Holt Winters Exponential Smoothing

```
library(forecast)
```

```
## Warning: 패키지 'forecast'는 R 버전 4.1.3에서 작성되었습니다
```

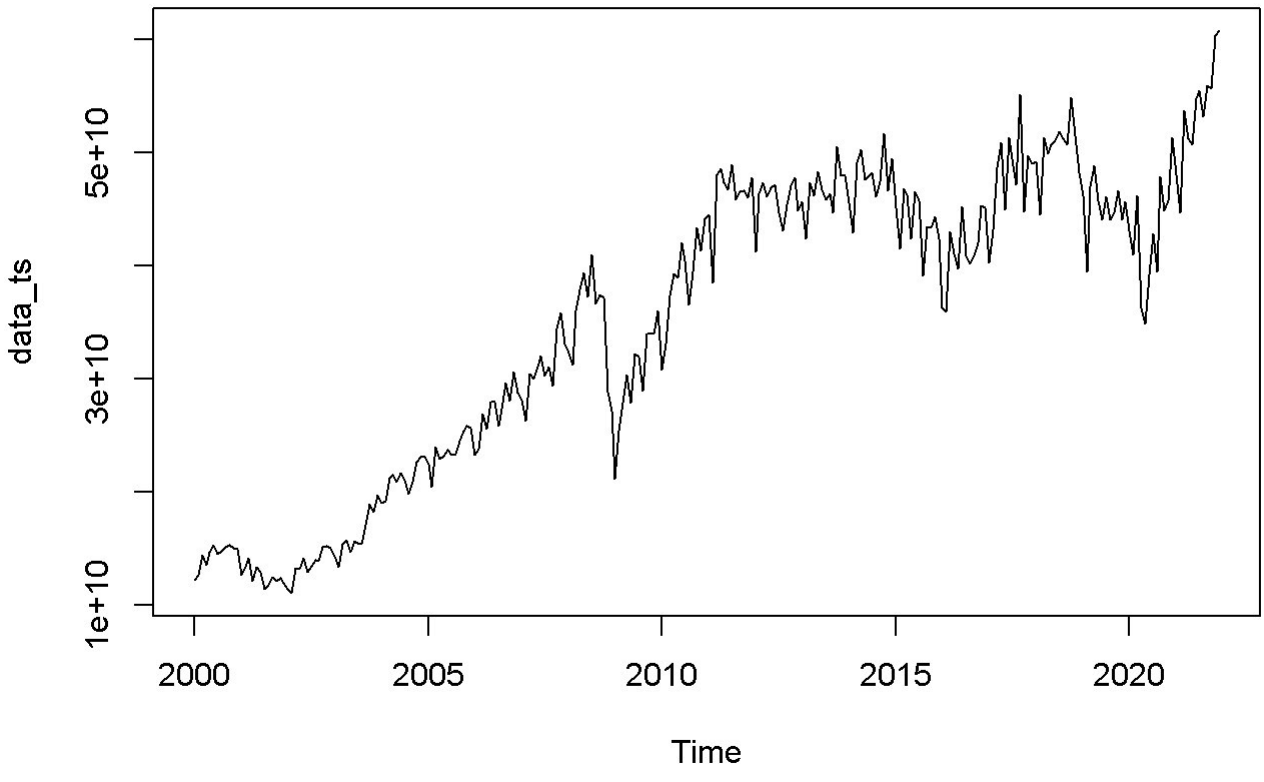
```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
data <- read.csv('HoltWinters.csv')
```

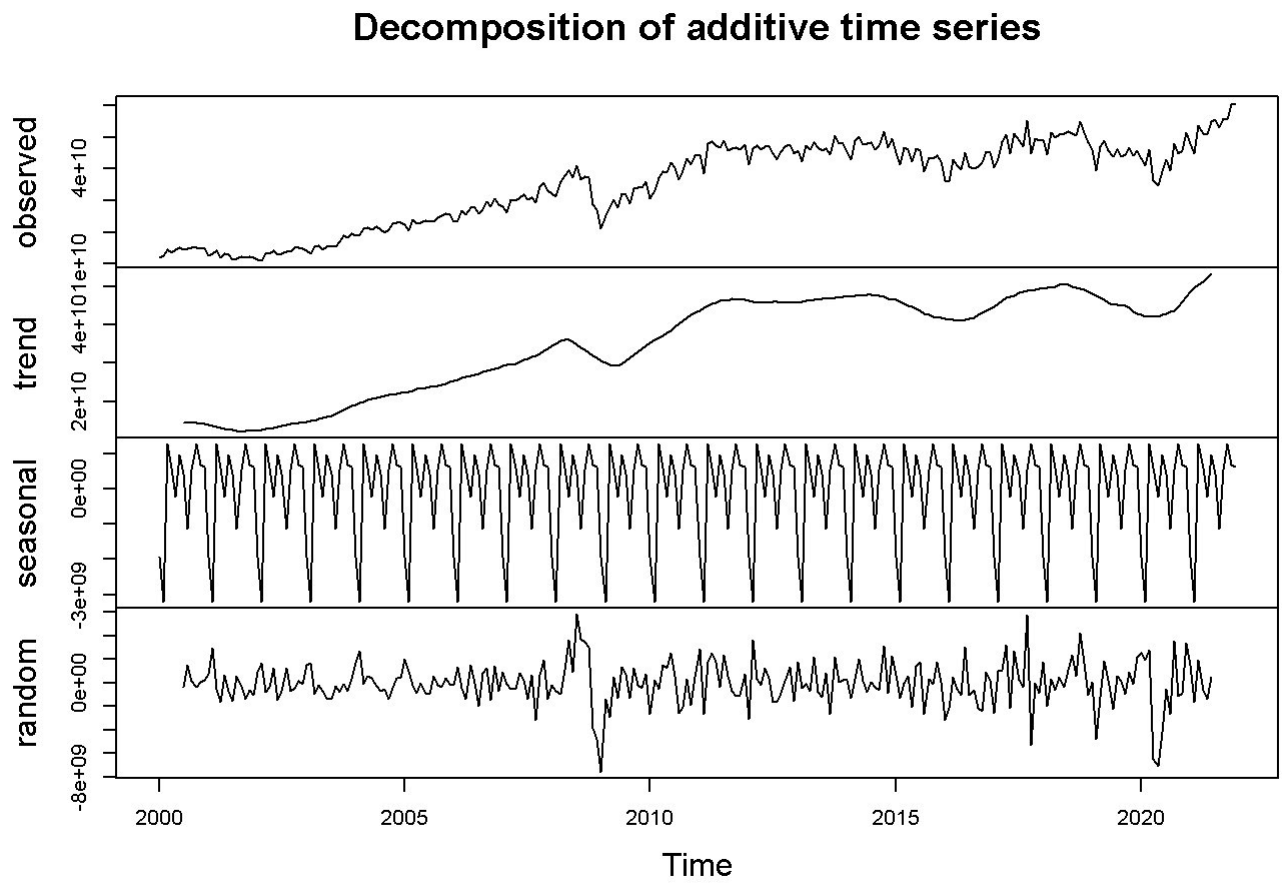
```
data_ts <- ts(data$한국수출금액_USD,frequency=12,start=c(2000,1),end=c(2021,12))
summary(data_ts)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 1.102e+10 2.325e+10 3.940e+10 3.523e+10 4.631e+10 6.073e+10
```

```
plot(data_ts)
```



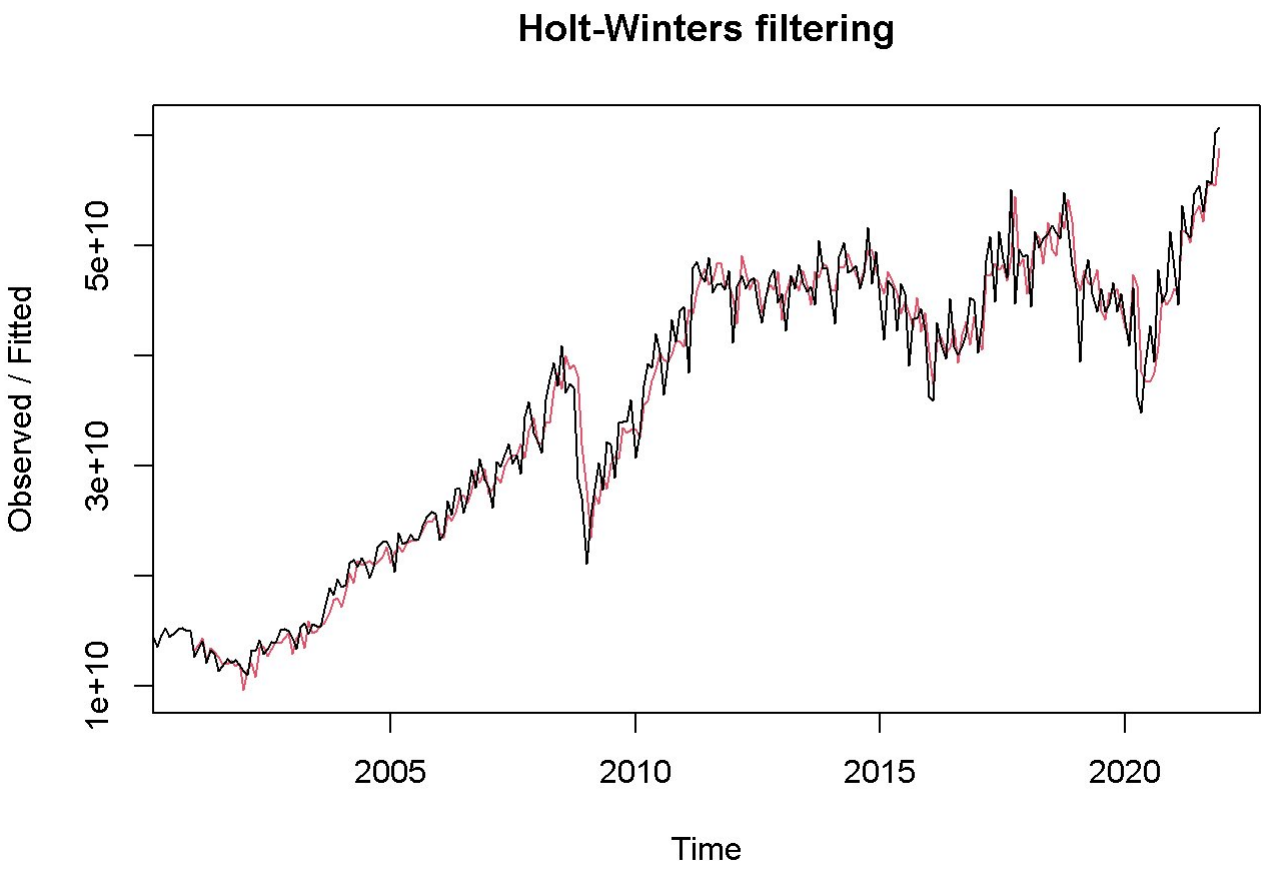
```
data_ts_decomp <- decompose(data_ts)
plot(data_ts_decomp)
```




```
HoltWinter_Fit <- HoltWinters(data_ts)
HoltWinter_Fit
```

```
## Holt-Winters exponential smoothing with trend and additive seasonal component.
##
## Call:
## HoltWinters(x = data_ts)
##
## Smoothing parameters:
##  alpha: 0.5771978
##  beta : 0.01402773
##  gamma: 0.302067
##
## Coefficients:
##            [,1]
## a   58693317399
## b     211810505
## s1  -1945589668
## s2  -3862296627
## s3   2684943939
## s4    887212441
## s5   -153820357
## s6   2135018852
## s7   1726066649
## s8  -1027542858
## s9   1452574643
## s10  1154871151
## s11  1471920586
## s12  1499196848
```

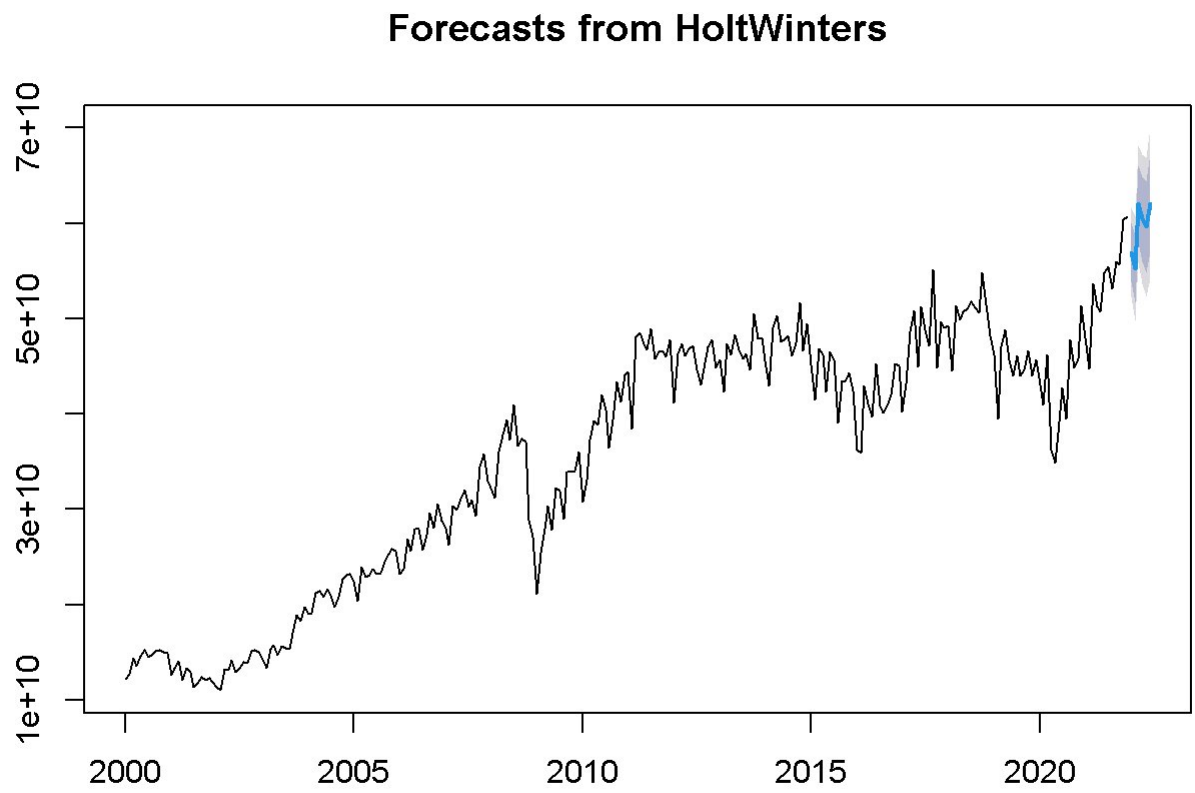
```
plot(HoltWinter_Fit)
```



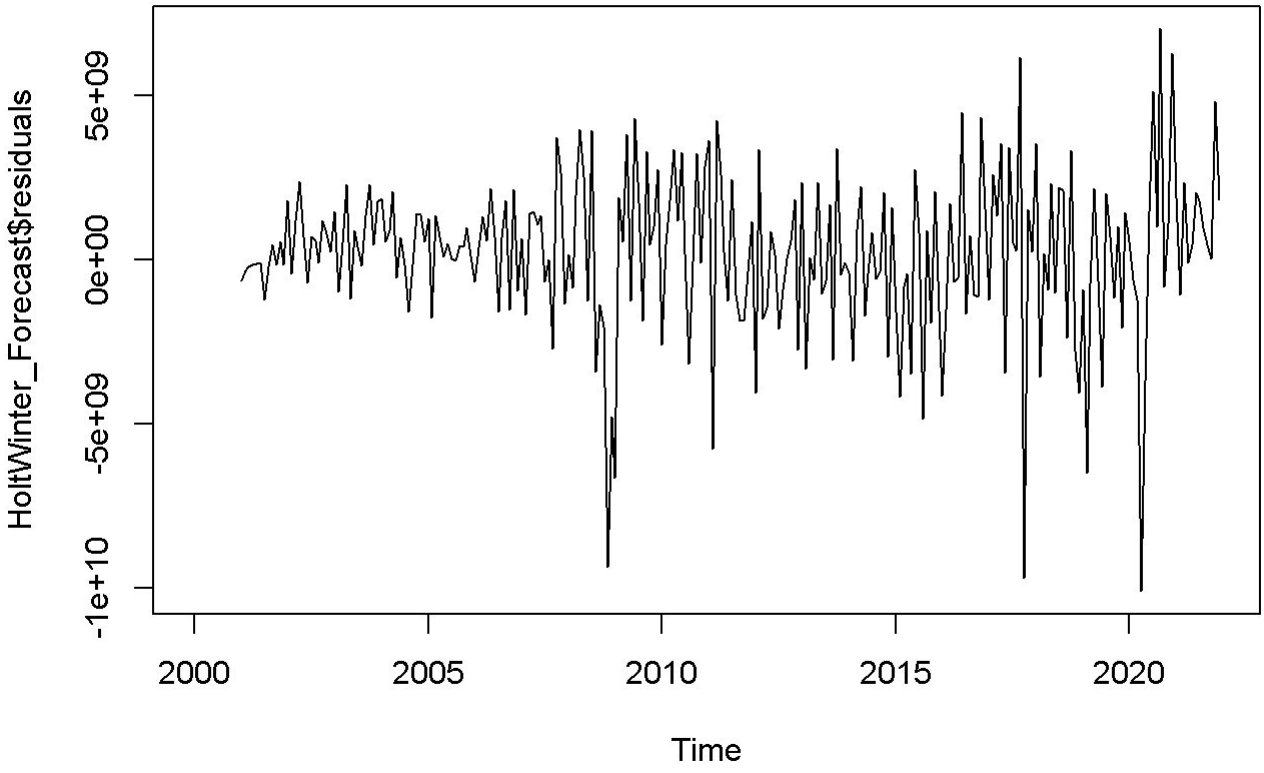

```
HoltWinter_Forecast <- forecast(HoltWinter_Fit, h=6)
HoltWinter_Forecast$mean
```

```
##              Jan         Feb         Mar         Apr         May         Jun
## 2022 56959538236 55254641782 62013692854 60427771861 59598549569 62099199283
```

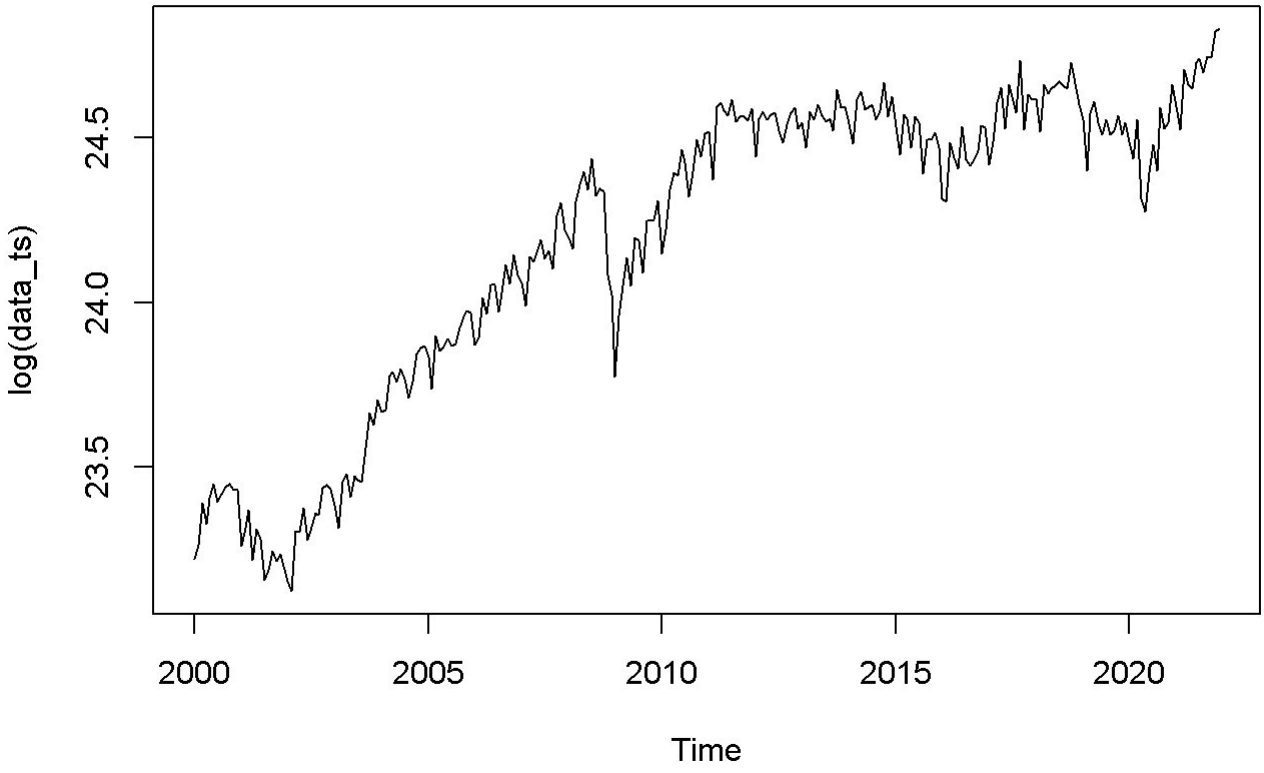
```
plot(HoltWinter_Forecast)
```




```
plot.ts(HoltWinter_Forecast$residuals)
```



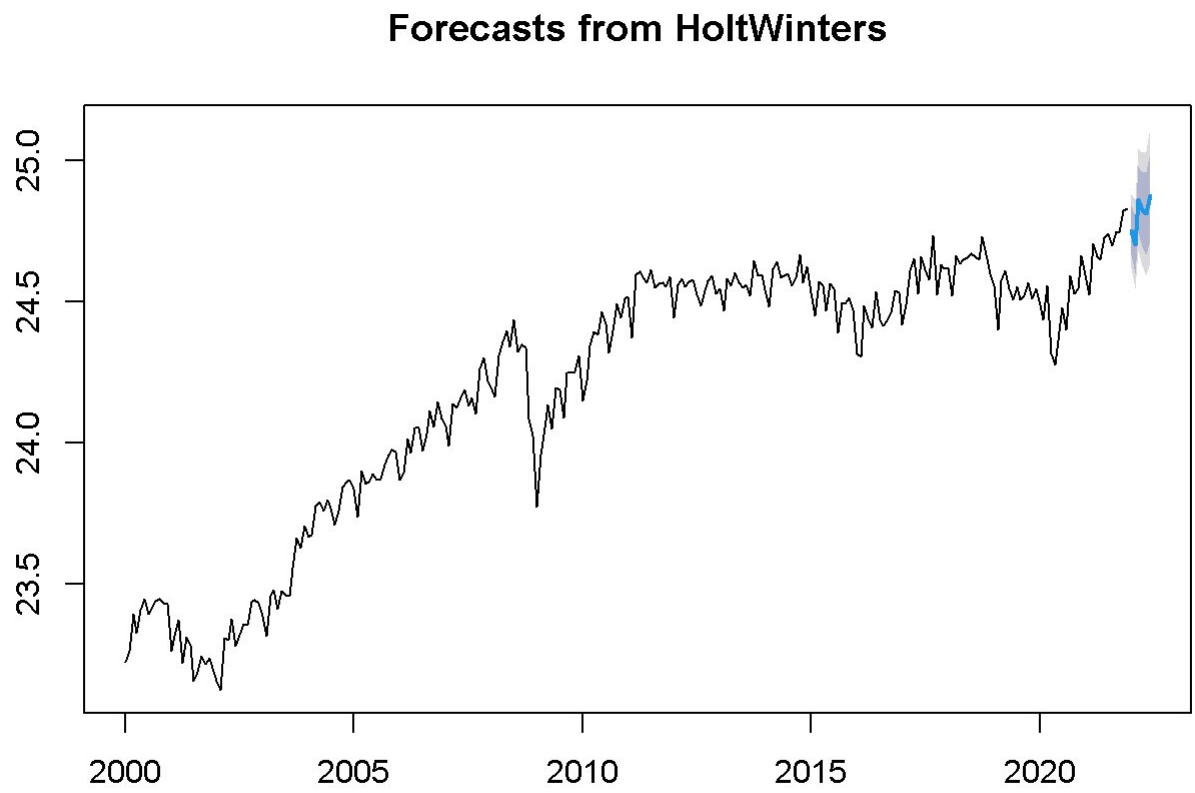

```
plot(log(data_ts))
```



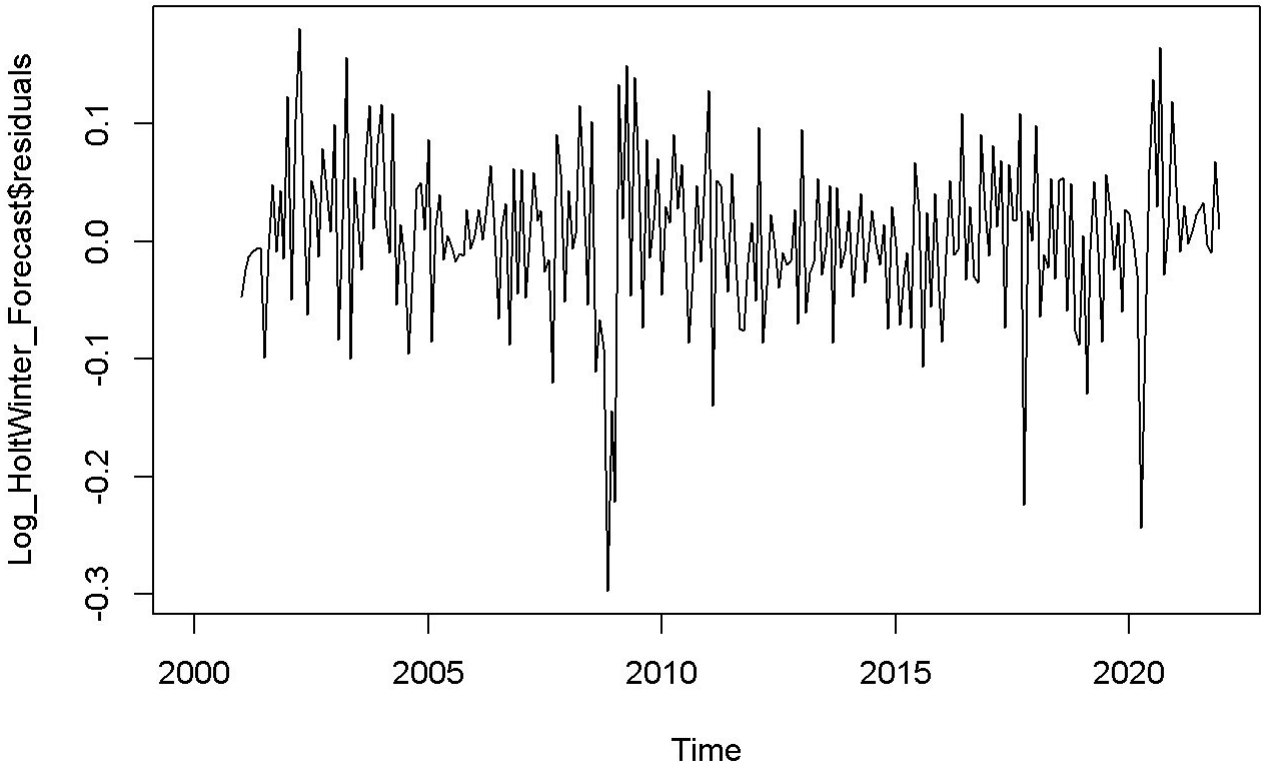

```
Log_HoltWinter_Fit <- HoltWinters(log(data_ts))
Log_HoltWinter_Fit
```

```
## Holt-Winters exponential smoothing with trend and additive seasonal component.
##
## Call:
## HoltWinters(x = log(data_ts))
##
## Smoothing parameters:
##  alpha: 0.621694
##  beta : 0.0320837
##  gamma: 0.3689733
##
## Coefficients:
##             [,1]
## a   24.781806616
## b    0.006929917
## s1  -0.036926425
## s2  -0.092968812
## s3   0.058487689
## s4   0.016578125
## s5  -0.004788927
## s6   0.050522504
## s7   0.040573069
## s8  -0.028424292
## s9   0.026310297
## s10  0.023731409
## s11  0.038321940
## s12  0.045470644
```

```
Log_HoltWinter_Forecast <- forecast(Log_HoltWinter_Fit, h=6)
plot(Log_HoltWinter_Forecast)
```




```
plot.ts(Log_HoltWinter_Forecast$residuals)
```




```
exp(Log_HoltWinter_Forecast$mean)
```

```
##              Jan         Feb         Mar         Apr         May         Jun
## 2022 56179070144 53486634482 62665948711 60511811029 59644469875 63474787650
```