ECON 451 PSET 5

(1.) This problem involves some data manipulation from the FRED database. I'm first going to start by using the quantmod library to access the time series data from the FRED API. This was all done in R, the best choice for statistical analysis and data visulization.

```
library(quantmod)
```

```
## Loading required package: xts
```

```
## Loading required package: zoo
```

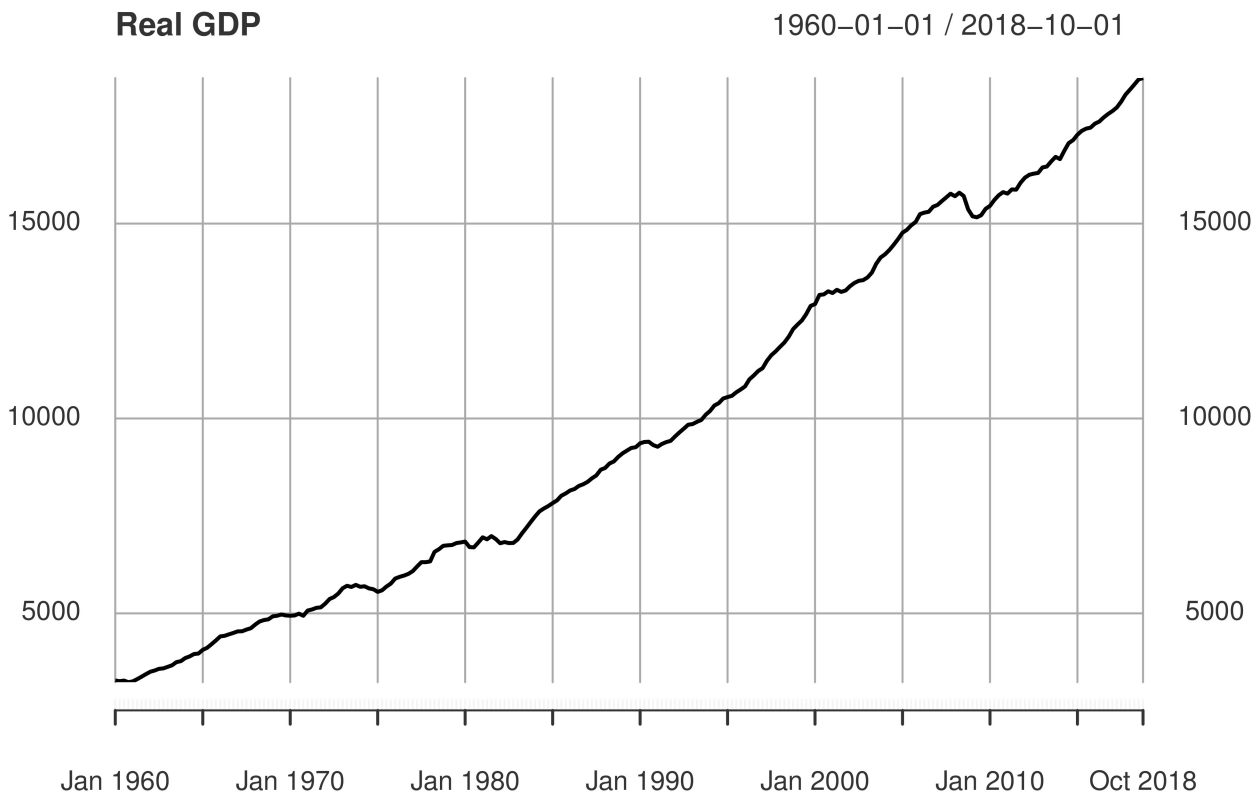
```
##
## Attaching package: 'zoo'
```

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

```
## Loading required package: TTR
```

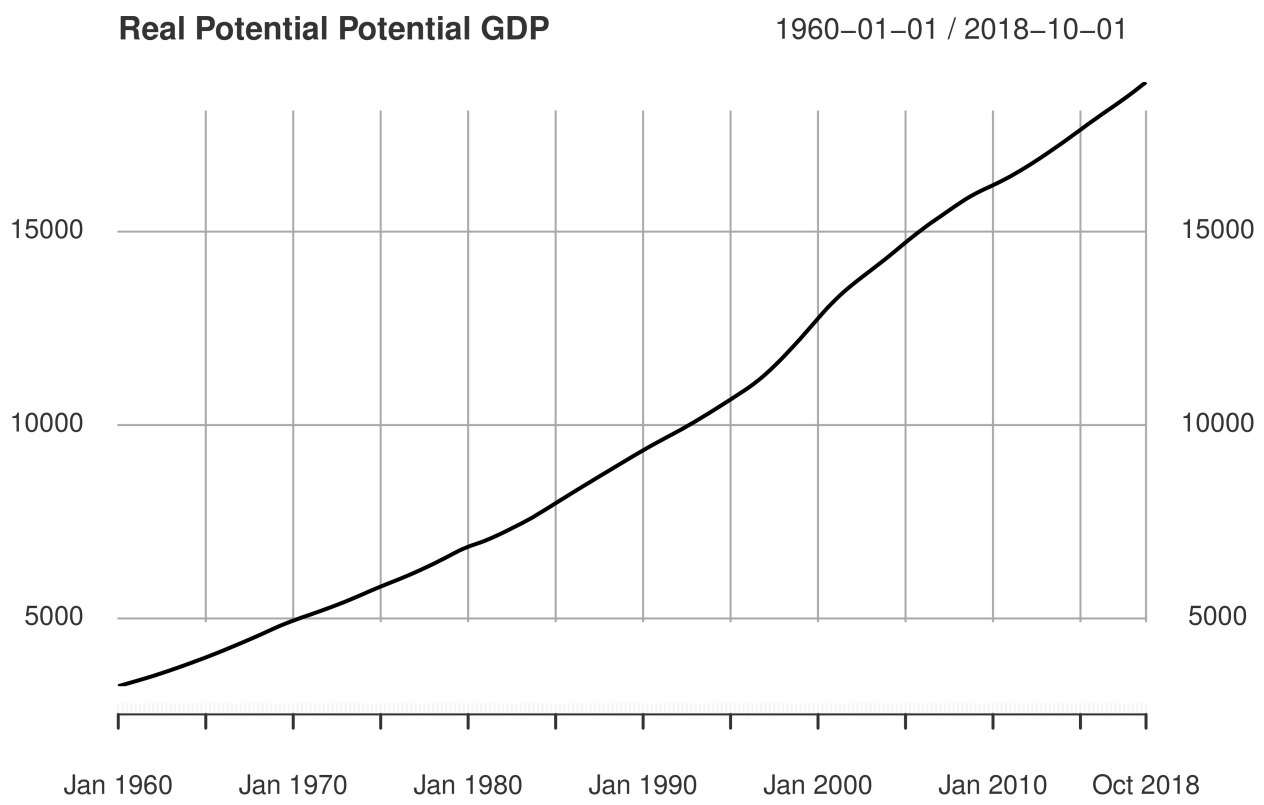
```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
GDP <- getSymbols("GDPC1", src = 'FRED', auto.assign = FALSE)
GDP <- na.omit(GDP)  #Omitting the Non observables
GDP <- GDP['1960-01-01/2018-12-31']
plot(GDP, main = "Real GDP")
```

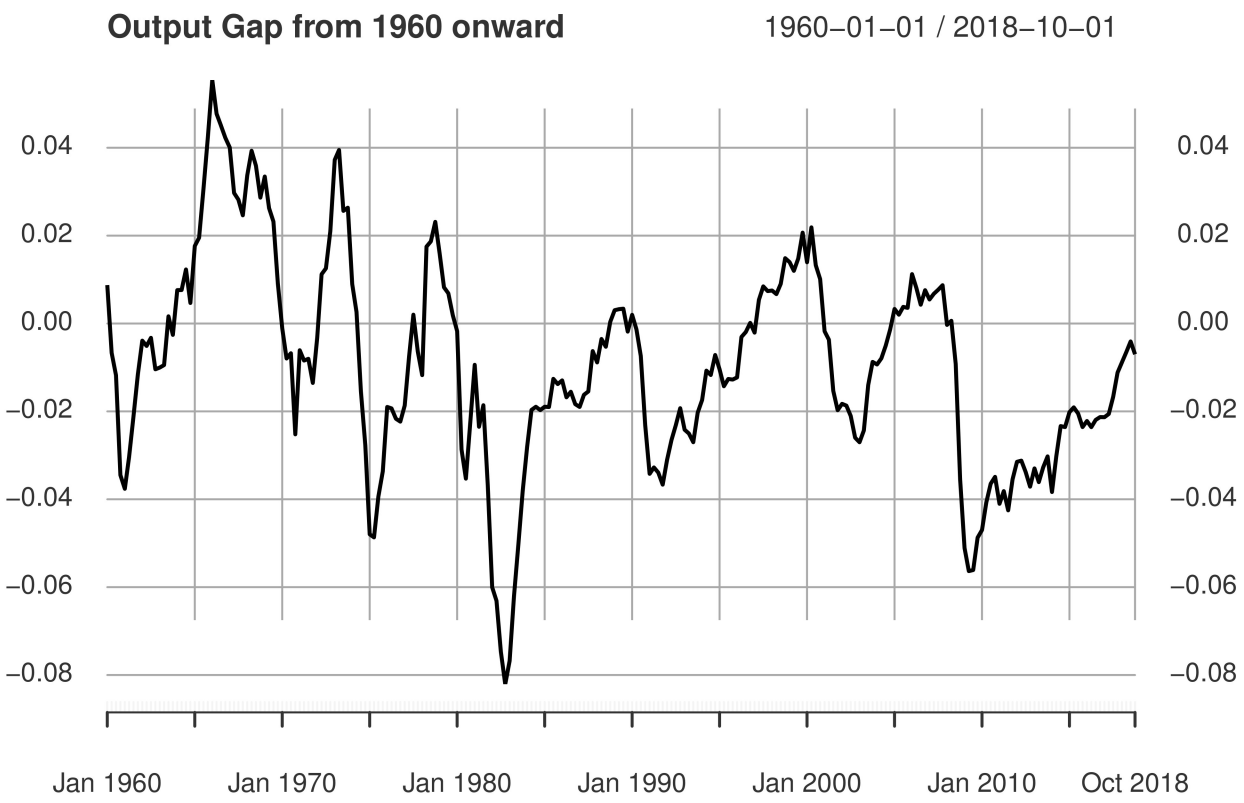



```
GDP <- log(GDP)
```

```
PotGDP <- getSymbols("GDPPOT", src = 'FRED', auto.assign = FALSE)
PotGDP <- na.omit(PotGDP)
PotGDP <- PotGDP['1960-01-01/2018-12-31']
plot(PotGDP, main = "Real Potential Potential GDP ")
```



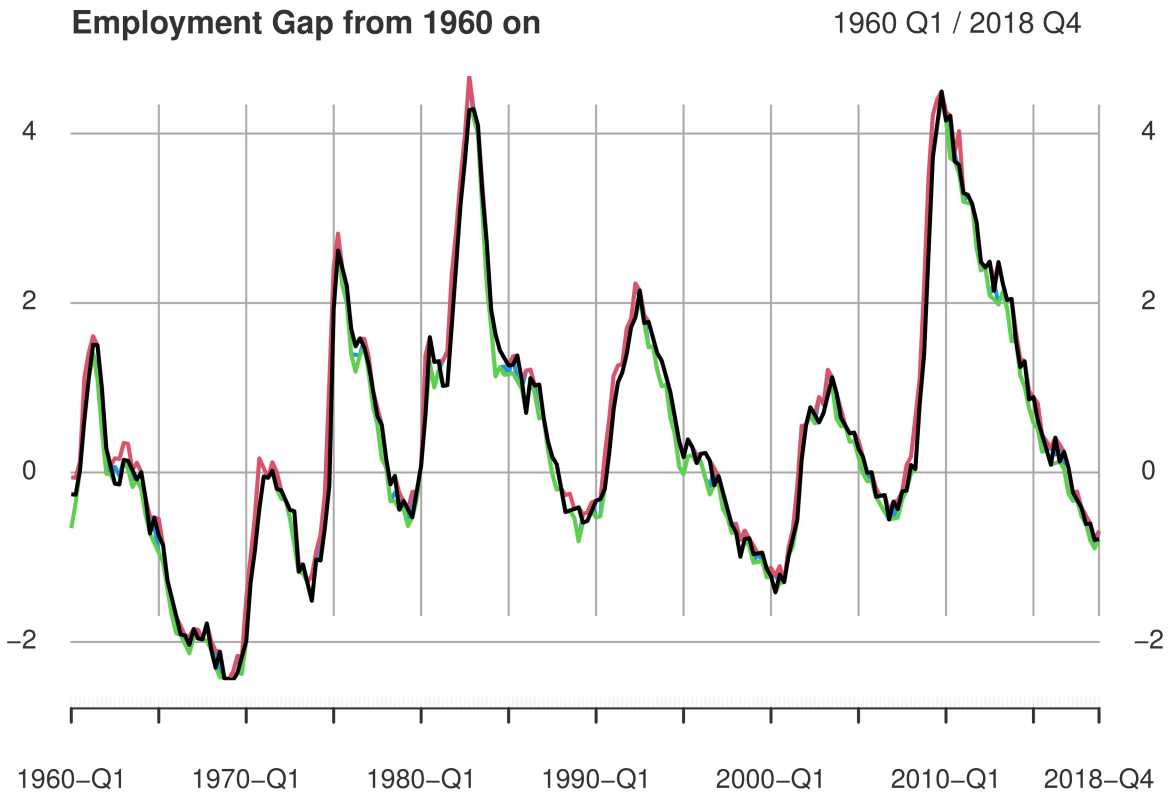

```
PotGDP <- log(PotGDP)




Y_gap <- (GDP - PotGDP)
plot(Y_gap, main = "Output Gap from 1960 onward")
```




```
U_observed <- getSymbols("UNRATE", src = 'FRED', auto.assign = FALSE)
U_observed <- na.omit(U_observed)
U_observed <- U_observed['1960-01-01/2018-12-31']
U_observed <- to.quarterly(U_observed)
plot(U_observed, main = 'Observed Unemployment rate' )
```


```
U_nat <- getSymbols("NROUST", src = "FRED", auto.assign = FALSE)
U_nat <- na.omit(U_nat)
U_nat <- U_nat["1960-01-01/2018-12-31"]
U_nat <- to.quarterly(U_nat)
plot(U_nat, main = "Natural rate of unemployment")
```

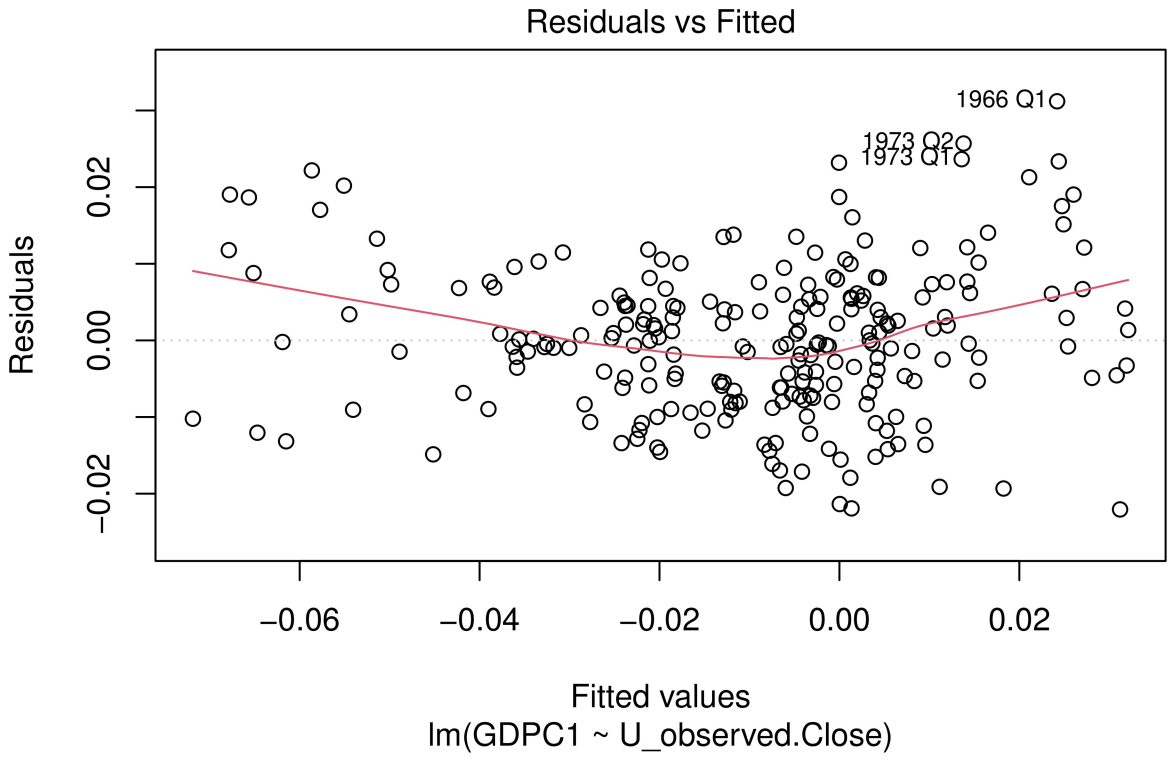

```
U_gap <- (U_observed-U_nat)
plot(U_gap, main = 'Employment Gap from 1960 on')
```

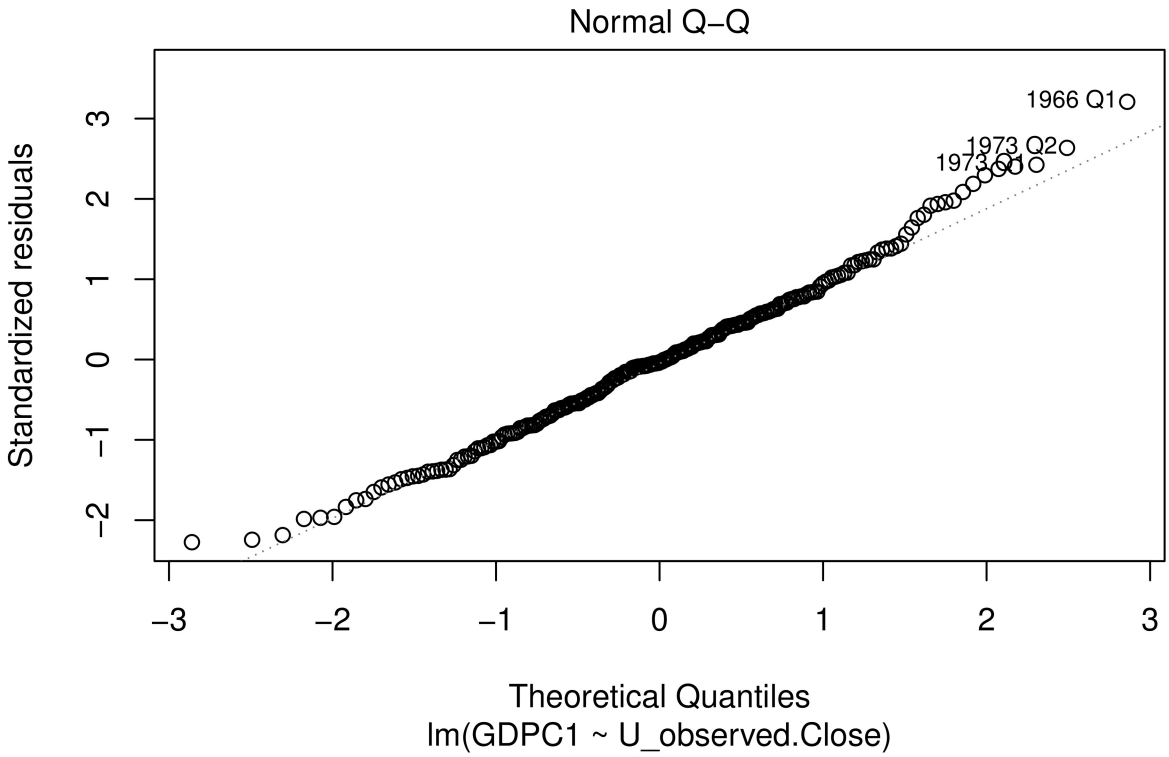


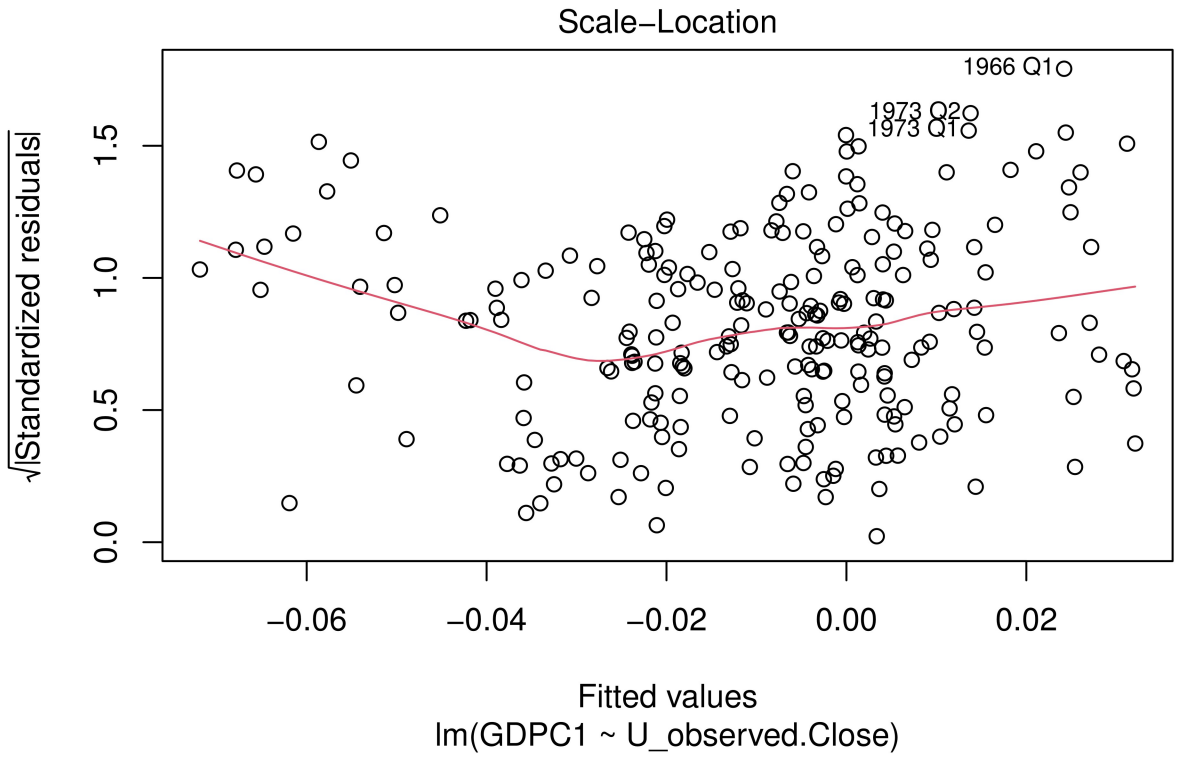

```
merged  <- merge(U_gap,Y_gap, all=TRUE)


model <- lm(GDPC1~U_observed.Close, data = merged) #Running a full linear regression model on the data
summary(model)
```

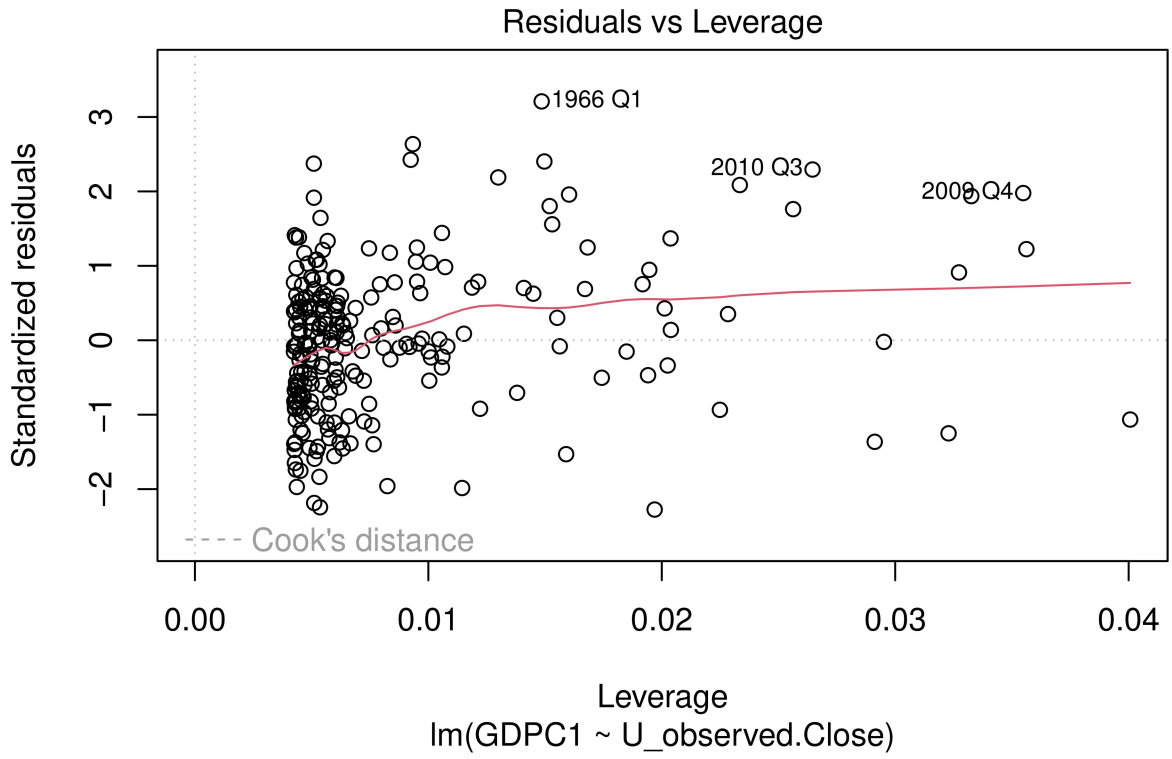
```
##
## Call:
## lm(formula = GDPC1 ~ U_observed.Close, data = merged)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -0.0220559 -0.0068255 -0.0003403  0.0058649  0.0312015
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)      -0.0035277  0.0006633  -5.318 2.44e-07 ***
## U_observed.Close -0.0146098  0.0004354 -33.551  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.009795 on 234 degrees of freedom
## Multiple R-squared:  0.8279, Adjusted R-squared:  0.8272
## F-statistic:  1126 on 1 and 234 DF,  p-value: < 2.2e-16
```

```
plot(model)
```

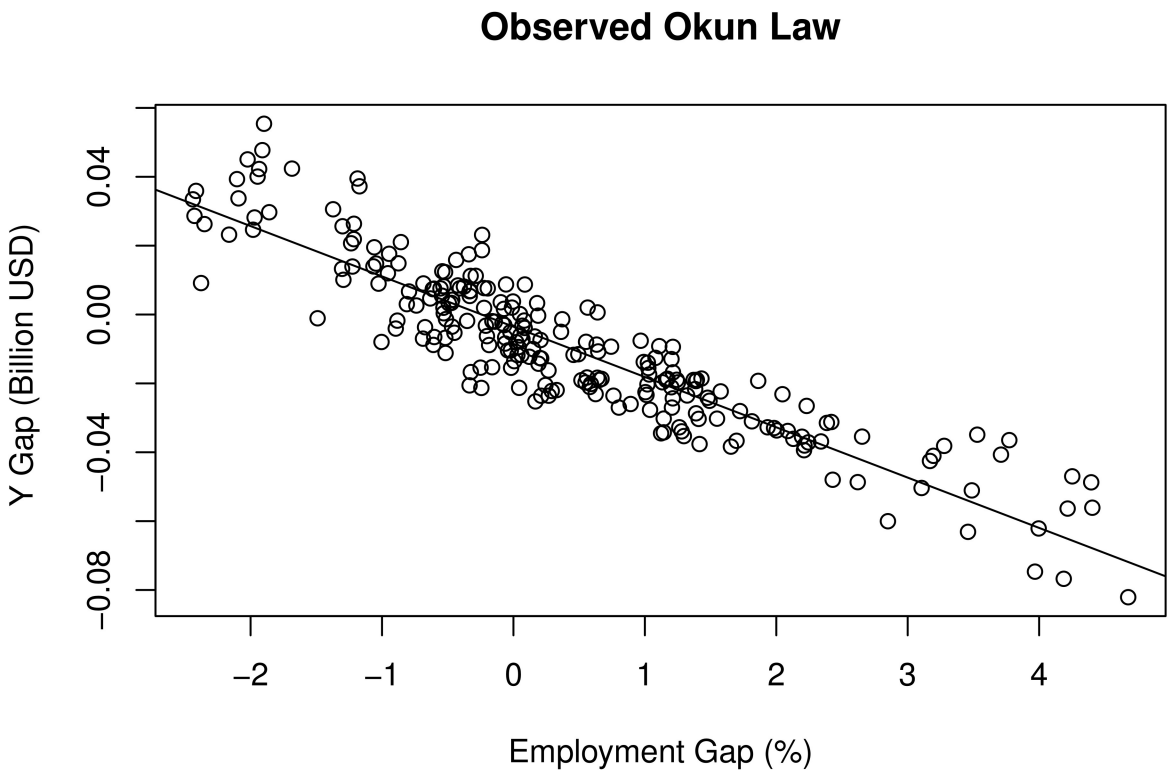

Residuals vs Fitted
1966 Q1
1973 Q2
1973 Q1
Residuals
0.02
0.00
−0.02
−0.06
−0.04
−0.02
0.00
0.02
Fitted values
lm(GDPC1 ~ U_observed.Close)


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(GDPC1 ~ U_observed.Close)
1966 Q1
1973 Q2
1973 Q3
1973 Q4
−3
−2
−1
0
1
2
3


Scale−Location
1966 Q1
1973 Q2
1973 Q1
√|Standardized residuals|
0.0
0.5
1.0
1.5
−0.06
−0.04
−0.02
0.00
0.02
Fitted values
lm(GDPC1 ~ U_observed.Close)



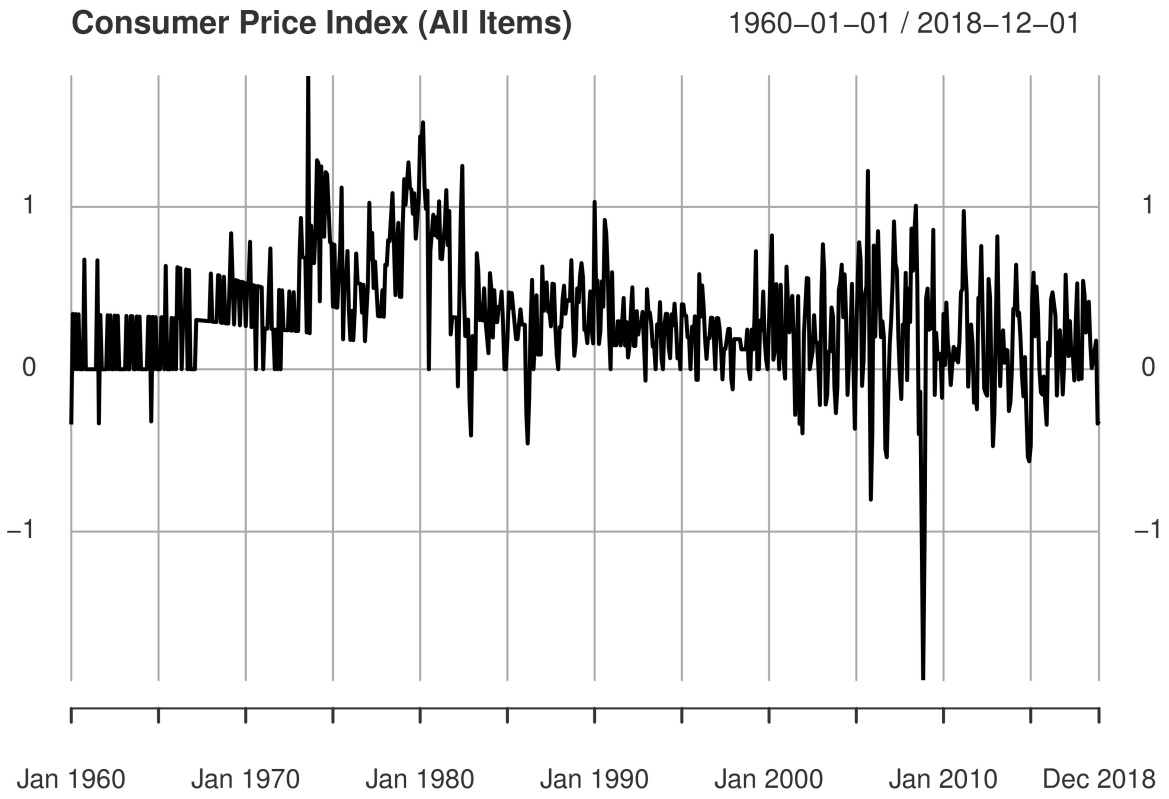

```
plot(GDPC1~U_observed.Close, data = merged, xlab = "Employment Gap (%)", ylab = "Y Gap (Billion USD) ",
abline(lm(GDPC1~U_observed.Close, data = merged))
```



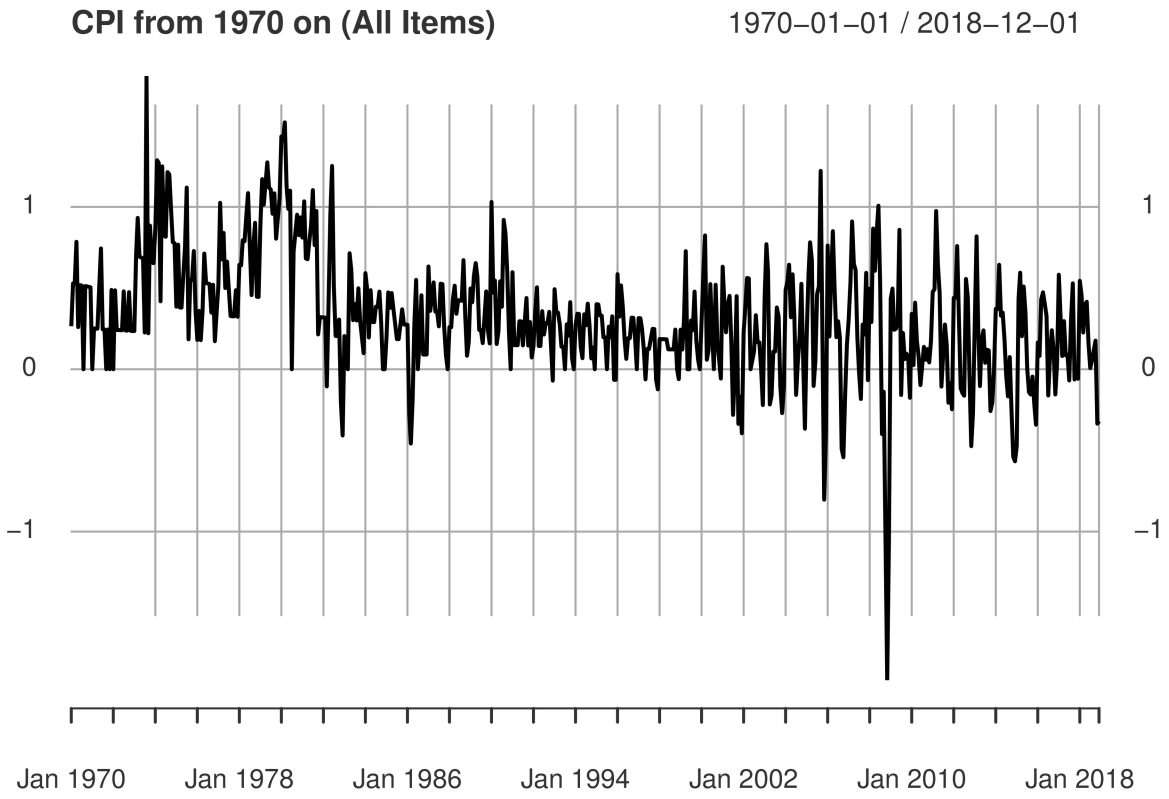
(1b) The regression equation for the Okun law observed in our data is: $\hat{Ygap}$ = -0.0035277 - 0.0146098($Ugap$). Ignoring the intercept, the coefficient is -0.0146098.

(1c)We know that the AS-curve is given by: $\pi_t = \mathrm{E}[\pi_t] + \gamma(\mathrm{Y}\text{-}Y^p) + \rho$. Since the relationship between the output and unemployment gaps is negative, we should now have: $\pi_t = \mathrm{E}[\pi]$ - $Y^p\epsilon(\mathrm{U}\text{-}U^n)$, where epsilon is a parameter similar to gamma.

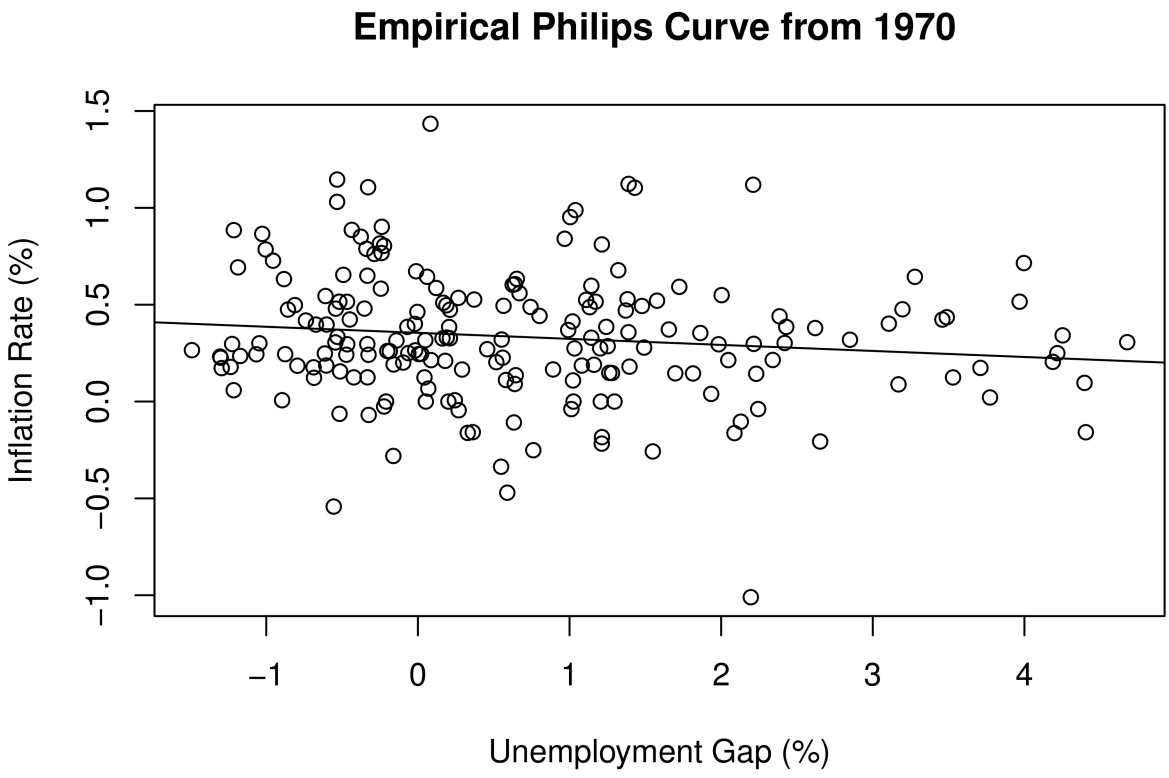
```
CPI1 <- getSymbols('CPALTT01USM657N', src = 'FRED', auto.assign = FALSE)
CPI1 <- na.omit(CPI1)
CPI1 <- CPI1["1960-01-01/2018-12-31"]
plot(CPI1, main = "Consumer Price Index (All Items)" )
```



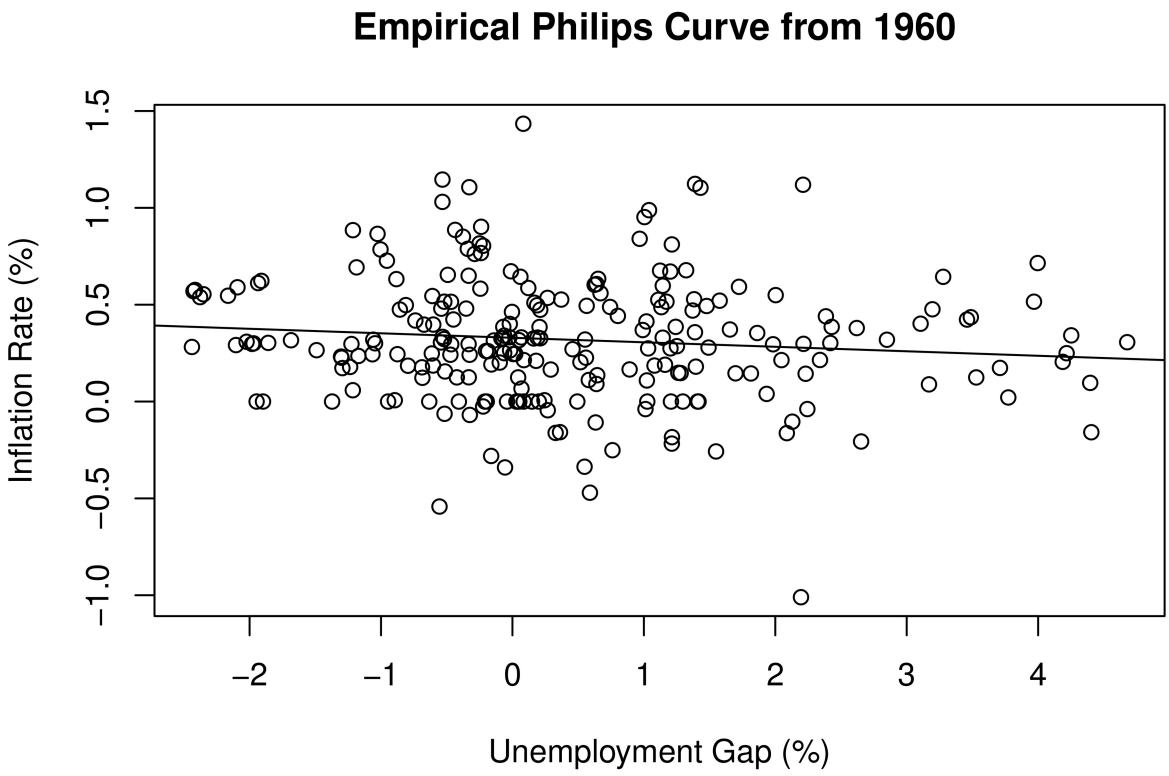

```
CPI2 <- CPI1["1970-01-01/2018-12-31"]
plot(CPI2, main = "CPI from 1970 on (All Items) ")
```




```
merge2 <- merge(merged, CPI1, CPI2, all = FALSE)
View(merge2)


merge3 <-merge(merged, CPI1,  all = FALSE)
View(merge3)


plot(CPALTT01USM657N~U_observed.Close, data = merge2, xlab = "Unemployment Gap (%)", ylab= "Inflation Ra
abline(lm(CPALTT01USM657N~U_observed.Close, data = merge2))
```




```
plot(CPALTT01USM657N~U_observed.Close, data = merge3, xlab = "Unemployment Gap (%)", ylab= "Inflation Ra
abline(lm(CPALTT01USM657N~U_observed.Close, data = merge3))
```



(1d)-The type of consumer price index to use was not specified so I used CPALTT01USM657N, the CPI index for all items. We can see that the period from 1960 onward has higher output gaps and the period from 1970 onward has slightly smaller employment gaps. The trend line for the philips curve is also slightly steeper for the period from 1970 onward , indicating a slightly more strongly negative relationship in this period.