Lab3

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September 15, 2018

1. For SOI data, calculate the 95% bounds for the autocorrelation.

```
data(soi)
upbound <- 1.96*1/sqrt(length(soi))
upbound
```

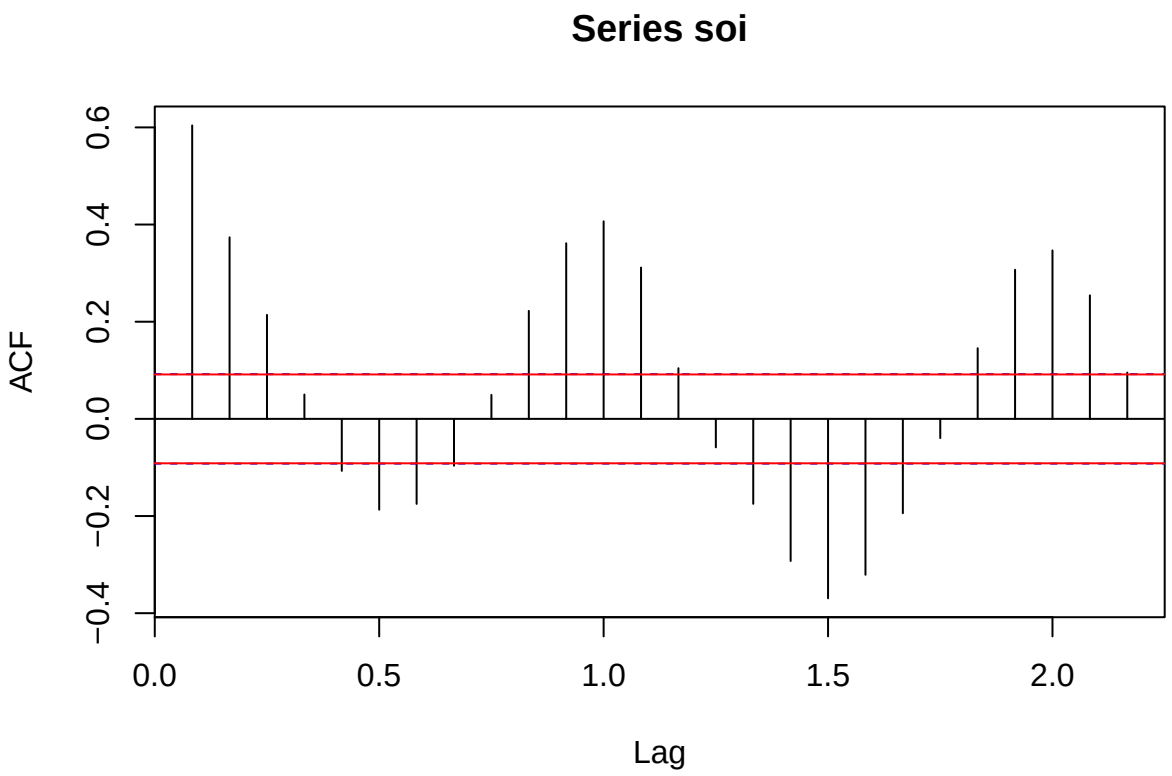
```
## [1] 0.09208883
```

```
lowbound <- -1.96*1/sqrt(length(soi))
lowbound
```

```
## [1] -0.09208883
```

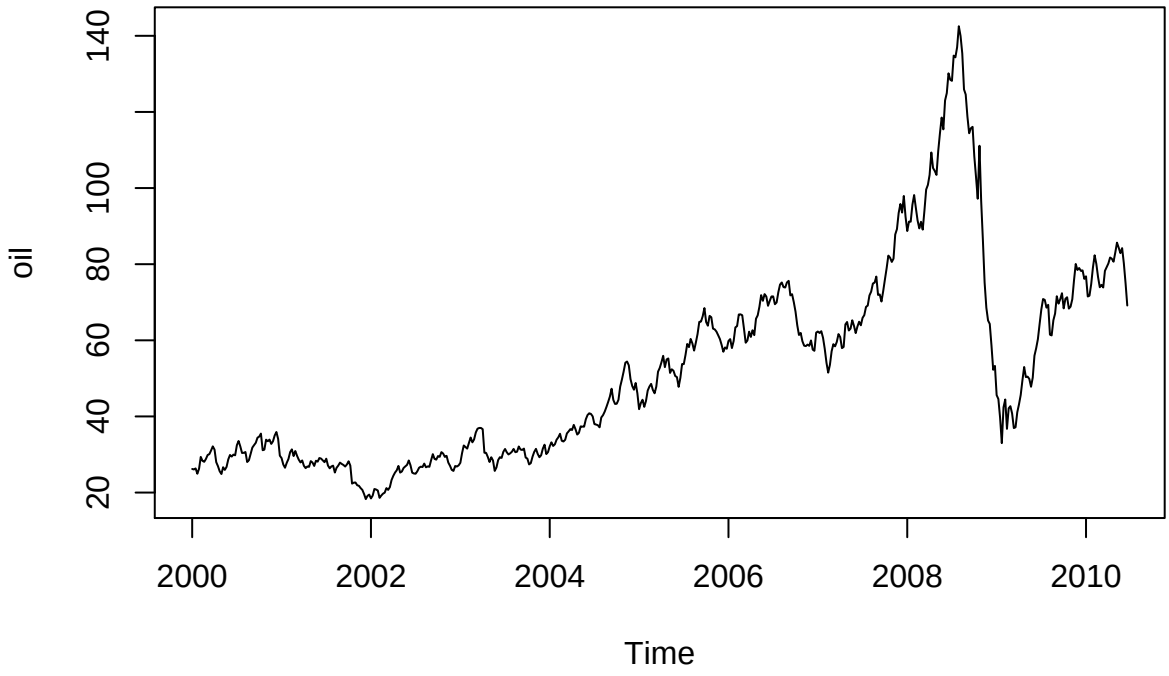
2. Verify your results in 1 by superimposing those bounds on the corresponding correlogram.

```
acf(soi, type = "correlation")
abline(h=1.96/sqrt(459),col="red")
abline(h=-1.96/sqrt(459),col="red")
```

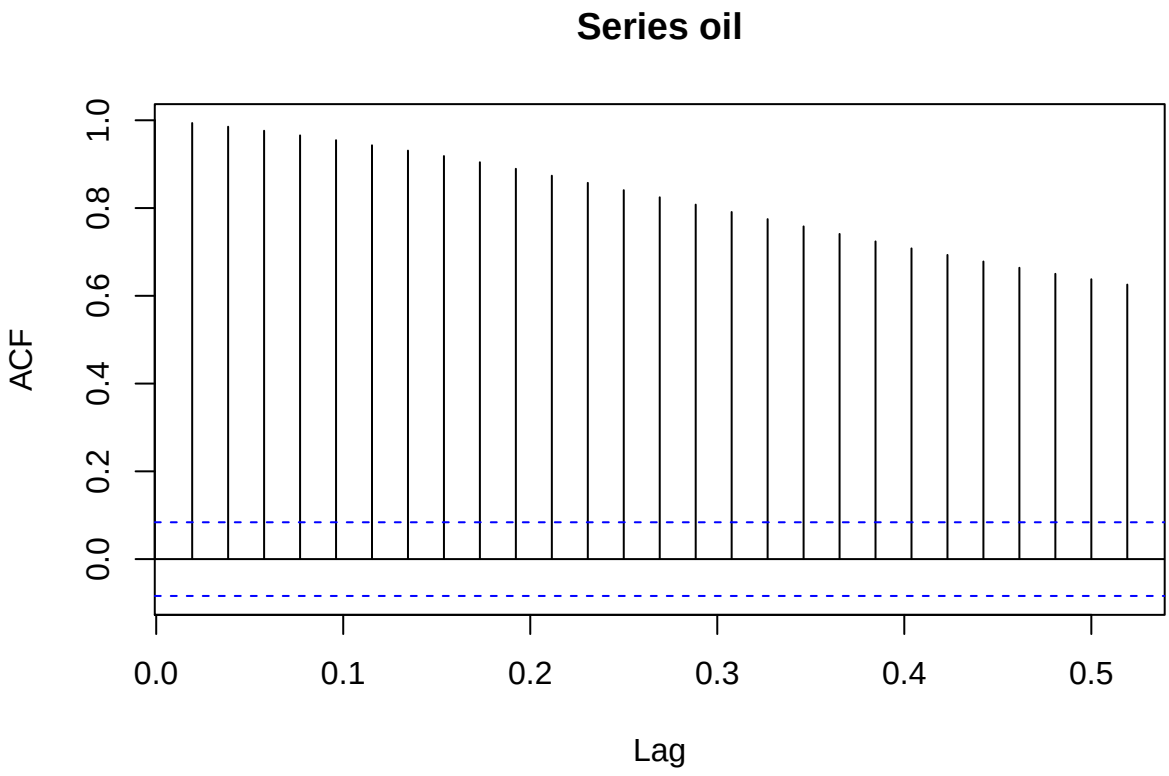


3. Consider two data sets: oil and gas from astsa package. Are any of these datasets stationary? Why or why not?

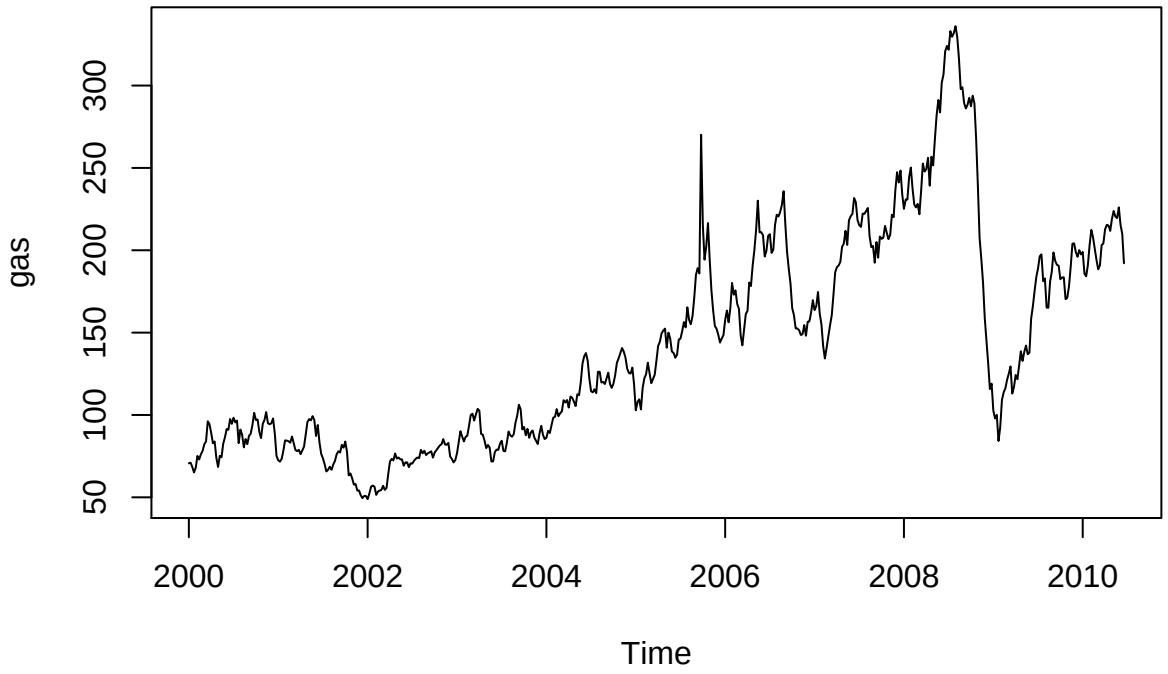
```
ts.plot(oil)
```



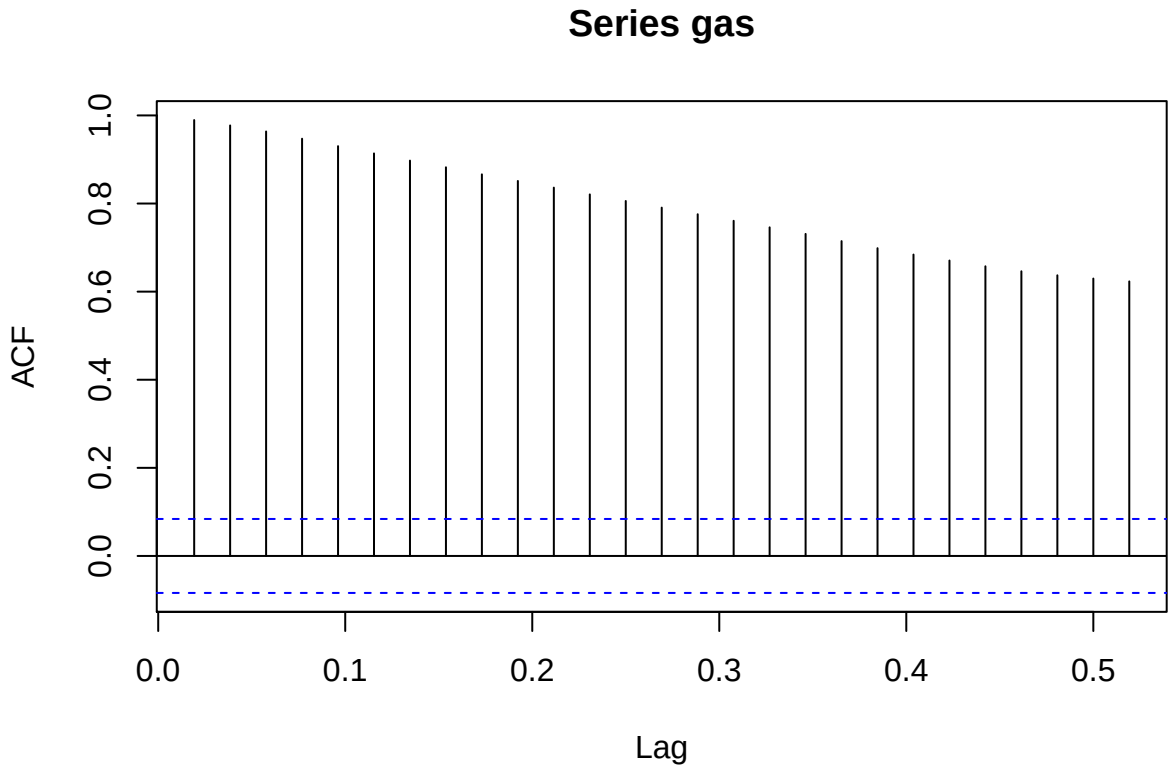

```
acf(oil, type = "correlation")
```



```r
ts.plot(gas)
```




```r
acf(gas, type = "correlation")
```



Both oil and gas datasets are not stationary, as there acf plot decays gradually as lag increases.

4. Apply the transformation

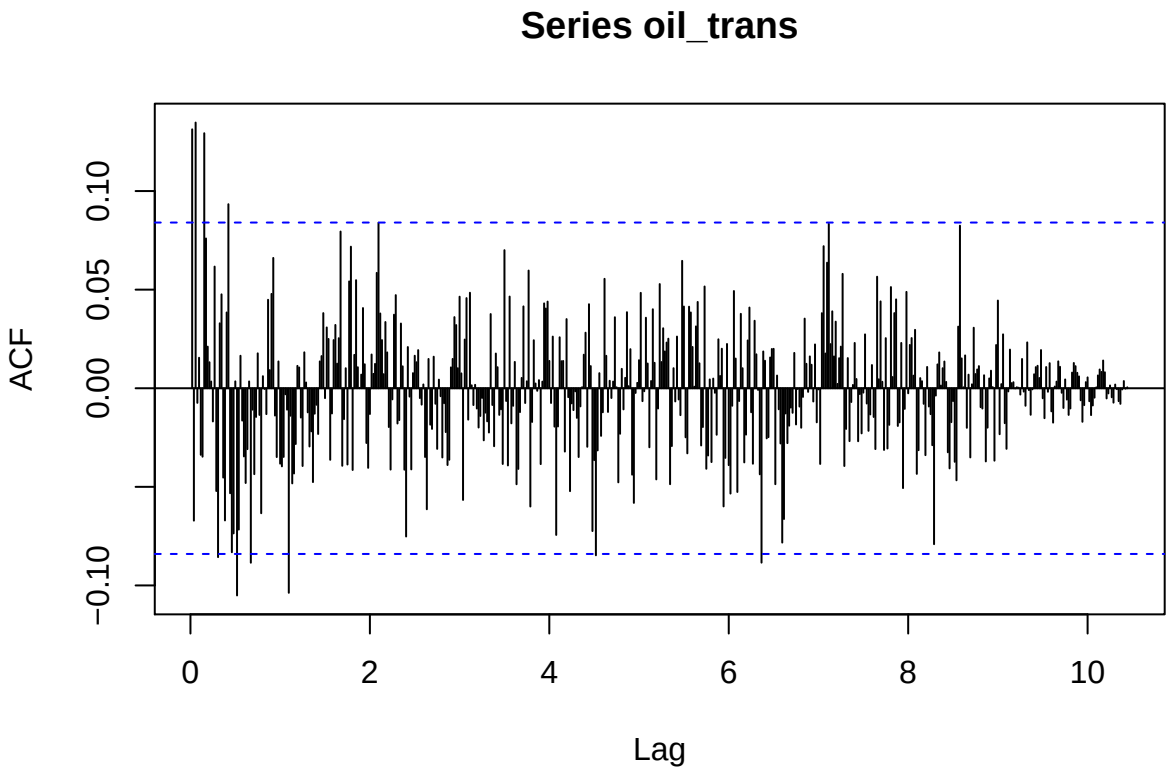
$$\nabla log X_t$$

, where

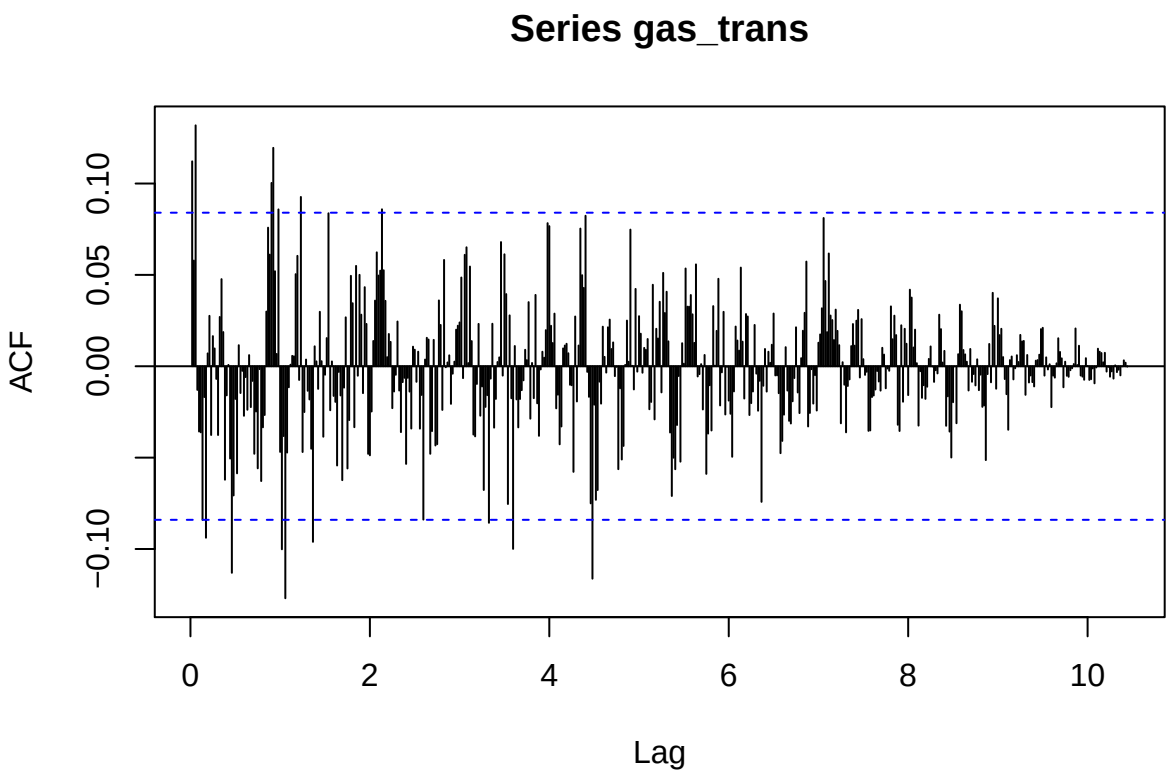
$$\nabla y_t = y_t - y_{t-1}$$

to both data sets. Are any of these dataset stationary? Why or why not?

```
oil_trans <- diff(log(oil))
gas_trans <- diff(log(gas))
acf(oil_trans, type = "correlation", lag.max = "m")
```



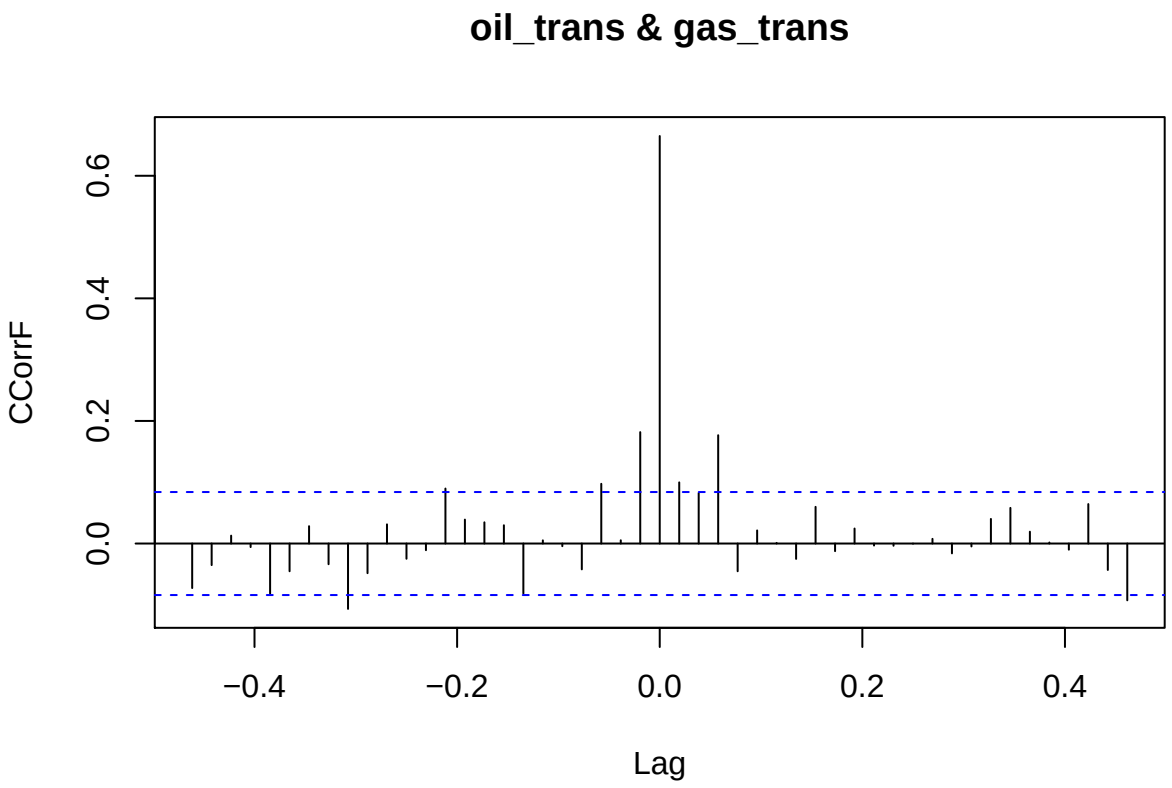

```
acf(gas_trans, type = "correlation", lag.max = "m")
```



The transformed data for oil and gas appears to be somewhat staionary now.

5. Produce a cross-correlation plot for the transformed data.

```
ccf(oil_trans, gas_trans, ylab='CCorrF', type = "correlation")
```



Both transformed data for oil and gas evolve concurrently. The correlation is nonetheless strong around 0.62.