work_sample

2023-10-08

```r
#install.packages(c("xts","pdfetch", "ggplot2", "mFilter"))


library(xts) # Library for plotting
```

```
## Loading required package: zoo

## Warning: package 'zoo' was built under R version 4.1.1

##
## Attaching package: 'zoo'

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

```r
library(pdfetch) #Library for loading FRED data
```

```
## Warning: package 'pdfetch' was built under R version 4.1.1
```

```r
library(mFilter) #Library for HP filter
library(rollRegres) #Library for regression
```

```
## Warning: package 'rollRegres' was built under R version 4.1.1
```

```r
data_pc_raw <- pdfetch_FRED(c("GDPC1", "UNRATE", "CPIAUCSL", "CPILFESL")) #API fetching from FRED
data_pc <- data_pc_raw["2005-01-01/2020-04-01"] # Date Range
data_pc <- to.period(data_pc, period = "quarter", OHLC = FALSE) # Convert data to quarterly frequency
```

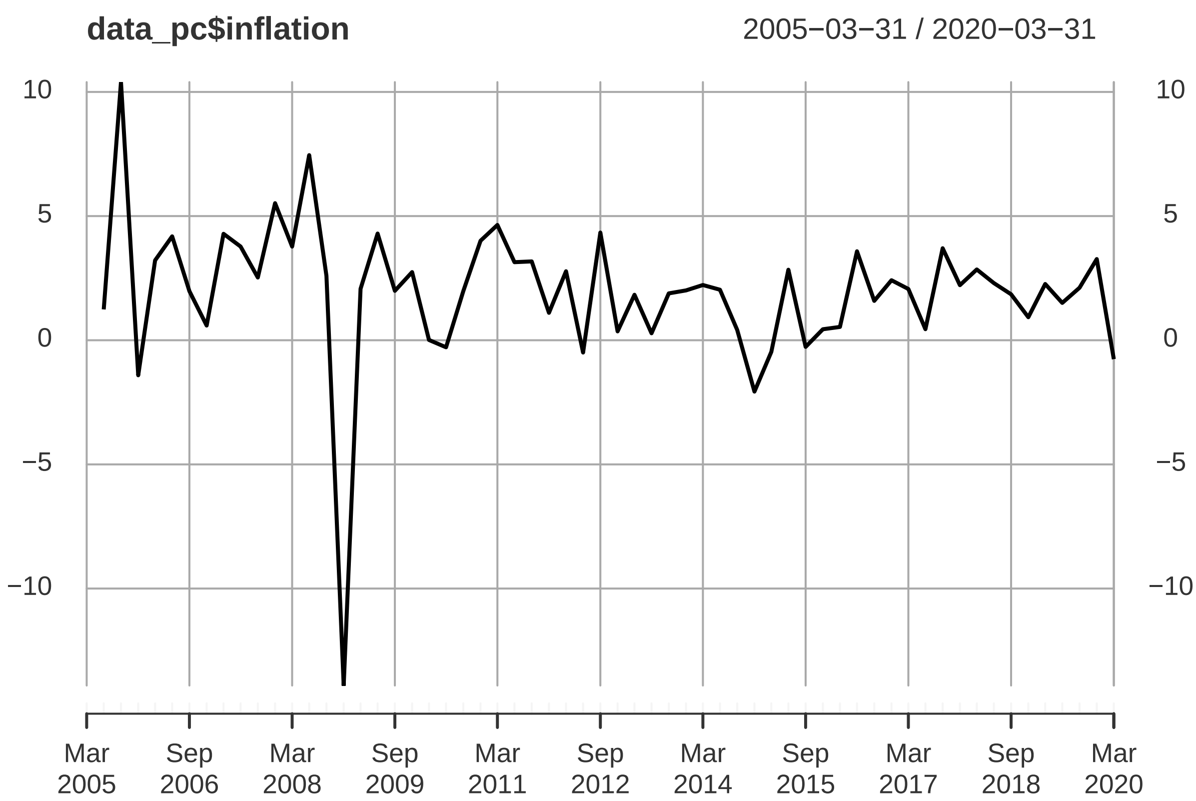
```
## Warning in to.period(data_pc, period = "quarter", OHLC = FALSE): missing values
## removed from data
```

```r
#View(data_pc)
```

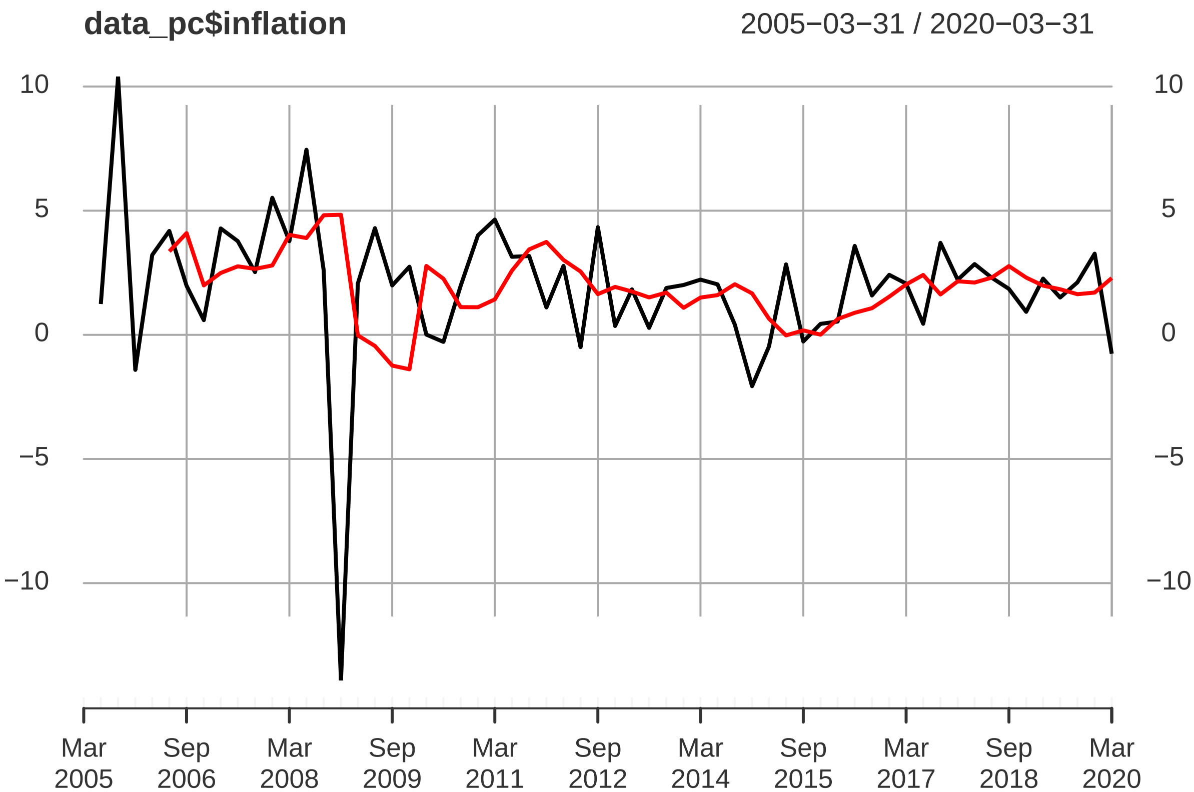
```r
#Transformations
data_pc$lgdp <- log(data_pc$GDPC1) # Take logs
hp_gdp <- hpfilter(data_pc$lgdp, freq = 1600, type="lambda")
data_pc$gdpgap <- 100*hp_gdp$cycle #hp cycle lambda at 100 per HP and Ball and Mankiw paper
data_pc$l_cpi <- log(data_pc$CPIAUCSL) # Consumer Price Index of All Items in the US
data_pc$l_cpi_core <- log(data_pc$CPILFESL) # Consumer Price Index of All Items minus food & energy in
```

```
data_pc$unemployment_rate <- (data_pc$UNRATE) # seasonally adjusted


#Quarterly inflation, annualized
data_pc$inflation_q = 4*100*diff(data_pc$l_cpi)
```

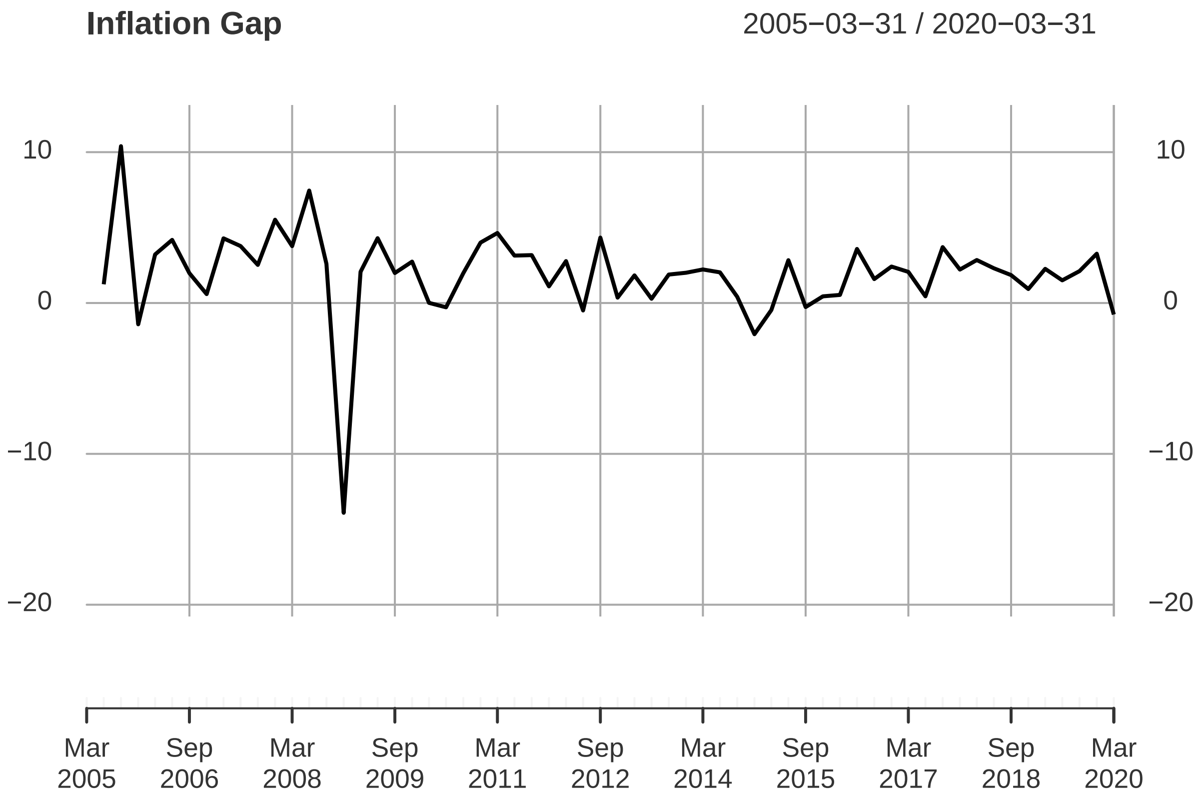
```
#Inflation expectations as an average of 4 past y-o-y inflation rates
data_pc$infexp <- 1/4*(lag(data_pc$inflation, k=1) + lag(data_pc$inflation, k=2) + lag(data_pc$inflatio

plot.xts(data_pc$inflation, col = "black", lwd = 2)
```



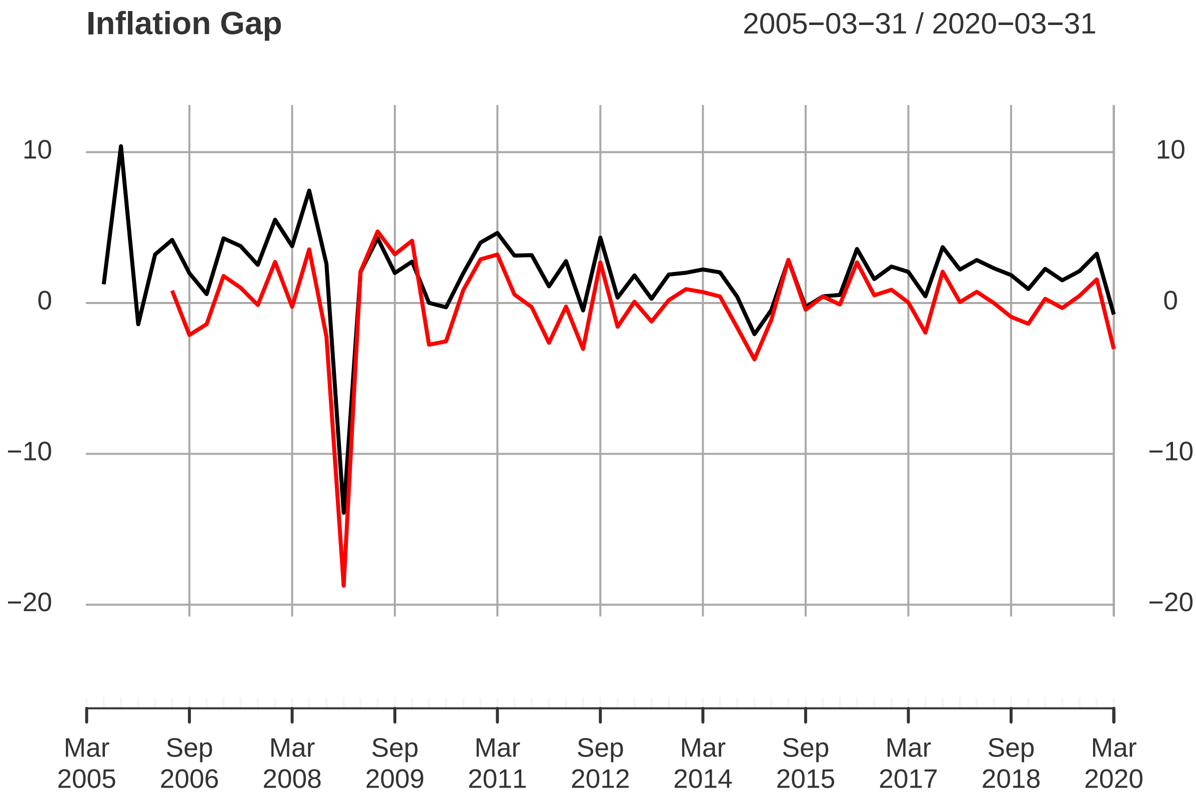

```
addSeries(data_pc$infexp, on = 1, col = "red", lwd = 2)
```



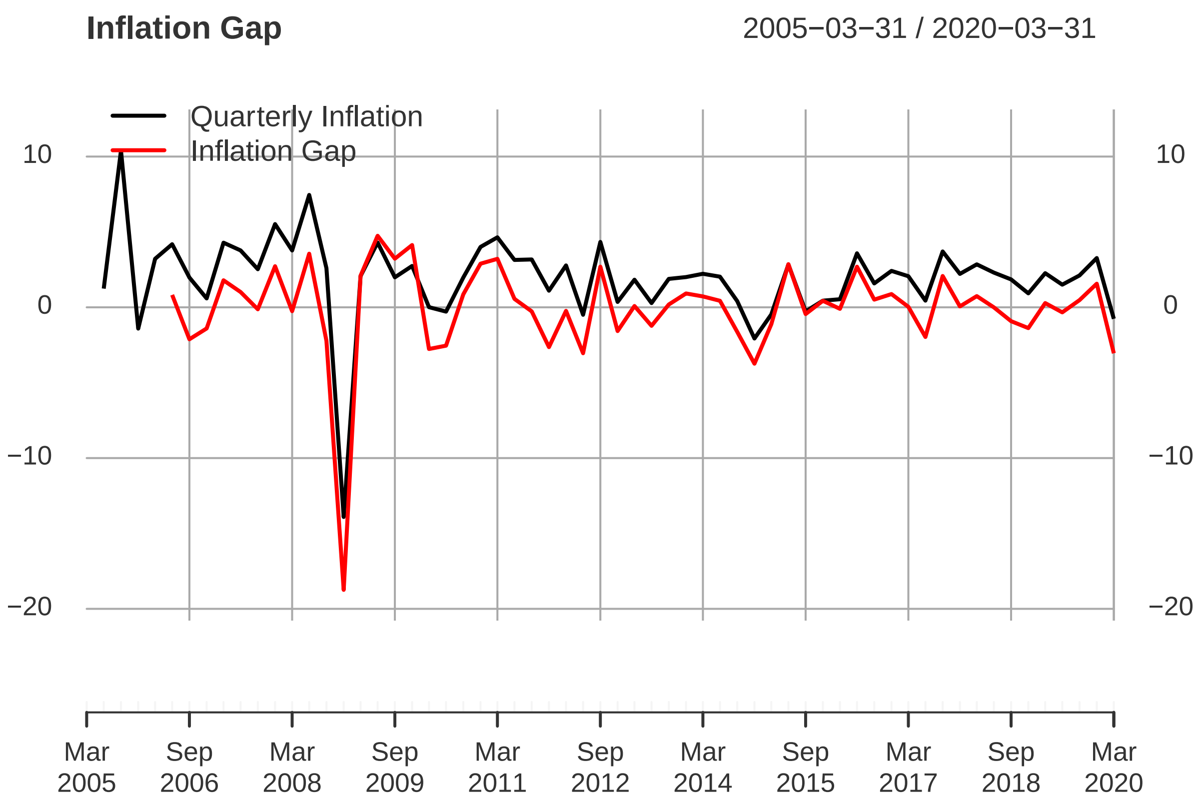

```r
#Creating inflation gap
data_pc$infgap <- data_pc$inflation_q-data_pc$infexp
plot.xts(data_pc$inflation_q, main = "Inflation Gap", ylim = c(-25, 15))
```




```r
addSeries(data_pc$infgap, on = 1, col = "red", lwd = 2)
```




```r
addLegend("topleft", on=1,
          legend.names = c("Quarterly Inflation", "Inflation Gap"),
          lty=c(1, 1), lwd=c(2, 2),
          col=c("black", "red"))
```




```r
#Supply shocks
data_pc$supply_shock <- 4*diff(data_pc$l_cpi)*100 - 4*diff(data_pc$l_cpi_core)*100
```

```r
model1 <- lm(infgap ~ unemployment_rate, data = data_pc)
summary(model1)
```

```
##
## Call:
## lm(formula = infgap ~ unemployment_rate, data = data_pc)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.7261  -1.1792   0.2388   1.3384   4.6324
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       -0.43779    1.36894  -0.320    0.750
## unemployment_rate  0.05787    0.21083   0.274    0.785
##
## Residual standard error: 3.227 on 54 degrees of freedom
##   (5 observations deleted due to missingness)
## Multiple R-squared:  0.001393,   Adjusted R-squared:  -0.0171
## F-statistic: 0.07535 on 1 and 54 DF,  p-value: 0.7848
```

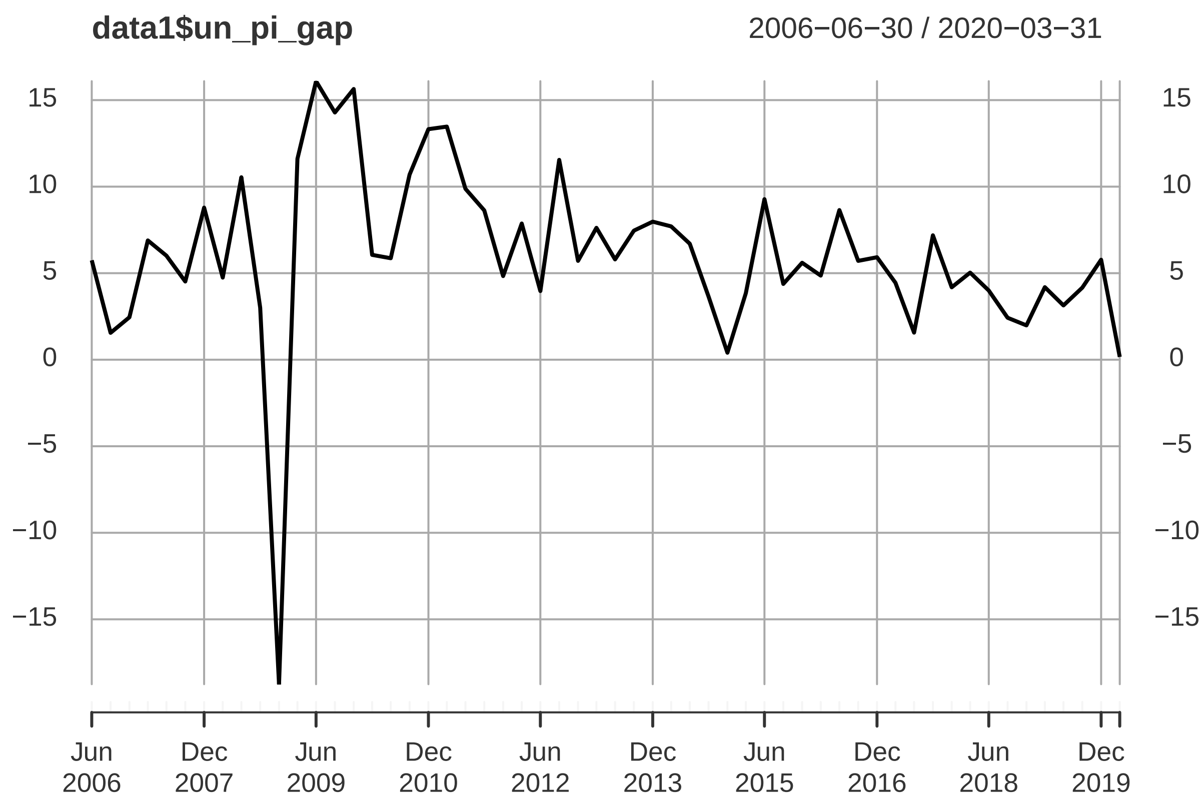
```r
model2 <- lm(infgap ~ 0 + gdpgap, data = data_pc)
summary(model2)
```

```
##
## Call:
## lm(formula = infgap ~ 0 + gdpgap, data = data_pc)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.6830  -1.2467   0.1392   1.0632   4.9169
##
## Coefficients:
##        Estimate Std. Error t value Pr(>|t|)
## gdpgap  0.06793    0.43113   0.158    0.875
##
## Residual standard error: 3.2 on 55 degrees of freedom
##   (5 observations deleted due to missingness)
## Multiple R-squared:  0.0004512,  Adjusted R-squared:  -0.01772
## F-statistic: 0.02483 on 1 and 55 DF,  p-value: 0.8754
```

```r
model3 <- lm(infgap ~ unemployment_rate + supply_shock, data = data_pc)
summary(model3)
```

```
##
## Call:
## lm(formula = infgap ~ unemployment_rate + supply_shock, data = data_pc)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.9684 -0.5616 -0.1596  0.6679  2.9882
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)        0.057197   0.581284   0.098    0.922
## unemployment_rate -0.007194   0.089487  -0.080    0.936
## supply_shock       1.157393   0.073588  15.728   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.368 on 53 degrees of freedom
##   (5 observations deleted due to missingness)
## Multiple R-squared:  0.8238, Adjusted R-squared:  0.8171
## F-statistic: 123.9 on 2 and 53 DF,  p-value: < 2.2e-16
```

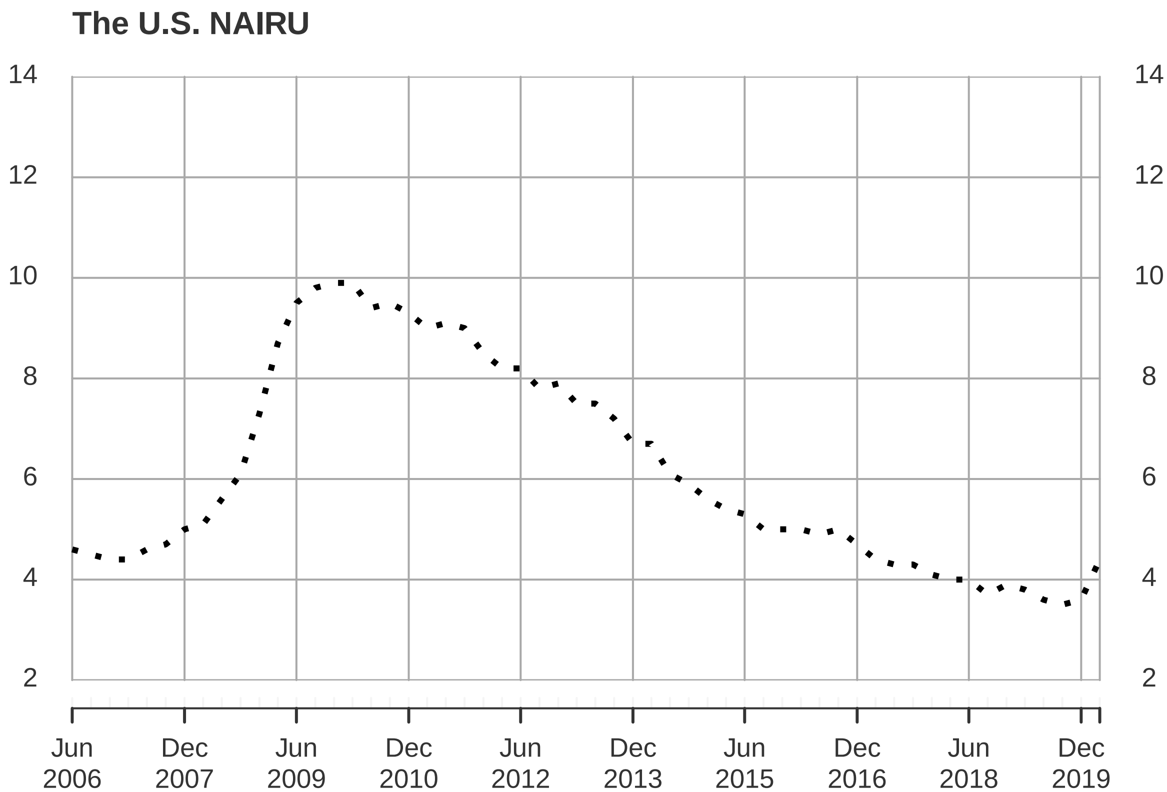
```r
data1 <- na.omit(data_pc)

pc_rolling <- roll_regres(data1$infgap ~ data1$unemployment_rate + data1$supply_shock, width = 40, do_d
data1$un_pi_gap <- data1$unemployment_rate + data1$infgap/(0.007194*100)
#Note that 0.007194 was the estimated coefficient of unemployment rate in model 3.
plot.xts(data1$un_pi_gap)
```



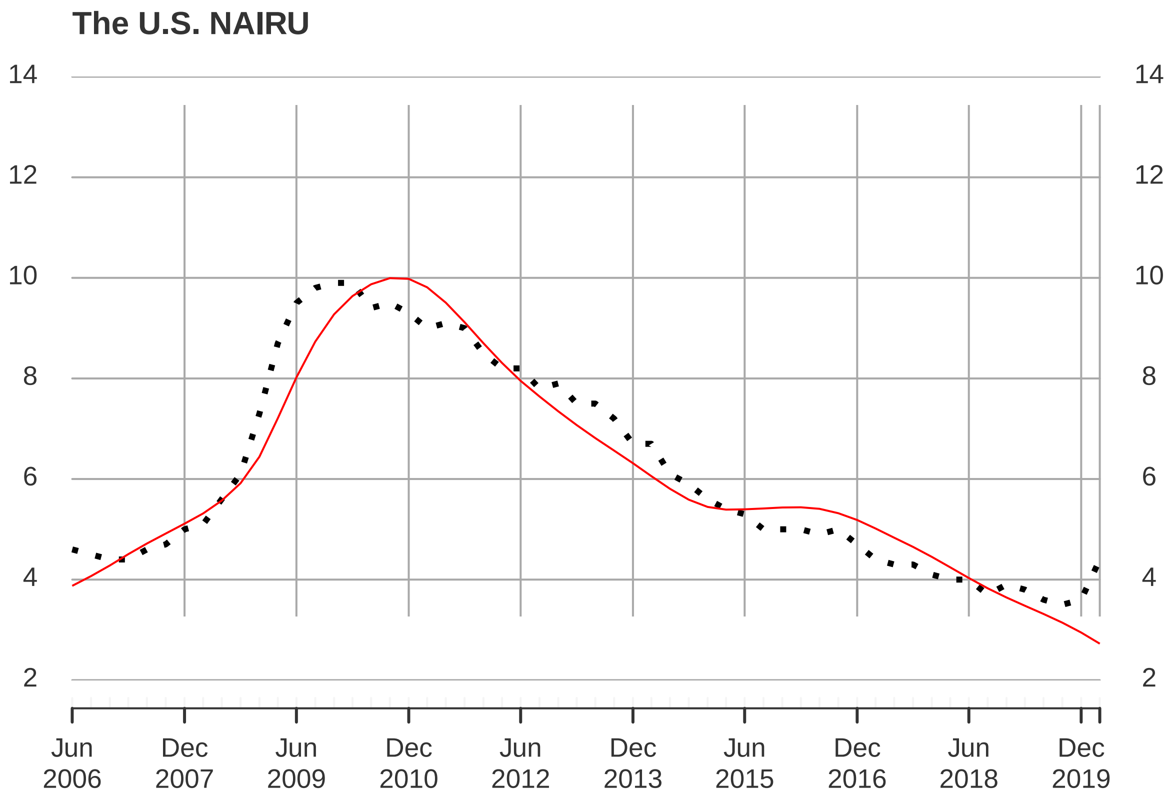

```
#Get trend using the HP filter with high lambda (much higner than for business cycles frequencies)
data1_1 <- na.omit(data1)

hp_un_pi_gap <- hpfilter(data1_1$un_pi_gap, freq = 100, type="lambda") # lambda at 100
hp_un_pi_gap_1000 <- hpfilter(data1_1$un_pi_gap, freq = 1000, type="lambda") # lambda at 1000
```

```
#data wrangling to adjust for hp filter rowname change

hpgap_dat <- data.frame(hp_un_pi_gap$trend) %>%
  tibble::rownames_to_column("date") %>%
  dplyr::rename(nairu = un_pi_gap)

data2 <- data.frame(data1) %>%
  tibble::rownames_to_column("date")

data3 <- merge(hpgap_dat, data2, by ="date") %>%
  tibble::column_to_rownames("date")

data4 <- as.xts(data3)

data5 <- na.omit(data4)
```

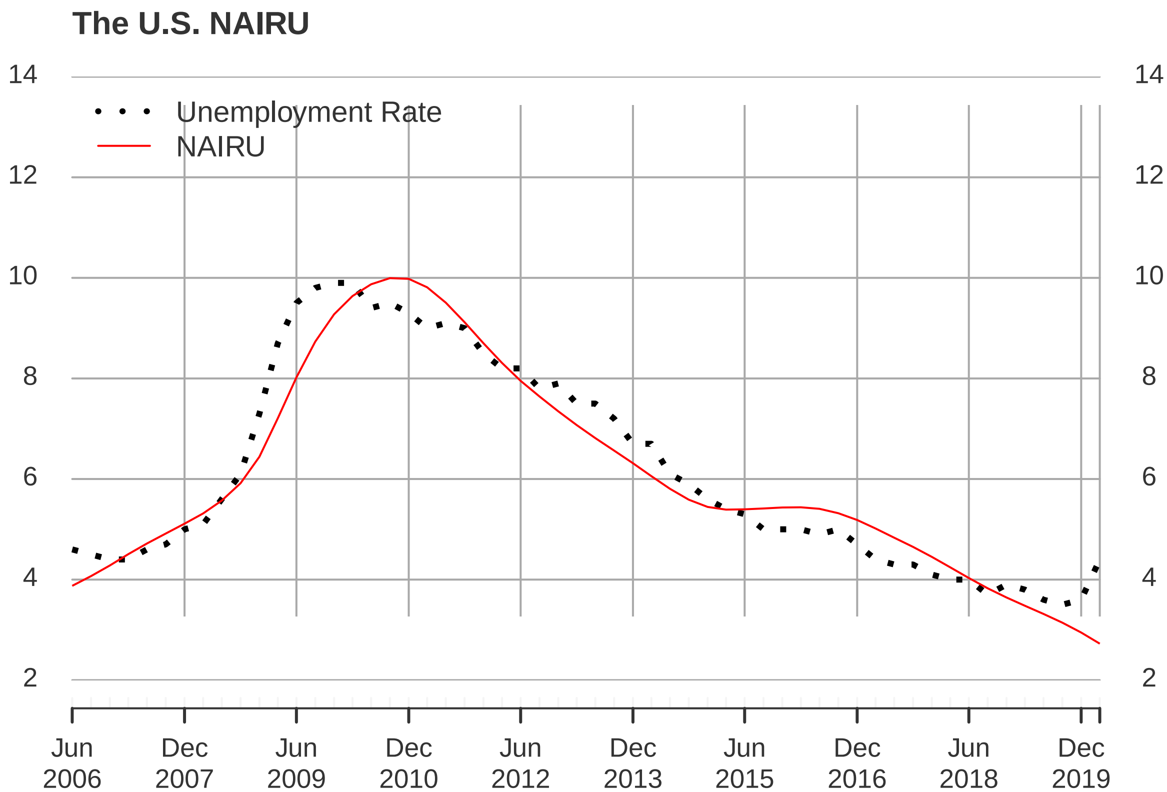
```
#Plotting NAIRU
plot.xts(data5$unemployment_rate, col = "black", lwd = 3, main = "The U.S. NAIRU", main.timespan = FALSE
```




```r
addSeries(data5$nairu, on = 1, col = "red", lwd = 1) # NAIRU
```




```r
addLegend("topleft", on=1,
          legend.names = c("Unemployment Rate", "NAIRU"),
          lty=c(3, 1), lwd=c(3, 1),
          col=c("black", "red"))
```


The U.S. NAIRU
14
12
10
8
6
4
2
14
12
10
8
6
4
2
Unemployment Rate
NAIRU
Jun 2006
Dec 2007
Jun 2009
Dec 2010
Jun 2012
Dec 2013
Jun 2015
Dec 2016
Jun 2018
Dec 2019