ARIMA_2_15

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Double difference makes the data looks much better (trend elimination)

```
library(forecast)
```

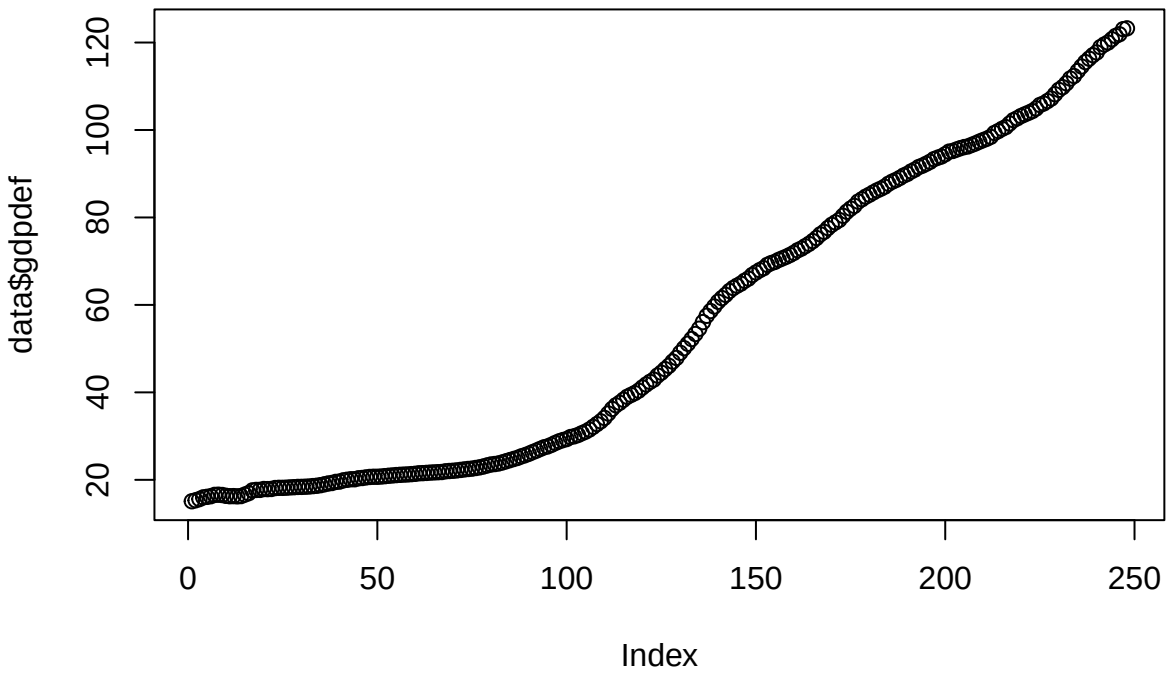
```
## Warning: package 'forecast' was built under R version 4.3.2
```

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

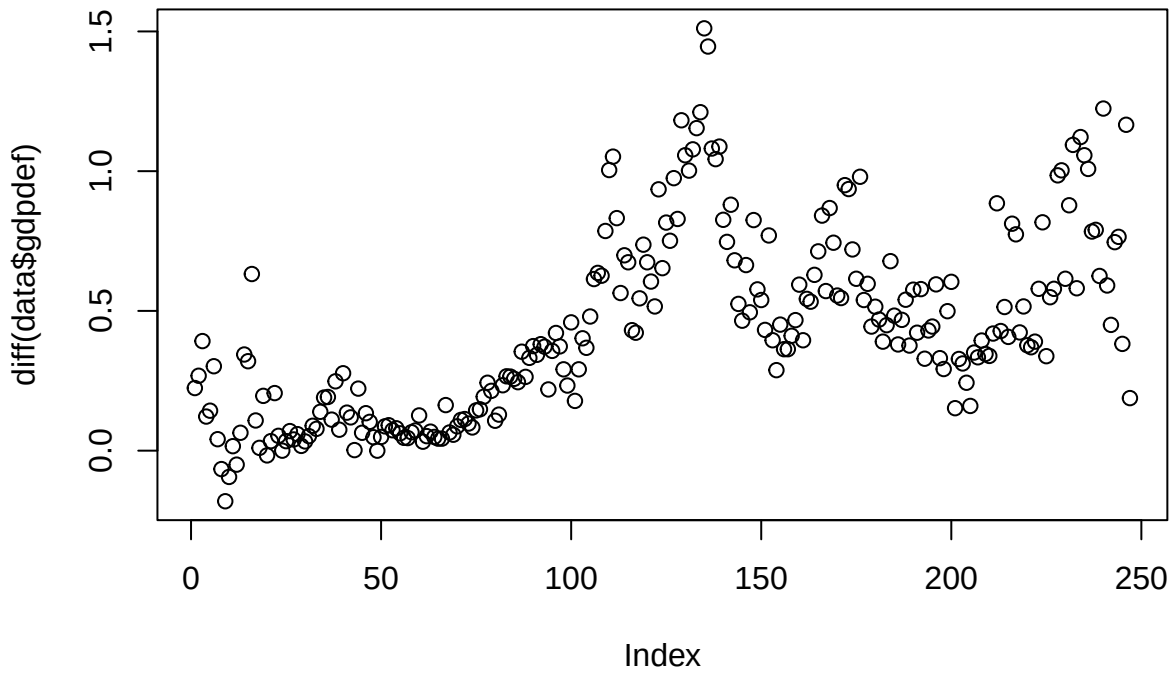
```
library(LSTS)
```

```
## Warning: package 'LSTS' was built under R version 4.3.3
```

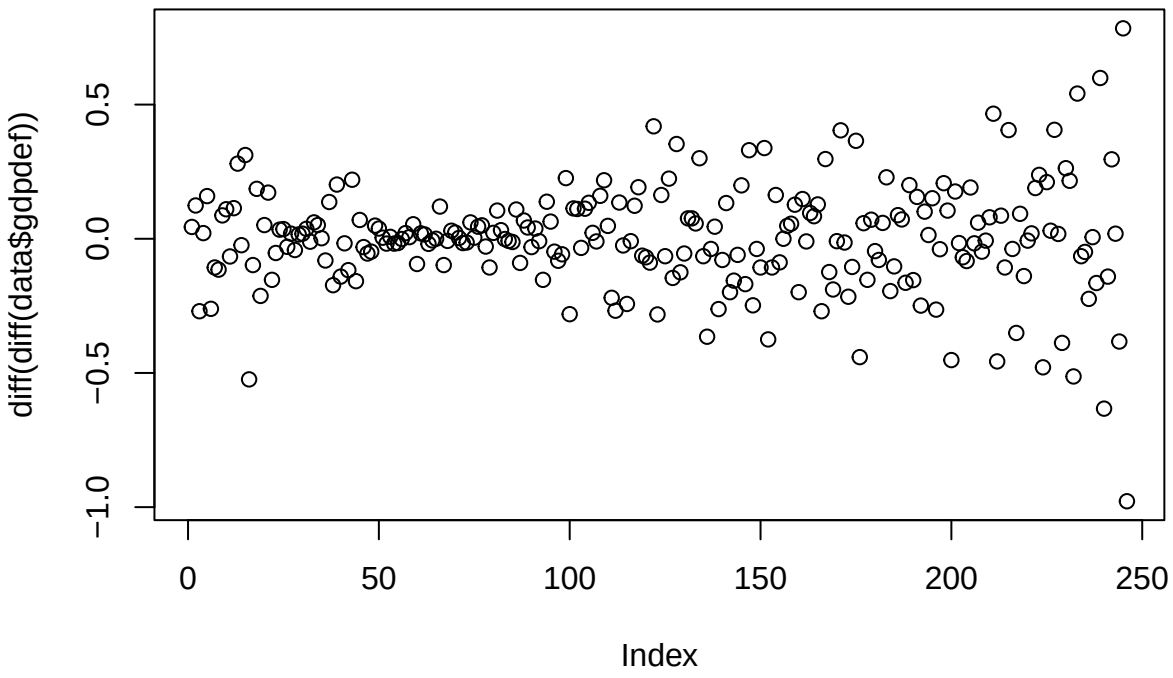
```
data = read.csv("q-gdpdef-1.txt",sep="", header=TRUE)
plot(data$gdpdef)
```



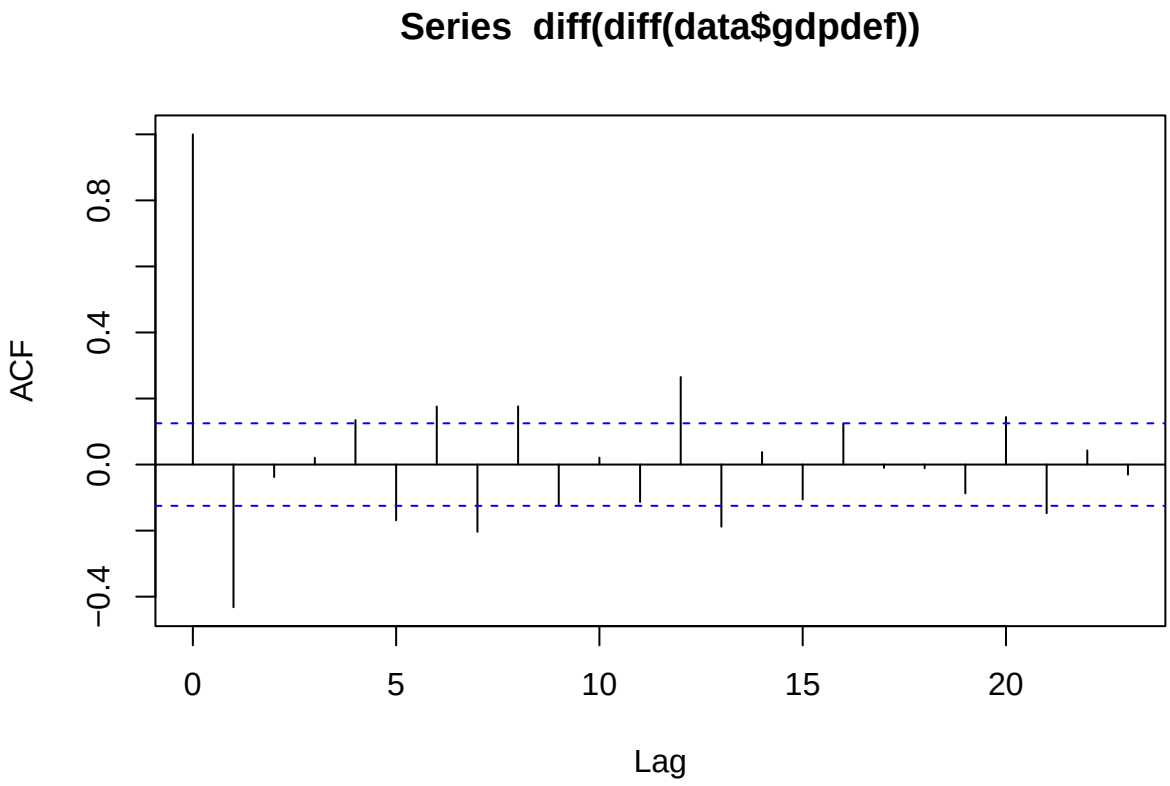

```
plot(diff(data$gdpdef))
```



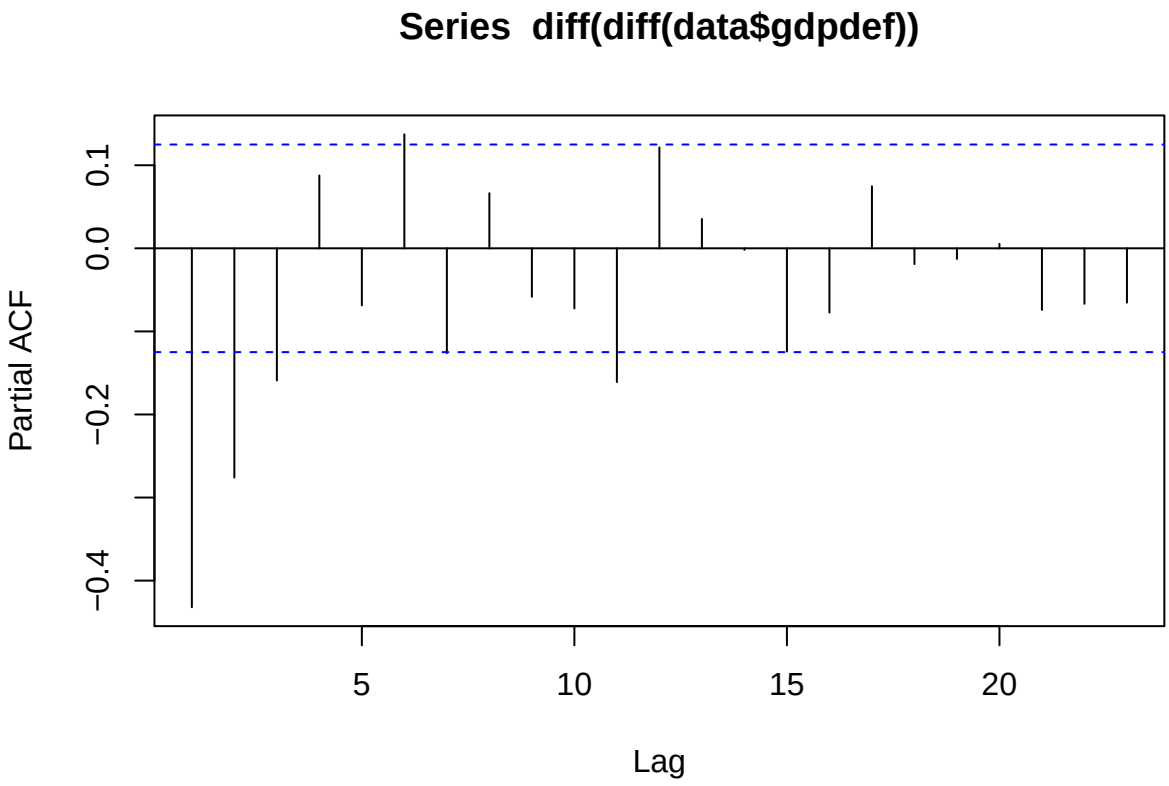

```
plot(diff(diff(data$gdpdef)))
```




```
acf(diff(diff(data$gdpdef)))
```




```
pacf(diff(diff(data$gdpdef)))
```

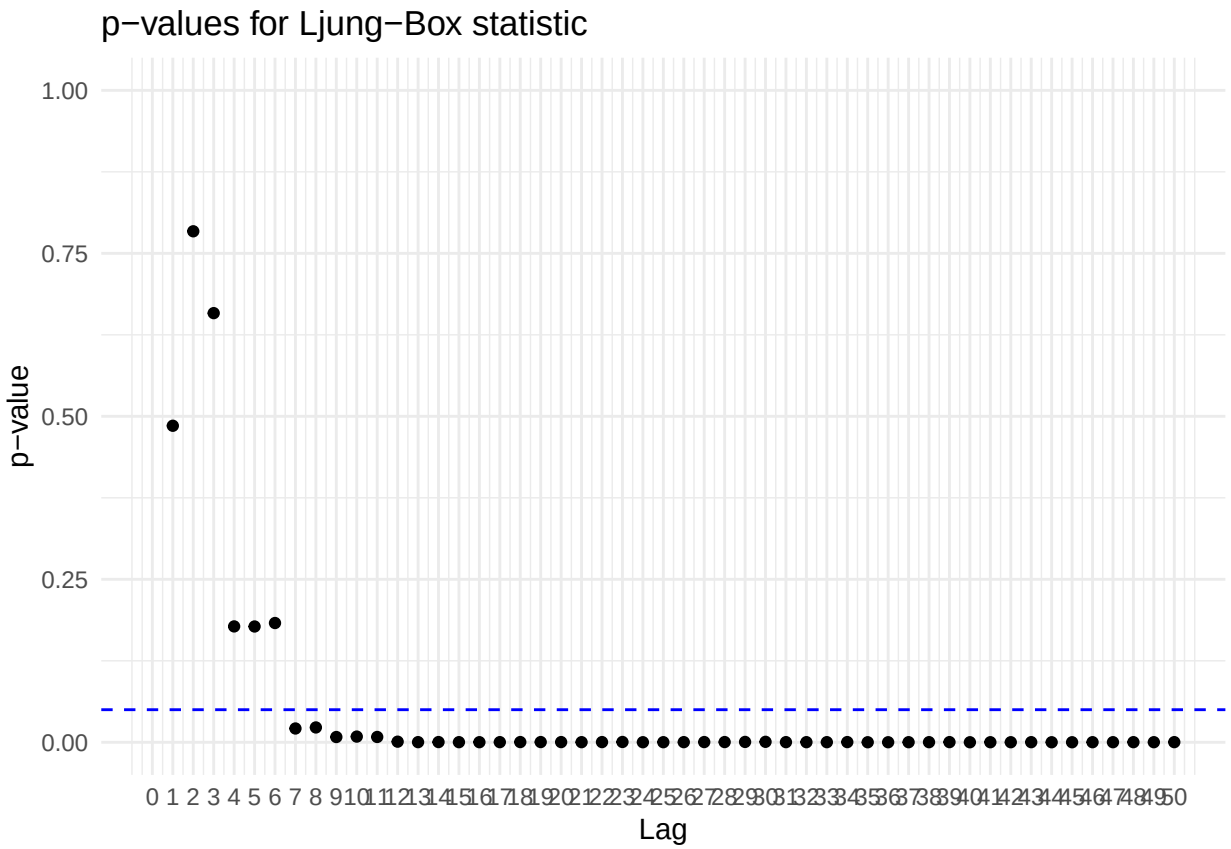


#Try using auto arima fit with BIC criteria (didn't work)

```
fit <- auto.arima(data$gdpdef,max.p = 15,max.q = 15, max.d = 15,seasonal = TRUE,ic = 'bic')
fit
```

```
## Series: data$gdpdef
## ARIMA(0,2,1)
##
## Coefficients:
##           ma1
##       -0.5862
## s.e.   0.0486
##
## sigma^2 = 0.02873:  log likelihood = 87.86
## AIC=-171.72   AICc=-171.67   BIC=-164.7
```

```
Box.Ljung.Test(residuals(fit), lag = 50)
```




```
forecast(fit,h=4)
```

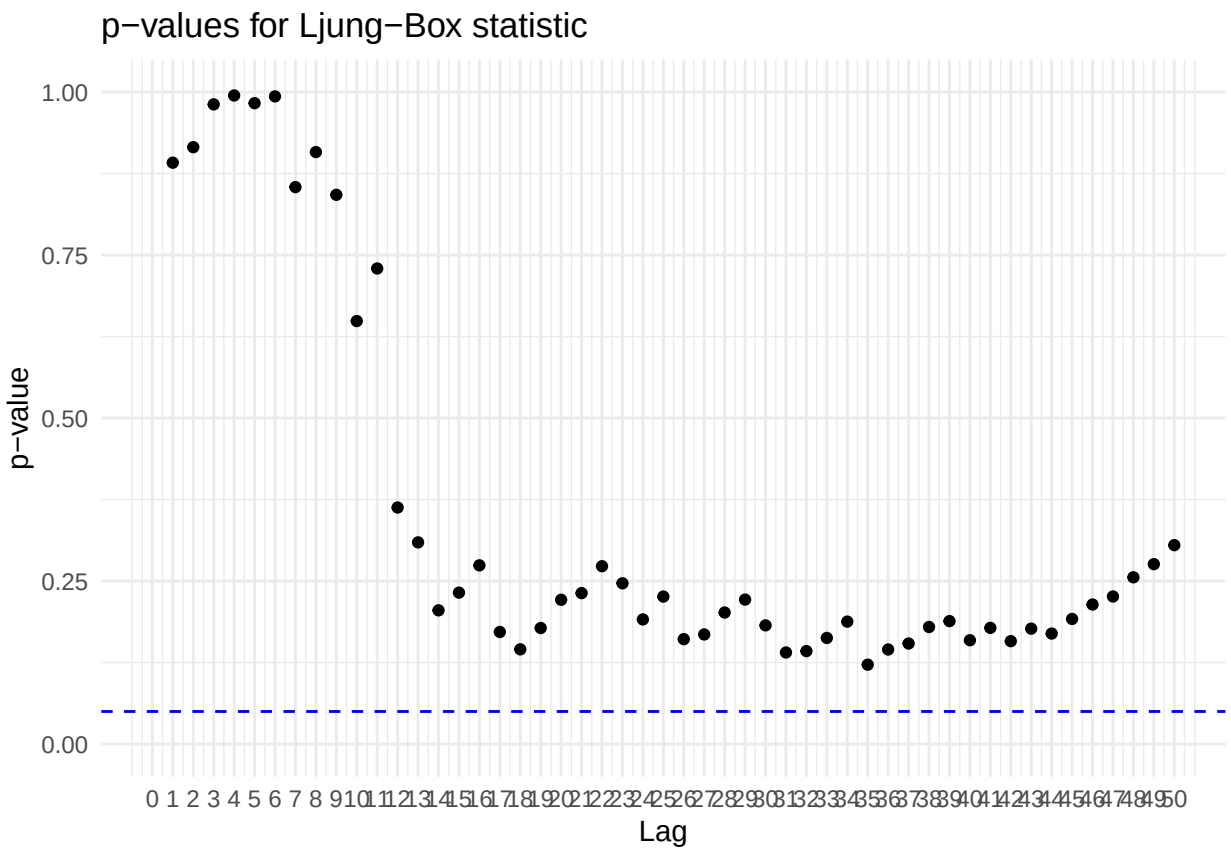
```
##     Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## 249       123.8046 123.5874 124.0219 123.4724 124.1369
## 250       124.3653 123.9891 124.7415 123.7900 124.9406
## 251       124.9259 124.3790 125.4729 124.0895 125.7624
## 252       125.4866 124.7543 126.2188 124.3667 126.6065
```

#Try arima(3,2,1) as indicated from ACF and PACF

```
fit2 = arima(data$gdpdef,order = c(3,2,1))
fit2
```

```
##
## Call:
## arima(x = data$gdpdef, order = c(3, 2, 1))
##
## Coefficients:
##           ar1      ar2      ar3     ma1
##       -1.4498  -0.8654  -0.4071  0.9051
## s.e.   0.0691   0.0978   0.0631  0.0483
##
## sigma^2 estimated as 0.02581:  log likelihood = 99.93,  aic = -189.87
```

```
Box.Ljung.Test(residuals(fit2), lag = 50)
```




```
predict(fit2, n.ahead=4)
```

```
## $pred
## Time Series:
## Start = 249
## End = 252
## Frequency = 1
## [1] 123.7783 124.3377 124.9592 125.3280
##
## $se
## Time Series:
## Start = 249
## End = 252
## Frequency = 1
## [1] 0.1606613 0.2836871 0.4091217 0.5609220
```

#The Ljung-Box test result looks much better!