1249475
ETS(M,A,M)

Call:
ets(y = a_95_ts, model = "MAM")

Smoothing parameters:
alpha = 0.9625
beta = 1e-04
gamma = 0.001

Initial states:
l = 1606.7633
b = 88.4407
s = 0.9562 1.0795 1.0212 0.9431

sigma: 0.0309

      AIC      AICc      BIC
944.1951 947.3530 964.0374

Training set error measures:
      ME      RMSE      MAE      MPE      MAPE
Training set -2.201728 161.4992 112.2567 -0.1046548 2.310579
      MASE      ACF1
Training set 0.28799 -0.1597983
ETS(M,A,M)

Call:
ets(y = a_95_ts, model = "MAM")

Smoothing parameters:
alpha = 0.9999
beta = 1e-04
gamma = 1e-04

Initial states:
l = 1665.3208
b = 75.8602
s = 1.0107 0.9914 1.0119 0.986

sigma: 0.1333

```



```

      AIC      AICc      BIC
1138.631 1141.788 1158.473

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set 12.62732 720.5704 342.3745 -0.5452424 6.915184

```

```

           MASE      ACF1
Training set 0.3763342 0.04951301

```

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.624
beta  = 1e-04
gamma = 0.2688

```

Initial states:

```

l = 1455.8918
b = 84.7987
s = 1.3224 0.8316 0.9108 0.9351

```

sigma: 0.0972

```

      AIC      AICc      BIC
1070.783 1073.941 1090.626

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -33.96423 309.6671 220.4585 -1.224302 6.355218

```

```

           MASE      ACF1
Training set 0.5960896 0.01896808

```

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.8656
beta  = 1e-04
gamma = 0.0025

```

Initial states:

```

l = 1926.6007
b = 101.9236
s = 0.9965 1.0226 0.9972 0.9838

```

sigma: 0.0405

```

      AIC      AICc      BIC
1006.033 1009.191 1025.876

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 24.72755 254.4215 154.2808 0.1771383 2.6183 0.2842264

```

```

           ACF1

```

Training set -0.08543788

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.904

beta = 3e-04

gamma = 0.096

Initial states:

l = 1559.062

b = 80.9233

s = 0.9783 1.0445 1.0128 0.9644

sigma: 0.0299

AIC	AICc	BIC
-----	------	-----

936.0964	939.2543	955.9387
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	1.505908	141.952	103.964	0.02185811	2.286498	0.2737267

ACF1

Training set -0.02998499

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

gamma = 1e-04

phi = 0.9607

Initial states:

l = 6014.4869

b = -100.6135

s = 0.9919 1.005 1.0292 0.974

sigma: 0.1119

AIC	AICc	BIC
-----	------	-----

1117.684	1121.543	1139.879
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-9.09177	442.9183	301.267	-0.7040973	7.43582	0.6258062

ACF1

Training set -0.07832734

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.7912
beta  = 1e-04
gamma = 1e-04
```

## Initial states:

```
l = 5474.3216
b = -34.9311
s = 0.9663 0.951 1.0569 1.0257
```

```
sigma: 0.1315
```

```
      AIC      AICc      BIC
1119.822 1122.925 1139.797
```

## Training set error measures:

```
              ME   RMSE      MAE      MPE      MAPE      MASE
Training set -7.665024 385.06 286.9574 -0.847031 9.252115 0.5281779
```

```
      ACF1
```

```
Training set 0.1874302
```

```
ETS(M,A,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.9433
beta  = 0.0066
gamma = 1e-04
```

## Initial states:

```
l = 3677.8792
b = 50.8324
s = 0.9593 0.8996 1.0513 1.0898
```

```
sigma: 0.1667
```

```
      AIC      AICc      BIC
1074.514 1077.618 1094.490
```

## Training set error measures:

```
              ME   RMSE      MAE      MPE      MAPE      MASE
Training set -78.65293 371.9926 282.1967 -5.24399 14.3212 0.5550272
```

```
      ACF1
```

```
Training set 0.1080308
```

```
ETS(M,A,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM")
```

## Smoothing parameters:

```
alpha = 0.8862
beta  = 0.0122
gamma = 1e-04
```

## Initial states:

```
l = 6072.7623
b = 131.0464
s = 0.9281 0.9634 1.043 1.0656
```

sigma: 0.1376

AIC	AICc	BIC
1145.896	1148.999	1165.871

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-138.9339	517.8181	373.8948	-4.355985	10.14363

	MASE	ACF1
Training set	0.4845943	0.1367803

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.2391  
 beta = 1e-04  
 gamma = 0.3551  
 phi = 0.9685

Initial states:

l = 9213.428  
 b = -130.6384  
 s = 0.8643 1.0045 1.0189 1.1123

sigma: 0.0963

AIC	AICc	BIC
1165.936	1169.796	1188.131

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-46.66939	558.8596	397.933	-1.251174	6.623041

	MASE	ACF1
Training set	0.7956173	0.1544919

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.9978  
 beta = 1e-04  
 gamma = 0.0019

Initial states:

l = 3178.1102  
 b = 42.4577  
 s = 0.9546 0.9774 1.0456 1.0224

sigma: 0.0844

AIC	AICc	BIC
1078.335	1081.439	1098.311

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-23.62166	280.39	201.0708	-0.9796204	5.756307

  

	MASE	ACF1
Training set	0.4744858	0.0656565

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.473
beta = 2e-04
gamma = 1e-04
phi = 0.971
```

Initial states:

```
l = 3138.1801
b = 101.7817
s = 0.9365 1.0109 1.1074 0.9451
```

sigma: 0.2334

AIC	AICc	BIC
1091.526	1096.016	1112.470

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-23.13415	921.0339	684.6299	-4.954759	17.70286

  

	MASE	ACF1
Training set	0.6371826	0.09709483

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.9059
beta = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 10032.1679
b = 29.9426
s = 0.9773 0.9368 1.0918 0.9942
```

sigma: 0.1931

AIC	AICc	BIC
901.1812	905.7966	918.2076

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-89.16523	1350.597	800.9524	-5.947474	16.32867

  

	MASE	ACF1
Training set	0.4561406	0.0433742

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.5334
beta  = 0.006
gamma = 1e-04
```

Initial states:

```
l = 3331.5092
b = 67.938
s = 0.9585 1.0266 0.9451 1.0698
```

```
sigma: 0.2052
```

```
      AIC      AICc      BIC
990.8557 994.7688 1009.0839
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -35.21725 749.6163 616.3838 -3.531741 15.6754
```

```
           MASE      ACF1
Training set 0.6699264 0.08166729
```

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.3805
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```
l = 4348.8604
b = 27.3789
s = 1.0491 0.8973 1.0061 1.0475
```

```
sigma: 0.0571
```

```
      AIC      AICc      BIC
937.1470 940.7470 955.9961
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 33.41945 276.7064 213.9942 0.2668551 4.12803 0.7504338
```

```
           ACF1
Training set 0.0722642
```

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```
alpha = 0.6061
beta  = 1e-04
gamma = 1e-04
```

Initial states:

```

l = 1942.6681
b = 64.5654
s = 1.0396 0.8984 1.0145 1.0474

```

```
sigma: 0.0425
```

```

      AIC      AICc      BIC
866.1049 869.7049 884.9540

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 12.2479 185.6319 115.5282 0.1149904 2.767434 0.3292407

```

```
ACF1
```

```
Training set -0.01974863
```

```
ETS(M,A,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.9957
```

```
beta = 0.1861
```

```
gamma = 0.0043
```

```
Initial states:
```

```
l = 2719.8423
```

```
b = 71.8805
```

```
s = 1.0084 0.9991 0.999 0.9936
```

```
sigma: 0.0737
```

```

      AIC      AICc      BIC
617.2939 623.1004 632.7161

```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 18.82285 223.9126 178.3516 0.3457159 5.023468

```

```
MASE      ACF1
```

```
Training set 0.3302808 0.057797
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.3835
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
phi = 0.9784
```

```
Initial states:
```

```
l = 2975.7791
```

```
b = 66.6377
```

```
s = 1.0201 0.9724 1.0897 0.9178
```

```
sigma: 0.0577
```

```

      AIC      AICc      BIC

```

915.4262 919.9160 936.3697

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-13.04066	239.7835	180.6551	-0.5231978	4.183606

	MASE	ACF1
Training set	0.6505908	0.06244708

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.2016  
beta = 0.0675  
gamma = 1e-04

Initial states:

l = 3772.7483  
b = 93.2851  
s = 1.0289 0.965 1.0805 0.9257

sigma: 0.0753

AIC	AICc	BIC
597.2470	603.6756	611.9853

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	40.03834	331.4248	241.2698	0.1588817	4.993103

	MASE	ACF1
Training set	0.6191074	0.05581718

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.975  
beta = 0.0016  
gamma = 1e-04

Initial states:

l = 4100.9229  
b = 91.5217  
s = 1.0825 0.7882 1.0507 1.0786

sigma: 0.0518

AIC	AICc	BIC
573.6668	580.0954	588.4051

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-32.49259	265.551	198.1444	-0.7148143	3.633694

	MASE	ACF1
Training set	0.4166302	0.05501063

ETS(M,A,M)



Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.6995

beta = 0.0124

gamma = 1e-04

Initial states:

l = 5077.5045

b = 110.0965

s = 0.9552 1.0102 1.0191 1.0155

sigma: 0.0709

AIC	AICc	BIC
-----	------	-----

743.9561	749.0989	760.2160
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-17.39216	496.4635	419.0404	-0.4786147	5.583812

	MASE	ACF1
Training set	0.6224875	0.1115021

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.9995

beta = 0.0475

gamma = 5e-04

Initial states:

l = 1674.8438

b = 222.4161

s = 1.0822 0.9841 1.014 0.9197

sigma: 0.1047

AIC	AICc	BIC
-----	------	-----

670.7082	676.5147	686.1303
----------	----------	----------

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-94.52541	531.012	392.6274	-2.090477	7.872403

	MASE	ACF1
Training set	0.3783128	0.2332096

ETS(M,A,M)

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

alpha = 0.9968

beta = 1e-04

gamma = 0.0032

Initial states:

l = 2696.1082  
b = 81.5615  
s = 1.0948 1.025 0.9983 0.8819

sigma: 0.0852

	AIC	AICc	BIC
	645.9898	651.7962	661.4119

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	28.0926	382.4846	297.3508	0.1150688	6.392155	0.3716885

ACF1

Training set 0.1646621

ETS(M,A,M)

Call:

ets(y = a\_95\_ts, model = "MAM")

Smoothing parameters:

alpha = 0.6045  
beta = 4e-04  
gamma = 1e-04

Initial states:

l = 3023.8078  
b = 56.5279  
s = 1.1303 0.9898 1.0058 0.8741

sigma: 0.0577

	AIC	AICc	BIC
	606.2709	612.0773	621.6930

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	29.16126	190.4023	160.1022	0.1803024	4.244435

MASE ACF1

Training set 0.4682832 0.08609392

ETS(M,A,M)

Call:

ets(y = a\_95\_ts, model = "MAM")

Smoothing parameters:

alpha = 0.6855  
beta = 1e-04  
gamma = 0.0096

Initial states:

l = 3207.3366  
b = 101.9447  
s = 0.9746 0.959 1.0393 1.0271

sigma: 0.0994

```

      AIC      AICc      BIC
1085.499 1088.833 1104.929

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -3.649084 593.0713 365.079 -1.037447 6.871482

```

```

              MASE      ACF1
Training set 0.4722885 0.04526448
ETS(M,A,M)

```

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.9999
beta  = 0.0344
gamma = 1e-04

```

Initial states:

```

l = 5963.8139
b = 157.9482
s = 0.9943 1.0178 0.9665 1.0214

```

sigma: 0.0668

```

      AIC      AICc      BIC
637.5899 643.7968 652.5620

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -39.4517 482.8447 303.0499 -0.7288104 4.043155

```

```

              MASE      ACF1
Training set 0.3289848 0.3458902
ETS(M,A,M)

```

Call:

```
ets(y = a_95_ts, model = "MAM")
```

Smoothing parameters:

```

alpha = 0.6234
beta  = 1e-04
gamma = 0.0038

```

Initial states:

```

l = 5735.2137
b = 88.3642
s = 1.0706 0.8555 1.0206 1.0533

```

sigma: 0.046

```

      AIC      AICc      BIC
654.0369 659.6619 669.6759

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -26.61201 295.0992 193.1202 -0.4969103 2.717199

```

```

              MASE      ACF1
Training set 0.3906948 0.2188873

```

```
ETS(M,A,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM")
```

```
Smoothing parameters:
```

```
alpha = 0.8219
```

```
beta = 1e-04
```

```
gamma = 0.1545
```

```
Initial states:
```

```
l = 5855.8235
```

```
b = 74.518
```

```
s = 1.0208 1.01 0.9719 0.9973
```

```
sigma: 0.0485
```

```
AIC      AICc      BIC
```

```
734.9842 739.8491 751.6355
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -38.62867 303.3773 210.9866 -0.6968937 3.186484
```

```
MASE      ACF1
```

```
Training set 0.4798967 0.08894747
```

Hide

```
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_mase_table$forecasting_mase %>% as.character()
```

```
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_mase_table$forecasting_mase %>% as.numeric()
```

Hide

```
mean(model_table_quarterly_industry$mase_v)
```

```
[1] 0.4979766
```

Hide

```
sum(model_table_quarterly_industry$p_val<0.05)
```

```
[1] 9
```

Hide

```
mean(quarterly_industry_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

```
[1] 0.8683289
```

Hide

```
quarterly_industry_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1:nrow(data_quater_industry)){

  a<- read_row(data_quater_industry[i,])
  starting<- read_starting_time_quater(data_quater_industry[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting,frequency = 4)
  a_5<- subset_5(a)
  best_model_quaterly_industry = ets(a_95_ts, model="MAM",damped = TRUE)
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_quaterly_
industry,a_5)
  quarterly_industry_forecast_mase_table[nrow(quarterly_industry_forecast_mase_table)+1
,]=c(forecast_mase)}
```

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5991
beta  = 0.0089
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 5191.4405
b = 28.5075
s = 0.9627 1.0839 0.9428 1.0106
```

sigma: 0.0233

AIC	AICc	BIC
786.9155	791.8043	807.1690

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	19.5709	128.3417	96.14522	0.2771793	1.59363	0.5876336

ACF1

Training set 0.003514186

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5745
beta  = 0.0312
gamma = 0.2477
phi   = 0.98
```

Initial states:

```
l = 6151.579
b = 67.538
s = 0.9553 1.1046 0.9525 0.9875
```

sigma: 0.023

AIC	AICc	BIC
814.9171	819.8060	835.1706

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	17.87378	160.7402	126.6012	0.1849074	1.63549	0.4504812

ACF1

Training set -0.08025553

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.8324  
 beta = 0.0129  
 gamma = 0.1676  
 phi = 0.98

## Initial states:

l = 6116.7401  
 b = 2.553  
 s = 0.9863 1.0246 1.0073 0.9819

sigma: 0.0227

AIC	AICc	BIC
792.2643	797.1531	812.5178

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	16.16706	128.3673	96.0032	0.2127587	1.526012	0.4742831

ACF1

Training set 0.1653258

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.1231  
 beta = 0.1198  
 gamma = 1e-04  
 phi = 0.9666

## Initial states:

l = 5357.3888  
 b = 25.7388  
 s = 1.0037 0.979 0.9543 1.0629

sigma: 0.0353

AIC	AICc	BIC
833.5212	838.4101	853.7747

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-8.021969	181.4587	135.8415	-0.1733267	2.317458

MASE ACF1

Training set 0.6997283 0.04845184

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.0498  
 beta = 0.0498  
 gamma = 1e-04  
 phi = 0.9647

## Initial states:

l = 5205.0585  
 b = 39.0041  
 s = 0.9304 1.1179 0.8708 1.0809

sigma: 0.0339

AIC	AICc	BIC
831.9334	836.8223	852.1869

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	13.13006	199.3933	154.8764	0.1618215	2.436779

	MASE	ACF1
Training set	0.7077298	0.1040908

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.4329  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.977

## Initial states:

l = 7417.6955  
 b = -2.5017  
 s = 1.0608 0.9493 0.9352 1.0547

sigma: 0.0288

AIC	AICc	BIC
834.8100	839.6989	855.0635

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	20.6452	191.2052	151.7742	0.2238277	2.080936	0.7815663

	ACF1
Training set	0.05037667

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.4171  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.9797

## Initial states:

l = 6010.0403  
 b = 79.9741  
 s = 0.9982 1.0252 0.9757 1.0009

sigma: 0.0447



```

      AIC      AICc      BIC
889.0750 893.9639 909.3285

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 51.81114 311.521 228.456 0.4359504 2.939212 0.5768951

```

ACF1

Training set 0.06342091

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.6188

beta = 0.0046

gamma = 2e-04

phi = 0.98

Initial states:

l = 4021.9421

b = -54.7317

s = 1.0027 1.0738 0.9722 0.9513

sigma: 0.1

```

      AIC      AICc      BIC
850.0226 854.9115 870.2761

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -27.06454 227.4859 178.2081 -1.88888 7.696907

```

MASE ACF1

Training set 0.5783088 -0.03631197

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4974

beta = 1e-04

gamma = 0.2855

phi = 0.9765

Initial states:

l = 1827.5218

b = 95.6572

s = 0.9389 1.1044 0.9521 1.0046

sigma: 0.0271

```

      AIC      AICc      BIC
745.0297 749.9186 765.2832

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE

```

```
Training set -0.2542389 86.85188 68.54752 -0.09003932 1.960967
```

```
          MASE          ACF1
```

```
Training set 0.3259779 0.009460387
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2404
```

```
beta  = 0.2404
```

```
gamma = 1e-04
```

```
phi   = 0.9786
```

```
Initial states:
```

```
l = 8978.8608
```

```
b = 38.523
```

```
s = 0.9991 0.9904 1.001 1.0096
```

```
sigma: 0.0026
```

```
      AIC      AICc      BIC
```

```
643.8773 648.3670 664.8207
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE
```

```
Training set 3.344528 22.09451 15.1477 0.0326308 0.1559364
```

```
          MASE      ACF1
```

```
Training set 0.1070996 -0.009600656
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2423
```

```
beta  = 0.2401
```

```
gamma = 1e-04
```

```
phi   = 0.9777
```

```
Initial states:
```

```
l = 8265.3562
```

```
b = 36.585
```

```
s = 0.9992 0.9912 1.0008 1.0088
```

```
sigma: 0.0025
```

```
      AIC      AICc      BIC
```

```
629.1573 633.6471 650.1007
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE
```

```
Training set 3.087515 19.5865 13.39878 0.03263821 0.1497442
```

```
          MASE      ACF1
```

```
Training set 0.1047715 0.009185694
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4859
beta  = 0.2068
gamma = 1e-04
phi   = 0.9783
```

Initial states:

```
l = 6707.5982
b = 32.8407
s = 0.9974 0.9802 1.0026 1.0198
```

```
sigma: 0.0052
```

```
      AIC      AICc      BIC
695.2093 699.6991 716.1528
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 3.240166 33.4701 23.5502 0.04175264 0.3223614
```

```
              MASE      ACF1
Training set 0.1675319 -0.01236664
ETS(M,Ad,M)
```

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.046
gamma = 1e-04
phi   = 0.9563
```

Initial states:

```
l = 8930.3573
b = 117.5856
s = 0.9991 0.9934 1.0013 1.0062
```

```
sigma: 0.0171
```

```
      AIC      AICc      BIC
859.4531 863.9429 880.3966
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -24.77054 140.4351 80.1659 -0.2801461 0.8989221
```

```
              MASE      ACF1
Training set 0.4652114 0.1029862
ETS(M,Ad,M)
```

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3563
beta  = 0.0316
gamma = 0.4976
```

```
phi = 0.9523
```

```
Initial states:
```

```
l = 3898.0259
```

```
b = 34.7806
```

```
s = 0.993 0.7025 0.8526 1.452
```

```
sigma: 0.0638
```

```
AIC      AICc      BIC
```

```
887.4394 891.9292 908.3828
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set -31.5127 206.828 151.2583 -1.490264 4.694183 0.8209405
```

```
ACF1
```

```
Training set 0.01426832
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0482
```

```
beta = 0.0272
```

```
gamma = 0.4412
```

```
phi = 0.8
```

```
Initial states:
```

```
l = 2461.8484
```

```
b = 15.5025
```

```
s = 1.0111 0.341 0.7286 1.9193
```

```
sigma: 0.0617
```

```
AIC      AICc      BIC
```

```
831.7521 836.2419 852.6956
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set -17.79902 174.1698 109.9362 -0.892015 4.279828 0.85768
```

```
ACF1
```

```
Training set 0.003539387
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0714
```

```
beta = 0.0245
```

```
gamma = 0.3474
```

```
phi = 0.8
```

```
Initial states:
```

```
l = 3113.2409
```

```
b = 14.1663
```

```
s = 1.0234 0.487 0.7583 1.7313
```

sigma: 0.055

AIC	AICc	BIC
853.4878	857.9776	874.4313

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-25.37549	180.4546	128.8015	-1.210332	4.173528

	MASE	ACF1
Training set	0.8664126	-0.04288279

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5492
beta = 0.0248
gamma = 0.4507
phi = 0.9533
```

Initial states:

```
l = 9855.679
b = -37.7165
s = 1.0111 1.0703 0.9904 0.9282
```

sigma: 0.1027

AIC	AICc	BIC
1086.858	1091.009	1108.447

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-113.9179	596.1842	422.1057	-2.462356	7.377493

	MASE	ACF1
Training set	0.5713783	0.354265

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.0565
beta = 1e-04
gamma = 6e-04
phi = 0.98
```

Initial states:

```
l = 5134.5643
b = -125.0767
s = 0.8966 1.4603 0.91 0.7331
```

sigma: 0.1563

AIC	AICc	BIC
483.8762	495.4551	497.8881

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-101.3057	479.9297	364.2965	-4.268875	11.5627

  

	MASE	ACF1
Training set	0.5793095	-0.1746595

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4796
beta  = 0.0078
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 4576.0562
b = 87.5432
s = 1.0906 0.66 0.8006 1.4488
```

sigma: 0.1709

AIC	AICc	BIC
1115.760	1119.911	1137.349

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-36.63957	710.7313	559.7199	-2.580672	13.30705

  

	MASE	ACF1
Training set	0.8837683	0.0288477

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3159
beta  = 0.1672
gamma = 0.5898
phi   = 0.8894
```

Initial states:

```
l = 2038.1798
b = 128.9968
s = 0.9879 0.673 0.8389 1.5002
```

sigma: 0.0653

AIC	AICc	BIC
904.7476	909.2374	925.6910

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	12.85101	244.1606	183.2241	-0.1207281	4.825484

  

	MASE	ACF1
Training set	0.4859111	-0.02728913

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1665
beta  = 0.1665
gamma = 0.3307
phi   = 0.9307
```

Initial states:

```
l = 2690.4409
b = 161.7838
s = 0.9951 0.3977 0.7609 1.8463
```

sigma: 0.0648

```
      AIC      AICc      BIC
940.2736 944.7634 961.2171
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -6.440621 406.5586 271.7707 0.153557 4.752238
```

```
              MASE      ACF1
Training set 0.5960818 -0.03977206
```

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2922
beta  = 0.1874
gamma = 0.3015
phi   = 0.9325
```

Initial states:

```
l = 2329.1489
b = 167.0995
s = 1.0076 0.4887 0.7654 1.7383
```

sigma: 0.0625

```
      AIC      AICc      BIC
927.3950 931.8848 948.3384
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 9.555791 357.2139 245.5802 -0.01480197 4.738342
```

```
              MASE      ACF1
Training set 0.5160022 -0.03764161
```

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4976
```

```

beta = 0.0051
gamma = 0.0476
phi = 0.9782

```

## Initial states:

```

l = 3055.3369
b = 216.8064
s = 1.0338 0.9708 0.9058 1.0897

```

```
sigma: 0.2605
```

```

      AIC      AICc      BIC
1188.835 1192.986 1210.424

```

## Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -231.7935 906.4738 657.4663 -10.54511 20.31959

```

```

              MASE      ACF1
Training set 0.5570804 0.4565395

```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```

alpha = 0.0057
beta = 0.0057
gamma = 1e-04
phi = 0.979

```

## Initial states:

```

l = 6267.2037
b = -173.6547
s = 1.0312 1.2476 0.7945 0.9267

```

```
sigma: 0.3992
```

```

      AIC      AICc      BIC
538.5483 550.1272 552.5603

```

## Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -355.7286 1311.514 948.8171 -18.66909 32.23102

```

```

              MASE      ACF1
Training set 0.732438 0.2798837

```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```

alpha = 0.2493
beta = 1e-04
gamma = 0.2729
phi = 0.97

```

## Initial states:

```
l = 1235.0361
```



```
b = 85.3273
s = 1.0773 0.7143 0.7586 1.4497
```

```
sigma: 0.1551
```

```
      AIC      AICc      BIC
1037.512 1041.663 1059.101
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set 1.937253 392.9175 310.669 -2.434634 12.23181 0.7595819
           ACF1
```

```
Training set 0.2542567
```

```
ETS(M,Ad,M)
```

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.0967
gamma = 1e-04
phi   = 0.9799
```

Initial states:

```
l = 1968.756
b = 126.0924
s = 0.9669 1.0696 1.0168 0.9467
```

```
sigma: 0.0293
```

```
      AIC      AICc      BIC
965.7410 969.6696 987.7880
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set 12.50303 183.5992 130.7721 0.1947483 2.195641
           MASE      ACF1
```

```
Training set 0.2625026 -0.1771499
```

```
ETS(M,Ad,M)
```

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9663
beta  = 0.0226
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1607.7819
b = 109.9022
s = 0.9561 1.08 1.0218 0.9421
```

```
sigma: 0.0325
```

```
      AIC      AICc      BIC
```

951.4261 955.3547 973.4730

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	19.06552	165.0889	120.8322	0.2706872	2.494909

	MASE	ACF1
Training set	0.3099903	-0.1551594

ETS(M,Ad,M)

Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

Smoothing parameters:

alpha = 0.9997  
beta = 1e-04  
gamma = 3e-04  
phi = 0.9762

Initial states:

l = 1665.7511  
b = 74.275  
s = 1.0138 0.9937 1.0127 0.9798

sigma: 0.1375

AIC	AICc	BIC
1142.491	1146.419	1164.538

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	51.62565	723.0847	342.8294	0.3313134	6.738571

	MASE	ACF1
Training set	0.3768342	0.05716438

ETS(M,Ad,M)

Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

Smoothing parameters:

alpha = 0.4806  
beta = 5e-04  
gamma = 1e-04  
phi = 0.98

Initial states:

l = 1453.5214  
b = 97.6749  
s = 1.1533 0.9156 0.9544 0.9766

sigma: 0.1026

AIC	AICc	BIC
1077.641	1081.569	1099.688

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	21.28305	294.0982	212.6406	-0.2778998	6.285616

	MASE	ACF1
--	------	------

```
Training set 0.5749511 0.1867322
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.7556
```

```
beta = 0.1499
```

```
gamma = 1e-04
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 1926.3518
```

```
b = 125.6897
```

```
s = 0.996 1.0234 0.9967 0.9839
```

```
sigma: 0.0421
```

```
AIC      AICc      BIC
```

```
1011.927 1015.856 1033.974
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 12.98924 264.8316 157.9299 0.152583 2.675234 0.2909491
```

```
ACF1
```

```
Training set -0.04161333
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9474
```

```
beta = 0.0557
```

```
gamma = 0.0526
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 1558.1003
```

```
b = 102.3594
```

```
s = 0.9791 1.0393 1.0137 0.9678
```

```
sigma: 0.0312
```

```
AIC      AICc      BIC
```

```
942.4099 946.3384 964.4568
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE      MASE
```

```
Training set 9.429944 145.128 108.1719 0.1767644 2.383476 0.2848058
```

```
ACF1
```

```
Training set -0.09513137
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

alpha = 0.9999  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.9607

## Initial states:

l = 6014.4869  
 b = -100.6135  
 s = 0.9919 1.005 1.0292 0.974

sigma: 0.1119

AIC	AICc	BIC
1117.684	1121.543	1139.879

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	-9.09177	442.9183	301.267	-0.7040973	7.43582	0.6258062

ACF1

Training set -0.07832734

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.871  
 beta = 4e-04  
 gamma = 1e-04  
 phi = 0.98

## Initial states:

l = 5475.4841  
 b = -38.3021  
 s = 0.9632 0.9548 1.0605 1.0216

sigma: 0.1309

AIC	AICc	BIC
1120.823	1124.683	1143.018

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-23.30553	380.7104	279.227	-1.346173	9.027543

MASE ACF1

Training set 0.5139492 0.1105569

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.946  
 beta = 0.002  
 gamma = 1e-04  
 phi = 0.98

## Initial states:

l = 3661.9522  
 b = 51.8233  
 s = 0.9604 0.8988 1.0494 1.0913

sigma: 0.1684

AIC	AICc	BIC
1076.091	1079.951	1098.286

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-70.48575	368.5444	280.3175	-4.773722	14.17403

	MASE	ACF1
Training set	0.5513313	0.1017382

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.8748  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.9459

## Initial states:

l = 6066.8901  
 b = 140.8656  
 s = 0.9262 0.9636 1.0446 1.0656

sigma: 0.1377

AIC	AICc	BIC
1145.825	1149.685	1168.020

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-108.0061	505.1566	367.9647	-3.576783	9.90226

	MASE	ACF1
Training set	0.4769085	0.1377537

ETS(M,Ad,M)

## Call:

ets(y = a\_95\_ts, model = "MAM", damped = TRUE)

## Smoothing parameters:

alpha = 0.2391  
 beta = 1e-04  
 gamma = 0.3551  
 phi = 0.9685

## Initial states:

l = 9213.428  
 b = -130.6384  
 s = 0.8643 1.0045 1.0189 1.1123

sigma: 0.0963

```

      AIC      AICc      BIC
1165.936 1169.796 1188.131

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -46.66939 558.8596 397.933 -1.251174 6.623041

```

```

              MASE      ACF1
Training set 0.7956173 0.1544919

```

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9984
beta  = 1e-04
gamma = 0.0016
phi   = 0.98

```

Initial states:

```

l = 3161.0262
b = 43.1976
s = 0.9556 0.9794 1.043 1.022

```

sigma: 0.0858

```

      AIC      AICc      BIC
1080.833 1084.693 1103.028

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -4.092051 278.8493 202.3085 -0.4636256 5.770544

```

```

              MASE      ACF1
Training set 0.4774066 0.06545523

```

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.473
beta  = 2e-04
gamma = 1e-04
phi   = 0.971

```

Initial states:

```

l = 3138.1801
b = 101.7817
s = 0.9365 1.0109 1.1074 0.9451

```

sigma: 0.2334

```

      AIC      AICc      BIC
1091.526 1096.016 1112.470

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE

```

```
Training set -23.13415 921.0339 684.6299 -4.954759 17.70286
```

```
      MASE      ACF1
```

```
Training set 0.6371826 0.09709483
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9028
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
phi   = 0.9467
```

```
Initial states:
```

```
l = 10031.7697
```

```
b = -102.5386
```

```
s = 0.9762 0.9369 1.0941 0.9928
```

```
sigma: 0.1993
```

```
      AIC      AICc      BIC
```

```
904.0066 909.7961 922.9248
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -18.72979 1344.931 810.4369 -4.841786 16.42889
```

```
      MASE      ACF1
```

```
Training set 0.461542 0.04256387
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.5501
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
phi   = 0.98
```

```
Initial states:
```

```
l = 3296.0773
```

```
b = 91.5825
```

```
s = 0.9508 1.0181 0.9567 1.0745
```

```
sigma: 0.2061
```

```
      AIC      AICc      BIC
```

```
991.9062 996.7951 1012.1597
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -24.28735 743.3484 611.6662 -3.300595 15.48979
```

```
      MASE      ACF1
```

```
Training set 0.6647989 0.06344029
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4171
beta  = 0.0068
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 4349.3223
b = 31.7397
s = 1.0474 0.8941 1.0087 1.0498
```

```
sigma: 0.0588
```

```
      AIC      AICc      BIC
941.1915 945.6813 962.1349
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 45.70168 279.6818 216.47 0.5234036 4.182823 0.7591158
```

```
      ACF1
```

```
Training set 0.05217497
```

```
ETS(M,Ad,M)
```

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6329
beta  = 0.0384
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1942.3157
b = 78.576
s = 1.0357 0.8996 1.0174 1.0473
```

```
sigma: 0.0444
```

```
      AIC      AICc      BIC
871.9894 876.4792 892.9329
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 15.74396 188.4359 118.4987 0.2686648 2.824542
```

```
      MASE      ACF1
```

```
Training set 0.3377062 -0.02821554
```

```
ETS(M,Ad,M)
```

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta  = 0.2007
gamma = 1e-04
```



```
phi = 0.9548
```

```
Initial states:
```

```
l = 2725.5426
```

```
b = 64.2906
```

```
s = 1.0078 1.0007 0.9996 0.9919
```

```
sigma: 0.0748
```

```
AIC      AICc      BIC
```

```
619.0085 626.3418 636.1442
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set 32.48341 222.7619 177.1722 0.6391595 5.007922
```

```
MASE      ACF1
```

```
Training set 0.3280966 0.02797064
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.3835
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
phi = 0.9784
```

```
Initial states:
```

```
l = 2975.7791
```

```
b = 66.6377
```

```
s = 1.0201 0.9724 1.0897 0.9178
```

```
sigma: 0.0577
```

```
AIC      AICc      BIC
```

```
915.4262 919.9160 936.3697
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -13.04066 239.7835 180.6551 -0.5231978 4.183606
```

```
MASE      ACF1
```

```
Training set 0.6505908 0.06244708
```

```
ETS(M,Ad,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.198
```

```
beta = 0.0692
```

```
gamma = 1e-04
```

```
phi = 0.977
```

```
Initial states:
```

```
l = 3729.914
```

```
b = 93.2823
```

```
s = 1.0294 0.9646 1.0808 0.9252
```

sigma: 0.0772

	AIC	AICc	BIC
	599.5100	607.6581	615.8858

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	58.70928	333.2887	244.7814	0.5508539	5.04048	0.6281182

ACF1

Training set 0.0497705

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

gamma = 1e-04

phi = 0.9771

Initial states:

l = 4021.0818

b = 92.7384

s = 1.0801 0.7873 1.0529 1.0797

sigma: 0.0526

	AIC	AICc	BIC
	575.1476	583.2958	591.5235

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-1.353228	263.3499	194.4752	-0.122233	3.53343

MASE ACF1

Training set 0.4089151 0.04539073

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.6998

beta = 1e-04

gamma = 1e-04

phi = 0.9756

Initial states:

l = 4950.3108

b = 156.1723

s = 0.9533 1.0127 1.0224 1.0117

sigma: 0.0713

	AIC	AICc	BIC
	744.9011	751.3717	762.9678

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	8.787458	489.4935	410.2831	-0.19659	5.450715	0.6094785

ACF1

Training set 0.1094311

ETS(M,Ad,M)

## Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04
phi   = 0.9743
```

## Initial states:

```
l = 1642.3503
b = 224.5057
s = 1.0832 0.984 1.0139 0.9189
```

```
sigma: 0.1069
```

AIC	AICc	BIC
672.3914	679.7247	689.5271

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-41.23252	516.884	390.0339	-1.101414	7.771459

MASE      ACF1

Training set 0.3758139 0.2428692

ETS(M,Ad,M)

## Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9995
beta  = 0.0806
gamma = 1e-04
phi   = 0.9307
```

## Initial states:

```
l = 2696.7931
b = 81.711
s = 1.0935 1.025 1.001 0.8806
```

```
sigma: 0.0889
```

AIC	AICc	BIC
649.7242	657.0576	666.8600

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	41.96934	387.902	307.1226	0.7507541	6.712715	0.3839033

ACF1

Training set 0.1082213

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5924
beta  = 0.0624
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3026.1681
b = 57.2077
s = 1.1327 0.9928 1.0041 0.8705
```

sigma: 0.0595

	AIC	AICc	BIC
	609.2010	616.5344	626.3367

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	32.62358	191.0742	157.3533	0.512687	4.19013	0.4602428

ACF1

Training set 0.03070197

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6974
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3198.9561
b = 102.2917
s = 0.9739 0.9579 1.0399 1.0283
```

sigma: 0.1024

	AIC	AICc	BIC
	1088.845	1092.996	1110.433

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	60.6048	596.6228	378.417	0.01261347	6.990769	0.4895433

ACF1

Training set 0.04512608

ETS(M,Ad,M)

Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.999
```

```
beta = 0.0072
gamma = 1e-04
phi = 0.98
```

## Initial states:

```
l = 5782.7071
b = 153.9536
s = 0.9929 1.0167 0.9671 1.0233
```

```
sigma: 0.0667
```

```
      AIC      AICc      BIC
637.9001 645.7572 654.5357
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -15.01095 475.5849 294.7447 -0.4068376 3.90518
```

```
           MASE      ACF1
Training set 0.3199688 0.3444732
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.6282
beta = 1e-04
gamma = 1e-04
phi = 0.98
```

## Initial states:

```
l = 5735.1436
b = 112.8694
s = 1.0675 0.8585 1.0199 1.054
```

```
sigma: 0.047
```

```
      AIC      AICc      BIC
656.2945 663.3913 673.6712
```

## Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -5.050054 294.4371 204.511 -0.2746967 2.862779
```

```
           MASE      ACF1
Training set 0.413739 0.2225799
```

```
ETS(M,Ad,M)
```

## Call:

```
ets(y = a_95_ts, model = "MAM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.7179
beta = 6e-04
gamma = 1e-04
phi = 0.98
```

## Initial states:

```
l = 5698.899
```

```
b = 70.7586
s = 1.0139 0.9921 0.9872 1.0068
```

```
sigma: 0.0481
```

```
      AIC      AICc      BIC
734.5819 740.6930 753.0834
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE
Training set -3.585064 293.7866 215.9103 -0.1921038 3.250427
           MASE      ACF1
Training set 0.4910959 0.1805076
```

Hide

```
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_m
ase_table$forecasting_mase %>% as.character()
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_m
ase_table$forecasting_mase %>% as.numeric()
```

Hide

```
mean(model_table_quarterly_industry$mase_v)
```

```
[1] 0.4979766
```

Hide

```
sum(model_table_quarterly_industry$p_val<0.05)
```

```
[1] 9
```

Hide

```
mean(quarterly_industry_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

```
[1] 0.8506738
```

Hide

```
quarterly_industry_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1: nrow(data_quater_industry)){

  a<- read_row(data_quater_industry[i,])
  starting<- read_starting_time_quater(data_quater_industry[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting,frequency = 4)
  a_5<- subset_5(a)
  best_model_quarterly_industry = ets(a_95_ts, model="MMM",damped = TRUE)
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_quarterly_
industry,a_5)
  quarterly_industry_forecast_mase_table[nrow(quarterly_industry_forecast_mase_table)+1
,]=c(forecast_mase)}
```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5604
beta  = 4e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 5191.4801
b = 1.0073
s = 0.9638 1.0836 0.9422 1.0105
```

sigma: 0.0232

	AIC	AICc	BIC
	786.4287	791.3176	806.6823

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	10.38725	127.7564	95.91157	0.1085119	1.592771
	MASE	ACF1			
Training set	0.5862055	0.04786075			

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5818
beta  = 1e-04
gamma = 0.2496
phi   = 0.98
```

Initial states:

```
l = 6152.1193
b = 1.0112
s = 0.9566 1.1032 0.9514 0.9888
```

sigma: 0.0228

	AIC	AICc	BIC
	814.2057	819.0946	834.4592

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	18.88432	160.1649	124.2325	0.1655791	1.597432
	MASE	ACF1			
Training set	0.4420527	-0.06868068			

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8663
beta  = 1e-04
gamma = 0.1337
phi   = 0.9567
```

## Initial states:

```
l = 6116.647
b = 1.0022
s = 0.9848 1.0279 1.0079 0.9794
```

```
sigma: 0.0227
```

```
      AIC      AICc      BIC
792.1253 797.0142 812.3788
```

## Training set error measures:

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 14.64184 128.925 96.37655 0.1827013 1.52866 0.4761276
```

```
      ACF1
```

```
Training set 0.1516026
```

```
ETS(M,Md,M)
```

## Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.1573
beta  = 0.0965
gamma = 1e-04
phi   = 0.9668
```

## Initial states:

```
l = 5357.5277
b = 0.9973
s = 1.0042 0.9791 0.9547 1.062
```

```
sigma: 0.0349
```

```
      AIC      AICc      BIC
832.0294 836.9183 852.2829
```

## Training set error measures:

```
      ME      RMSE      MAE      MPE      MAPE
Training set -4.851217 180.1866 133.5882 -0.1045281 2.274985
```

```
      MASE      ACF1
```

```
Training set 0.6881212 0.03019364
```

```
ETS(M,Md,M)
```

## Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.0465
beta  = 0.0465
gamma = 1e-04
phi   = 0.9601
```



Initial states:

l = 5204.7026  
b = 1.0049  
s = 0.9297 1.1203 0.8701 1.0799

sigma: 0.0337

AIC	AICc	BIC
831.3397	836.2286	851.5932

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	15.89581	198.3803	154.0767	0.2325883	2.42473	0.7040752

ACF1

Training set 0.1016187

ETS(M,Md,M)

Call:

ets(y = a\_95\_ts, model = "MMM", damped = TRUE)

Smoothing parameters:

alpha = 0.4202  
beta = 0.0118  
gamma = 1e-04  
phi = 0.9748

Initial states:

l = 7418.1791  
b = 0.9989  
s = 1.0605 0.9496 0.9365 1.0535

sigma: 0.0288

AIC	AICc	BIC
834.7803	839.6692	855.0338

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	23.94276	191.2316	151.1452	0.2668341	2.069777

MASE ACF1

Training set 0.7783272 0.04660703

ETS(M,Md,M)

Call:

ets(y = a\_95\_ts, model = "MMM", damped = TRUE)

Smoothing parameters:

alpha = 0.3195  
beta = 0.0198  
gamma = 1e-04  
phi = 0.98

Initial states:

l = 6010.8027  
b = 1.0108  
s = 0.9932 1.0234 0.9789 1.0045

sigma: 0.0445

```

      AIC      AICc      BIC
888.7249 893.6138 908.9784

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 43.39485 308.6921 226.1157 0.366658 2.918209 0.5709854

```

```

              ACF1
Training set 0.1182725

```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.6085
beta  = 1e-04
gamma = 1e-04
phi   = 0.98

```

Initial states:

```

l = 4025.8049
b = 0.9707
s = 1.0048 1.0713 0.9753 0.9487

```

sigma: 0.0999

```

      AIC      AICc      BIC
849.2707 854.1596 869.5242

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -5.204963 222.0666 179.4134 -1.24504 7.754725

```

```

              MASE      ACF1
Training set 0.5822202 -0.03258398

```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.5599
beta  = 1e-04
gamma = 0.2514
phi   = 0.9636

```

Initial states:

```

l = 1893.8934
b = 1.0408
s = 0.9368 1.109 0.9531 1.0012

```

sigma: 0.0279

```

      AIC      AICc      BIC
748.4356 753.3245 768.6892

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE

```

```
Training set -0.3506947 88.74095 71.69128 -0.08210145 2.085571
```

```
          MASE          ACF1
```

```
Training set 0.3409281 0.0008097627
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2198
```

```
beta  = 0.2198
```

```
gamma = 0.2031
```

```
phi   = 0.9757
```

```
Initial states:
```

```
l = 8980.2648
```

```
b = 1.0026
```

```
s = 1.0006 0.9892 1.0001 1.0101
```

```
sigma: 0.0025
```

```
      AIC      AICc      BIC
```

```
642.1358 646.6256 663.0792
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE          MAPE
```

```
Training set 4.7207 21.86514 16.73183 0.04769009 0.1730296
```

```
          MASE          ACF1
```

```
Training set 0.1182999 -0.06221466
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.2309
```

```
beta  = 0.2294
```

```
gamma = 1e-04
```

```
phi   = 0.9791
```

```
Initial states:
```

```
l = 8266.1191
```

```
b = 1.0029
```

```
s = 0.9992 0.9913 1.0008 1.0087
```

```
sigma: 0.0024
```

```
      AIC      AICc      BIC
```

```
625.1316 629.6214 646.0750
```

```
Training set error measures:
```

```
          ME          RMSE          MAE          MPE          MAPE
```

```
Training set 3.425428 18.97449 12.90695 0.03737392 0.1438938
```

```
          MASE          ACF1
```

```
Training set 0.1009257 -0.03013089
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.3983
beta  = 0.1777
gamma = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 6707.5501
b = 0.9998
s = 0.9974 0.9803 1.0026 1.0197
```

```
sigma: 0.0049
```

```
      AIC      AICc      BIC
688.5078 692.9976 709.4513
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set 5.763451 31.68823 23.01547 0.08038675 0.3139077
```

```
              MASE      ACF1
Training set 0.163728 -0.02496557
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9999
beta  = 1e-04
gamma = 1e-04
phi   = 0.9404
```

```
Initial states:
```

```
l = 8922.231
b = 1.004
s = 0.9985 0.9937 1.0013 1.0066
```

```
sigma: 0.0167
```

```
      AIC      AICc      BIC
856.7122 861.2020 877.6556
```

```
Training set error measures:
```

```
              ME      RMSE      MAE      MPE      MAPE
Training set -16.15066 136.6911 71.87999 -0.1918326 0.809126
```

```
              MASE      ACF1
Training set 0.4171274 0.1234965
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.4011
beta  = 1e-04
gamma = 0.4746
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 3897.2856
```

```
b = 0.9885
```

```
s = 0.9965 0.6986 0.8615 1.4434
```

```
sigma: 0.0635
```

```
    AIC    AICc    BIC
```

```
885.8284 890.3182 906.7718
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE
```

```
Training set -0.6698829 199.1351 150.6528 -0.741061 4.746906
```

```
          MASE      ACF1
```

```
Training set 0.817654 0.0008694945
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.1148
```

```
beta = 1e-04
```

```
gamma = 0.4109
```

```
phi = 0.9689
```

```
Initial states:
```

```
l = 2459.543
```

```
b = 0.9971
```

```
s = 1.009 0.3398 0.7343 1.9168
```

```
sigma: 0.0621
```

```
    AIC    AICc    BIC
```

```
831.6123 836.1021 852.5558
```

```
Training set error measures:
```

```
          ME      RMSE      MAE      MPE      MAPE
```

```
Training set -2.140248 171.3523 111.9797 -0.2463094 4.340244
```

```
          MASE      ACF1
```

```
Training set 0.8736223 -0.01917447
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.045
```

```
beta = 1e-04
```

```
gamma = 0.4003
```

```
phi = 0.98
```

```
Initial states:
```

```
l = 3107.9675
```

```
b = 0.9966
```

```
s = 1.0286 0.4965 0.764 1.7109
```

```

sigma: 0.0544

      AIC      AICc      BIC
851.1196 855.6094 872.0631

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 1.449642 176.0518 125.3168 -0.377054 4.04876 0.8429722
              ACF1
Training set -0.03358331
ETS(M,Md,M)

Call:
ets(y = a_95_ts, model = "MMM", damped = TRUE)

Smoothing parameters:
alpha = 0.5544
beta  = 0.0359
gamma = 0.4456
phi   = 0.98

Initial states:
l = 9855.5448
b = 0.9798
s = 1.0186 1.075 0.9805 0.9259

sigma: 0.1026

      AIC      AICc      BIC
1086.058 1090.209 1107.647

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -67.66903 592.5396 416.9861 -1.962599 7.29714
              MASE      ACF1
Training set 0.5644482 0.3575563
ETS(M,Md,M)

Call:
ets(y = a_95_ts, model = "MMM", damped = TRUE)

Smoothing parameters:
alpha = 2e-04
beta  = 1e-04
gamma = 1e-04
phi   = 0.9786

Initial states:
l = 5139.7247
b = 0.9638
s = 0.8959 1.46 0.9135 0.7306

sigma: 0.1508

      AIC      AICc      BIC
480.2555 491.8344 494.2675

```

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.9190386	441.4855	332.7435	-1.644389	10.47214

  

	MASE	ACF1
Training set	0.5291334	-0.2236769

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.4134
beta  = 0.011
gamma = 1e-04
phi   = 0.8
```

Initial states:

```
l = 4722.2588
b = 1.0693
s = 1.0895 0.6583 0.7958 1.4563
```

sigma: 0.1697

AIC	AICc	BIC
1114.382	1118.533	1135.971

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-27.27646	719.1488	552.4618	-2.225481	12.97949

  

	MASE	ACF1
Training set	0.872308	0.05785595

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2967
beta  = 0.166
gamma = 0.5707
phi   = 0.918
```

Initial states:

```
l = 2138.2162
b = 1.0266
s = 1.0009 0.6735 0.8328 1.4929
```

sigma: 0.0656

AIC	AICc	BIC
905.6781	910.1679	926.6215

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.295353	244.0149	181.9238	-0.3599965	4.854752

  

	MASE	ACF1
Training set	0.4824627	-0.01926332

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.1609
beta  = 0.1599
gamma = 0.3133
phi   = 0.9325
```

Initial states:

```
l = 2857.4625
b = 1.0248
s = 1.0099 0.3961 0.7563 1.8377
```

sigma: 0.065

```
      AIC      AICc      BIC
940.7524 945.2422 961.6959
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -17.64407 411.2935 279.0838 0.06138794 4.868526
```

```
              MASE      ACF1
Training set 0.6121218 -0.01785736
```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2898
beta  = 0.1578
gamma = 0.2802
phi   = 0.9454
```

Initial states:

```
l = 2564.8475
b = 1.0296
s = 1.0141 0.4852 0.7603 1.7404
```

sigma: 0.0645

```
      AIC      AICc      BIC
931.5858 936.0756 952.5292
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -8.360648 364.8109 256.0948 -0.2529305 4.941439
```

```
              MASE      ACF1
Training set 0.5380949 -0.003373429
```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.3805
```



```
beta = 1e-04
gamma = 0.1945
phi = 0.9055
```

Initial states:

```
l = 3372.0557
b = 1.0549
s = 1.0062 1.0273 0.9775 0.989
```

sigma: 0.2564

```
      AIC      AICc      BIC
1186.362 1190.513 1207.951
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -155.5046 960.2965 649.0266 -10.474 19.9958 0.5499293
```

ACF1

Training set 0.5824651

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 1e-04
beta = 1e-04
gamma = 1e-04
phi = 0.9728
```

Initial states:

```
l = 6821.3069
b = 0.9322
s = 0.9652 1.2176 0.8506 0.9666
```

sigma: 0.4544

```
      AIC      AICc      BIC
543.1905 554.7695 557.2025
```

Training set error measures:

```
           ME      RMSE      MAE      MPE      MAPE      MASE
Training set -90.57891 1217.542 839.949 -12.12995 27.4038 0.6483974
```

ACF1

Training set 0.2316673

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.2487
beta = 1e-04
gamma = 0.2634
phi = 0.9468
```

Initial states:

```
l = 1283.4577
```

```
b = 1.0619
s = 1.0784 0.7043 0.7489 1.4685
```

```
sigma: 0.1565
```

```
      AIC      AICc      BIC
1038.596 1042.747 1060.185
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set 5.042015 392.0293 309.8262 -2.394988 12.29159
```

```
           MASE      ACF1
Training set 0.7575213 0.2489283
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9562
beta   = 1e-04
gamma  = 0.0438
phi    = 0.98
```

```
Initial states:
```

```
l = 1985.8665
b = 1.045
s = 0.9685 1.0726 1.0131 0.9458
```

```
sigma: 0.0284
```

```
      AIC      AICc      BIC
961.8915 965.8201 983.9384
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -0.901728 180.4627 127.7307 -0.05349526 2.125536
```

```
           MASE      ACF1
Training set 0.2563975 -0.1243671
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9631
beta   = 1e-04
gamma  = 1e-04
phi    = 0.9799
```

```
Initial states:
```

```
l = 1649.1945
b = 1.0422
s = 0.9559 1.0803 1.0215 0.9423
```

```
sigma: 0.0314
```

```
      AIC      AICc      BIC
```

947.0060 950.9346 969.0530

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-1.870549	163.0436	113.2523	-0.0402041	2.31337
	MASE	ACF1			
Training set	0.2905443	-0.1608883			

ETS(M,Md,M)

Call:

ets(y = a\_95\_ts, model = "MMM", damped = TRUE)

Smoothing parameters:

alpha = 0.9969  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.9712

Initial states:

l = 1669.1345  
 b = 1.0456  
 s = 1.0149 0.997 1.0064 0.9817

sigma: 0.1361

AIC	AICc	BIC
1142.077	1146.006	1164.124

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	17.42485	730.7146	333.1878	-0.404112	6.687929
	MASE	ACF1			
Training set	0.3662362	0.04693168			

ETS(M,Md,M)

Call:

ets(y = a\_95\_ts, model = "MMM", damped = TRUE)

Smoothing parameters:

alpha = 0.4642  
 beta = 1e-04  
 gamma = 1e-04  
 phi = 0.9723

Initial states:

l = 1512.9749  
 b = 1.0481  
 s = 1.1601 0.9058 0.9535 0.9805

sigma: 0.1037

AIC	AICc	BIC
1079.675	1083.604	1101.722

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-4.302618	307.7539	224.8372	-0.7592123	6.468487
	MASE	ACF1			

Training set 0.6079289 0.1791472

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7899

beta = 1e-04

gamma = 1e-04

phi = 0.98

Initial states:

l = 1960.3767

b = 1.0443

s = 0.9974 1.0235 0.9962 0.9829

sigma: 0.0407

AIC AICc BIC

1007.735 1011.663 1029.782

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	14.51288	252.3099	153.5226	0.04847222	2.577588

	MASE	ACF1
Training set	0.2828296	-0.02010312

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9897

beta = 1e-04

gamma = 1e-04

phi = 0.9784

Initial states:

l = 1570.3749

b = 1.0456

s = 0.9766 1.0364 1.0195 0.9675

sigma: 0.03

AIC AICc BIC

937.6957 941.6242 959.7426

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-4.70233	140.764	101.2964	-0.1024714	2.238041

	MASE	ACF1
Training set	0.2667033	-0.09843223

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8951
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

## Initial states:

```
l = 6015.8089
b = 0.9899
s = 0.9922 1.0051 1.0286 0.9741
```

```
sigma: 0.111
```

```
      AIC      AICc      BIC
1117.139 1120.999 1139.334
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -22.37726 439.679 301.4534 -1.068484 7.49678 0.6261933
```

```
      ACF1
```

```
Training set -0.005890588
```

```
ETS(M,Md,M)
```

## Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.8587
beta  = 1e-04
gamma = 1e-04
phi   = 0.9795
```

## Initial states:

```
l = 5475.4879
b = 0.9924
s = 0.9653 0.9529 1.0594 1.0225
```

```
sigma: 0.1298
```

```
      AIC      AICc      BIC
1119.984 1123.843 1142.179
```

## Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set -29.92478 381.0367 280.719 -1.607659 9.08882 0.5166955
```

```
      ACF1
```

```
Training set 0.118866
```

```
ETS(M,Md,M)
```

## Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9066
beta  = 0.0571
gamma = 1e-04
phi   = 0.8026
```

```

Initial states:
  l = 4028.3922
  b = 1.0196
  s = 0.9563 0.9034 1.0541 1.0862

sigma: 0.1711

      AIC      AICc      BIC
1076.758 1080.618 1098.953

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -57.08575 375.2768 282.5853 -3.644558 14.12643
              MASE      ACF1
Training set 0.5557916 0.08106465
ETS(M,Md,M)

Call:
ets(y = a_95_ts, model = "MMM", damped = TRUE)

Smoothing parameters:
  alpha = 0.8
  beta  = 1e-04
  gamma = 1e-04
  phi   = 0.98

Initial states:
  l = 6676.6811
  b = 1.0018
  s = 0.9384 0.9567 1.0443 1.0607

sigma: 0.1393

      AIC      AICc      BIC
1147.030 1150.890 1169.225

Training set error measures:
              ME      RMSE      MAE      MPE      MAPE
Training set -89.93001 511.1149 379.0172 -3.363241 10.30411
              MASE      ACF1
Training set 0.4912333 0.2208503
ETS(M,Md,M)

Call:
ets(y = a_95_ts, model = "MMM", damped = TRUE)

Smoothing parameters:
  alpha = 0.2569
  beta  = 1e-04
  gamma = 0.3399
  phi   = 0.9781

Initial states:
  l = 9435.0441
  b = 0.9826
  s = 0.8631 1.0052 1.028 1.1037

sigma: 0.0965

```

```

      AIC      AICc      BIC
1165.865 1169.725 1188.060

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -27.17408 557.448 401.4802 -0.9366354 6.641662

```

```

           MASE      ACF1
Training set 0.8027096 0.1366712

```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.9998
beta  = 1e-04
gamma = 2e-04
phi   = 0.9655

```

Initial states:

```

l = 3211.9076
b = 1.0175
s = 0.9563 0.9773 1.0437 1.0228

```

sigma: 0.0863

```

      AIC      AICc      BIC
1081.515 1085.375 1103.710

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE
Training set -4.859903 279.8649 203.1329 -0.4816935 5.791534

```

```

           MASE      ACF1
Training set 0.4793519 0.06353231

```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.5014
beta  = 1e-04
gamma = 1e-04
phi   = 0.9792

```

Initial states:

```

l = 3159.6846
b = 1.0396
s = 0.9414 1.023 1.1113 0.9242

```

sigma: 0.2321

```

      AIC      AICc      BIC
1093.302 1097.791 1114.245

```

Training set error measures:

```

           ME      RMSE      MAE      MPE      MAPE

```

```
Training set -128.9523 941.0181 698.0611 -7.067644 18.04696
```

```
      MASE      ACF1
```

```
Training set 0.649683 0.0789697
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9074
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
phi   = 0.9781
```

```
Initial states:
```

```
l = 10056.1456
```

```
b = 1.0079
```

```
s = 0.9752 0.9371 1.0913 0.9964
```

```
sigma: 0.1965
```

```
      AIC      AICc      BIC
```

```
903.7068 909.4963 922.6250
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -95.0278 1362.823 809.0517 -6.010857 16.49896
```

```
      MASE      ACF1
```

```
Training set 0.4607531 0.04097046
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.5843
```

```
beta  = 1e-04
```

```
gamma = 1e-04
```

```
phi   = 0.9656
```

```
Initial states:
```

```
l = 3453.1847
```

```
b = 1.0337
```

```
s = 0.9432 1.0261 0.9534 1.0773
```

```
sigma: 0.2088
```

```
      AIC      AICc      BIC
```

```
993.4993 998.3882 1013.7528
```

```
Training set error measures:
```

```
      ME      RMSE      MAE      MPE      MAPE
```

```
Training set -33.71307 755.1835 615.5189 -3.446918 15.58644
```

```
      MASE      ACF1
```

```
Training set 0.6689864 0.03786214
```

```
ETS(M,Md,M)
```

```
Call:
```



```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.36
beta  = 1e-04
gamma = 2e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 4349.2191
b = 1.0087
s = 1.0496 0.8948 1.0073 1.0483
```

```
sigma: 0.0586
```

```
      AIC      AICc      BIC
940.9986 945.4884 961.9421
```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 40.74442 281.6322 219.3609 0.3742332 4.217868
              MASE      ACF1
Training set 0.7692534 0.1143986
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.6691
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

```
Initial states:
```

```
l = 1943.3883
b = 1.0311
s = 1.036 0.8964 1.0188 1.0487
```

```
sigma: 0.0433
```

```
      AIC      AICc      BIC
868.9957 873.4854 889.9391
```

```
Training set error measures:
```

```

              ME      RMSE      MAE      MPE      MAPE
Training set 11.74247 186.0035 115.5801 0.1671994 2.752563
              MASE      ACF1
Training set 0.3293885 -0.07468767
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.9998
beta  = 0.1965
gamma = 1e-04
```

```
phi = 0.868
```

```
Initial states:
```

```
l = 2725.1424
```

```
b = 1.0295
```

```
s = 1.0094 0.9992 0.9985 0.9928
```

```
sigma: 0.0745
```

```
AIC      AICc      BIC
```

```
618.6612 625.9945 635.7969
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set 36.67372 223.2369 173.7289 0.6417512 4.902397
```

```
MASE      ACF1
```

```
Training set 0.3217202 0.01639598
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.4044
```

```
beta = 1e-04
```

```
gamma = 1e-04
```

```
phi = 0.978
```

```
Initial states:
```

```
l = 3027.3438
```

```
b = 1.0167
```

```
s = 1.0208 0.9697 1.0927 0.9167
```

```
sigma: 0.0585
```

```
AIC      AICc      BIC
```

```
916.8966 921.3864 937.8400
```

```
Training set error measures:
```

```
ME      RMSE      MAE      MPE      MAPE
```

```
Training set -14.39341 241.315 185.561 -0.5149631 4.319526
```

```
MASE      ACF1
```

```
Training set 0.6682582 0.05897772
```

```
ETS(M,Md,M)
```

```
Call:
```

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

```
Smoothing parameters:
```

```
alpha = 0.0749
```

```
beta = 0.0749
```

```
gamma = 1e-04
```

```
phi = 0.9731
```

```
Initial states:
```

```
l = 3731.924
```

```
b = 1.034
```

```
s = 1.0276 0.9642 1.0805 0.9277
```

sigma: 0.0761

	AIC	AICc	BIC
	598.7753	606.9234	615.1511

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	38.56917	326.2591	234.9407	0.07688566	4.8924	0.6028667

ACF1

Training set 0.1460688

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
beta = 1e-04
gamma = 1e-04
phi = 0.98
```

Initial states:

```
l = 4041.0219
b = 1.0193
s = 1.082 0.7874 1.0514 1.0792
```

sigma: 0.0528

	AIC	AICc	BIC
	575.5204	583.6686	591.8963

Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-8.294171	264.8298	196.2033	-0.2449325	3.574226

MASE ACF1

Training set 0.4125487 0.03947852

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7003
beta = 1e-04
gamma = 1e-04
phi = 0.9685
```

Initial states:

```
l = 5101.463
b = 1.0224
s = 0.953 1.0113 1.0204 1.0153
```

sigma: 0.0724

	AIC	AICc	BIC
	746.1303	752.6009	764.1969

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	22.66572	494.0467	415.647	0.01507652	5.53161	0.6174466

ACF1

Training set 0.1058162

ETS(M,Md,M)

## Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9999
beta  = 0.0525
gamma = 1e-04
phi   = 0.8946
```

## Initial states:

```
l = 1658.124
b = 1.1415
s = 1.0829 0.9849 1.0145 0.9177
```

```
sigma: 0.1096
```

AIC	AICc	BIC
673.9670	681.3003	691.1027

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-18.75832	520.151	391.9163	-0.5990382	7.912857

MASE ACF1

Training set 0.3776276 0.216601

ETS(M,Md,M)

## Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

## Smoothing parameters:

```
alpha = 0.9955
beta  = 0.0017
gamma = 1e-04
phi   = 0.9776
```

## Initial states:

```
l = 2699.5254
b = 1.0483
s = 1.093 1.0256 1.0037 0.8777
```

```
sigma: 0.0864
```

AIC	AICc	BIC
648.7572	656.0905	665.8929

## Training set error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-18.06515	390.239	293.4665	-0.9092159	6.341453

MASE ACF1

Training set 0.3668331 0.1462228

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6159
beta  = 0.067
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3026.3325
b = 1.0073
s = 1.1333 0.9926 1.0029 0.8712
```

sigma: 0.0592

```
      AIC      AICc      BIC
608.7216 616.0549 625.8573
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 28.11267 188.3107 154.0596 0.5408952 4.121532 0.450609
```

ACF1

```
Training set -0.03208213
```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.6913
beta  = 6e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3201.704
b = 1.0289
s = 0.9719 0.957 1.0425 1.0286
```

sigma: 0.1019

```
      AIC      AICc      BIC
1088.832 1092.983 1110.421
```

Training set error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 23.91359 594.0132 374.5385 -0.5225234 6.989099
```

MASE ACF1

```
Training set 0.4845259 0.04976805
```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9999
```

```

beta = 1e-04
gamma = 1e-04
phi = 0.9705

```

Initial states:

```

l = 5833.1894
b = 1.0309
s = 0.995 1.0197 0.9655 1.0198

```

sigma: 0.067

```

      AIC      AICc      BIC
638.5993 646.4564 655.2349

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set -44.13489 477.0264 297.0766 -0.7993807 3.956413

```

```

              MASE      ACF1
Training set 0.3225004 0.3475052

```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.6383
beta = 1e-04
gamma = 1e-04
phi = 0.962

```

Initial states:

```

l = 5735.2386
b = 1.0176
s = 1.0684 0.857 1.0199 1.0547

```

sigma: 0.0475

```

      AIC      AICc      BIC
656.9820 664.0788 674.3587

```

Training set error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 22.03624 295.6327 203.3311 0.1172439 2.816356

```

```

              MASE      ACF1
Training set 0.4113521 0.2138134

```

ETS(M,Md,M)

Call:

```
ets(y = a_95_ts, model = "MMM", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.6648
beta = 1e-04
gamma = 1e-04
phi = 0.98

```

Initial states:

```

l = 5730.7321

```

```
b = 1.0119
s = 1.0104 0.9934 0.9894 1.0068
```

```
sigma: 0.0485
```

```
      AIC      AICc      BIC
735.3650 741.4761 753.8665
```

```
Training set error measures:
```

```
           ME      RMSE      MAE      MPE      MAPE
Training set -12.69834 298.1705 214.6698 -0.3344447 3.236027
           MASE      ACF1
Training set 0.4882742 0.2205366
```

Hide

```
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_m
ase_table$forecasting_mase %>% as.character()
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_m
ase_table$forecasting_mase %>% as.numeric()
```

Hide

```
mean(model_table_quarterly_industry$mase_v)
```

```
[1] 0.4979766
```

Hide

```
sum(model_table_quarterly_industry$p_val<0.05)
```

```
[1] 9
```

Hide

```
mean(quarterly_industry_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

```
[1] 0.8440501
```

Hide

```
Quater_table[nrow(Quater_table)+1 ,] =c("industry","ETS(MMdM)",mean(model_table_quate
rly_industry$mase_v),mean(quarterly_industry_forecast_mase_table$forecasting_mase,na.r
m=TRUE),sum(model_table_quarterly_industry$p_val<0.05))
```

Hide

```

quarterly_industry_forecast_mase_table<-data.frame( forecasting_mase = NA)
for (i in 1: nrow(data_quater_industry)){

  a<- read_row(data_quater_industry[i,])
  starting<- read_starting_time_quater(data_quater_industry[i,])
  a_95<- subset_95(a)
  a_95_ts<- ts(a_95, start = starting,frequency = 4)
  a_5<- subset_5(a)
  best_model_quaterly_industry = hw(a_95_ts, seasonal = "multiplicative",damped = TRU
E,h=nrow(a_5))#ets(a_95_ts, model="MAM")
  forecast_mase<- mase_trycatch_forecasting_2(as.vector(a_95_ts),best_model_quaterly_
industry,a_5)
  quarterly_industry_forecast_mase_table[nrow(quarterly_industry_forecast_mase_table)+1
,]=c(forecast_mase)}

```

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```

alpha = 0.5189
beta  = 0.0161
gamma = 0.2632
phi   = 0.98

```

Initial states:

```

l = 5190.249
b = 30.4984
s = 0.9581 1.0681 0.9485 1.0254

```

sigma: 0.0235

```

      AIC      AICc      BIC
787.6400 792.5289 807.8936

```

Error measures:

```

              ME      RMSE      MAE      MPE      MAPE
Training set 15.71613 127.3579 96.54664 0.2136883 1.602793
              MASE      ACF1
Training set 0.5900871 -0.01224264

```

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	6862.447	6656.129	7068.764	6546.911	7177.982
1993 Q2	6579.768	6355.542	6803.993	6236.844	6922.691
1993 Q3	7606.458	7318.546	7894.369	7166.135	8046.781



3 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.5213

beta = 0.0426

gamma = 0.2769

phi = 0.98

Initial states:

l = 6153.3354

b = 71.8079

s = 0.9548 1.1039 0.9548 0.9865

sigma: 0.023

AIC	AICc	BIC
815.3761	820.2650	835.6296

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	12.78552	160.3579	126.3549	0.1262178	1.637377
	MASE	ACF1			
Training set	0.4496048	-0.03803965			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	9149.176	8879.003	9419.350	8735.982	9562.371
1993 Q2	9317.552	9001.967	9633.137	8834.906	9800.198
1993 Q3	10797.725	10384.847	11210.604	10166.282	11429.169

3 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8109

beta = 0.0128

gamma = 0.1891

phi = 0.98

Initial states:

l = 6116.4944

b = 1.6858

s = 0.9837 1.0246 1.0083 0.9834

sigma: 0.0228

AIC	AICc	BIC
792.4409	797.3298	812.6944

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	16.70112	128.1644	96.76267	0.2222927	1.540475

	MASE	ACF1
Training set	0.4780351	0.1860042

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	6838.857	6639.236	7038.478	6533.563	7144.151
1993 Q2	7136.728	6866.962	7406.494	6724.156	7549.300
1993 Q3	7456.690	7121.385	7791.995	6943.885	7969.495

3 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.1193

beta = 0.1193

gamma = 1e-04

phi = 0.9647

Initial states:

l = 5357.3823

b = 26.141

s = 1.0073 0.9763 0.9547 1.0617

sigma: 0.0355

AIC	AICc	BIC
833.8524	838.7413	854.1059

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-8.046476	181.1044	131.9913	-0.1739406	2.254315
	MASE	ACF1			
Training set	0.6798957	0.05726704			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	6705.575	6400.919	7010.231	6239.644	7171.507
1993 Q2	5968.785	5689.833	6247.738	5542.164	6395.406
1993 Q3	6043.428	5744.104	6342.752	5585.652	6501.205
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2146

beta = 0.0241

gamma = 1e-04

phi = 0.98

Initial states:

l = 5204.6917

b = 40.7681

s = 0.9326 1.1199 0.8702 1.0773

sigma: 0.0342

AIC	AICc	BIC
833.1266	838.0155	853.3801

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	13.63324	202.5384	154.5834	0.1386022	2.422987

	MASE	ACF1
Training set	0.7063907	0.02424971

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	7690.564	7353.177	8027.951	7174.576	8206.553
1993 Q2	6232.189	5951.138	6513.241	5802.358	6662.020
1993 Q3	8045.895	7671.549	8420.241	7473.383	8618.408
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4337

beta = 1e-04

gamma = 1e-04

phi = 0.9768

Initial states:

l = 7418.083

b = -2.1554

s = 1.0611 0.9497 0.9354 1.0538

sigma: 0.0288

AIC AICc BIC

834.7166 839.6054 854.9701

Error measures:

ME RMSE MAE MPE MAPE

Training set 20.27023 191.0744 151.8061 0.2162307 2.081281

MASE ACF1

Training set 0.7817307 0.05089017

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1993 Q1	8271.565	7966.608	8576.522	7805.173	8737.956
1993 Q2	7342.067	7046.983	7637.151	6890.774	7793.360
1993 Q3	7454.164	7131.687	7776.642	6960.978	7947.351
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3669

beta = 0.0199

gamma = 2e-04

phi = 0.98

Initial states:

l = 6010.3

b = 81.0362

s = 0.9957 1.0259 0.9788 0.9996

sigma: 0.0447

AIC AICc BIC

889.1581 894.0470 909.4116

Error measures:

ME RMSE MAE MPE MAPE

Training set 42.62085 309.0215 225.3824 0.3413204 2.916225

MASE ACF1

Training set 0.5691336 0.08645761

Forecasts:

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1993 Q1	9971.021	9399.958	10542.08	9097.656	10844.39
1993 Q2	9827.573	9224.509	10430.64	8905.267	10749.88
1993 Q3	10366.383	9687.023	11045.74	9327.391	11405.38
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.6339

beta = 1e-04

gamma = 8e-04

phi = 0.98

Initial states:

l = 4021.6143

b = -63.4079

s = 0.9969 1.0601 0.9835 0.9595

sigma: 0.1008

	AIC	AICc	BIC
	850.6756	855.5645	870.9291

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-19.53929	222.6298	179.8665	-1.653717	7.792862

	MASE	ACF1
Training set	0.5836905	-0.05123694

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	1139.970	992.7415	1287.199	914.8032	1365.138
1993 Q2	1148.966	972.1291	1325.804	878.5170	1419.416
1993 Q3	1217.868	1003.5446	1432.191	890.0888	1545.646
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4973

beta = 1e-04

gamma = 0.3014

phi = 0.9756

Initial states:

l = 1871.4125

b = 96.2126

s = 0.9317 1.1125 0.9598 0.996

sigma: 0.0279

AIC AICc BIC

748.3205 753.2094 768.5740

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-0.1690988	87.12606	69.2723	-0.1171782	2.023692

	MASE	ACF1
Training set	0.3294246	0.02208814

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	4551.161	4388.575	4713.748	4302.508	4799.815
1993 Q2	4502.492	4323.004	4681.979	4227.990	4776.993
1993 Q3	5497.032	5257.463	5736.601	5130.643	5863.421

3 rows



Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.238

beta = 0.238

gamma = 0.214

phi = 0.976

Initial states:

l = 8980.0835

b = 38.5289

s = 1 0.989 1.0003 1.0107

sigma: 0.0026

AIC	AICc	BIC
646.4648	650.9546	667.4083

Error measures:

	ME	RMSE	MAE	MPE	MAPE	MASE
Training set	3.80218	22.5661	16.79323	0.03730156	0.1740423	0.118734

ACF1

Training set -0.03968415

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q1	11245.47	11207.88	11283.05	11187.99	11302.95
1992 Q2	11199.78	11158.36	11241.21	11136.43	11263.14
1992 Q3	11126.51	11077.75	11175.26	11051.94	11201.07
1992 Q4	11245.16	11184.86	11305.46	11152.94	11337.39

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2516

beta = 0.2516

gamma = 1e-04

phi = 0.976

Initial states:

l = 8265.7885

b = 35.8248

s = 0.9993 0.9912 1.0009 1.0087

sigma: 0.0025

AIC AICc BIC

629.0107 633.5005 649.9541

Error measures:

ME RMSE MAE MPE MAPE

Training set 3.209953 19.55514 13.27064 0.03403677 0.1482446

MASE ACF1

Training set 0.1037695 -0.01731421

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1992 Q1	10312.90	10280.49	10345.31	10263.33	10362.46
1992 Q2	10270.75	10234.65	10306.86	10215.53	10325.97
1992 Q3	10207.42	10164.33	10250.51	10141.52	10273.31
1992 Q4	10325.84	10271.92	10379.76	10243.38	10408.30

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4773

beta = 0.2353

gamma = 1e-04

phi = 0.9799

Initial states:

l = 6707.5688

b = 33.1871

s = 0.997 0.9803 1.0028 1.0198

sigma: 0.0052

AIC AICc BIC

695.7525 700.2423 716.6959

Error measures:

ME RMSE MAE MPE MAPE

Training set 2.61016 33.49811 23.0805 0.03369257 0.3168791

MASE ACF1

Training set 0.1641905 -0.03139961

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q1	8901.449	8842.333	8960.564	8811.040	8991.858
1992 Q2	8783.728	8712.182	8855.273	8674.308	8893.147
1992 Q3	8615.968	8527.662	8704.274	8480.916	8751.020
1992 Q4	8791.818	8679.186	8904.450	8619.562	8964.074
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9648

beta = 0.009

gamma = 0.0162

phi = 0.8979

Initial states:

l = 8956.7587

b = 119.785

s = 0.9979 0.9946 1.0022 1.0052

sigma: 0.0172

AIC	AICc	BIC
860.0414	864.5312	880.9849

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-23.81457	140.8838	77.84583	-0.2762468	0.8770051
	MASE	ACF1			
Training set	0.4517478	0.1335365			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q1	8552.082	8363.857	8740.308	8264.216	8839.948
1992 Q2	8526.868	8264.918	8788.818	8126.250	8927.486
1992 Q3	8466.437	8148.434	8784.439	7980.094	8952.780
1992 Q4	8501.318	8132.240	8870.396	7936.862	9065.774

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.3949

beta = 1e-04

gamma = 0.3982

phi = 0.8423

Initial states:

l = 3769.56

b = 35.6055

s = 0.9986 0.7157 0.8696 1.4161

sigma: 0.0641

AIC AICc BIC

888.7939 893.2837 909.7373

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-43.38968	189.5184	145.7987	-2.177581	4.809736

	MASE	ACF1
Training set	0.7913089	-0.01615265

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q1	3563.567	3270.747	3856.387	3115.738	4011.396
1992 Q2	1735.234	1581.885	1888.582	1500.707	1969.760
1992 Q3	1394.415	1263.096	1525.734	1193.580	1595.250
1992 Q4	2704.069	2434.623	2973.515	2291.988	3116.151

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.0225

beta = 0.0225

gamma = 0.2578

phi = 0.9119

Initial states:

l = 2515.7422

b = 15.8547

s = 1.0149 0.396 0.7292 1.8599

sigma: 0.0715

AIC	AICc	BIC
849.7680	854.2578	870.7115

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-5.753498	169.2866	120.984	-1.257541	5.249335

  

	MASE	ACF1
Training set	0.9438705	0.007570972

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q1	4228.9066	3841.3818	4616.4314	3636.2386	4821.5747
1992 Q2	1591.7055	1445.6981	1737.7128	1368.4065	1815.0044
1992 Q3	790.4947	717.8271	863.1623	679.3592	901.6302
1992 Q4	2674.8117	2428.0592	2921.5641	2297.4364	3052.1870

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.0153

beta = 0.0153

gamma = 0.203

phi = 0.8704

Initial states:

l = 3062.1435

b = 13.9348

s = 1.0382 0.5033 0.7619 1.6967

sigma: 0.0577

	AIC	AICc	BIC
	859.8484	864.3382	880.7919

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-28.30877	170.9132	124.6094	-1.697834	4.29855
	MASE	ACF1			
Training set	0.8382135	-0.02705047			

Forecasts:

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1992 Q1	4716.964	4368.076	5065.852	4183.385	5250.542
1992 Q2	2004.237	1855.925	2152.550	1777.413	2231.062
1992 Q3	1291.531	1195.866	1387.196	1145.224	1437.838
1992 Q4	3104.922	2874.581	3335.263	2752.646	3457.198

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.6908

beta = 0.0714

gamma = 0.3092

phi = 0.8897

Initial states:

l = 9855.7009

b = -37.4302

s = 1.0181 1.0614 0.9854 0.9352

sigma: 0.1083

AIC AICc BIC

1093.348 1097.498 1114.936

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-90.87557	577.2495	420.1666	-2.234651	7.635886

	MASE	ACF1
Training set	0.5687534	0.1847162

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q1	2382.970	2052.091	2713.849	1876.935	2889.005
1992 Q2	1640.898	1352.328	1929.469	1199.567	2082.229
1992 Q3	1600.630	1261.119	1940.141	1081.393	2119.867
1992 Q4	2297.534	1728.018	2867.049	1426.535	3168.533

4 rows



Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.1231

beta = 1e-04

gamma = 1e-04

phi = 0.9677

Initial states:

l = 5134.5539

b = -136.6532

s = 0.9078 1.4216 0.9335 0.7371

sigma: 0.159

AIC	AICc	BIC
484.8501	496.4291	498.8621

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-73.10398	465.4183	361.8562	-4.203024	11.75455
	MASE	ACF1			
Training set	0.5754288	-0.2140531			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q3	3141.528	2501.328	3781.728	2162.426	4120.63
1992 Q4	1961.122	1558.232	2364.012	1344.955	2577.29
2 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2771

beta = 0.009

gamma = 3e-04

phi = 0.8

Initial states:

l = 4494.2985

b = 87.9868

s = 1.0852 0.6757 0.7961 1.443

sigma: 0.1738

AIC AICc BIC

1116.395 1120.546 1137.984

Error measures:

ME RMSE MAE MPE MAPE

Training set 39.47373 667.3384 537.1613 -1.425231 13.14416

MASE ACF1

Training set 0.8481494 0.1440241

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1992 Q1	7882.291	6126.700	9637.883	5197.346	10567.237
1992 Q2	4362.024	3350.586	5373.462	2815.164	5908.885
1992 Q3	3710.975	2816.256	4605.694	2342.621	5079.329
1992 Q4	5973.415	4478.051	7468.779	3686.453	8260.377
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2071

beta = 0.2071

gamma = 0.5841

phi = 0.8409

Initial states:

l = 2095.0917

b = 125.7214

s = 1.0108 0.664 0.8461 1.4791

sigma: 0.0675

AIC AICc BIC

908.5775 913.0673 929.5210

Error measures:

ME RMSE MAE MPE MAPE

Training set 17.23562 241.336 186.8885 -0.008385868 5.05812

MASE ACF1

Training set 0.4956291 0.0364257

Forecasts:

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1992 Q1	5190.214	4741.412	5639.016	4503.831	5876.597
1992 Q2	2354.598	2133.847	2575.350	2016.988	2692.208
1992 Q3	1701.051	1518.825	1883.277	1422.360	1979.742
1992 Q4	3633.229	3177.816	4088.643	2936.735	4329.724

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.1335

beta = 0.1335

gamma = 0.3084

phi = 0.886

Initial states:

l = 2825.206

b = 185.3651

s = 1.0522 0.3571 0.7776 1.8131

sigma: 0.0724

AIC AICc BIC

953.1515 957.6413 974.0950

Error measures:

ME RMSE MAE MPE MAPE MASE

Training set 1.807151 399.168 285.1988 0.4482063 5.445749 0.625534

ACF1

Training set 0.01624257

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1992 Q1	11209.982	10170.093	12249.871	9619.609	12800.355
1992 Q2	4678.263	4229.116	5127.409	3991.352	5365.173
1992 Q3	2723.140	2444.305	3001.975	2296.699	3149.581
1992 Q4	7407.627	6578.570	8236.683	6139.694	8675.559
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.1797

beta = 0.1795

gamma = 0.2127

phi = 0.8231

Initial states:

l = 2445.9641

b = 188.5437

s = 1.0564 0.4456 0.7606 1.7374

sigma: 0.0716

AIC AICc BIC

943.0103 947.5001 963.9537

Error measures:

ME RMSE MAE MPE MAPE

Training set 25.42297 345.9668 258.3832 0.5819491 5.458546

MASE ACF1

Training set 0.5429033 0.04894088

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1992 Q1	8947.213	8126.268	9768.159	7691.685	10202.742
1992 Q2	3795.514	3425.283	4165.744	3229.295	4361.732
1992 Q3	2439.448	2175.521	2703.375	2035.806	2843.089
1992 Q4	5844.733	5126.953	6562.512	4746.984	6942.482
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7224

beta = 0.1193

gamma = 0.0551

phi = 0.902

Initial states:

l = 3217.3708

b = 334.8982

s = 1.0161 1.0081 0.9327 1.0432

sigma: 0.4045

AIC	AICc	BIC
1237.239	1241.390	1258.827

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-35.77743	746.4807	567.3428	-4.17449	17.97671
	MASE	ACF1			
Training set	0.4807175	0.04432392			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q1	2182.472	1051.2239	3313.719	452.3777	3912.565
1992 Q2	1705.557	509.0914	2902.023	-124.2792	3535.393
1992 Q3	1901.940	195.9448	3607.934	-707.1542	4511.033
1992 Q4	2095.773	-223.3647	4414.911	-1451.0421	5642.589

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2721

beta = 1e-04

gamma = 6e-04

phi = 0.9735

Initial states:

l = 6173.5188

b = -211.4828

s = 1.0725 1.2517 0.8809 0.7949

sigma: 0.6019

AIC	AICc	BIC
559.2315	570.8104	573.2434

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-65.53945	1144.745	702.4445	-9.621704	22.25115

	MASE	ACF1
Training set	0.542251	0.03546314

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q3	1646.979	376.4551	2917.503	-296.1196	3590.077
1992 Q4	1312.046	242.4530	2381.639	-323.7553	2947.847
2 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2923

beta = 1e-04

gamma = 1e-04

phi = 0.9798

Initial states:

l = 1162.5878

b = 95.1587

s = 1.1003 0.5877 0.7764 1.5356

sigma: 0.158

AIC AICc BIC

1041.981 1046.132 1063.570

Error measures:

ME RMSE MAE MPE MAPE

Training set -51.45349 357.645 285.5983 -4.168306 12.28604

MASE ACF1

Training set 0.6982843 0.2490468

Forecasts:

	<b>Point Forecast</b>	<b>Lo 80</b>	<b>Hi 80</b>	<b>Lo 95</b>	<b>Hi 95</b>
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1992 Q1	5137.811	4097.676	6177.946	3547.062	6728.560
1992 Q2	2617.231	2064.974	3169.487	1772.628	3461.834
1992 Q3	1995.370	1558.097	2432.644	1326.618	2664.123
1992 Q4	3762.412	2908.689	4616.134	2456.755	5068.068

4 rows



Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.858
beta  = 0.0703
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1969.5164
b = 126.7314
s = 0.9704 1.0621 1.0163 0.9512
```

sigma: 0.0308

```
      AIC      AICc      BIC
972.3432 976.2718 994.3901
```

Error measures:

```
      ME      RMSE      MAE      MPE      MAPE      MASE
Training set 19.6067 175.7815 126.519 0.2598216 2.242464 0.2539653
      ACF1
Training set -0.006408156
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1992 Q4	9552.844	9175.613	9930.074	8975.920	10129.77
1993 Q1	9438.690	8931.853	9945.527	8663.550	10213.83
1993 Q2	10162.152	9488.849	10835.455	9132.424	11191.88
1993 Q3	10699.662	9865.074	11534.250	9423.270	11976.05
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8515

beta = 0.0205

gamma = 1e-04

phi = 0.98

Initial states:

l = 1607.6683

b = 113.8092

s = 0.959 1.0755 1.0216 0.9438

sigma: 0.0333

AIC AICc BIC

954.5663 958.4949 976.6132

Error measures:

ME RMSE MAE MPE MAPE

Training set 21.18752 162.0037 117.3928 0.2571107 2.483627

MASE ACF1

Training set 0.3011665 -0.02595293

Forecasts:

	<b>Point Forecast</b>	<b>Lo 80</b>	<b>Hi 80</b>	<b>Lo 95</b>	<b>Hi 95</b>
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1992 Q4	7176.603	6870.392	7482.814	6708.293	7644.912
1993 Q1	7107.417	6706.042	7508.793	6493.566	7721.268
1993 Q2	7740.154	7214.860	8265.448	6936.786	8543.522
1993 Q3	8197.487	7558.806	8836.168	7220.709	9174.265

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.001

gamma = 1e-04

phi = 0.9713

Initial states:

l = 1666.0501

b = 82.0611

s = 1.0206 0.9623 1.0238 0.9933

sigma: 0.1417

AIC	AICc	BIC
1146.497	1150.426	1168.544

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	53.13061	705.3473	367.1061	0.3324292	7.604685
	MASE	ACF1			
Training set	0.4035188	0.06476806			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1992 Q4	7935.846	6494.578	9377.114	5731.617	10140.08
1993 Q1	7735.826	5739.765	9731.886	4683.114	10788.54
1993 Q2	7986.857	5451.026	10522.688	4108.638	11865.08
1993 Q3	7518.865	4749.261	10288.468	3283.122	11754.61

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.7126

beta = 0.0194

gamma = 1e-04

phi = 0.98

Initial states:

l = 1453.2948

b = 103.1206

s = 1.1247 0.9285 0.9708 0.976

sigma: 0.1087

AIC AICc BIC

1085.518 1089.447 1107.565

Error measures:

ME RMSE MAE MPE MAPE

Training set 17.63735 275.3591 180.2847 -0.3902853 5.708176

MASE ACF1

Training set 0.4874651 0.004149809

Forecasts:

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1992 Q4	6733.031	5794.851	7671.210	5298.209	8167.852
1993 Q1	5888.008	4871.940	6904.076	4334.066	7441.950
1993 Q2	5901.733	4712.665	7090.802	4083.210	7720.257
1993 Q3	5686.544	4391.535	6981.553	3705.999	7667.090

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.783
beta  = 0.0631
gamma = 6e-04
phi   = 0.98
```

Initial states:

```
l = 1926.3797
b = 125.2655
s = 1.0074 1.02 0.9917 0.9809
```

sigma: 0.0435

```
      AIC      AICc      BIC
1016.119 1020.047 1038.166
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 28.85392 252.6338 165.4783 0.329239 2.859387 0.3048553
              ACF1
Training set -0.01481269
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1992 Q4	10394.71	9815.196	10974.22	9508.420	11281.00
1993 Q1	10229.96	9485.847	10974.07	9091.938	11367.98
1993 Q2	10448.09	9527.832	11368.36	9040.674	11855.52
1993 Q3	10851.65	9738.806	11964.50	9149.700	12553.61
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9041
beta  = 0.0386
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 1557.6853
b = 106.6586
s = 0.9798 1.027 1.0211 0.9721
```

sigma: 0.0327

```
      AIC      AICc      BIC
948.6634 952.5920 970.7103
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 14.13436 136.6362 99.59155 0.1979166 2.323651
              MASE      ACF1
Training set 0.2622145 0.008930764
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1992 Q4	7067.315	6771.471	7363.159	6614.861	7519.769
1993 Q1	7055.029	6650.224	7459.834	6435.932	7674.126
1993 Q2	7454.731	6930.747	7978.715	6653.367	8256.096
1993 Q3	7541.207	6924.032	8158.382	6597.319	8485.095
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7694
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 6014.3888
b = -100.5359
s = 0.9803 1.0113 1.0373 0.9711
```

sigma: 0.1147

```
      AIC      AICc      BIC
1120.285 1124.145 1142.480
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 14.39306 436.458 303.0027 -0.1285053 7.646426
              MASE      ACF1
Training set 0.6294116 0.07856145
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1993 Q1	2996.230	2555.840	3436.621	2322.711	3669.750
1993 Q2	3174.561	2582.553	3766.568	2269.163	4079.958
1993 Q3	3070.770	2396.124	3745.417	2038.988	4102.553
1993 Q4	2953.253	2217.426	3689.079	1827.904	4078.602

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9944

beta = 1e-04

gamma = 1e-04

phi = 0.98

Initial states:

l = 5475.6073

b = -38.5801

s = 0.9557 0.9624 1.0539 1.028

sigma: 0.1324

AIC AICc BIC

1122.067 1125.927 1144.262

Error measures:

ME RMSE MAE MPE MAPE

Training set -19.83733 375.8603 282.701 -1.170111 9.133129

MASE ACF1

Training set 0.5203435 0.006873665

Forecasts:

	<b>Point Forecast</b>	<b>Lo 80</b>	<b>Hi 80</b>	<b>Lo 95</b>	<b>Hi 95</b>
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1993 Q1	2794.677	2320.633	3268.721	2069.690	3519.665
1993 Q2	2855.099	2167.881	3542.317	1804.090	3906.108
1993 Q3	2598.034	1828.139	3367.930	1420.580	3775.488
1993 Q4	2571.052	1686.282	3455.823	1217.912	3924.193
4 rows					



Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.8765

beta = 0.1201

gamma = 0.0557

phi = 0.8

Initial states:

l = 4027.7612

b = 51.6649

s = 1.0286 0.9318 1.0026 1.0371

sigma: 0.1875

AIC	AICc	BIC
1087.629	1091.488	1109.824

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-32.50639	330.3139	252.8196	-2.69958	14.48014
	MASE	ACF1			
Training set	0.4972482	0.05089676			

Forecasts:

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1993 Q1	1129.7586	858.2856	1401.232	714.5764	1544.941
1993 Q2	1026.7194	673.6679	1379.771	486.7737	1566.665
1993 Q3	868.5497	485.9723	1251.127	283.4480	1453.651
1993 Q4	971.2659	453.3884	1489.143	179.2406	1763.291

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9843

beta = 0.0295

gamma = 1e-04

phi = 0.8782

Initial states:

l = 6673.2609

b = 140.6501

s = 0.9389 0.9687 1.0475 1.0449

sigma: 0.1462

AIC	AICc	BIC
1152.313	1156.172	1174.508

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-69.56624	494.2356	360.7093	-2.383415	9.664949

  

	MASE	ACF1
Training set	0.467505	-0.007398141

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	2143.076	1741.626	2544.525	1529.1113	2757.040
1993 Q2	2142.671	1567.257	2718.085	1262.6512	3022.691
1993 Q3	1977.123	1315.343	2638.904	965.0171	2989.230
1993 Q4	1912.432	1160.156	2664.708	761.9245	3062.940

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.2879

beta = 1e-04

gamma = 0.3475

phi = 0.9792

Initial states:

l = 9311.7994

b = -128.8418

s = 0.8517 1.0009 1.0282 1.1193

sigma: 0.0975

	AIC	AICc	BIC
	1166.741	1170.601	1188.936

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-7.770973	556.1985	395.7519	-0.522626	6.555661
	MASE	ACF1			
Training set	0.7912566	0.1136304			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	4404.961	3854.275	4955.646	3562.760	5247.161
1993 Q2	5058.716	4400.038	5717.394	4051.355	6066.077
1993 Q3	4883.527	4222.944	5544.109	3873.253	5893.800
1993 Q4	4622.314	3974.214	5270.413	3631.131	5613.496
4 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.0015

gamma = 1e-04

phi = 0.98

Initial states:

l = 3379.8961

b = 43.0436

s = 0.9641 0.9843 1.039 1.0126

sigma: 0.0874

AIC AICc BIC

1083.442 1087.302 1105.637

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-7.029645	279.1706	209.7503	-0.5653386	6.013599

	MASE	ACF1
Training set	0.4949678	0.05209754

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1993 Q1	4505.860	4000.983	5010.737	3733.717	5278.003
1993 Q2	4633.856	3898.535	5369.177	3509.280	5758.432
1993 Q3	4400.077	3543.675	5256.480	3090.323	5709.832
1993 Q4	4319.959	3347.617	5292.300	2832.891	5807.026

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5523
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3450.3888
b = 101.6063
s = 0.9486 1.011 1.1179 0.9225
```

sigma: 0.2356

```
      AIC      AICc      BIC
1093.148 1097.638 1114.092
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -53.11573 923.5159 692.9429 -5.313053 17.78236
              MASE      ACF1
Training set 0.6449194 0.008703673
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1989 Q1	4823.962	3367.629	6280.295	2596.693	7051.231
1989 Q2	5878.931	3840.964	7916.899	2762.129	8995.734
1989 Q3	5346.000	3279.727	7412.273	2185.908	8506.092
1989 Q4	5042.459	2910.194	7174.724	1781.441	8303.476

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.923
beta  = 0.0482
gamma = 1e-04
phi   = 0.8
```

Initial states:

```
l = 10031.3596
b = -150.8077
s = 1.0423 0.9595 1.0591 0.9391
```

sigma: 0.2217

```
      AIC      AICc      BIC
914.1537 919.9432 933.0719
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set -24.69785 1258.122 800.9798 -4.017096 16.0101
              MASE      ACF1
Training set 0.4561562 0.01713456
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1986 Q2	8535.359	6109.765	10960.95	4825.734	12244.98
1986 Q3	7767.095	4660.487	10873.70	3015.948	12518.24
1986 Q4	8467.916	4244.182	12691.65	2008.272	14927.56
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.5559

beta = 5e-04

gamma = 2e-04

phi = 0.98

Initial states:

l = 3335.4175

b = 66.0806

s = 0.9455 1.0186 0.961 1.0749

sigma: 0.2088

AIC	AICc	BIC
992.6140	997.5029	1012.8675

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	2.312141	744.0232	612.3722	-2.594753	15.38525
	MASE	ACF1			
Training set	0.6655663	0.05879926			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1988 Q1	6057.216	4436.437	7677.995	3578.448	8535.983
1988 Q2	5435.984	3764.379	7107.589	2879.485	7992.483
1988 Q3	5783.313	3799.123	7767.504	2748.756	8817.871
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.5069
beta  = 0.0189
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 4349.1528
b = 31.3871
s = 1.0461 0.8889 1.0095 1.0555
```

sigma: 0.0596

```
      AIC      AICc      BIC
943.0667 947.5565 964.0102
```

Error measures:

```
      ME  RMSE  MAE  MPE  MAPE  MASE
Training set 31.57017 277.7 215.461 0.3292077 4.222689 0.7555774
      ACF1
Training set -0.02891044
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1975 Q1	7212.258	6661.081	7763.435	6369.305	8055.210
1975 Q2	6937.119	6338.668	7535.570	6021.867	7852.371
1975 Q3	6141.630	5554.409	6728.851	5243.553	7039.707
1975 Q4	7266.020	6506.037	8026.004	6103.726	8428.315

4 rows



Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.697
beta  = 0.0525
gamma = 1e-04
phi   = 0.9723
```

Initial states:

```
l = 1942.407
b = 83.742
s = 1.0332 0.9037 1.0126 1.0504
```

sigma: 0.0453

```
      AIC      AICc      BIC
874.4244 878.9142 895.3678
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 15.01221 186.8053 119.3816 0.2557499 2.878126
              MASE      ACF1
Training set 0.3402224 -0.06629719
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1975 Q1	6556.637	6175.844	6937.429	5974.264	7139.009
1975 Q2	6345.628	5885.568	6805.688	5642.027	7049.229
1975 Q3	5684.845	5196.116	6173.575	4937.398	6432.292
1975 Q4	6523.380	5878.127	7168.634	5536.550	7510.211

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9993

beta = 0.2774

gamma = 1e-04

phi = 0.9253

Initial states:

l = 2725.3555

b = 85.4001

s = 1.0043 0.9948 1.0061 0.9949

sigma: 0.0755

AIC AICc BIC

619.8141 627.1474 636.9498

Error measures:

ME RMSE MAE MPE MAPE MASE

Training set 31.37667 220.3376 170.1385 0.608493 4.969169 0.3150713

ACF1

Training set -0.03725344

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1970 Q2	7045.633	6363.811	7727.454	6002.877	8088.389
1970 Q3	7168.117	6060.747	8275.486	5474.541	8861.692
1970 Q4	7424.066	5867.693	8980.439	5043.798	9804.334
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.4474

beta = 0.0087

gamma = 1e-04

phi = 0.9762

Initial states:

l = 3021.8727

b = 64.9475

s = 1.024 0.9633 1.092 0.9207

sigma: 0.059

AIC AICc BIC

917.7968 922.2866 938.7403

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-6.891847	239.8434	188.2942	-0.3816295	4.402246

	MASE	ACF1
Training set	0.6781013	0.01440731

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1975 Q1	4485.096	4146.055	4824.137	3966.578	5003.614
1975 Q2	5332.458	4889.482	5775.434	4654.984	6009.932
1975 Q3	4714.998	4289.937	5140.059	4064.923	5365.073
1975 Q4	5023.427	4536.575	5510.280	4278.852	5768.003

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.251
beta  = 0.0743
gamma = 1e-04
phi   = 0.9797
```

Initial states:

```
l = 3730.4832
b = 93.1104
s = 1.0261 0.9695 1.0846 0.9198
```

sigma: 0.0775

```
      AIC      AICc      BIC
599.8966 608.0447 616.2724
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 50.82145 331.4041 245.5158 0.4287997 5.068931
              MASE      ACF1
Training set 0.6300029 -0.005076375
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1964 Q3	6633.112	5974.718	7291.505	5626.186	7640.038
1964 Q4	7207.444	6456.797	7958.090	6059.429	8355.458
1965 Q1	6625.326	5891.544	7359.107	5503.104	7747.547
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 1e-04

gamma = 1e-04

phi = 0.9765

Initial states:

l = 4011.0122

b = 92.5325

s = 1.0801 0.7866 1.049 1.0844

sigma: 0.0528

	AIC	AICc	BIC
	575.4463	583.5945	591.8222

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	1.044014	261.689	197.1374	-0.09204753	3.60289
	MASE	ACF1			
Training set	0.4145128	0.04530951			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1964 Q3	5023.380	4683.401	5363.359	4503.427	5543.332
1964 Q4	6937.615	6275.025	7600.205	5924.271	7950.959
1965 Q1	7003.843	6186.237	7821.450	5753.422	8254.265
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.6993

beta = 1e-04

gamma = 1e-04

phi = 0.979

Initial states:

l = 4949.6284

b = 159.8205

s = 0.9526 1.0123 1.0222 1.0129

sigma: 0.071

AIC AICc BIC

744.7387 751.2093 762.8053

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-3.613798	489.2322	412.1695	-0.3600662	5.480588

	MASE	ACF1
Training set	0.6122808	0.1091551

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1962 Q2	9679.322	8798.277	10560.37	8331.881	11026.76
1962 Q3	9646.406	8576.236	10716.58	8009.722	11283.09
1962 Q4	9134.035	7968.126	10299.95	7350.930	10917.14
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9997

beta = 0.0231

gamma = 1e-04

phi = 0.9357

Initial states:

l = 1633.1368

b = 224.6533

s = 1.0755 0.9943 1.0278 0.9024

sigma: 0.1122

	AIC	AICc	BIC
	675.4026	682.7360	692.5384

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	9.779548	506.9477	392.8885	0.0198958	7.917788

	MASE	ACF1
Training set	0.3785645	0.2402517

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1968 Q2	5796.127	4962.694	6629.560	4521.501	7070.753
1968 Q3	5596.607	4440.564	6752.651	3828.591	7364.624
1968 Q4	6042.783	4490.713	7594.853	3669.097	8416.470
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 2e-04

gamma = 1e-04

phi = 0.98

Initial states:

l = 2697.2764

b = 119.9474

s = 1.0891 1.0249 0.9962 0.8897

sigma: 0.0874

	AIC	AICc	BIC
	648.9989	656.3322	666.1346

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	29.7527	381.2388	300.5182	-0.02455068	6.452601
	MASE	ACF1			
Training set	0.3756478	0.189318			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1968 Q2	7218.696	6409.837	8027.556	5981.652	8455.740
1968 Q3	7479.575	6296.220	8662.931	5669.789	9289.362
1968 Q4	8003.307	6454.716	9551.899	5634.941	10371.674
3 rows					



Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.6216

beta = 0.0811

gamma = 1e-04

phi = 0.98

Initial states:

l = 3026.3373

b = 73.0709

s = 1.1321 0.9869 1.0051 0.8759

sigma: 0.0602

AIC AICc BIC

610.3406 617.6739 627.4763

Error measures:

ME RMSE MAE MPE MAPE

Training set 22.56723 190.6113 155.8079 0.2665194 4.193535

MASE ACF1

Training set 0.4557226 -0.002940195

Forecasts:

	<b>Point Forecast</b>	<b>Lo 80</b>	<b>Hi 80</b>	<b>Lo 95</b>	<b>Hi 95</b>
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1968 Q2	6197.304	5719.197	6675.412	5466.102	6928.506
1968 Q3	6179.492	5599.413	6759.571	5292.338	7066.646
1968 Q4	7193.815	6397.278	7990.352	5975.617	8412.013
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.7182
beta  = 1e-04
gamma = 1e-04
phi   = 0.98
```

Initial states:

```
l = 3199.1184
b = 102.4052
s = 0.9732 0.9474 1.0528 1.0267
```

sigma: 0.1033

```
      AIC      AICc      BIC
1089.914 1094.065 1111.503
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE      MASE
Training set 57.43189 590.0958 385.4637 0.0149701 7.11066 0.4986593
              ACF1
Training set 0.04535241
```

Forecasts:

	<b>Point Forecast</b> <dbl>	<b>Lo 80</b> <dbl>	<b>Hi 80</b> <dbl>	<b>Lo 95</b> <dbl>	<b>Hi 95</b> <dbl>
1971 Q1	9797.158	8500.673	11093.64	7814.356	11779.96
1971 Q2	10075.257	8432.316	11718.20	7562.596	12587.92
1971 Q3	9092.835	7375.481	10810.19	6466.369	11719.30
1971 Q4	9366.215	7384.731	11347.70	6335.796	12396.63

4 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9999

beta = 0.0016

gamma = 1e-04

phi = 0.9744

Initial states:

l = 5968.0997

b = 154.5217

s = 0.9975 1.0207 0.967 1.0147

sigma: 0.0675

AIC	AICc	BIC
638.8096	646.6667	655.4452

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-12.73259	472.3631	309.8161	-0.4051969	4.11426

	MASE	ACF1
Training set	0.3363301	0.3466746

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1977 Q4	9207.463	8411.089	10003.84	7989.514	10425.41
1978 Q1	9422.019	8270.783	10573.26	7661.355	11182.68
1978 Q2	9030.550	7680.434	10380.67	6965.726	11095.37

3 rows

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

alpha = 0.9106

beta = 1e-04

gamma = 1e-04

phi = 0.9795

Initial states:

l = 5734.8526

b = 121.7865

s = 1.066 0.8561 1.0225 1.0555

sigma: 0.0495

AIC	AICc	BIC
660.7343	667.8311	678.1110

Error measures:

	ME	RMSE	MAE	MPE	MAPE
Training set	-8.767902	284.2206	188.5214	-0.270562	2.704972
	MASE	ACF1			
Training set	0.381391	-0.04109474			

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1976 Q3	7586.442	7105.144	8067.741	6850.360	8322.525
1976 Q4	9499.902	8686.360	10313.444	8255.697	10744.108
1977 Q1	9458.198	8483.738	10432.657	7967.890	10948.505
3 rows					

Forecast method: Damped Holt-Winters' multiplicative method

Model Information:

Damped Holt-Winters' multiplicative method

Call:

```
hw(y = a_95_ts, h = nrow(a_5), seasonal = "multiplicative", damped = TRUE)
```

Smoothing parameters:

```
alpha = 0.9274
beta  = 1e-04
gamma = 0.001
phi   = 0.9737
```

Initial states:

```
l = 5746.8087
b = 71.2201
s = 1.0138 0.9897 0.9883 1.0082
```

sigma: 0.0489

```
      AIC      AICc      BIC
735.9244 742.0355 754.4259
```

Error measures:

```
              ME      RMSE      MAE      MPE      MAPE
Training set 1.322832 291.1083 220.4883 -0.0984685 3.322699
              MASE      ACF1
Training set 0.5015087 0.03320387
```

Forecasts:

	Point Forecast <dbl>	Lo 80 <dbl>	Hi 80 <dbl>	Lo 95 <dbl>	Hi 95 <dbl>
1977 Q1	7815.721	7326.078	8305.364	7066.876	8564.565
1977 Q2	7792.940	7127.482	8458.397	6775.210	8810.669
1977 Q3	7657.898	6867.602	8448.194	6449.245	8866.552

3 rows

Hide

```
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_m
ase_table$forecasting_mase %>% as.character()
quarterly_industry_forecast_mase_table$forecasting_mase<- quarterly_industry_forecast_m
ase_table$forecasting_mase %>% as.numeric()
```

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```
mean(model_table_quarterly_industry$mase_v)
```

```
[1] 0.4979766
```

Hide

```
sum(model_table_quaterly_industry$p_val<0.05)
```

```
[1] 9
```

Hide

```
mean(quarterly_industry_forecast_mase_table$forecasting_mase,na.rm=TRUE)
```

```
[1] 0.8598513
```