Fixed Effects

Simulating Fixed Effects

Danny Moncada monca016

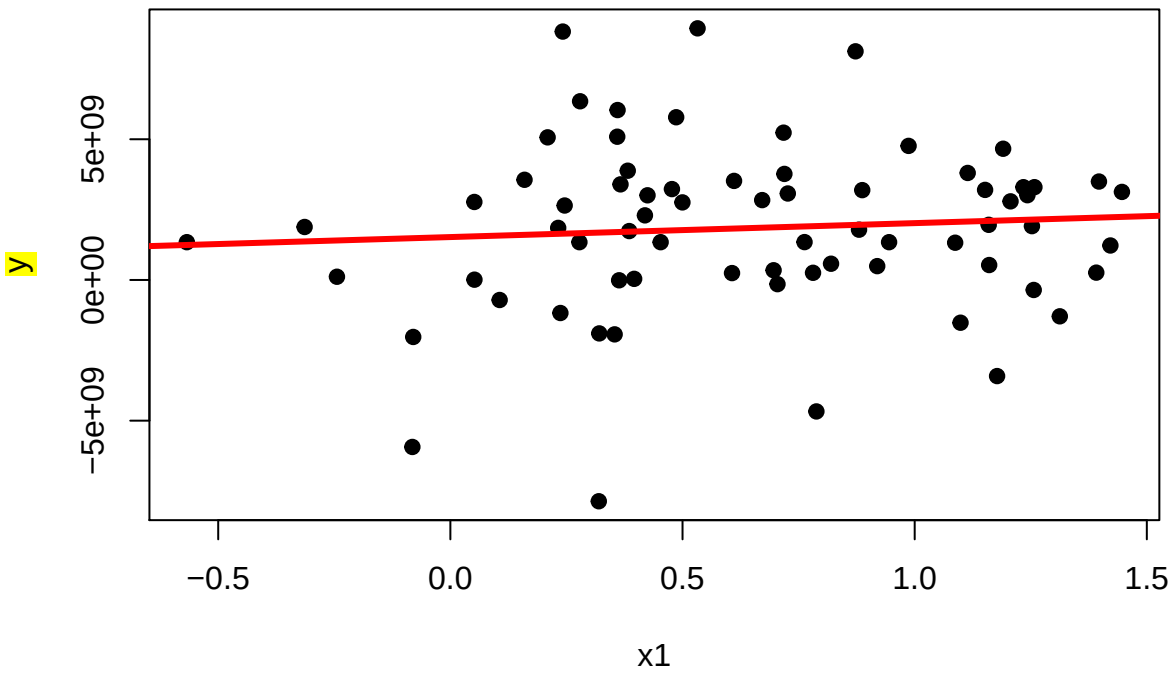
March 17, 2020

```
# Authors: Gordon Burtch and Gautam Ray
# Course: MSBA 6440
# Session: Fixed Effects
# Topic: Simulating Fixed Effects
# Lecture 5

suppressWarnings(suppressPackageStartupMessages({
library(stargazer)
library(plm)
library(car)
}))
```

```
# Read in the data
CountryData<-read.csv("CountryData.csv")

# Create an ordinary least squares regression
ols<-lm(y ~ x1, data=CountryData)
summary(ols)
```

```
##
## Call:
## lm(formula = y ~ x1, data = CountryData)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -9.546e+09 -1.578e+09  1.554e+08  1.422e+09  7.183e+09
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.524e+09  6.211e+08   2.454   0.0167 *
## x1          4.950e+08  7.789e+08   0.636   0.5272
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.028e+09 on 68 degrees of freedom
## Multiple R-squared:  0.005905,   Adjusted R-squared:  -0.008714
## F-statistic: 0.4039 on 1 and 68 DF,  p-value: 0.5272
```

```
yhat <-ols$fitted
plot(CountryData$x1, CountryData$y, pch=19, xlab="x1", ylab="y")
abline(lm(CountryData$y~CountryData$x1),lwd=3, col="red")
```

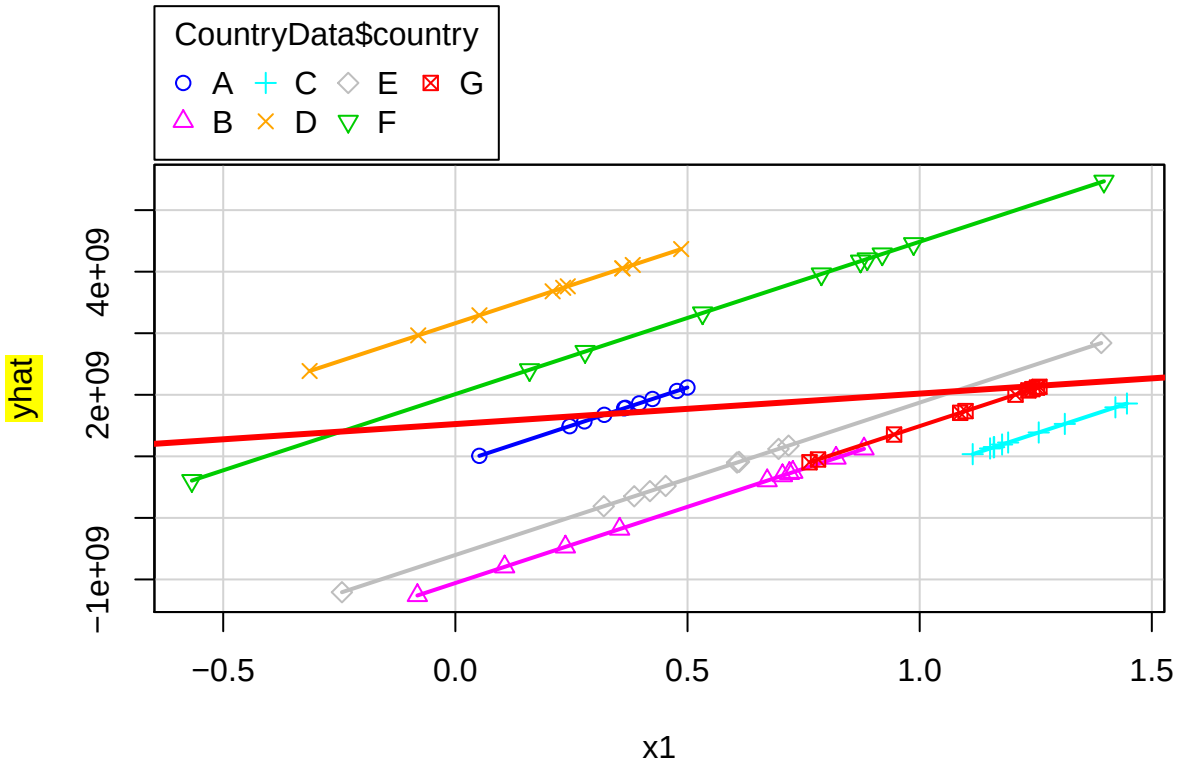



```
fixed.dum <-lm(y ~ x1 + factor(country), data=CountryData)
summary(fixed.dum)
```

```
##
## Call:
## lm(formula = y ~ x1 + factor(country), data = CountryData)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -8.634e+09 -9.697e+08  5.405e+08  1.386e+09  5.612e+09
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)         8.805e+08  9.618e+08   0.916   0.3635
## x1                  2.476e+09  1.107e+09   2.237   0.0289 *
## factor(country)B -1.938e+09  1.265e+09  -1.533   0.1304
## factor(country)C -2.603e+09  1.596e+09  -1.631   0.1080
## factor(country)D  2.282e+09  1.261e+09   1.810   0.0752 .
## factor(country)E -1.483e+09  1.268e+09  -1.169   0.2467
## factor(country)F  1.130e+09  1.289e+09   0.877   0.3839
## factor(country)G -1.865e+09  1.497e+09  -1.246   0.2175
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.796e+09 on 62 degrees of freedom
## Multiple R-squared:  0.2276, Adjusted R-squared:  0.1404
```

```
## F-statistic:  2.61 on 7 and 62 DF,  p-value: 0.01991
```

```
yhat<-fixed.dum$fitted
scatterplot(yhat~CountryData$x1|CountryData$country, boxplots=FALSE, xlab="x1", ylab="yhat",smooth=FALSE
abline(lm(CountryData$y~CountryData$x1),lwd=3, col="red")
```




```
#Individual Effect Models

fixed <-plm(y ~ x1, data=CountryData, index=c("country", "year"), effect = "individual", model="within")
summary(fixed)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = y ~ x1, data = CountryData, effect = "individual",
##     model = "within", index = c("country", "year"))
##
## Balanced Panel: n = 7, T = 10, N = 70
##
## Residuals:
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -8.63e+09 -9.70e+08  5.40e+08  0.00e+00  1.39e+09  5.61e+09
##
## Coefficients:
##      Estimate Std. Error t-value Pr(>|t|)
## x1 2475617825 1106675594   2.237  0.02889 *
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    5.2364e+20
## Residual Sum of Squares: 4.8454e+20
## R-Squared:      0.074684
## Adj. R-Squared: -0.029788
## F-statistic: 5.00411 on 1 and 62 DF, p-value: 0.028892
```

```
pool <-plm(y ~ x1, data=CountryData, index=c("country", "year"), model="pooling")
summary(pool)
```

```
## Pooling Model
##
## Call:
## plm(formula = y ~ x1, data = CountryData, model = "pooling",
##     index = c("country", "year"))
##
## Balanced Panel: n = 7, T = 10, N = 70
##
## Residuals:
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -9.55e+09 -1.58e+09  1.55e+08  0.00e+00  1.42e+09  7.18e+09
##
## Coefficients:
##               Estimate Std. Error t-value Pr(>|t|)
## (Intercept) 1524319072  621072623  2.4543  0.01668 *
## x1           494988911  778861260  0.6355  0.52722
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    6.2729e+20
## Residual Sum of Squares: 6.2359e+20
## R-Squared:      0.0059046
## Adj. R-Squared: -0.0087145
## F-statistic: 0.403897 on 1 and 68 DF, p-value: 0.52722
```

```
pFtest(fixed, ols)
```

```
##
##  F test for individual effects
##
## data:  y ~ x1
## F = 2.9655, df1 = 6, df2 = 62, p-value = 0.01307
## alternative hypothesis: significant effects
```

```
pFtest(fixed, pool)
```

```
##
##  F test for individual effects
##
## data:  y ~ x1
## F = 2.9655, df1 = 6, df2 = 62, p-value = 0.01307
## alternative hypothesis: significant effects
```

```
random <-plm(y ~ x1, data=CountryData, index=c("country", "year"), effect = "individual", model="random
summary(random)
```

```
## Oneway (individual) effect Random Effect Model
##    (Swamy-Arora's transformation)
##
## Call:
## plm(formula = y ~ x1, data = CountryData, effect = "individual",
##     model = "random", index = c("country", "year"))
##
## Balanced Panel: n = 7, T = 10, N = 70
##
## Effects:
##                       var   std.dev share
## idiosyncratic 7.815e+18 2.796e+09 0.873
## individual    1.133e+18 1.065e+09 0.127
## theta: 0.3611
##
## Residuals:
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -8.94e+09 -1.51e+09  2.82e+08  0.00e+00  1.56e+09  6.63e+09
##
## Coefficients:
##               Estimate Std. Error z-value Pr(>|z|)
## (Intercept) 1037014287  790626206  1.3116   0.1896
## x1          1247001778  902145601  1.3823   0.1669
##
## Total Sum of Squares:    5.6595e+20
## Residual Sum of Squares: 5.5048e+20
## R-Squared:      0.02733
## Adj. R-Squared: 0.013026
## Chisq: 1.91065 on 1 DF, p-value: 0.16689
```

```
phtest(fixed, random)
```

```
##
##  Hausman Test
##
## data:  y ~ x1
## chisq = 3.674, df = 1, p-value = 0.05527
## alternative hypothesis: one model is inconsistent
```

```
#Two-ways effect

fixed.twoways <-plm(y ~ x1, data=CountryData, index=c("country", "year"), effect ="twoways", model="wit
summary(fixed.twoways)
```

```
## Twoways effects Within Model
##
## Call:
## plm(formula = y ~ x1, data = CountryData, effect = "twoways",
##     model = "within", index = c("country", "year"))
##
## Balanced Panel: n = 7, T = 10, N = 70
##
## Residuals:
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -7.92e+09 -1.05e+09 -1.40e+08  0.00e+00  1.63e+09  5.49e+09
```

```
##
## Coefficients:
##      Estimate Std. Error t-value Pr(>|t|)
## x1 1389050353 1319849567  1.0524   0.2974
##
## Total Sum of Squares:    4.1041e+20
## Residual Sum of Squares: 4.0201e+20
## R-Squared:      0.020471
## Adj. R-Squared: -0.27524
## F-statistic: 1.10761 on 1 and 53 DF, p-value: 0.29738
```

```
pFtest(fixed.twoways, ols)
```

```
##
##  F test for twoways effects
##
## data:  y ~ x1
## F = 1.9476, df1 = 15, df2 = 53, p-value = 0.03856
## alternative hypothesis: significant effects
```

```
pFtest(fixed.twoways, fixed)
```

```
##
##  F test for twoways effects
##
## data:  y ~ x1
## F = 1.209, df1 = 9, df2 = 53, p-value = 0.3094
## alternative hypothesis: significant effects
```

```
fixed.time <-plm(y ~ x1 + factor(year), data=CountryData, index=c("country", "year"), model="within")
summary(fixed.time)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = y ~ x1 + factor(year), data = CountryData, model = "within",
##     index = c("country", "year"))
##
## Balanced Panel: n = 7, T = 10, N = 70
##
## Residuals:
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -7.92e+09 -1.05e+09 -1.40e+08  0.00e+00  1.63e+09  5.49e+09
##
## Coefficients:
##                     Estimate Std. Error t-value Pr(>|t|)
## x1                1389050353 1319849567  1.0524  0.29738
## factor(year)1991   296381562 1503368528  0.1971  0.84447
## factor(year)1992   145369667 1547226548  0.0940  0.92550
## factor(year)1993  2874386797 1503862554  1.9113  0.06138 .
## factor(year)1994  2848156292 1661498926  1.7142  0.09233 .
## factor(year)1995   973941306 1567245748  0.6214  0.53698
## factor(year)1996  1672812557 1631539254  1.0253  0.30988
## factor(year)1997  2991770064 1627062032  1.8388  0.07156 .
## factor(year)1998   367463596 1587924444  0.2314  0.81789
## factor(year)1999  1258751933 1512397632  0.8323  0.40898
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    5.2364e+20
## Residual Sum of Squares: 4.0201e+20
## R-Squared:      0.23229
## Adj. R-Squared: 0.00052851
## F-statistic: 1.60365 on 10 and 53 DF, p-value: 0.13113
```

```
pFtest(fixed.time, fixed)
```

```
##
##  F test for individual effects
##
## data:  y ~ x1 + factor(year)
## F = 1.209, df1 = 9, df2 = 53, p-value = 0.3094
## alternative hypothesis: significant effects
```

```
random.twoways <-plm(y ~ x1, data=CountryData, index=c("country", "year"), effect="twoways", model="ran
summary(random.twoways)
```

```
## Twoways effects Random Effect Model
##    (Swamy-Arora's transformation)
##
## Call:
## plm(formula = y ~ x1, data = CountryData, effect = "twoways",
##     model = "random", index = c("country", "year"))
##
## Balanced Panel: n = 7, T = 10, N = 70
##
## Effects:
##                      var   std.dev share
## idiosyncratic 7.585e+18 2.754e+09 0.858
## individual    1.156e+18 1.075e+09 0.131
## time          1.012e+17 3.181e+08 0.011
## theta: 0.3706 (id) 0.04365 (time) 0.03232 (total)
##
## Residuals:
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -8.93e+09 -1.49e+09  2.71e+08  0.00e+00  1.52e+09  6.62e+09
##
## Coefficients:
##               Estimate Std. Error z-value Pr(>|z|)
## (Intercept) 1062873374  801857334  1.3255   0.1850
## x1          1207095816  907065664  1.3308   0.1833
##
## Total Sum of Squares:    5.5504e+20
## Residual Sum of Squares: 5.4095e+20
## R-Squared:      0.025382
## Adj. R-Squared: 0.01105
## Chisq: 1.77095 on 1 DF, p-value: 0.18326
```

```
phtest(fixed.twoways, random.twoways)
```

```
##
##  Hausman Test
```

```
##
## data:  y ~ x1
## chisq = 0.036016, df = 1, p-value = 0.8495
## alternative hypothesis: one model is inconsistent
```

```
# Lagrange Multiplier does a comparison with the Pooling model


plmtest(fixed, effect ="individual")
```

```
##
##  Lagrange Multiplier Test - (Honda) for balanced panels
##
## data:  y ~ x1
## normal = 1.6338, p-value = 0.05115
## alternative hypothesis: significant effects
```

```
plmtest(fixed, effect ="time")
```

```
##
##  Lagrange Multiplier Test - time effects (Honda) for balanced
##  panels
##
## data:  y ~ x1
## normal = 0.4066, p-value = 0.3422
## alternative hypothesis: significant effects
```

```
plmtest(fixed, effect ="twoways")
```

```
##
##  Lagrange Multiplier Test - two-ways effects (Honda) for balanced
##  panels
##
## data:  y ~ x1
## normal = 1.4428, p-value = 0.07455
## alternative hypothesis: significant effects
```