Group 9

107205008 *Yu-Chen, Den*
108208014 *Fu-Chien, Hsiao*
109102057 *Liang-Yu, Hsu*

Ch11-C4

Find the first difference model

```
install.package("wooldridge")
library(wooldridge)
data("phillips")
head(phillips)
tail(phillips)
fdm <- lm(data = phillips, cnif ~ cunem)
summary(fdm)
```

```
Call:
lm(formula = cinf ~ cunem, data = phillips)

Residuals:
    Min      1Q  Median      3Q     Max
-7.4790 -0.9441  0.1384  1.0889  5.4551

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.07214    0.30584  -0.236  0.81443
cunem       -0.83281    0.28984  -2.873  0.00583 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.267 on 53 degrees of freedom
  (1 observation deleted due to missingness)
Multiple R-squared:  0.1348,    Adjusted R-squared:  0.1185
F-statistic: 8.256 on 1 and 53 DF,  p-value: 0.005831
```

Figure 1: summary of fdm

1. β_1 = -0.83281 and the P-value is 0.00583 $<$ 0.01
2. The fdm model fits better, because the $\hat{R}^2$ is bigger.

Ch11-C8

Estimate the AR (1) model and predict *unem* of 2004

```
AR1= arima(phillips$unem,order=c(1,0,0))
AR1
5.5631+0.7493*phillips$unem[length(phillips$unem)]
plot.ts(phillips$unem)
```

The predict value of $unem = 10.0589$, and the true $unem = 5.5$

Add a lag of inflation to the AR (1) model

```
AR2= arima(phillips$unem,order=c(1,0,0), xreg=phillips$inf_1)
AR2
(1-pnorm(abs(AR2$coef)/sqrt(diag(AR2$var.coef))))*2
```

```
Call:
arima(x = phillips$unem, order = c(1, 0, 0), xreg = phillips$inf_1)

Coefficients:
         ar1  intercept  phillips$inf_1
      0.7090     5.1810          0.1277
s.e.  0.0953     0.4692          0.0581

sigma^2 estimated as 0.8404:  log likelihood = -73.61,  aic = 155.22
```

Figure 2: summary of AR1

the t-ratio of inf_{t-1}

$$\frac{0.1277}{0.0581} = 2.1979 > t_{0.025}(30) \simeq 1.96$$

We can say that inf_{t-1} is significant.

Predict the *unem* of 2004

```
(5.1810+0.7090*phillips$unem[length(phillips$unem)]+
   0.1277*phillips$inf_1[length(phillips$inf_1)])
```

The predict value of *unem* in 2004 = 9.63932

Ch12-C10

Estimate the static Phillips curve equation

```
library(wooldridge)
str(phillips)
ph1 <- phillips
model1 <- lm(data = ph1, inf~unem)
summary(model1)
```

```
Call:
lm(formula = inf ~ unem, data = ph1)

Residuals:
    Min      1Q  Median      3Q     Max
-5.2176 -1.7812 -0.6659  1.1473  8.8795

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   1.0536     1.5480   0.681   0.4990
unem          0.5024     0.2656   1.892   0.0639 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.972 on 54 degrees of freedom
Multiple R-squared:  0.06215,   Adjusted R-squared:  0.04479
F-statistic: 3.579 on 1 and 54 DF,  p-value: 0.06389
```

Figure 3: summary of model1

See if serial correlation exists

```
u_round<- round(residuals(model1),digits = 2)
c1 <- c(0,u_round)
c2 <- c(u_round,0)
m1 <- matrix(0, nrow = 57, ncol = 2)
m1[,1] <- c1
m1[,2] <- c2
colnames(m1) <- c("ut_1","ut")
data1 <- data.frame(m1)
data_c <- data1[-c(1,57),]
model2 <- lm(ut ~ ut_1, data = data_c)
summary(model2)
```

```
Call:
lm(formula = ut ~ ut_1, data = data_c)

Residuals:
    Min      1Q  Median      3Q     Max
-8.0495 -1.1023 -0.2416  1.0274  6.6871

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  -0.1121     0.3181  -0.352    0.726
ut_1          0.5723     0.1084   5.281 2.45e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.359 on 53 degrees of freedom
Multiple R-squared:  0.3448,    Adjusted R-squared:  0.3324
F-statistic: 27.89 on 1 and 53 DF,  p-value: 2.451e-06
```

Figure 4: summary of model2

The coefficient of $u_{t-1} = 0.5723$, and the t-ratio = 5.281, so there's strong evidence of serial correlation.

Find out if there is much difference when the later years are added

```
install.packages("prais")
library(prais)
p1 <- prais_winsten(inf ~ unem, data = ph1, index = "year")
summary(p1)
```

```
Call:
prais_winsten(formula = inf ~ unem, data = ph1, index = "year")

Residuals:
   Min     1Q Median     3Q    Max
-5.258 -2.447 -1.073  1.463 10.570

AR(1) coefficient rho after 9 iterations: 0.7885

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   7.9994     2.0483   3.905 0.000264 ***
unem         -0.7140     0.2898  -2.464 0.016965 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.138 on 54 degrees of freedom
Multiple R-squared:  0.1345,    Adjusted R-squared:  0.1185
F-statistic: 8.393 on 1 and 54 DF,  p-value: 0.00543

Durbin-Watson statistic (original): 0.8015
Durbin-Watson statistic (transformed): 1.914
```

Figure 5: summary of static Phillips curve model by iterative Prais-Winsten

New coefficient of *unem* is -0.714, and it has only small difference between the origin -0.716