Personal Savings Analysis

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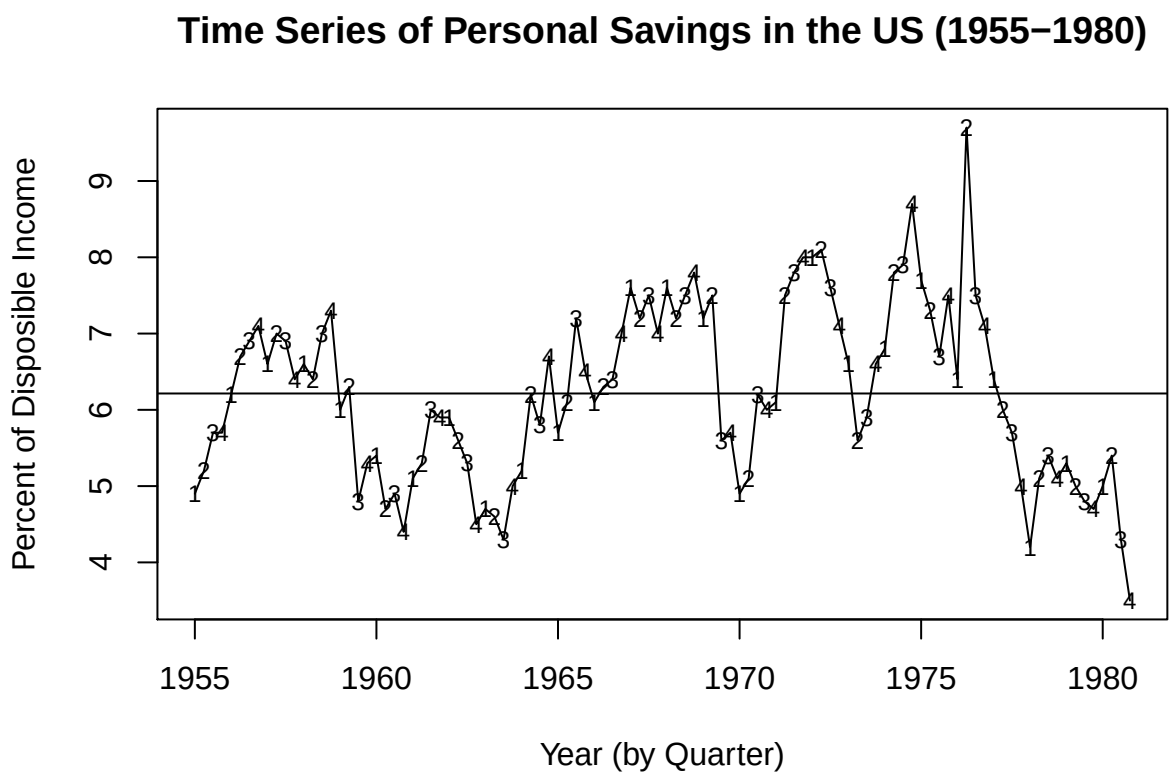
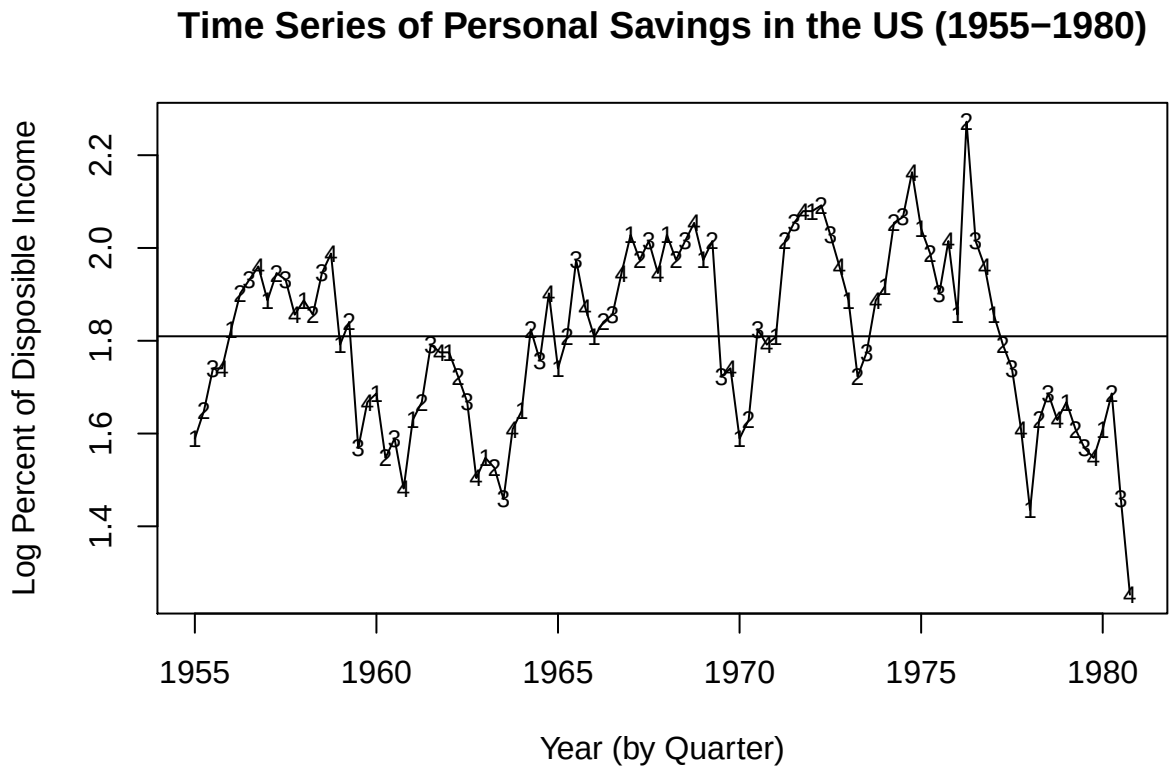
```
# load the time series
savings<-ts(read.csv("savings.csv",header=TRUE, nrows=104) %>% select(2), start=c(1955),frequency=4)

# plot the original time series with labels for quarters
plot(savings, xlab="Year (by Quarter)",
     ylab= "Percent of Disposible Income",
     main= "Time Series of Personal Savings in the US (1955-1980)")
points(y=savings,x=as.vector(time(savings)),pch=as.vector(season(savings)), cex=.75)
abline(mean(savings),0)
```




```
# should we do a transformation?
boxcox = BoxCox.ar(savings)
boxcox$ci
lambda = boxcox$mle
lambda
```

```
# log transform the data
savings = log(savings)
```

```r
# plot the transformed time series with labels for quarters
plot(savings, xlab="Year (by Quarter)",
     ylab= "Log Percent of Disposible Income",
     main= "Time Series of Personal Savings in the US (1955-1980)")
points(y=savings,x=as.vector(time(savings)),pch=as.vector(season(savings)), cex=.75)
abline(mean(savings),0)
```




```r
# use the eacf and best subsets to find a candidate model
eacf(savings)
```

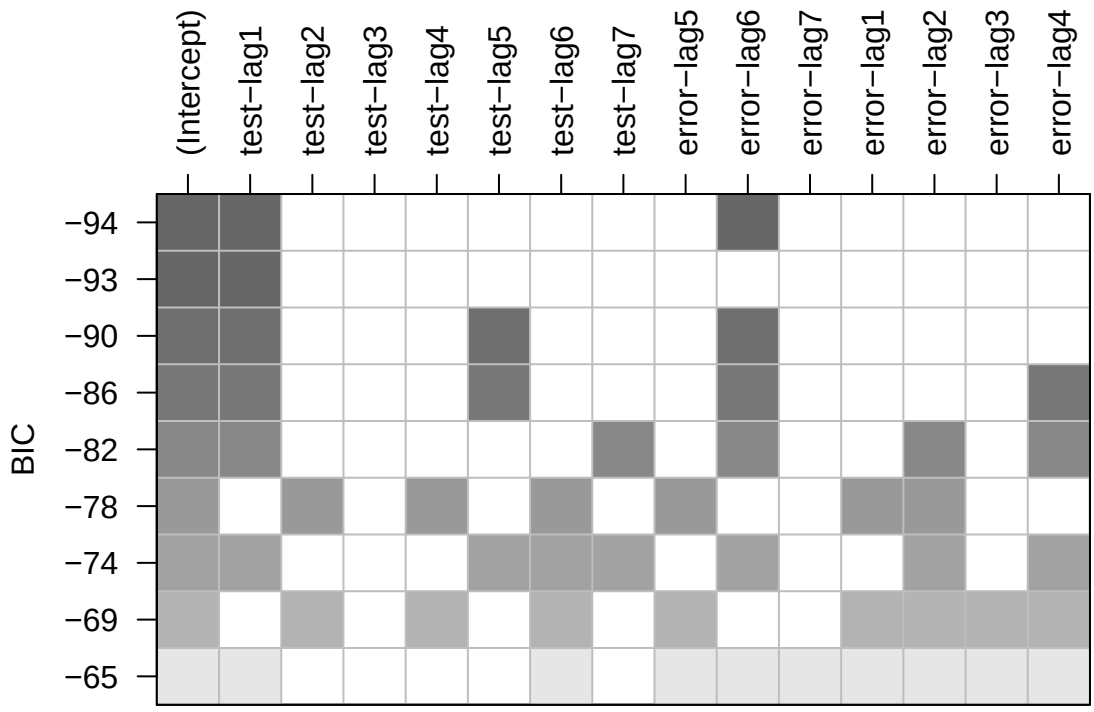
```
## AR/MA
##   0 1 2 3 4 5 6 7 8 9 10 11 12 13
## 0 x x x x x o o o o o o  o  o  o
## 1 o x o o o o o o o o o  o  o  o
## 2 x x o o o o o o o o o  o  o  o
## 3 x x o o o o o o o o o  o  o  o
## 4 x x o o o o o o o o o  o  o  o
## 5 o o o o o o o o o o o  o  o  o
## 6 o o x o o o o o o o o  o  o  o
## 7 x o x o o o o o o o o  o  o  o
```

```r
sub = armasubsets(y=savings,nar=7,nma=7, y.name='test', ar.method='ols')
```

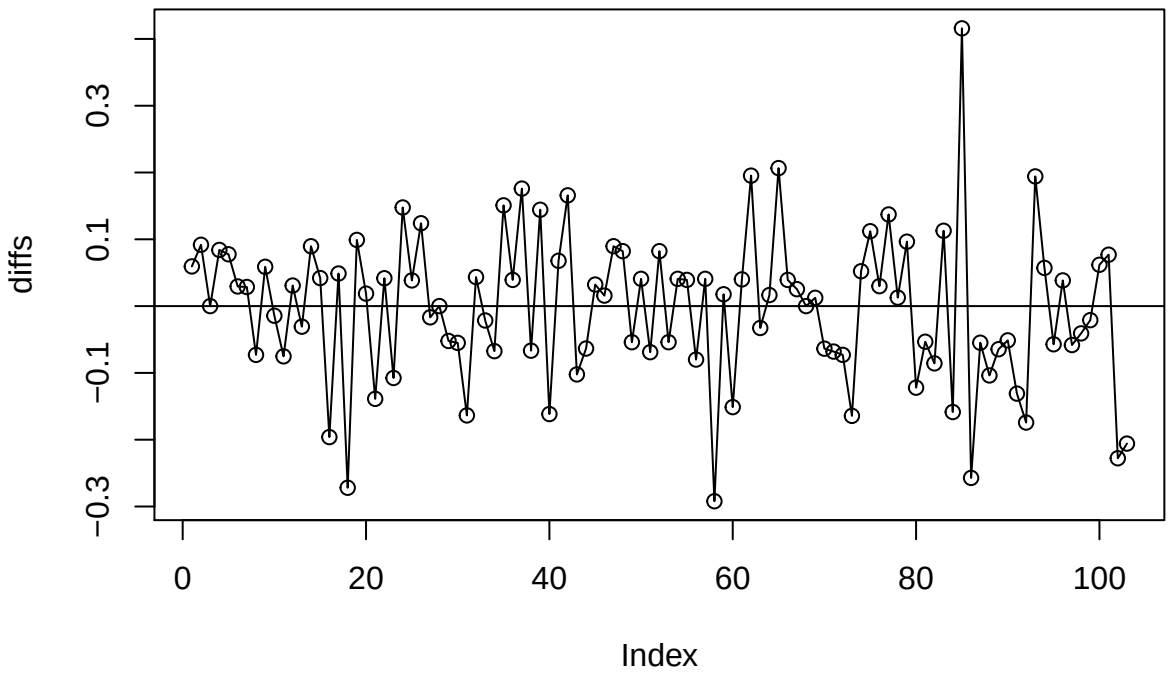
```
## Warning in leaps.setup(x, y, wt = wt, nbest = nbest, nvmax = nvmax,
## force.in = force.in, : 4 linear dependencies found
```

```
## Reordering variables and trying again:
```

```
plot(sub)
```




```
# take a difference of the series
diffs = (savings - zlag(savings))[2:104]
plot(diffs, type="o")
abline(0,0)
```




```
# find candidate models for the differenced series
eacf(diffs)
```

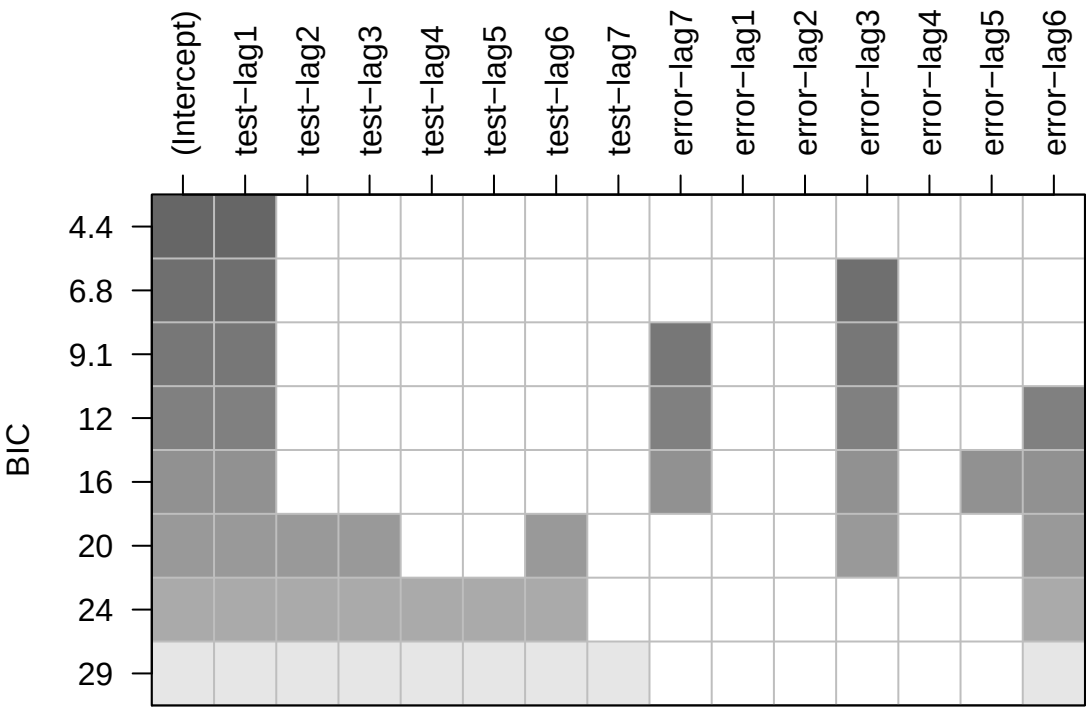
```
## AR/MA
##   0 1 2 3 4 5 6 7 8 9 10 11 12 13
## 0 x o o o o o o o o o o  o  o  o
## 1 x o o o o o o o o o o  o  o  o
## 2 o o o o o o o o o o o  o  o  o
## 3 o x x o o o o o o o o  o  o  o
## 4 x x x o o o o o o o o  o  o  o
## 5 x o x o o o o o o o o  o  o  o
## 6 x o x o o o o o o o o  o  o  o
## 7 o x o x o o o o o o o  o  o  o
```

```
best.subsets = armasubsets(y=diffs,nar=7,nma=7, y.name='test', ar.method='ols')
```

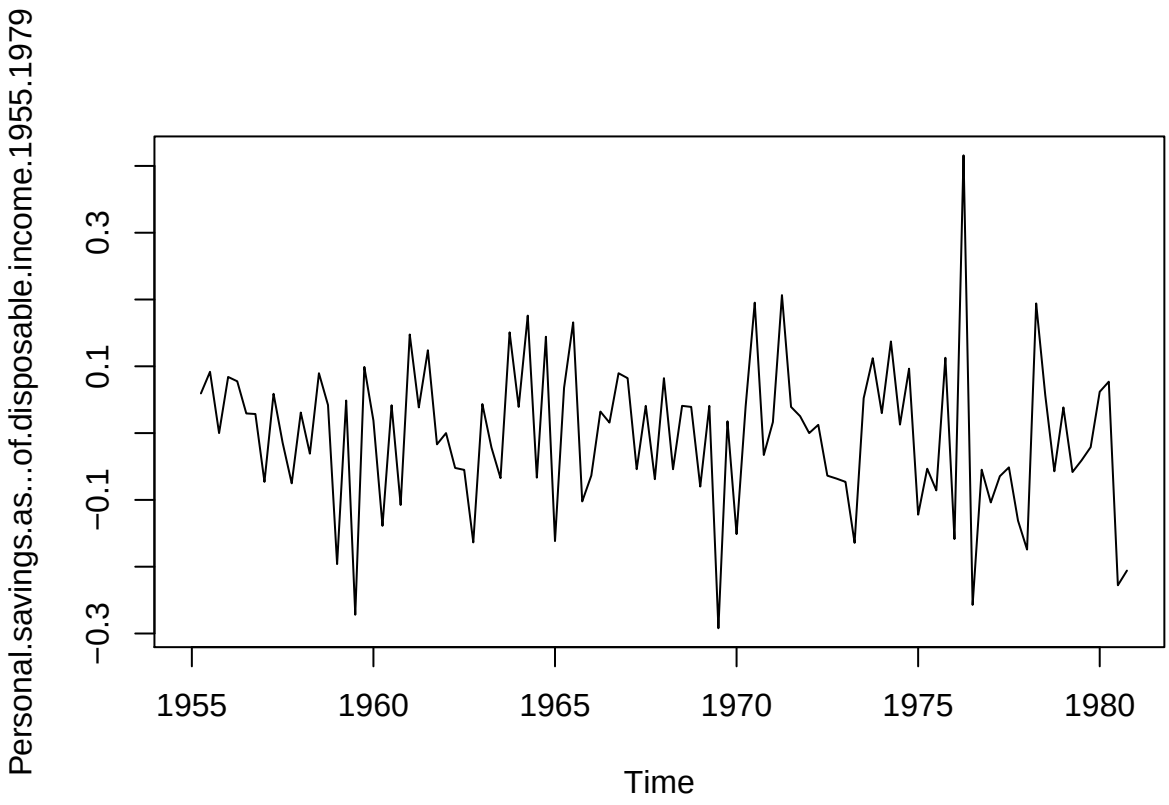
```
## Warning in leaps.setup(x, y, wt = wt, nbest = nbest, nvmax = nvmax,
## force.in = force.in, : 6 linear dependencies found
```

```
## Reordering variables and trying again:
```

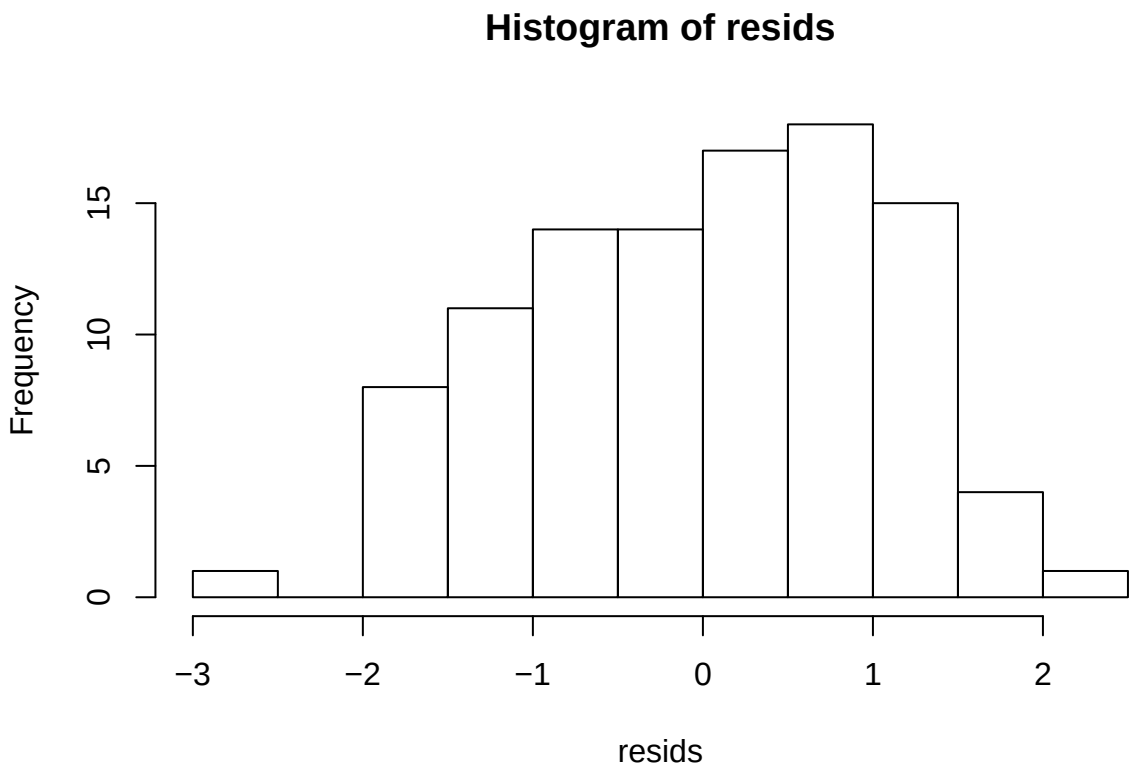
```
plot(best.subsets)
```



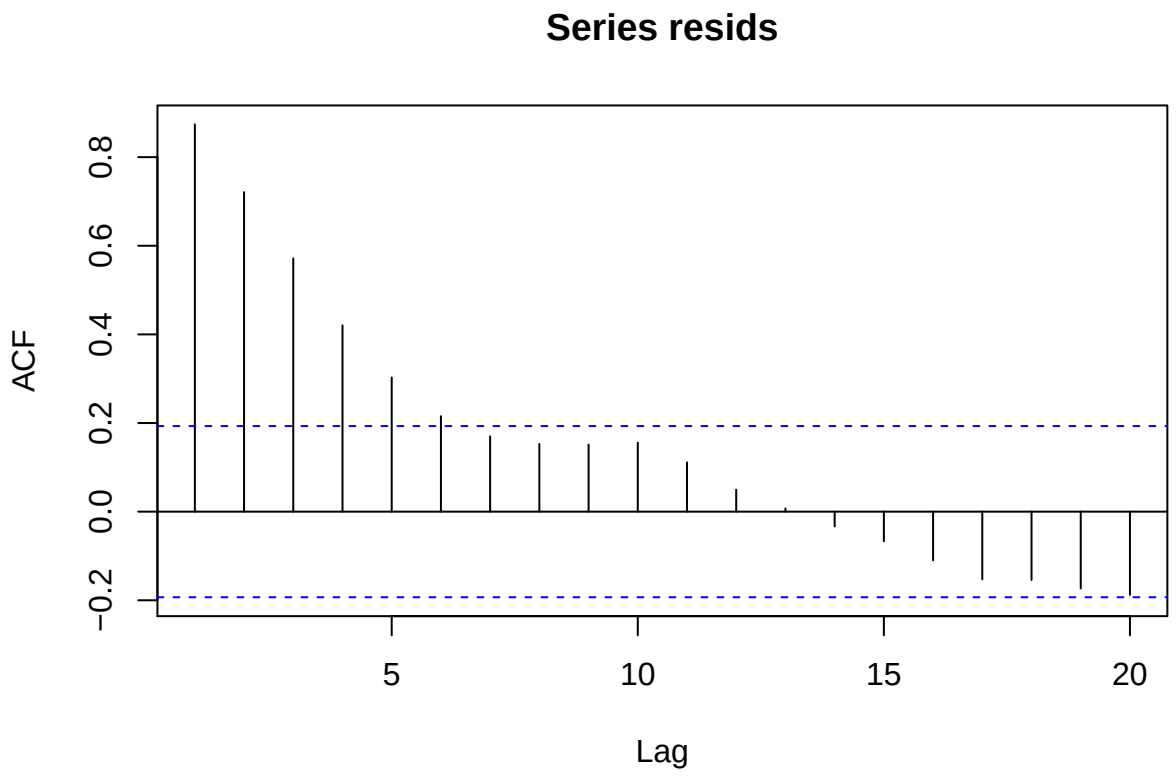

```
diffs<-(savings-zlag(savings))
fit<-lm(savings~diffs)
#predicts<-predict.lm(fit)
plot(diffs)
```



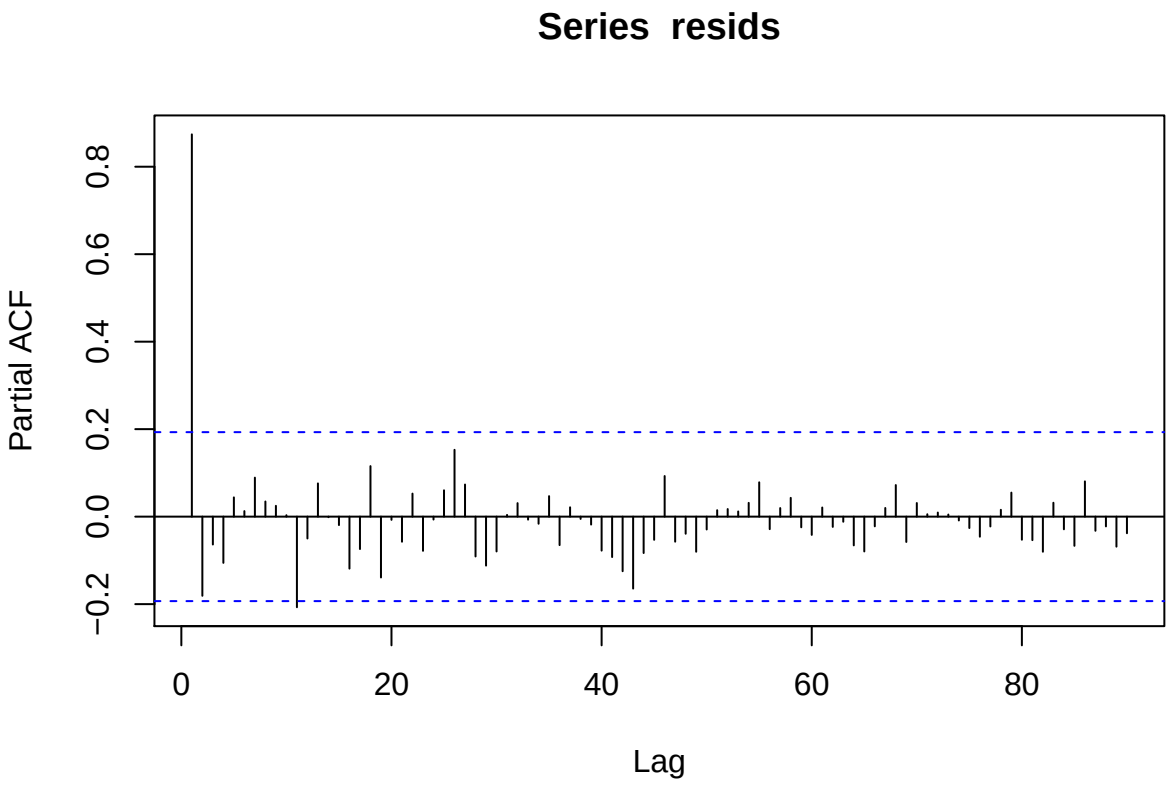

```
resids<-rstudent(fit)
hist(resids)
```




```
acf(resids)
```




```
pacf(resids,lag=90)
```




```
ar(diffs[3:length(diffs)-1],order.max=2,AIC=F,method="yw")
```

```
##
## Call:
## ar(x = diffs[3:length(diffs) - 1], order.max = 2, method = "yw",     AIC = F)
##
## Coefficients:
##      1       2
## -0.208   0.142
##
## Order selected 2  sigma^2 estimated as  0.01166
```

```
arima(savings,order=c(2,1,0),method='ML')
```

```
##
## Call:
## arima(x = savings, order = c(2, 1, 0), method = "ML")
##
## Coefficients:
##           ar1     ar2
##       -0.1680  0.1425
## s.e.   0.0999  0.1020
##
## sigma^2 estimated as 0.01182:  log likelihood = 82.34,  aic = -160.69
```

```
eacf(diffs[3:length(diffs)-1])
```

```
## AR/MA
```

```
##   0 1 2 3 4 5 6 7 8 9 10 11 12 13
## 0 x o o o o o o o o o o  o  o  o
## 1 x o o o o o o o o o o  o  o  o
## 2 o x o o o o o o o o o  o  o  o
## 3 o x x o o o o o o o o  o  o  o
## 4 x x x o o o o o o o o  o  o  o
## 5 x o x o o o o o o o o  o  o  o
## 6 x o x o o o o o o o o  o  o  o
## 7 x x x o o o o o o o o  o  o  o
```