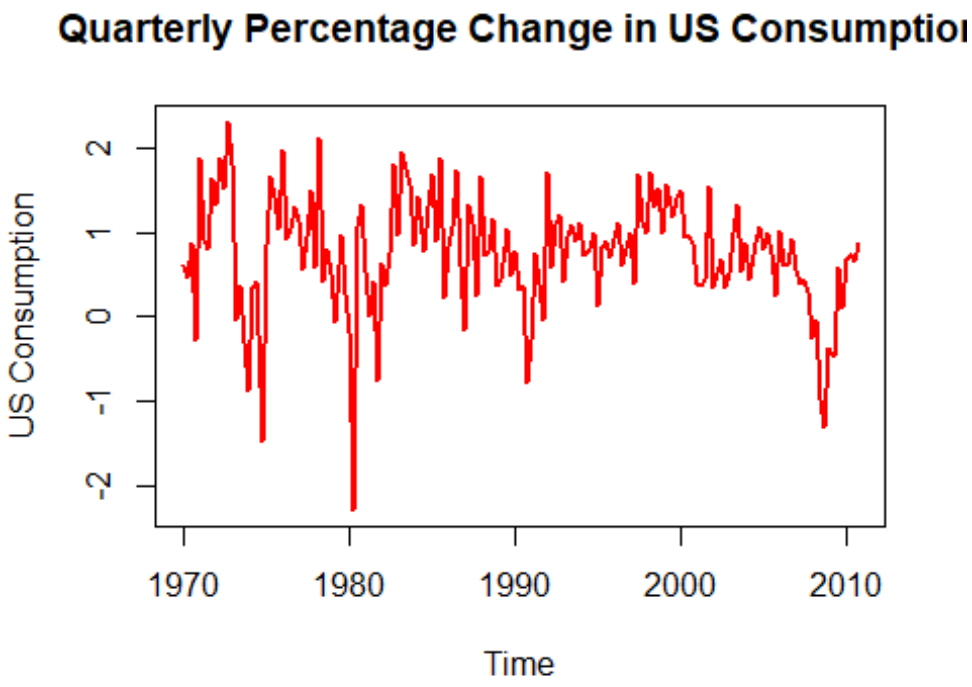
Application1

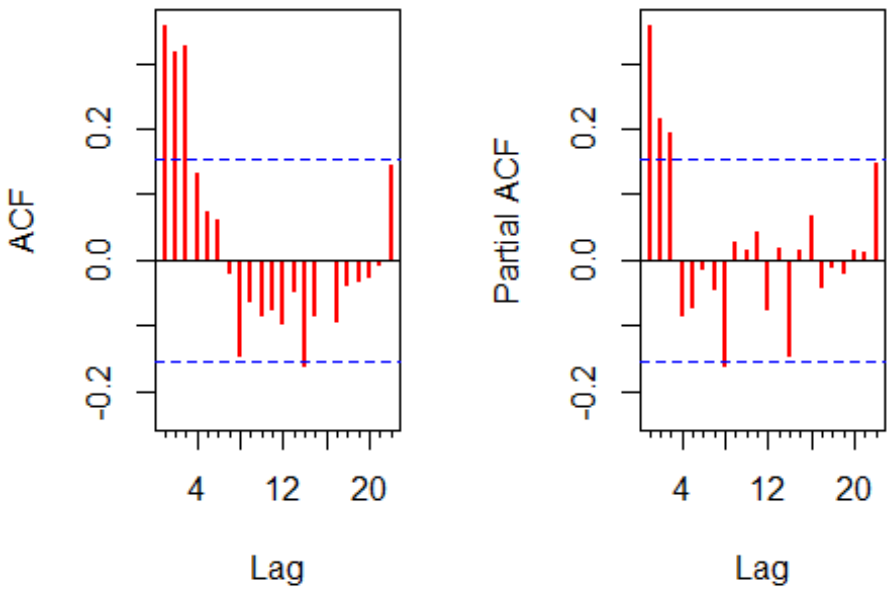
```r
# Loading library
library("fpp")
```

```
## Loading required package: forecast

## Loading required package: fma

## Loading required package: expsmooth

## Loading required package: lmtest

## Loading required package: zoo

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

## Loading required package: tseries
```

```r
# Time Series Plot
plot(usconsumption[,1],lwd=2,col="red",ylab="US Consumption",main="Quarterly
Percentage Change in US Consumption")
```

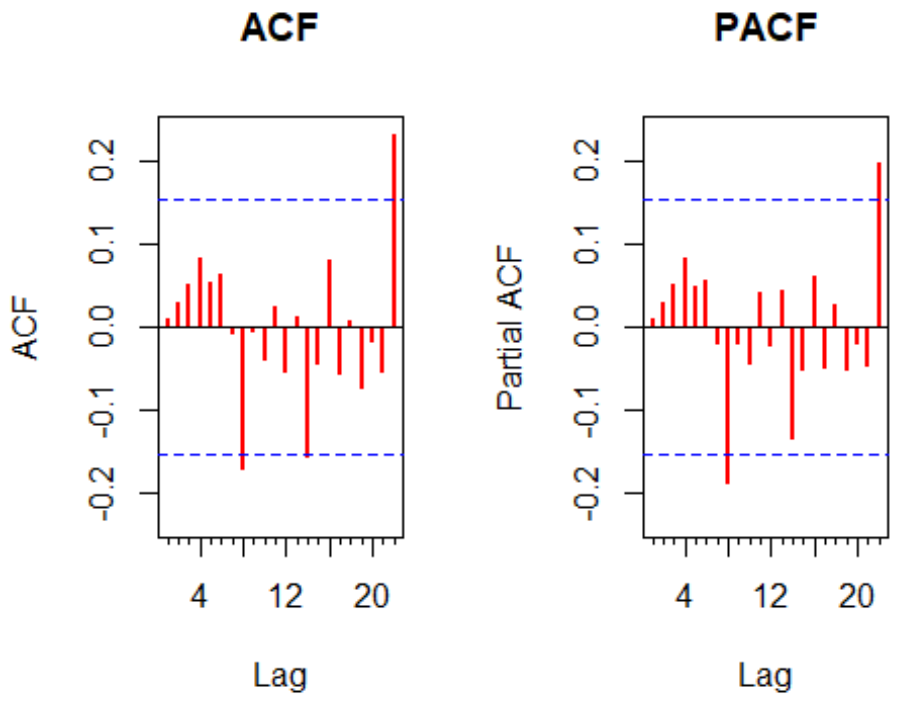



```r
# ACF and PACF of quarterly percentage change in US consumption
par(mfrow=c(1,2))
Acf(usconsumption[,1],main="",col="red",lwd=2)
Pacf(usconsumption[,1],main="",col="red",lwd=2)
```




```
# Check whether White Noise
Box.test(usconsumption[,1])

##
##  Box-Pierce test
##
## data:  usconsumption[, 1]
## X-squared = 20.939, df = 1, p-value = 4.74e-06

Box.test(usconsumption[,1],type="Lj")

##
##  Box-Ljung test
##
## data:  usconsumption[, 1]
## X-squared = 21.325, df = 1, p-value = 3.877e-06

# Stationarity Check
# Formal Tests
adf.test(usconsumption[,1], alternative = "stationary")

## Warning in adf.test(usconsumption[, 1], alternative = "stationary"): p-
## value smaller than printed p-value

##
##  Augmented Dickey-Fuller Test
##
## data:  usconsumption[, 1]
```

```
## Dickey-Fuller = -4.2556, Lag order = 5, p-value = 0.01
## alternative hypothesis: stationary

kpss.test(usconsumption[,1])

## Warning in kpss.test(usconsumption[, 1]): p-value greater than printed p-
## value

##
##  KPSS Test for Level Stationarity
##
## data:  usconsumption[, 1]
## KPSS Level = 0.26046, Truncation lag parameter = 2, p-value = 0.1

# ARIMA Model
fit=auto.arima(usconsumption[,1],seasonal=FALSE)

# Alternative
fit=Arima(usconsumption[,1], order=c(0,0,3))

# Diagnostic
res=residuals(fit)
par(mfrow=c(1,2))
Acf(res,main="ACF",col="red",lwd=2)
Pacf(res,main="PACF",col="red",lwd=2)
```



```r
Box.test(res,fitdf=3,lag=10) # fitdf is the number of parameters in the
fitted model, set lag=10 for ARIMA models
```

```
##
##  Box-Pierce test
##
## data:  res
## X-squared = 7.842, df = 7, p-value = 0.3467
```

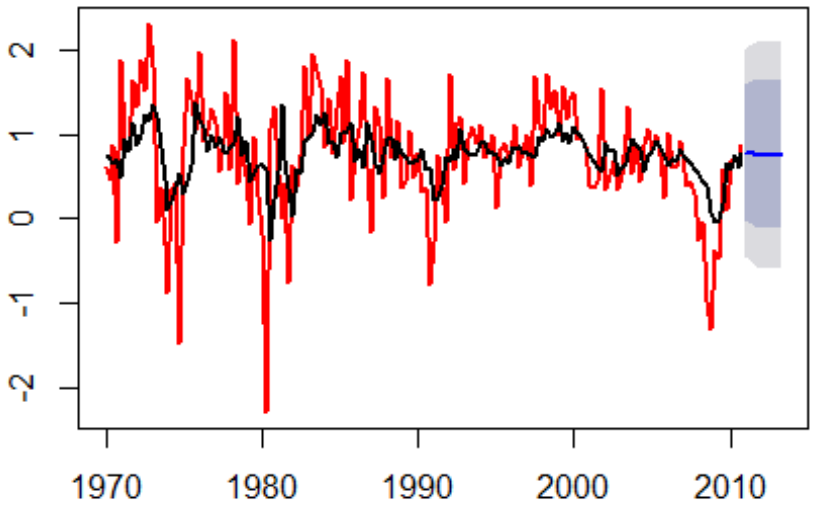
```r
Box.test(res,fitdf=3,lag=10,type="Lj")
```

```
##
##  Box-Ljung test
##
## data:  res
## X-squared = 8.2809, df = 7, p-value = 0.3085
```

```r
# Forecasting
# Point Forecast
forecast(fit,h=10)$mean
```

```
##           Qtr1      Qtr2      Qtr3      Qtr4
## 2011 0.7771954 0.7875042 0.7820586 0.7561744
## 2012 0.7561744 0.7561744 0.7561744 0.7561744
## 2013 0.7561744 0.7561744
```

```r
# Plots
par(mfrow=c(1,1))
plot(forecast(fit,h=10),col="red",lwd=2,main="")
lines(fitted(fit),lwd=2,col="black")
```




```
# Accuracy
accuracy(fit)
```

```
##                         ME      RMSE       MAE  MPE MAPE      MASE
## Training set -4.013475e-05 0.6209988 0.4578466 -Inf  Inf 0.6590496
##                     ACF1
## Training set 0.0101825
```