An introduction to econometrics - J.Wooldridge - Ch14 - Ex2

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Use CRIME4.RAW for this exercise.

i. Reestimate the unobserved effects model for crime in Example 13.9 but use fixed effects rather than differencing. Are there any notable sign or magnitude changes in the coefficients? What about statistical significance?

Upload package

```
library(wooldridge)
library(plm)
```

Upload data

```
data<-wooldridge::crime4
```

Fixed effects regression

```
crime_fe <- plm(crmrte ~ prbarr + prbconv + prbpris + avgsen + polpc, data = crime4, index = c("county","year"),
                model = "within")
```

Results

```
summary(crime_fe)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = crmrte ~ prbarr + prbconv + prbpris + avgsen +
##     polpc, data = crime4, model = "within", index = c("county",
##     "year"))
##
## Balanced Panel: n = 90, T = 7, N = 630
##
## Residuals:
##        Min.    1st Qu.      Median    3rd Qu.        Max.
## -0.04045575 -0.00255882 -0.00031571  0.00221623  0.06638033
##
## Coefficients:
##             Estimate  Std. Error t-value  Pr(>|t|)
## prbarr  -0.00801828  0.00246155 -3.2574  0.001196 **
## prbconv -0.00103514  0.00019359 -5.3472 1.326e-07 ***
## prbpris -0.00174695  0.00357370 -0.4888  0.625158
## avgsen   0.00025918  0.00011263  2.3011  0.021770 *
## polpc    2.07501723  0.15935302 13.0215 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    0.026722
## Residual Sum of Squares: 0.020249
## R-Squared:       0.24221
## Adj. R-Squared: 0.10906
## F-statistic: 34.1999 on 5 and 535 DF, p-value: < 2.22e-16
```

ii. Add the logs of each wage variable in the data set and estimate the model by fixed effects. How does including these variables affect the coefficients on the criminal justice variables in part (i)?

Add the logs of each wage variable

Estimate the fixed effects model with logged wage variables

```
crime_fe_logwage <- plm(crmrte ~ prbarr + prbconv + prbpris + avgsen + polpc
                        +data$lwcon
                        +data$lwfed
                        +data$lwfir
                        +data$lwloc
                        +data$lwmfg
                        +data$lwser
                        +data$lwsta
                        +data$lwtrd
                        +data$lwtuc,
                        data = crime4,
                        index = c("county", "year"),
                        model = "within")
```

Results

```
summary(crime_fe_logwage)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = crmrte ~ prbarr + prbconv + prbpris + avgsen +
##      polpc + data$lwcon + data$lwfed + data$lwfir + data$lwloc +
##      data$lwmfg + data$lwser + data$lwsta + data$lwtrd + data$lwtuc,
##      data = crime4, model = "within", index = c("county", "year"))
##
## Balanced Panel: n = 90, T = 7, N = 630
##
## Residuals:
##        Min.     1st Qu.      Median     3rd Qu.         Max.
## -0.04042558 -0.00237446 -0.00023258  0.00226956  0.06609539
##
## Coefficients:
##                Estimate  Std. Error t-value  Pr(>|t|)
## prbarr      -0.00785689  0.00246100 -3.1926 0.0014945 **
## prbconv     -0.00098245  0.00019324 -5.0840 5.145e-07 ***
## prbpris     -0.00079830  0.00360322 -0.2216 0.8247494
## avgsen       0.00021745  0.00011302  1.9239 0.0549037 .
## polpc        2.12765829  0.16073950 13.2367 < 2.2e-16 ***
## data$lwcon   0.00019928  0.00169938  0.1173 0.9066943
## data$lwfed  -0.02526080  0.00704371 -3.5863 0.0003667 ***
## data$lwfir  -0.00059594  0.00124614 -0.4782 0.6326867
## data$lwloc   0.00830484  0.00443380  1.8731 0.0616125 .
## data$lwmfg   0.00026081  0.00435732  0.0599 0.9522926
## data$lwser   0.00034690  0.00084321  0.4114 0.6809442
## data$lwsta   0.00620579  0.00411976  1.5063 0.1325780
## data$lwtrd  -0.00186971  0.00178814 -1.0456 0.2962190
## data$lwtuc   0.00013682  0.00076755  0.1783 0.8585911
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:     0.026722
## Residual Sum of Squares: 0.019605
## R-Squared:       0.26634
## Adj. R-Squared: 0.12267
## F-statistic: 13.6393 on 14 and 526 DF, p-value: < 2.22e-16
```

iii. Do the wage variables in part (ii) all have the expected sign? Explain. Are they jointly significant?

Test joint significance of wage variables

```
library(car)
```

```
## Carregando pacotes exigidos: carData
```

```
linearHypothesis(crime_fe_logwage, c("data$lwcon=0"
                                    ,"data$lwfed=0"
                                    ,"data$lwfir=0"
                                    ,"data$lwloc=0"
                                    ,"data$lwmfg=0"
                                    ,"data$lwser=0"
                                    ,"data$lwsta=0"
                                    ,"data$lwtrd=0"
                                    ,"data$lwtuc=0"), vcov = vcovHC(crime_fe_logwage, type = "HC1"))
```

```
## Linear hypothesis test
##
## Hypothesis:
## data$lwcon = 0
## data$lwfed = 0
## data$lwfir = 0
## data$lwloc = 0
## data$lwmfg = 0
## data$lwser = 0
## data$lwsta = 0
## data$lwtrd = 0
## data$lwtuc = 0
##
## Model 1: restricted model
## Model 2: crmrte ~ prbarr + prbconv + prbpris + avgsen + polpc + data$lwcon +
##     data$lwfed + data$lwfir + data$lwloc + data$lwmfg + data$lwser +
##     data$lwsta + data$lwtrd + data$lwtuc
##
## Note: Coefficient covariance matrix supplied.
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1    535
## 2    526  9 36.203   3.65e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The test statistic indicates that we can reject the null hypothesis and conclude that the wage variables are jointly significant at conventional levels.