Autocorrelation tests in Time series analysis

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Loading the libraries

```r
library(wooldridge)
library(dynlm)
library(stats)
library(lmtest)
library(dplyr)
library(ggplot2)
```

Loading the data

```r
data("USDistLag")
```

Descriptives

```r
??USDistLag                    #checking what the data is about
```

```
## starting httpd help server ... done
```

```r
data1=USDistLag                #store USDistLag to data1
summary(data1)                 #brief summary of the data
```

```
##   consumption        gnp
## Min.   :522.7   Min.   : 832.6
## 1st Qu.:642.9   1st Qu.:1046.5
## Median :752.5   Median :1208.7
## Mean   :747.8   Mean   :1197.2
## 3rd Qu.:868.8   3rd Qu.:1386.9
## Max.   :951.6   Max.   :1502.6
```

```r
variable.names(data1)          #gives you the names of the variables
```
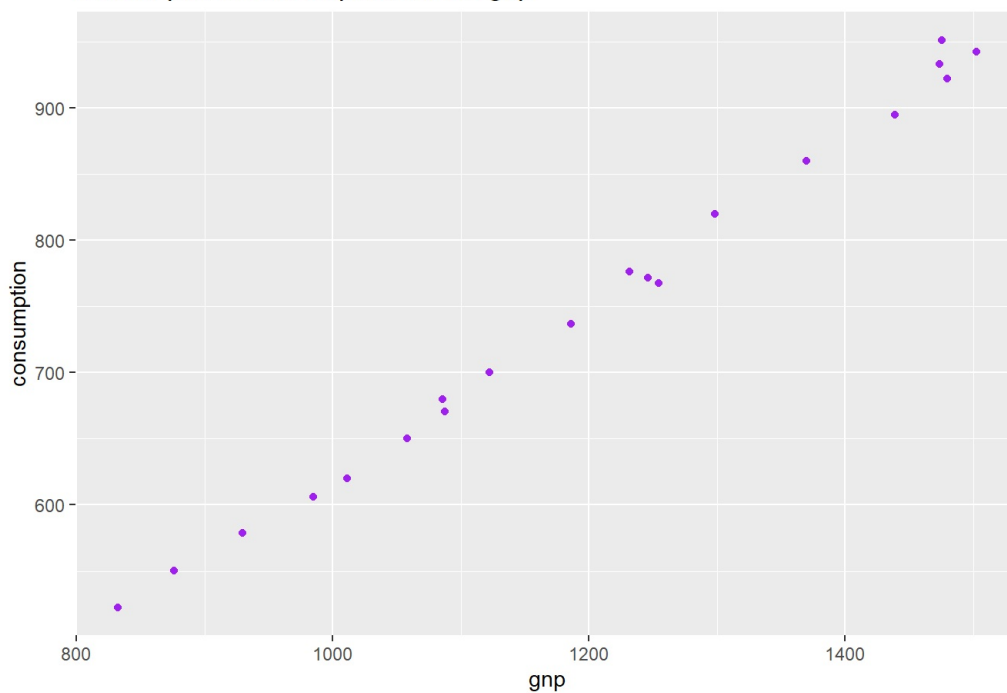
```
## [1] "consumption" "gnp"
```

```r
View(data1)                    #to view the data
```

Data Visualization

```r
#Scatter Plot
data1Df = as.data.frame(data1)    #converting data1 to a data frame
data1Df %>%
  ggplot(aes(gnp,consumption))+
  geom_point(color="purple")+
  labs(title="Scatter plot of consumption versus gnp")
```

Scatter plot of consumption versus gnp

Dynamic Linear Regression

```
#1.Define independent and dependent variables
#independent:gnp
#Dependent;consumption

#2.Define and fit the model
Reg1 = dynlm(consumption ~ gnp + L(gnp,1), data = data1)

#3.Regression results
summary(Reg1)
```

```
##
## Time series regression with "ts" data:
## Start = 1964, End = 1982
##
## Call:
## dynlm(formula = consumption ~ gnp + L(gnp, 1), data = data1)
##
## Residuals:
##     Min       1Q   Median       3Q      Max
## -13.3090  -5.7110  -0.5148   4.1788  15.7771
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -21.15693   12.95287  -1.633   0.1219
## gnp           0.50109    0.06702   7.477 1.32e-06 ***
## L(gnp, 1)     0.14486    0.06448   2.247   0.0391 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.448 on 16 degrees of freedom
## Multiple R-squared:  0.9963, Adjusted R-squared:  0.9958
## F-statistic:  2160 on 2 and 16 DF,  p-value: < 2.2e-16
```

Autocorrelation Test

1. Visual Inspection

```
#ACF Plot
acf(Reg1$residuals, type = "correlation")
```

Series Reg1$residuals
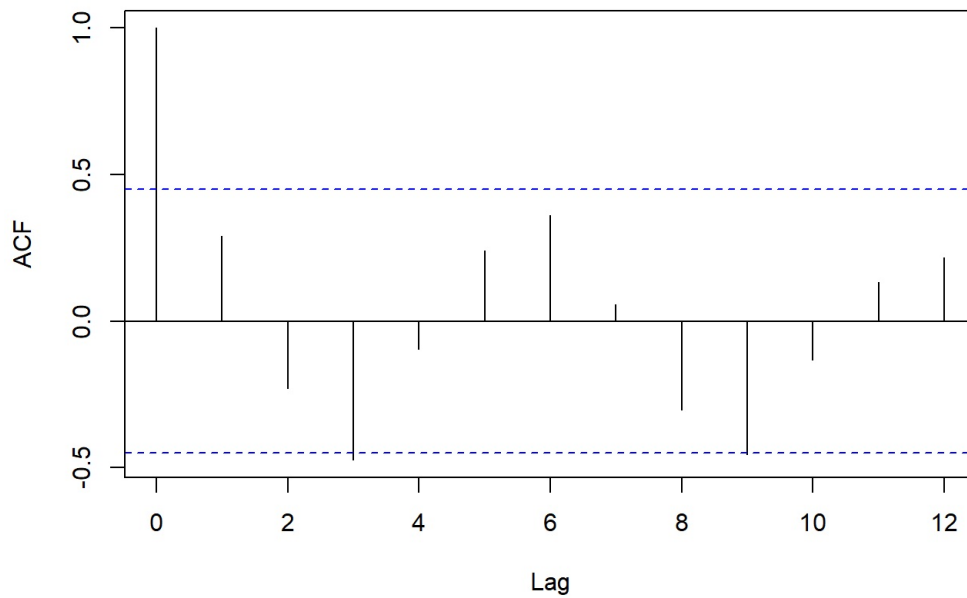
2. Statistical Tests

```
#Durbin-Watson Test==========#
dwtest(Reg1)
```

```
##
##   Durbin-Watson test
##
## data:  Reg1
## DW = 1.0812, p-value = 0.006054
## alternative hypothesis: true autocorrelation is greater than 0
```

```
#Breusch-Godfrey Test
bgtest(Reg1)
```

```
##
##   Breusch-Godfrey test for serial correlation of order up to 1
##
## data:  Reg1
## LM test = 4.2686, df = 1, p-value = 0.03882
```