

Exponential Smoothing Using Data set

-- Jay Rahtod

Data set:

The screenshot shows a Microsoft Excel-like application window titled "WPS Office" with a file named "RELIANCE.csv" open. The sheet is titled "Document1". The data starts at row 2 and includes columns for Date, Symbol, Series, Prev Close, Open, High, Low, Last, Close, VWAP, Volume, Turnover, Trades, Deliverable, %Deliverable, and P, Q, R, S, T. The data spans from January 1996 to December 2020. The interface includes a ribbon bar with Home, Insert, Page Layout, Formulas, Data, Review, View, Tools, and a "Click to find commands" search bar. The bottom taskbar shows the file name "RelianceIndustries" and various system icons.

Date	Symbol	Series	Prev Close	Open	High	Low	Last	Close	VWAP	Volume	Turnover	Trades	Deliverable	%Deliverable	P	Q	R	S	T
01-01-1996	RELIANCE	EQ	204.65	205	206.1	203.65		205.75	205.26	3717450	7.63E+13								
02-01-1996	RELIANCE	EQ	205.75	205.25	206.25	202.65		204.15	204.13	6024650	1.23E+14								
03-01-1996	RELIANCE	EQ	204.15	207.5	216.95	205.25		205.7	207.04	7473500	1.55E+14								
04-01-1996	RELIANCE	EQ	205.7	203.75	204.4	201.05		203.8	202.47	7744000	1.57E+14								
05-01-1996	RELIANCE	EQ	203.8	203	203	200.65		202.4	202.05	5952000	1.20E+14								
08-01-1996	RELIANCE	EQ	202.4	202	202.15	192.3		194.3	197.57	6675550	1.32E+14								
09-01-1996	RELIANCE	EQ	194.3	188.55	192	182.25		188.7	186.15	13880150	2.58E+14								
10-01-1996	RELIANCE	EQ	188.7	185	189.45	183		183.85	186.24	9875700	1.84E+14								
11-01-1996	RELIANCE	EQ	183.85	182	190.5	181.75		189.6	185.82	14625600	2.72E+14								
11-12-1996	RELIANCE	EQ	189.6	191	192.45	186.35		187.6	188.95	13377500	2.53E+14								
12-01-1996	RELIANCE	EQ	187.6	187.05	188	184.6		185.65	186.15	7139950	1.33E+14								
13-01-1996	RELIANCE	EQ	185.65	185	187	184.4		186	185.71	7756400	1.44E+14								
14-01-1996	RELIANCE	EQ	186	185	185.25	177.05		178.6	181.66	10697700	1.94E+14								
15-01-1996	RELIANCE	EQ	178.6	174.05	176.9	171.8		173.65	174.42	13478000	2.35E+14								
16-01-1996	RELIANCE	EQ	173.65	171.25	173.4	169.45		170.6	171.23	11586900	1.98E+14								
17-01-1996	RELIANCE	EQ	170.6	171.15	175.75	171		173.5	173.8	12089550	2.10E+14								
18-01-1996	RELIANCE	EQ	173.5	174.1	174.85	157		166.15	170.68	12671700	2.16E+14								
19-01-1996	RELIANCE	EQ	166.15	164.7	165.7	158		160.45	161.39	12538400	2.02E+14								
20-01-1996	RELIANCE	EQ	160.45	160.1	160.8	152.75		153.7	157.11	12883650	2.02E+14								
21-01-1996	RELIANCE	EQ	153.7	153	167.25	152.05		165.8	160.64	23310600	3.74E+14								
22-01-1996	RELIANCE	EQ	165.8	171	189	168.5		180.7	174.76	37914350	6.63E+14								
23-01-1996	RELIANCE	EQ	180.7	179	185.75	172.25		176.75	179.43	26118950	4.69E+14								
24-01-1996	RELIANCE	EQ	176.75	175	185	174.5		183.85	180.21	22865050	4.12E+14								
25-02-1996	RELIANCE	EQ	183.85	188.75	206	188.75		203.8	196.45	29231000	5.74E+14								
26-02-1996	RELIANCE	EQ	203.8	215	225.2	208.55		220.75	216.42	43646350	9.45E+14								
27-02-1996	RELIANCE	EQ	220.75	226.05	230	197.6		202.25	218.04	44354450	9.67E+14								
28-02-1996	RELIANCE	EQ	202.25	191.05	208	189.05		206	201.29	31970000	6.44E+14								
29-02-1996	RELIANCE	EQ	206	208.1	227.65	206		224	214.12	29335550	6.28E+14								
30-02-1996	RELIANCE	EQ	224	232	242	224.1		237	233.49	35504550	8.29E+14								

It is a data set of reliance stock prices from 1996 to 2020 having the following columns

Code:

RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Project: (None)

Graph Plotting.R Exponential Smoothing using database... ▾

Source on Save Run Source

Search: goog Next Prev All reliance Replace All

In selection Match case Whole word Regex Wrap

```
1 library(tidyverse)
2 library(fpp2)
3
4 rel_data = read.csv("Z:\\\\Jay\\\\Data Science Advance\\\\Main Project\\\\RelianceIndustries.csv")
5
6 print(head(rel_data))
7
8 Y <- ts(rel_data[,6], start = c(2005,1), frequency = 12)
9
10 Y2 <- diff(Y)
11
12 autoplot(Y2)
13 |
14 #ggseasonplot(Y2)
15
16 fit_ets <- ets(Y2)
17
18 print(summary(fit_ets))
19
20 checkresiduals(fit_ets)
21
22 fcst1 <- forecast(fit_ets, h=24)
23 print(fcst1)
24
25 autoplot(fcst1)
26
27 #####
28 ## Simple Exponential Smoothing ##
29 #####
30
31: (Top Level) ▾ R Script ▾
```

Console

Type here to search

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RStudio

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Project: (None)

Graph Plotting.R Exponential Smoothing using database... ▾

Source on Save Run Source

Search: goog Next Prev All reliance Replace All

In selection Match case Whole word Regex Wrap

```
26
27 #####
28 ## Simple Exponential Smoothing ##
29 #####
30 ses <- ses(Y, alpha = .2, h = 100)
31 autoplot(ses)
32
33 #difference our data to remove the trend
34 # reliance.dif represents the change in stock price from the previous day.
35 reliance.dif <- diff(Y)
36 autoplot(reliance.dif)
37
38 #we've effectively removed the trend from our data and
39 #can reapply the SES model.
40 ses.reliance.dif <- ses(reliance.dif, alpha = .2, h = 100)
41 autoplot(ses.reliance.dif)
42
43 #first we need to create a differenced validation set
44 #since our training data was built on differenced data.
45 #then we can compare our forecasts to our validation data set.
46 #We see that performance measures are smaller on the test set than the training
47 #so we are not overfitting our model.
48 reliance.dif.test <- diff(Y2)
49 accuracy(ses.reliance.dif, reliance.dif.test)
50
51 #we can tune our alpha parameter to identify the value that reduces our
52 #forecasting error. Here we loop through alpha values from 0.01-0.99
53 #and identify the level that minimizes our test RMSE.
54 #Turns out that  $\alpha = 0.05$  minimizes our prediction error.
```

Console

Type here to search

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RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Project: (None)

Graph Plotting.R Exponential Smoothing using database... ▾

Source on Save Run Source

Search: goog Next Prev All Replace All

In selection Match case Whole word Regex Wrap

```
51 # we can tune our alpha parameter to identify the value that reduces our
52 #forecasting error. Here we loop through alpha values from 0.01-0.99
53 #and identify the level that minimizes our test RMSE.
54 #Turns out that  $\alpha = 0.05$  minimizes our prediction error.
55 # identify optimal alpha parameter
56 alpha <- seq(.01, .99, by = .01)
57 RMSE <- NA
58 for(i in seq_along(alpha)) {
59   fit <- ses(reliance.dif, alpha = alpha[i], h = 100)
60   RMSE[i] <- accuracy(fit, reliance.dif.test)[2,2]
61 }
62
63 # convert to a data frame and identify min alpha value
64 alpha.fit <- data_frame(alpha, RMSE)
65 alpha.min <- filter(alpha.fit, RMSE == min(RMSE))
66
67 # plot RMSE vs. alpha
68 ggplot(alpha.fit, aes(alpha, RMSE)) +
69   geom_line() +
70   geom_point(data = alpha.min, aes(alpha, RMSE), size = 2, color = "blue")
71
72 # refit model with alpha = .05
73 ses.reliance.opt <- ses(reliance.dif, alpha = .05, h = 100)
74
75 # performance eval
76 accuracy(ses.reliance.opt, reliance.dif.test)
77 # plotting results
78 autoplot(ses.reliance.opt) +
79   theme(legend.position = "bottom")
```

13:1 (Top Level) ▾ R Script

Console

Type here to search

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RStudio

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Project: (None)

Graph Plotting.R Exponential Smoothing using database... ▾

Source on Save Run Source

Search: goog Next Prev All Replace All

In selection Match case Whole word Regex Wrap

```
b1 ▾
62
63 # convert to a data frame and identify min alpha value
64 alpha.fit <- data_frame(alpha, RMSE)
65 alpha.min <- filter(alpha.fit, RMSE == min(RMSE))
66
67 # plot RMSE vs. alpha
68 ggplot(alpha.fit, aes(alpha, RMSE)) +
69   geom_line() +
70   geom_point(data = alpha.min, aes(alpha, RMSE), size = 2, color = "blue")
71
72 # refit model with alpha = .05
73 ses.reliance.opt <- ses(reliance.dif, alpha = .05, h = 100)
74
75 # performance eval
76 accuracy(ses.reliance.opt, reliance.dif.test)
77 # plotting results
78 autoplot(ses.reliance.opt) +
79   theme(legend.position = "bottom")
80 autoplot(reliance.dif.test) +
81   autolayer(ses.reliance.opt, alpha = .5) +
82   ggtitle("Predicted vs. actuals for the test data set")
83
84
85
86
87
88
89
```

13:1 (Top Level) ▾ R Script

Console

Type here to search

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Output:

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
+ Go to file/function | Addins | Project: (None)
Source
Console Jobs R 4.1.0 - ~/ ~
> library(tidyverse)
-- Attaching packages ----- tidyverse 1.3.1 --
v ggplot2 3.3.5     v purrr  0.3.4
v tibble  3.1.3     v dplyr   1.0.7
v tidy    1.1.3     v stringr 1.4.0
v readr   2.0.1     v forcats 0.5.1
-- Conflicts ----- tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()   masks stats::lag()
Warning messages:
1: package 'tidyverse' was built under R version 4.1.1
2: package 'tidyr' was built under R version 4.1.1
3: package 'readr' was built under R version 4.1.1
4: package 'purrr' was built under R version 4.1.1
5: package 'dplyr' was built under R version 4.1.1
6: package 'stringr' was built under R version 4.1.1
7: package 'forcats' was built under R version 4.1.1
> library(fpp2)
Registered S3 method overwritten by 'quantmod':
  method      from
  as.zoo.data.frame zoo
-- Attaching packages ----- fpp2 2.4 --
v forecast 8.15     v expsmooth 2.3
v fma       2.4
Warning messages:
1: package 'fpp2' was built under R version 4.1.1
2: package 'forecast' was built under R version 4.1.1
3: package 'fma' was built under R version 4.1.1
4: package 'expsmooth' was built under R version 4.1.1
> rel_data = read.csv("Z:\\\\Jay\\\\Data Science Advance\\\\Main Project\\\\RelianceIndustries.csv")
> print(head(rel_data))
  Date Symbol Series Prev.Close Open High Low Last
```



```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
+ Go to file/function | Addins | Project: (None)
Source
Console Jobs R 4.1.0 - ~/ ~
> rel_data = read.csv("Z:\\\\Jay\\\\Data Science Advance\\\\Main Project\\\\RelianceIndustries.csv")
> print(head(rel_data))
  Date Symbol Series Prev.Close Open High Low Last
1 01-01-1996 RELIANCE   EQ    204.65 205.00 206.10 203.65 NA
2 02-01-1996 RELIANCE   EQ    205.75 205.25 206.25 202.65 NA
3 03-01-1996 RELIANCE   EQ    204.15 207.50 216.95 205.25 NA
4 04-01-1996 RELIANCE   EQ    205.70 203.75 204.40 201.05 NA
5 05-01-1996 RELIANCE   EQ    203.80 203.00 203.00 200.65 NA
6 08-01-1996 RELIANCE   EQ    202.40 202.00 202.15 192.30 NA
  Close Vwap Volume Turnover Trades Deliverable.Volume X.Deliverable
1 205.75 205.26 3717450 7.63e+13 NA        NA        NA
2 204.15 204.13 6024650 1.23e+14 NA        NA        NA
3 205.70 207.04 7473500 1.55e+14 NA        NA        NA
4 203.80 202.47 7744000 1.57e+14 NA        NA        NA
5 202.40 202.05 5952000 1.20e+14 NA        NA        NA
6 194.30 197.57 6675550 1.32e+14 NA        NA        NA
> Y <- ts(rel_data[,6], start = c(2005,1), frequency = 12)
> Y2 <- diff(Y)
> ggseasonplot(Y2)
> ggseasonplot(Y2)
> fit_ets <- ets(Y2)
> print(summary(fit_ets))
ETS(A,N,N)
Call:
 ets(y = Y2)

Smoothing parameters:
  alpha = 1e-04

Initial states:
  1 = 0.2923
```



```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
+ - Open Project: (None) ▾
Source
Console Jobs ×
R 4.1.0 - ~/ ◀
Smoothing parameters:
alpha = 1e-04

Initial states:
l = 0.2923

sigma: 31.4995

AIC      AICc      BIC
96990.48 96990.48 97010.68

Training set error measures:
          ME      RMSE      MAE      MPE      MAPE      MASE
Training set 0.009771313 31.49445 13.23506 -Inf Inf 0.672675
ACF1
Training set -0.005312006
> fcst1 <- forecast(fit_ets, h=24)
> print(fcst1)
  Point Forecast    Lo 80   Hi 80    Lo 95   Hi 95
Feb 2522 0.2984403 -40.06982 40.66671 -61.43949 62.03637
Mar 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03637
Apr 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03637
May 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03637
Jun 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03638
Jul 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Aug 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Sep 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Oct 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Nov 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Dec 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jan 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Feb 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Mar 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
```

```
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+ - Open Project: (None) ▾
Source
Console Jobs ×
R 4.1.0 - ~/ ◀
Nov 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Dec 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jan 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Feb 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Mar 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Apr 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
May 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jun 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jul 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Aug 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Sep 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Oct 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Nov 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Dec 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jan 2524 0.2984403 -40.06983 40.66671 -61.43950 62.03638
> autoplot(fcst1)
> #####
> ## Simple Exponential Smoothing ##
> #####
> ses <- ses(Y, alpha = .2, h = 100)
> autoplot(ses)
> #difference our data to remove the trend
> # reliance.dif represents the change in stock price from the previous day.
> reliance.dif <- diff(Y)
> #we've effectively removed the trend from our data and
> #can reapply the SES model.
> ses.reliance.dif <- ses(reliance.dif, alpha = .2, h = 100)
> autoplot(ses.reliance.dif)
> #first we need to create a differenced validation set
> #since our training data was built on differenced data.
> #then we can compare our forecasts to our validation data set.
> #we see that performance measures are smaller on the test set than the training
> #so we are not overfitting our model.
```

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23-10-2021

```
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+ - Addins Project: (None)

Source

Console Jobs ×
R 4.1.0 - ~/ ◁
> autoplot(ses)
> #difference our data to remove the trend
> # reliance.dif represents the change in stock price from the previous day.
> reliance.dif <- diff(Y)
> #we've effectively removed the trend from our data and
> #can reapply the SES model.
> ses.reliance.dif <- ses(reliance.dif, alpha = .2, h = 100)
> autoplot(ses.reliance.dif)
> #first we need to create a differenced validation set
> #since our training data was built on differenced data.
> #then we can compare our forecasts to our validation data set.
> #We see that performance measures are smaller on the test set than the training
> #so we are not overfitting our model.
> reliance.dif.test <- diff(Y2)
> accuracy(ses.reliance.dif, Y2)
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
> #first we need to create a differenced validation set
> #since our training data was built on differenced data.
> #then we can compare our forecasts to our validation data set.
> #We see that performance measures are smaller on the test set than the training
> #so we are not overfitting our model.
> reliance.dif.test <- diff(Y2)
> accuracy(ses.reliance.dif, reliance.dif.test)
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
> #we can tune our alpha parameter to identify the value that reduces our
> #forecasting error. Here we loop through alpha values from 0.01-0.99
> #and identify the level that minimizes our test RMSE.
> #Turns out that  $\alpha = 0.05$  minimizes our prediction error.
> # identify optimal alpha parameter
> alpha <- seq(.01, .99, by = .01)
```

```
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23-10-2021
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
+ - Addins Project: (None)

Source

Console Jobs ×
R 4.1.0 - ~/ ◁
> accuracy(ses.reliance.dif, reliance.dif.test)
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
> #we can tune our alpha parameter to identify the value that reduces our
> #forecasting error. Here we loop through alpha values from 0.01-0.99
> #and identify the level that minimizes our test RMSE.
> #Turns out that  $\alpha = 0.05$  minimizes our prediction error.
> # identify optimal alpha parameter
> alpha <- seq(.01, .99, by = .01)
> RMSE <- NA
> for(i in seq_along(alpha)) {
+   fit <- ses(reliance.dif, alpha = alpha[i], h = 100)
+   RMSE[i] <- accuracy(fit, Y2)[2,2]
+ }
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
> #we can tune our alpha parameter to identify the value that reduces our
> #forecasting error. Here we loop through alpha values from 0.01-0.99
> #and identify the level that minimizes our test RMSE.
> #Turns out that  $\alpha = 0.05$  minimizes our prediction error.
> # identify optimal alpha parameter
> alpha <- seq(.01, .99, by = .01)
> RMSE <- NA
> for(i in seq_along(alpha)) {
+   fit <- ses(reliance.dif, alpha = alpha[i], h = 100)
+   RMSE[i] <- accuracy(fit, Y2)[2,2]
+ }
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
> rel_data = read.csv("Z:\\\\Jay\\\\Data Science Advance\\\\Main Project\\\\RelianceIndustries.csv")
```

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function | Addins

Source

Console Jobs ×
R 4.1.0 - ~/r
> #Turns out that alpha = 0.05 minimizes our prediction error.
> # identify optimal alpha parameter
> alpha <- seq(.01, .99, by = .01)
> RMSE <- NA
> for(i in seq_along(alpha)) {
+   fit <- ses(reliance.dif, alpha = alpha[i], h = 100)
+   RMSE[i] <- accuracy(fit, Y)[2,2]
+ }
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
> rel_data = read.csv("Z:\\Jay\\Data Science Advance\\Main Project\\RelianceIndustries.csv")
>
> print(head(rel_data))
  Date Symbol Series Prev.Close Open High Low Last Close VWAP Volume Turnover Trades
1 01-01-1996 RELIANCE EQ 204.65 205.00 206.10 203.65 NA 205.75 205.26 3717450 7.63e+13 NA
2 02-01-1996 RELIANCE EQ 205.75 205.25 206.25 202.65 NA 204.15 204.13 6024650 1.23e+14 NA
3 03-01-1996 RELIANCE EQ 204.15 207.50 216.95 205.25 NA 205.70 207.04 7473500 1.55e+14 NA
4 04-01-1996 RELIANCE EQ 205.70 203.75 204.40 201.05 NA 203.80 202.47 7744000 1.57e+14 NA
5 05-01-1996 RELIANCE EQ 203.80 203.00 203.00 200.65 NA 202.40 202.05 5952000 1.20e+14 NA
6 08-01-1996 RELIANCE EQ 202.40 202.00 202.15 192.30 NA 194.30 197.57 6675550 1.32e+14 NA
  Deliverable.Volume X.Deliverable
1                      NA
2                      NA
3                      NA
4                      NA
5                      NA
6                      NA
>
> Y <- ts(rel_data[,6], start = c(2005,1), frequency = 12)
>
> Y2 <- diff(Y)
>
```

```
R 4.1.0 : ~/r
3 03-01-1996 RELIANCE   EQ    204.15 207.50 216.95 205.25  NA 205.70 207.04 743500 1.55e+14  NA
4 04-01-1996 RELIANCE   EQ    205.70 203.75 204.40 201.05  NA 203.80 202.47 7744000 1.57e+14  NA
5 05-01-1996 RELIANCE   EQ    203.80 203.00 203.00 200.65  NA 202.40 202.05 5952000 1.20e+14  NA
6 08-01-1996 RELIANCE   EQ    202.40 202.00 202.15 192.30  NA 194.30 197.57 6675550 1.32e+14  NA
Deliverable.Volume X.Deliverable
1          NA        NA
2          NA        NA
3          NA        NA
4          NA        NA
5          NA        NA
6          NA        NA
>
> Y <- ts(rel_data[,6], start = c(2005,1), frequency = 12)
>
> Y2 <- diff(Y)
>
> autoplot(Y2)
>
> ggseasonplot(Y2)
>
> fit_ets <- ets(Y2)
>
> print(summary(fit_ets))
ETS(A,N,N)

Call:
ets(y = Y2)

Smoothing parameters:
alpha = 1e-04

Initial states:
l = 0.2923
```

```
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Source
Console Jobs
R 4.1.0 ~/ ~/
>
> print(summary(fit_ets))
ETS(A,N,N)
call:
ets(y = Y2)

Smoothing parameters:
alpha = 1e-04

Initial states:
l = 0.2923

sigma: 31.4995

      AIC     AICC     BIC
96990.48 96990.48 97010.68

Training set error measures:
      ME    RMSE     MAE    MPE    MAPE    MASE      ACF1
Training set 0.009771313 31.49445 13.23506 -Inf Inf 0.672675 -0.005312006
>
> checkresiduals(fit_ets)

Ljung-Box test

data: Residuals from ETS(A,N,N)
Q^* = 70.6, df = 22, p-value = 5.32e-07

Model df: 2. Total lags used: 24

>
> fcst1 <- forecast(fit_ets, h=24)
```

```
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Source
Console Jobs
R 4.1.0 ~/ ~/
Q^* = 70.6, df = 22, p-value = 5.32e-07

Model df: 2. Total lags used: 24

>
> fcst1 <- forecast(fit_ets, h=24)
> print(fcst1)
  Point Forecast   Lo 80   Hi 80   Lo 95   Hi 95
Feb 2522 0.2984403 -40.06982 40.66671 -61.43949 62.03637
Mar 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03637
Apr 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03637
May 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03637
Jun 2522 0.2984403 -40.06983 40.66671 -61.43949 62.03638
Jul 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Aug 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Sep 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Oct 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Nov 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Dec 2522 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jan 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Feb 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Mar 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Apr 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
May 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jun 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jul 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Aug 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Sep 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Oct 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Nov 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Dec 2523 0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jan 2524 0.2984403 -40.06983 40.66671 -61.43950 62.03638
>
> autoplot(fcst1)
```

RStudio

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Go to file/function Addins Project: (None)

Source

Console Jobs

```
R 4.1.0 - ~/ ◊
Nov 2523    0.2984403 -40.06983 40.66671 -61.43950 62.03638
Dec 2523    0.2984403 -40.06983 40.66671 -61.43950 62.03638
Jan 2524    0.2984403 -40.06983 40.66671 -61.43950 62.03638
>
> autoplot(fcst1)
>
> #####
> ## Simple Exponential Smoothing ##
> #####
> ses <- ses(Y, alpha = .2, h = 100)
> autoplot(ses)
>
> #difference our data to remove the trend
> # reliance.dif represents the change in stock price from the previous day.
> reliance.dif <- diff(Y)
> autoplot(reliance.dif)
>
> #we've effectively removed the trend from our data and
> #can reapply the SES model.
> ses.reliance.dif <- ses(reliance.dif, alpha = .2, h = 100)
> autoplot(ses.reliance.dif)
>
> #first we need to create a differenced validation set
> #since our training data was built on differenced data.
> #then we can compare our forecasts to our validation data set.
> #We see that performance measures are smaller on the test set than the training
> #so we are not overfitting our model.
> reliance.dif.test <- diff(Y2)
> accuracy(ses.reliance.dif, reliance.dif.test)
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
>
> #we can tune our alpha parameter to identify the value that reduces our
```

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```
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Source
Console Jobs

R 4.1.0 -/→
> #which we can compare our forecasts to our validation data set.
> #We see that performance measures are smaller on the test set than the training
> #so we are not overfitting our model.
> reliance.dif.test <- diff(Y2)
> accuracy(ses.reliance.dif, reliance.dif.test)
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
>
> #we can tune our alpha parameter to identify the value that reduces our
> #forecasting error. Here we loop through alpha values from 0.01-0.99
> #and identify the level that minimizes our test RMSE.
> #Turns out that  $\alpha = 0.05$  minimizes our prediction error.
> # identify optimal alpha parameter
> alpha <- seq(.01, .99, by = .01)
> RMSE <- NA
> for(i in seq_along(alpha)) {
+   fit <- ses(reliance.dif, alpha = alpha[i], h = 100)
+   RMSE[i] <- accuracy(fit, reliance.dif.test)[2,2]
+ }
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
>
> # convert to a data frame and idenitify min alpha value
> alpha.fit <- data.frame(alpha, RMSE)
Warning message:
'data_frame()' was deprecated in tibble 1.1.0.
Please use 'tibble()' instead.
This warning is displayed once every 8 hours.
Call lifecycle::last_warnings() to see where this warning was generated.
> alpha.min <- filter(alpha.fit, RMSE == min(RMSE))
>
> # plot RMSE vs. alpha
```

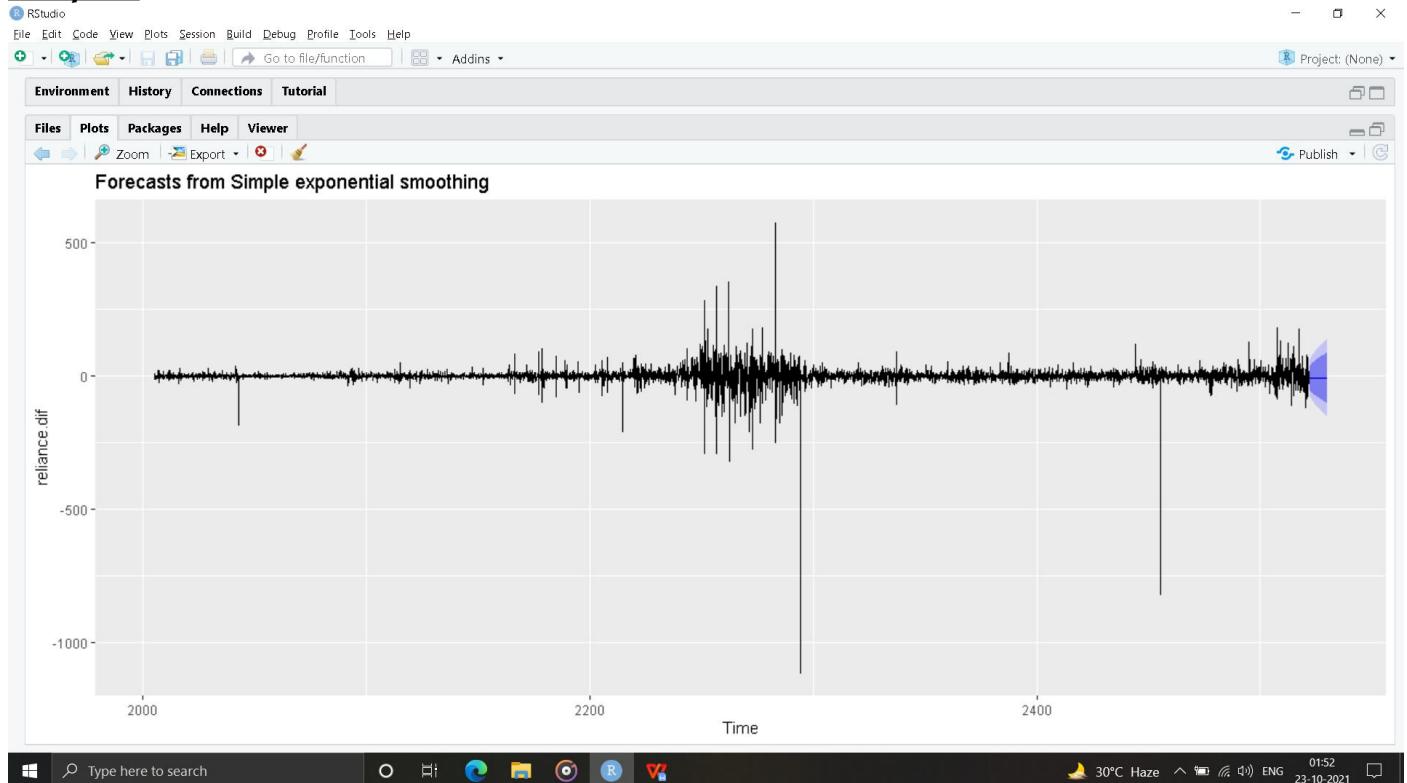
```
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Source
Console Jobs

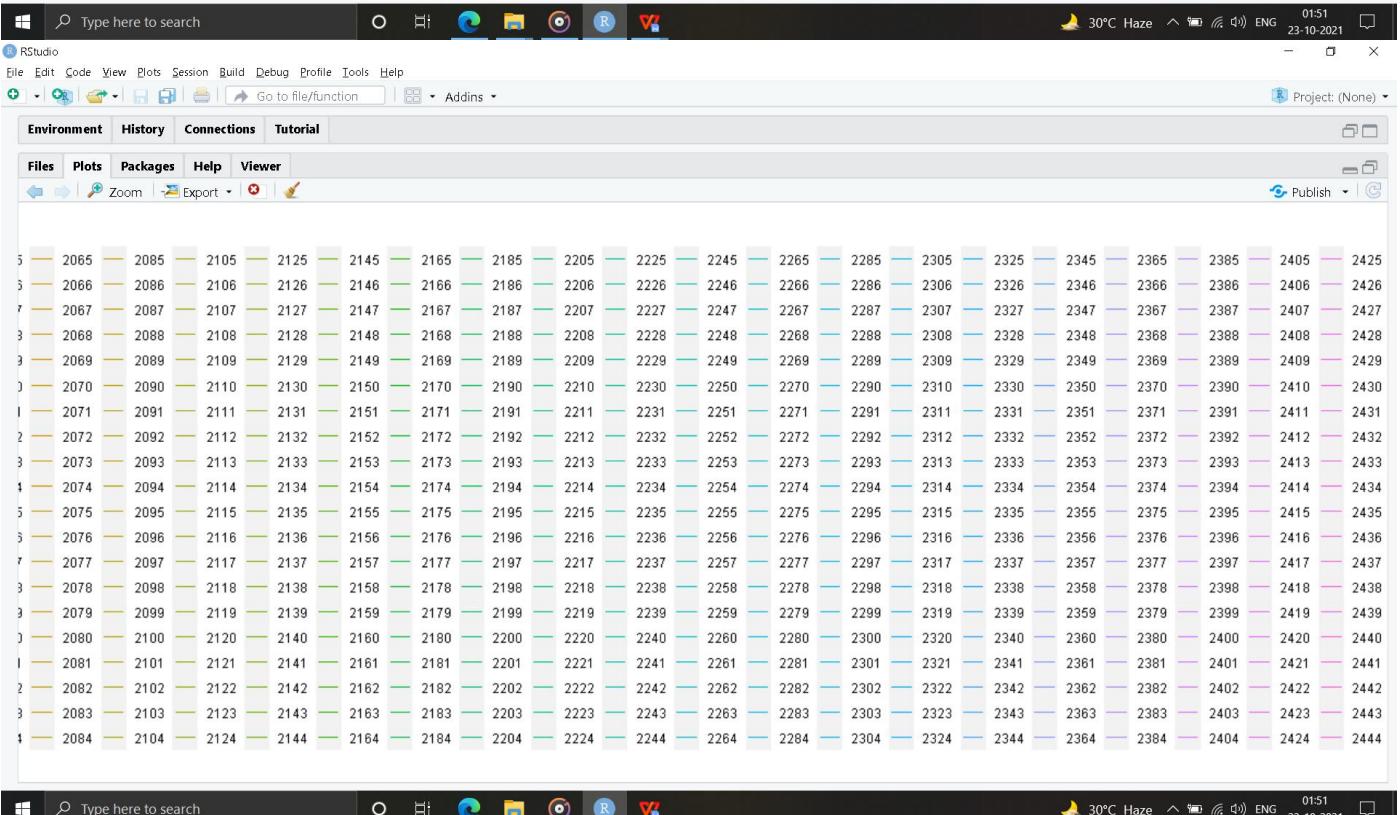
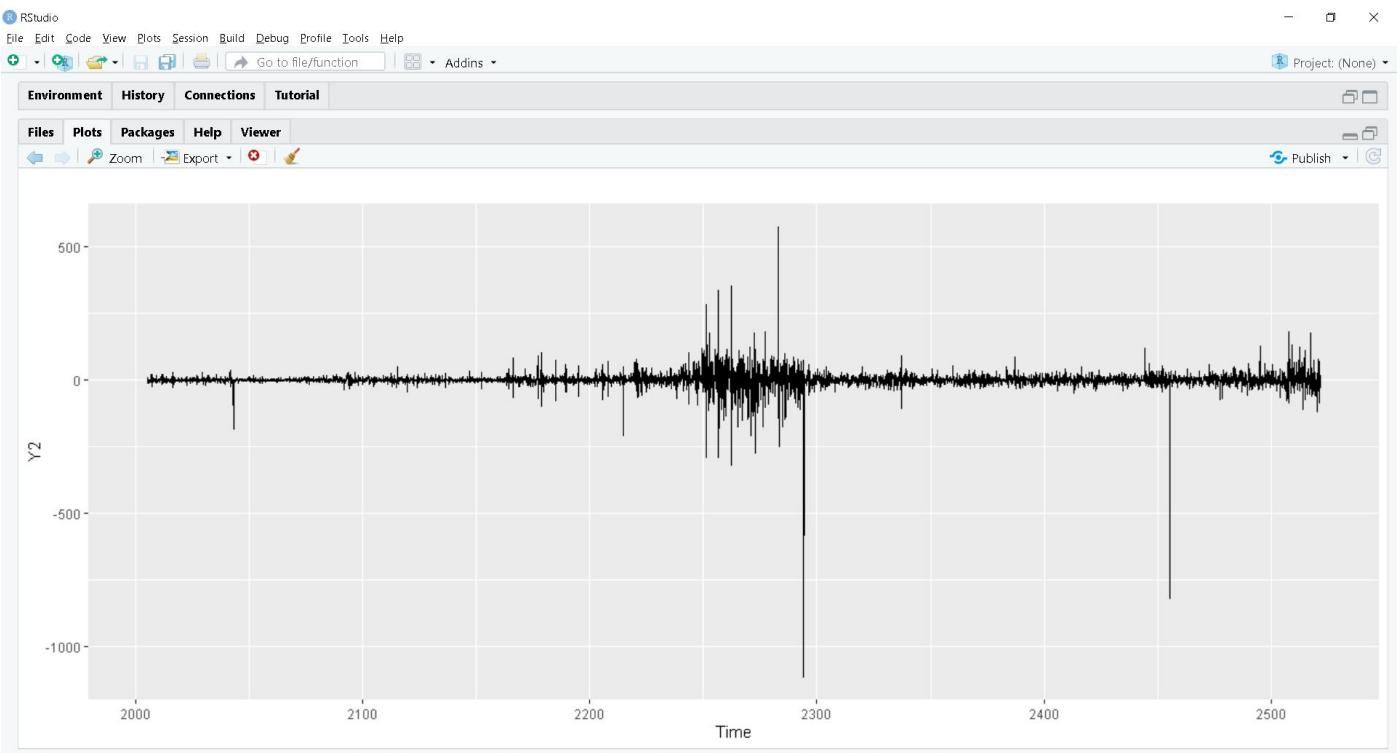
R 4.1.0 -/→
In window.default(x, ...) : 'start' value not changed
>
> # convert to a data frame and idenitify min alpha value
> alpha.fit <- data.frame(alpha, RMSE)
Warning message:
'data_frame()' was deprecated in tibble 1.1.0.
Please use 'tibble()' instead.
This warning is displayed once every 8 hours.
Call lifecycle::last_warnings() to see where this warning was generated.
> alpha.min <- filter(alpha.fit, RMSE == min(RMSE))
>
> # plot RMSE vs. alpha
> ggplot(alpha.fit, aes(alpha, RMSE)) +
+   geom_line() +
+   geom_point(data = alpha.min, aes(alpha, RMSE), size = 2, color = "blue")
>
> # refit model with alpha = .05
> ses.reliance.opt <- ses(reliance.dif, alpha = .05, h = 100)
>
> # performance eval
> accuracy(ses.reliance.opt, reliance.dif.test)
Error in window.default(x, ...) : 'start' cannot be after 'end'
In addition: Warning message:
In window.default(x, ...) : 'start' value not changed
> # plotting results
> autoplot(ses.reliance.opt) +
+   theme(legend.position = "bottom")
> autoplot(reliance.dif.test) +
+   autolayer(ses.reliance.opt, alpha = .5) +
+   ggtitle("Predicted vs. actuals for the test data set")
Not all of the characters in Z:/Jay/Data Science Advance/Time Series Forcasting/Exponential Smoothing using database.R could be encoded using ISO8859-1. T
o save using a different encoding, choose "File | Save with Encoding..." from the main menu.
>
```

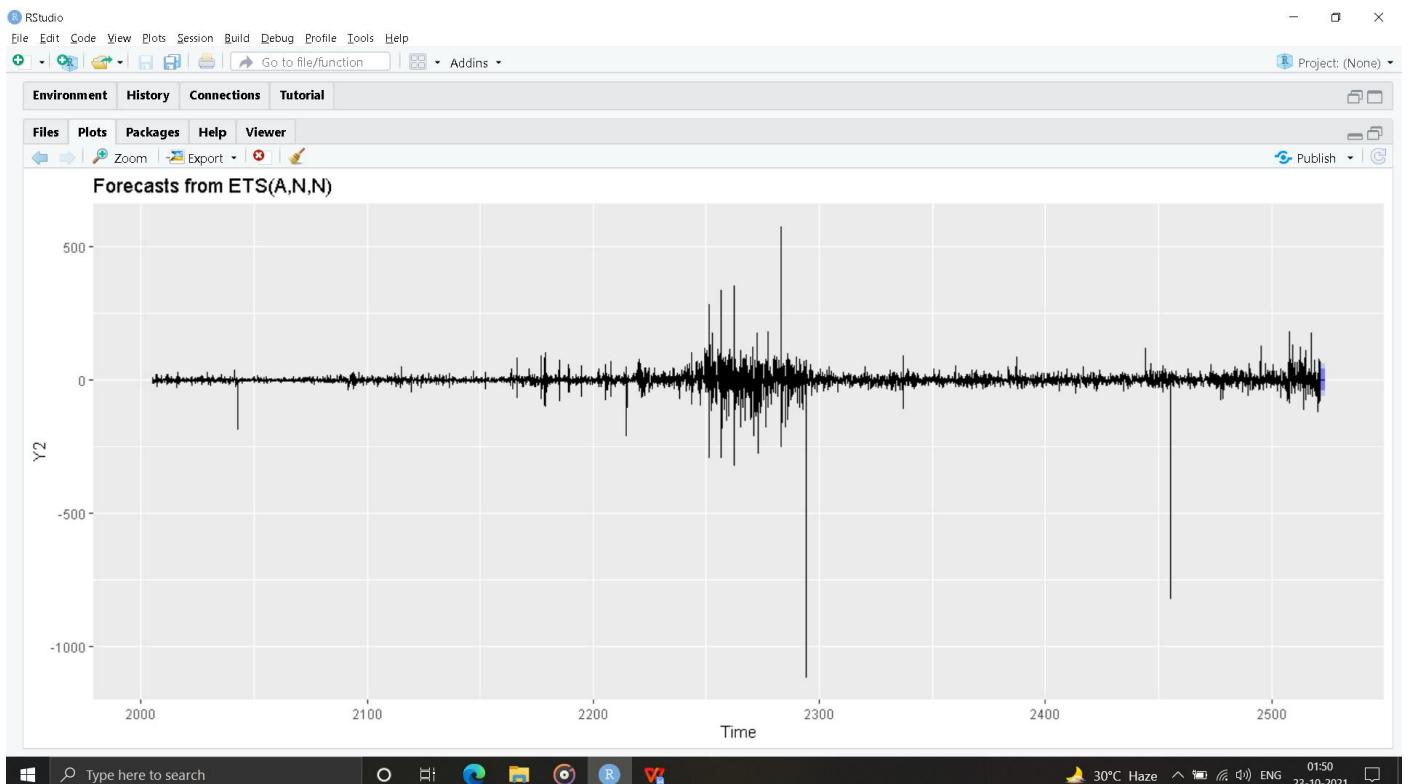
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RStudio 23-10-2021

Graphs:



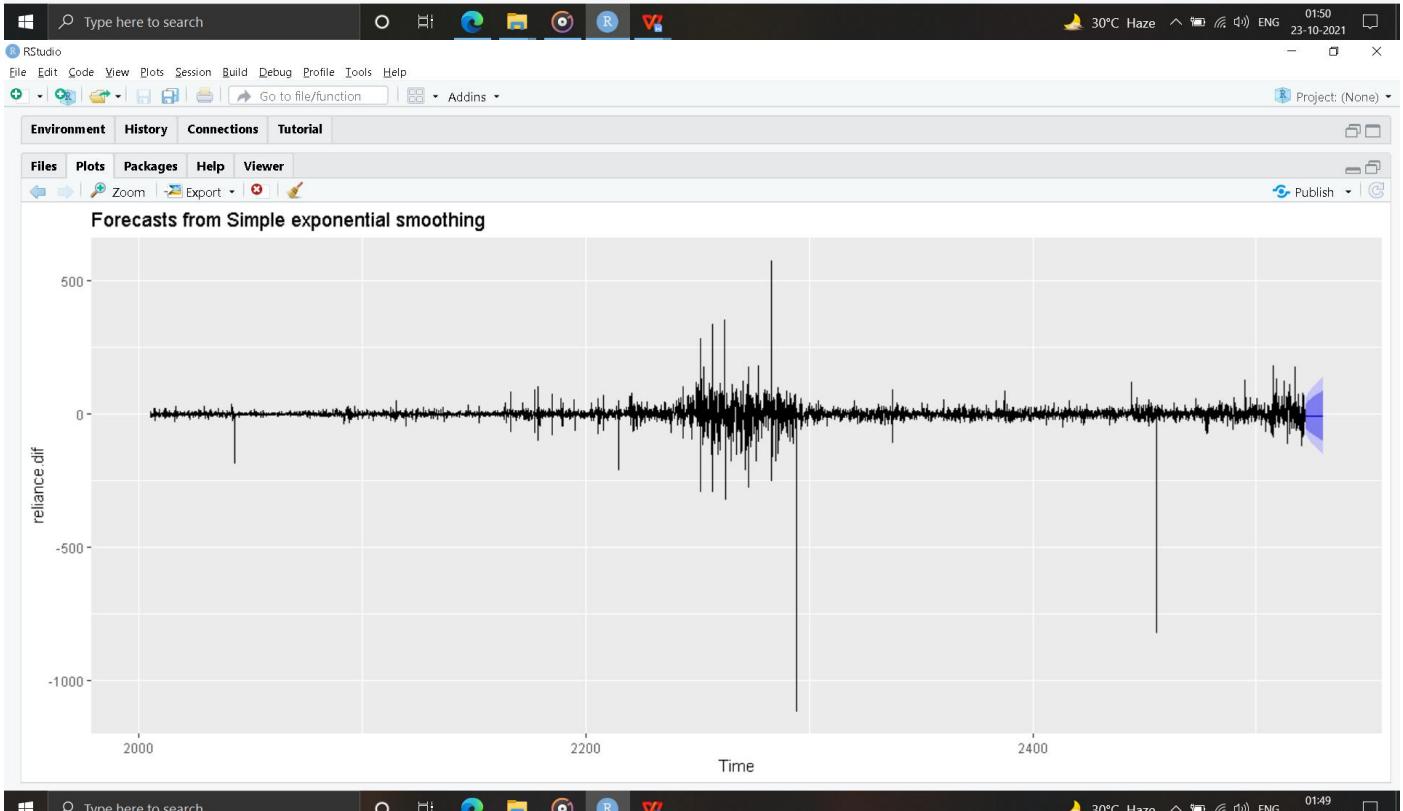
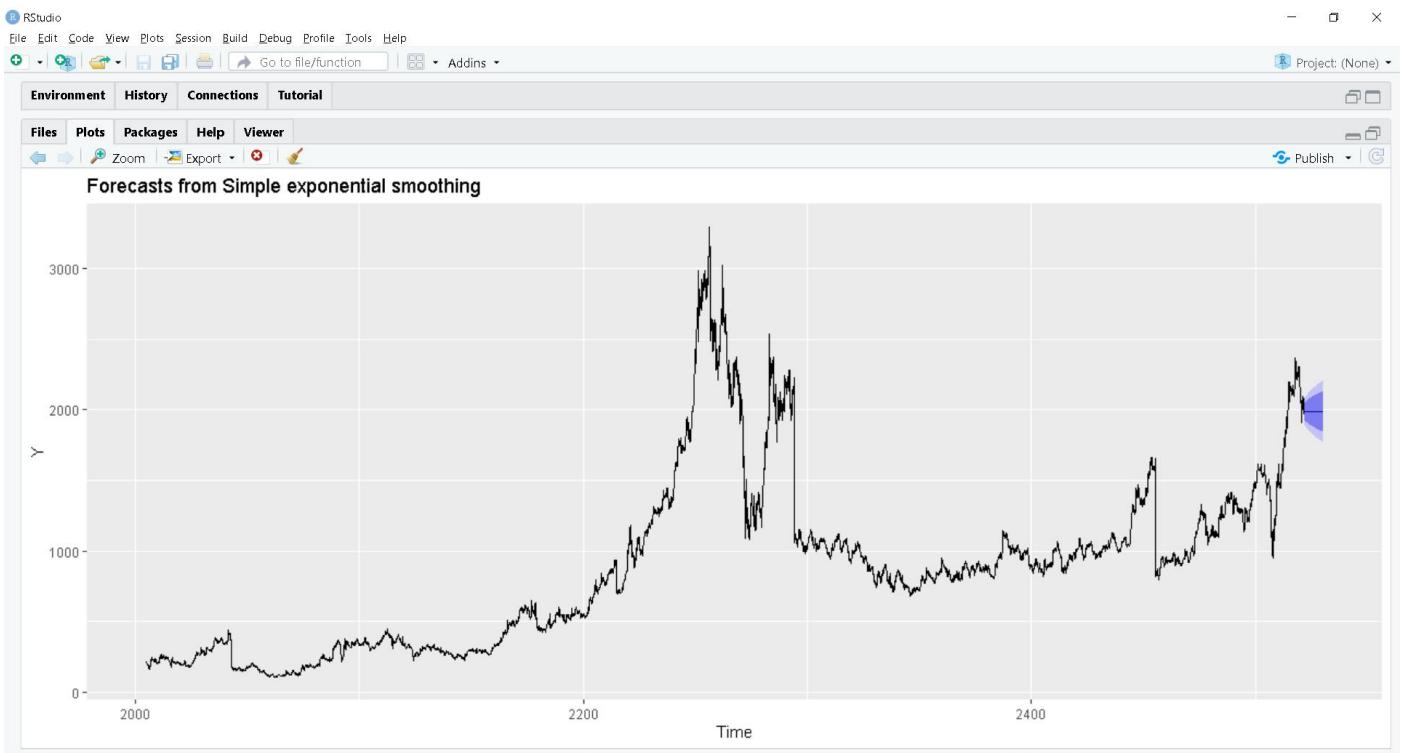
Windows Taskbar: Type here to search | 0:152 30°C Haze ENG 23-10-2021

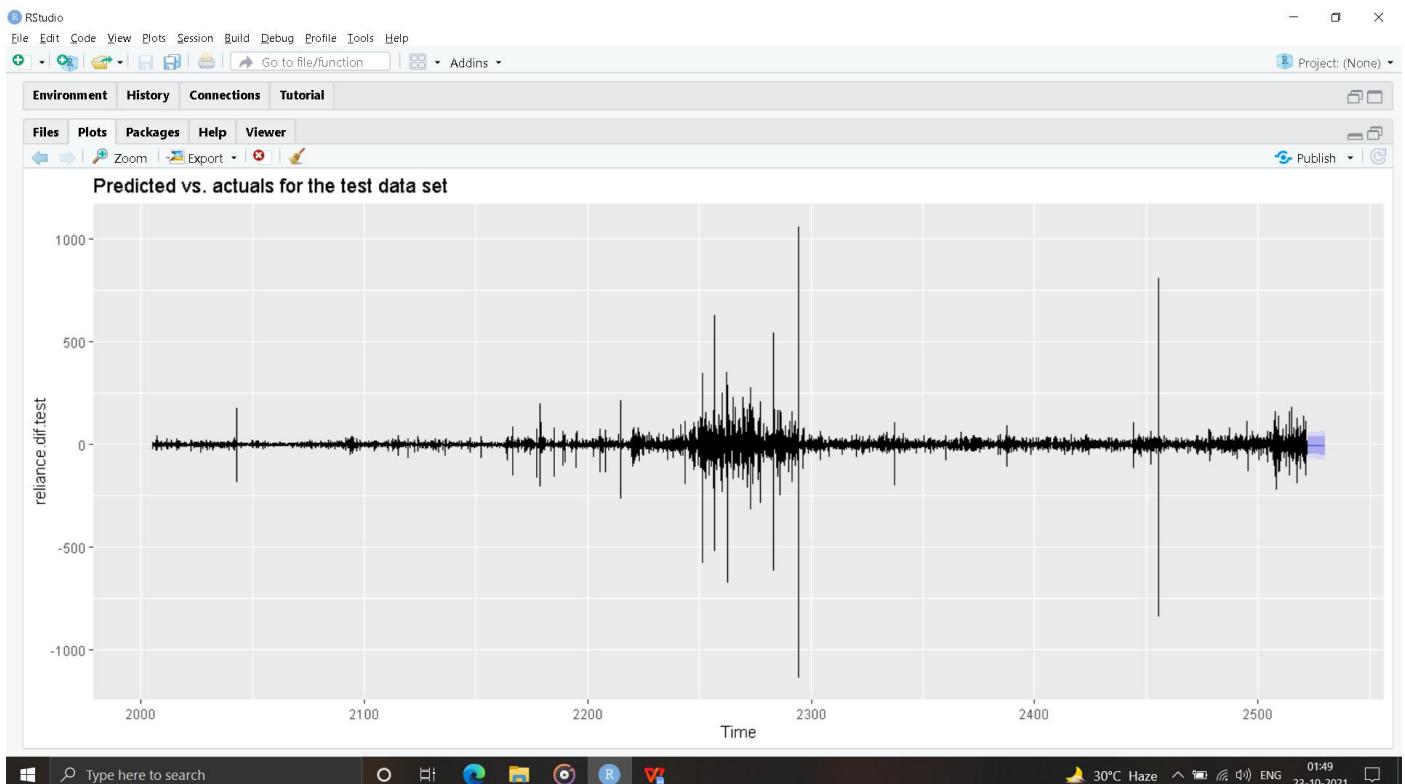




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