Assingment 9

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if(!require("pacman")) install.packages("pacman")  
pacman::p\_load(tidyverse, reshape, gplots, ggmap, RStata,haven,plm,ivpanel,  
 data.table,margins,pastecs,MASS,lmtest,broom,car,stargazer,sandwich,knitr,dplyr)  
search()  
theme\_set(theme\_classic())

df<-read\_dta('mexican.dta')  
head(df)

## # A tibble: 6 x 13  
## id trans lnprice bar street othersite nocondom attractive school age  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 1 1 5.30 1 0 0 0 0 0 35  
## 2 1 2 5.19 1 0 0 0 0 0 35  
## 3 1 3 5.52 1 0 0 0 0 0 35  
## 4 1 4 5.30 1 0 0 0 0 0 35  
## 5 2 1 5.70 1 0 0 0 0 0 27  
## 6 2 2 5.86 1 0 0 0 0 0 27  
## # ... with 3 more variables: rich <dbl>, regular <dbl>, alcohol <dbl>

str(df)

## Classes 'tbl\_df', 'tbl' and 'data.frame': 3016 obs. of 13 variables:  
## $ id : num 1 1 1 1 2 2 2 2 3 3 ...  
## ..- attr(\*, "label")= chr "sex worker identifier; 754 total"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ trans : num 1 2 3 4 1 2 3 4 1 2 ...  
## ..- attr(\*, "label")= chr "transaction number; 4 for each sex worker"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ lnprice : num 5.3 5.19 5.52 5.3 5.7 ...  
## ..- attr(\*, "label")= chr "log(price) of transaction"  
## ..- attr(\*, "format.stata")= chr "%10.0g"  
## $ bar : num 1 1 1 1 1 1 1 1 1 1 ...  
## ..- attr(\*, "label")= chr "1 if transaction originated in a bar; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ street : num 0 0 0 0 0 0 0 0 0 0 ...  
## ..- attr(\*, "label")= chr "1 if transaction originated in a street; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ othersite : num 0 0 0 0 0 0 0 0 0 0 ...  
## ..- attr(\*, "label")= chr "1 if transaction originated in another site; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ nocondom : num 0 0 0 0 0 0 0 0 0 0 ...  
## ..- attr(\*, "label")= chr "1 if a condom was not used; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ attractive: num 0 0 0 0 0 0 0 0 0 0 ...  
## ..- attr(\*, "label")= chr "1 if the sex worker is attractive; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ school : num 0 0 0 0 0 0 0 0 0 0 ...  
## ..- attr(\*, "label")= chr "1 if sex worker has completed secondary school or higher; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ age : num 35 35 35 35 27 27 27 27 28 28 ...  
## ..- attr(\*, "label")= chr "age of sex worker in years"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ rich : num 1 1 1 1 1 1 1 1 0 1 ...  
## ..- attr(\*, "label")= chr "1 if client is rich; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ regular : num 1 1 1 1 1 1 1 1 0 0 ...  
## ..- attr(\*, "label")= chr "1 if client is regular; 0 otherwise"  
## ..- attr(\*, "format.stata")= chr "%8.0g"  
## $ alcohol : num 1 1 1 1 1 1 1 1 1 1 ...  
## ..- attr(\*, "label")= chr "1 if client consumed alcohol prior to the transaction"  
## ..- attr(\*, "format.stata")= chr "%8.0g"

names(df)

## [1] "id" "trans" "lnprice" "bar" "street"   
## [6] "othersite" "nocondom" "attractive" "school" "age"   
## [11] "rich" "regular" "alcohol"

# estimate the fixed effects regression with plm()  
fe <- plm(lnprice ~ bar+street+nocondom+rich+regular+alcohol,   
 data = df,  
 index = c("id","trans"),   
 model = "within")  
summary(fe)

## Oneway (individual) effect Within Model  
##   
## Call:  
## plm(formula = lnprice ~ bar + street + nocondom + rich + regular +   
## alcohol, data = df, model = "within", index = c("id", "trans"))  
##   
## Balanced Panel: n = 754, T = 4, N = 3016  
##   
## Residuals:  
## Min. 1st Qu. Median 3rd Qu. Max.   
## -2.844848 -0.038538 0.000000 0.020045 1.664766   
##   
## Coefficients:  
## Estimate Std. Error t-value Pr(>|t|)   
## bar 0.298455 0.134450 2.2198 0.0265299 \*   
## street 0.455159 0.130465 3.4887 0.0004946 \*\*\*  
## nocondom 0.170282 0.025817 6.5957 5.256e-11 \*\*\*  
## rich 0.082636 0.020528 4.0254 5.875e-05 \*\*\*  
## regular 0.037219 0.016849 2.2090 0.0272770 \*   
## alcohol -0.056856 0.026139 -2.1751 0.0297261 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Total Sum of Squares: 111.72  
## Residual Sum of Squares: 107.6  
## R-Squared: 0.03688  
## Adj. R-Squared: -0.28715  
## F-statistic: 14.3978 on 6 and 2256 DF, p-value: 3.5477e-16

mean(fixef(fe))

## [1] 5.461258

#summary(fixef(fe))

# estimate the random effects regression with plm()  
re <- plm(lnprice ~ bar+street+nocondom+rich+regular+alcohol+age+school+attractive,   
 data = df,  
 index = c("id","trans"),   
 model = "random")  
summary(re)

## Oneway (individual) effect Random Effect Model   
## (Swamy-Arora's transformation)  
##   
## Call:  
## plm(formula = lnprice ~ bar + street + nocondom + rich + regular +   
## alcohol + age + school + attractive, data = df, model = "random",   
## index = c("id", "trans"))  
##   
## Balanced Panel: n = 754, T = 4, N = 3016  
##   
## Effects:  
## var std.dev share  
## idiosyncratic 0.04769 0.21839 0.14  
## individual 0.29337 0.54163 0.86  
## theta: 0.8024  
##   
## Residuals:  
## Min. 1st Qu. Median 3rd Qu. Max.   
## -3.042579 -0.102652 -0.010356 0.094877 1.782238   
##   
## Coefficients:  
## Estimate Std. Error z-value Pr(>|z|)   
## (Intercept) 5.9103651 0.1303194 45.3529 < 2.2e-16 \*\*\*  
## bar 0.4642454 0.0998912 4.6475 3.360e-06 \*\*\*  
## street 0.1032864 0.1010769 1.0219 0.3068   
## nocondom 0.1389842 0.0250266 5.5535 2.801e-08 \*\*\*  
## rich 0.1160067 0.0200346 5.7903 7.026e-09 \*\*\*  
## regular 0.0236290 0.0161849 1.4599 0.1443   
## alcohol 0.0148896 0.0249556 0.5966 0.5507   
## age -0.0257651 0.0027534 -9.3574 < 2.2e-16 \*\*\*  
## school 0.2161494 0.0453396 4.7673 1.867e-06 \*\*\*  
## attractive 0.2768274 0.0602379 4.5956 4.316e-06 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Total Sum of Squares: 167.65  
## Residual Sum of Squares: 149.03  
## R-Squared: 0.11104  
## Adj. R-Squared: 0.10838  
## Chisq: 375.488 on 9 DF, p-value: < 2.22e-16

phtest(fe, re)

##   
## Hausman Test  
##   
## data: lnprice ~ bar + street + nocondom + rich + regular + alcohol  
## chisq = 155.43, df = 6, p-value < 2.2e-16  
## alternative hypothesis: one model is inconsistent

#Question -15.10

crime\_df<-read\_dta('crime.dta')  
head(crime\_df)

## # A tibble: 6 x 59  
## county year crmrte prbarr prbconv prbpris avgsen polpc density taxpc west  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 1 81 0.0399 0.290 0.402 0.472 5.61 0.00179 2.31 25.7 0  
## 2 1 82 0.0383 0.338 0.433 0.507 5.59 0.00177 2.33 24.9 0  
## 3 1 83 0.0303 0.330 0.526 0.480 5.80 0.00184 2.34 26.5 0  
## 4 1 84 0.0347 0.363 0.605 0.520 6.89 0.00189 2.35 26.8 0  
## 5 1 85 0.0366 0.325 0.579 0.497 6.55 0.00192 2.36 28.1 0  
## 6 1 86 0.0348 0.326 0.512 0.440 6.90 0.00190 2.39 29.7 0  
## # ... with 48 more variables: central <dbl>, urban <dbl>, pctmin80 <dbl>,  
## # wcon <dbl>, wtuc <dbl>, wtrd <dbl>, wfir <dbl>, wser <dbl>, wmfg <dbl>,  
## # wfed <dbl>, wsta <dbl>, wloc <dbl>, mix <dbl>, pctymle <dbl>, d82 <dbl>,  
## # d83 <dbl>, d84 <dbl>, d85 <dbl>, d86 <dbl>, d87 <dbl>, lcrmrte <dbl>,  
## # lprbarr <dbl>, lprbconv <dbl>, lprbpris <dbl>, lavgsen <dbl>, lpolpc <dbl>,  
## # ldensity <dbl>, ltaxpc <dbl>, lwcon <dbl>, lwtuc <dbl>, lwtrd <dbl>,  
## # lwfir <dbl>, lwser <dbl>, lwmfg <dbl>, lwfed <dbl>, lwsta <dbl>,  
## # lwloc <dbl>, lmix <dbl>, lpctymle <dbl>, lpctmin <dbl>, clcrmrte <dbl>,  
## # clprbarr <dbl>, clprbcon <dbl>, clprbpri <dbl>, clavgsen <dbl>,  
## # clpolpc <dbl>, cltaxpc <dbl>, clmix <dbl>

names(crime\_df)

## [1] "county" "year" "crmrte" "prbarr" "prbconv" "prbpris"   
## [7] "avgsen" "polpc" "density" "taxpc" "west" "central"   
## [13] "urban" "pctmin80" "wcon" "wtuc" "wtrd" "wfir"   
## [19] "wser" "wmfg" "wfed" "wsta" "wloc" "mix"   
## [25] "pctymle" "d82" "d83" "d84" "d85" "d86"   
## [31] "d87" "lcrmrte" "lprbarr" "lprbconv" "lprbpris" "lavgsen"   
## [37] "lpolpc" "ldensity" "ltaxpc" "lwcon" "lwtuc" "lwtrd"   
## [43] "lwfir" "lwser" "lwmfg" "lwfed" "lwsta" "lwloc"   
## [49] "lmix" "lpctymle" "lpctmin" "clcrmrte" "clprbarr" "clprbcon"  
## [55] "clprbpri" "clavgsen" "clpolpc" "cltaxpc" "clmix"

lm <- lm(log(crmrte) ~ log(prbarr)+log(prbconv)+log(prbpris)+log(avgsen)+log(wmfg) , data=crime\_df)  
summary(lm)

##   
## Call:  
## lm(formula = log(crmrte) ~ log(prbarr) + log(prbconv) + log(prbpris) +   
## log(avgsen) + log(wmfg), data = crime\_df)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.54913 -0.24408 0.02184 0.26066 2.22985   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -6.08610 0.36536 -16.658 < 2e-16 \*\*\*  
## log(prbarr) -0.65658 0.04035 -16.274 < 2e-16 \*\*\*  
## log(prbconv) -0.44658 0.02774 -16.098 < 2e-16 \*\*\*  
## log(prbpris) 0.20823 0.07267 2.865 0.0043 \*\*   
## log(avgsen) -0.05863 0.06060 -0.967 0.3337   
## log(wmfg) 0.29206 0.06190 4.718 2.94e-06 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.4137 on 624 degrees of freedom  
## Multiple R-squared: 0.4824, Adjusted R-squared: 0.4783   
## F-statistic: 116.3 on 5 and 624 DF, p-value: < 2.2e-16

# estimate the fixed effects regression with plm()  
fe1 <- plm(log(crmrte) ~ log(prbarr)+log(prbconv)+log(prbpris)+log(avgsen)+log(wmfg),   
 data = crime\_df,  
 index = c("county","year" ),   
 model = "within")  
summary(fe1)

## Oneway (individual) effect Within Model  
##   
## Call:  
## plm(formula = log(crmrte) ~ log(prbarr) + log(prbconv) + log(prbpris) +   
## log(avgsen) + log(wmfg), data = crime\_df, model = "within",   
## index = c("county", "year"))  
##   
## Balanced Panel: n = 90, T = 7, N = 630  
##   
## Residuals:  
## Min. 1st Qu. Median 3rd Qu. Max.   
## -0.9948711 -0.0776321 -0.0020173 0.0789327 1.0771077   
##   
## Coefficients:  
## Estimate Std. Error t-value Pr(>|t|)   
## log(prbarr) -0.231271 0.037648 -6.1429 1.582e-09 \*\*\*  
## log(prbconv) -0.137803 0.022187 -6.2110 1.058e-09 \*\*\*  
## log(prbpris) -0.143137 0.039303 -3.6418 0.000297 \*\*\*  
## log(avgsen) 0.018281 0.030950 0.5907 0.554994   
## log(wmfg) -0.166641 0.055267 -3.0152 0.002690 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Total Sum of Squares: 17.991  
## Residual Sum of Squares: 16.149  
## R-Squared: 0.10238  
## Adj. R-Squared: -0.05533  
## F-statistic: 12.2044 on 5 and 535 DF, p-value: 3.2267e-11

mean(fixef(fe1))

## [1] -3.228824

sum(fe1$residuals^2)

## [1] 16.14881

# estimate the fixed effects regression with plm()  
lm\_u <- lm(log(crmrte) ~ log(prbarr)+log(prbconv)+log(prbpris)+log(avgsen)+log(wmfg)+county ,   
 data = crime\_df)  
summary(lm\_u)

##   
## Call:  
## lm(formula = log(crmrte) ~ log(prbarr) + log(prbconv) + log(prbpris) +   
## log(avgsen) + log(wmfg) + county, data = crime\_df)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.60103 -0.25249 0.02794 0.26888 2.21251   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -6.1570734 0.3641957 -16.906 < 2e-16 \*\*\*  
## log(prbarr) -0.6508697 0.0401721 -16.202 < 2e-16 \*\*\*  
## log(prbconv) -0.4591405 0.0279429 -16.431 < 2e-16 \*\*\*  
## log(prbpris) 0.2083678 0.0722653 2.883 0.00407 \*\*   
## log(avgsen) -0.0687828 0.0603692 -1.139 0.25499   
## log(wmfg) 0.2937983 0.0615590 4.773 2.27e-06 \*\*\*  
## county 0.0008129 0.0002876 2.827 0.00485 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.4114 on 623 degrees of freedom  
## Multiple R-squared: 0.489, Adjusted R-squared: 0.4841   
## F-statistic: 99.36 on 6 and 623 DF, p-value: < 2.2e-16

sum(lm\_u$residuals^2)

## [1] 105.4618

**PART e** #OLS

lm3a<-lm(lcrmrte~lprbarr+lprbconv+lprbpris+lavgsen+lwmfg+ldensity+lpctymle+d82+d83+d84+d85+d86+d87,  
 data=crime\_df)  
summary(lm3a)

##   
## Call:  
## lm(formula = lcrmrte ~ lprbarr + lprbconv + lprbpris + lavgsen +   
## lwmfg + ldensity + lpctymle + d82 + d83 + d84 + d85 + d86 +   
## d87, data = crime\_df)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.28650 -0.21313 0.00437 0.22888 2.34934   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -3.67693 0.46621 -7.887 1.42e-14 \*\*\*  
## lprbarr -0.42453 0.04191 -10.129 < 2e-16 \*\*\*  
## lprbconv -0.28270 0.02879 -9.819 < 2e-16 \*\*\*  
## lprbpris 0.08771 0.06935 1.265 0.2064   
## lavgsen -0.10834 0.05774 -1.876 0.0611 .   
## lwmfg 0.01598 0.07049 0.227 0.8208   
## ldensity 0.30521 0.02737 11.152 < 2e-16 \*\*\*  
## lpctymle 0.15907 0.08405 1.893 0.0589 .   
## d82 -0.01757 0.05737 -0.306 0.7595   
## d83 -0.06686 0.05786 -1.156 0.2483   
## d84 -0.11935 0.05855 -2.039 0.0419 \*   
## d85 -0.10563 0.05998 -1.761 0.0787 .   
## d86 -0.06574 0.06117 -1.075 0.2829   
## d87 -0.01011 0.06166 -0.164 0.8699   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3743 on 616 degrees of freedom  
## Multiple R-squared: 0.5818, Adjusted R-squared: 0.573   
## F-statistic: 65.92 on 13 and 616 DF, p-value: < 2.2e-16

lm3b<-lm(lcrmrte~lprbarr+lprbconv+lprbpris+lavgsen+lwmfg+ldensity+lpctymle,data=crime\_df)  
summary(lm3b)

##   
## Call:  
## lm(formula = lcrmrte ~ lprbarr + lprbconv + lprbpris + lavgsen +   
## lwmfg + ldensity + lpctymle, data = crime\_df)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.31614 -0.21754 -0.00317 0.22244 2.35663   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -3.707400 0.419464 -8.838 <2e-16 \*\*\*  
## lprbarr -0.430791 0.041731 -10.323 <2e-16 \*\*\*  
## lprbconv -0.290357 0.028606 -10.150 <2e-16 \*\*\*  
## lprbpris 0.077992 0.068344 1.141 0.2542   
## lavgsen -0.072291 0.055003 -1.314 0.1892   
## lwmfg -0.008637 0.062876 -0.137 0.8908   
## ldensity 0.305187 0.027080 11.270 <2e-16 \*\*\*  
## lpctymle 0.153256 0.082736 1.852 0.0644 .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.3749 on 622 degrees of freedom  
## Multiple R-squared: 0.5764, Adjusted R-squared: 0.5716   
## F-statistic: 120.9 on 7 and 622 DF, p-value: < 2.2e-16

anova(lm3a,lm3b)

## Analysis of Variance Table  
##   
## Model 1: lcrmrte ~ lprbarr + lprbconv + lprbpris + lavgsen + lwmfg + ldensity +   
## lpctymle + d82 + d83 + d84 + d85 + d86 + d87  
## Model 2: lcrmrte ~ lprbarr + lprbconv + lprbpris + lavgsen + lwmfg + ldensity +   
## lpctymle  
## Res.Df RSS Df Sum of Sq F Pr(>F)  
## 1 616 86.313   
## 2 622 87.426 -6 -1.1128 1.3237 0.2442

#Fixed effect

lm4a<-plm(lcrmrte~lprbarr+lprbconv+lprbpris+lavgsen+lwmfg+ldensity+lpctymle+d82+d83+d84+d85+d86+d87,  
 data=crime\_df,model='within')  
summary(lm4a)

## Oneway (individual) effect Within Model  
##   
## Call:  
## plm(formula = lcrmrte ~ lprbarr + lprbconv + lprbpris + lavgsen +   
## lwmfg + ldensity + lpctymle + d82 + d83 + d84 + d85 + d86 +   
## d87, data = crime\_df, model = "within")  
##   
## Balanced Panel: n = 90, T = 7, N = 630  
##   
## Residuals:  
## Min. 1st Qu. Median 3rd Qu. Max.   
## -0.8989832 -0.0676036 0.0050666 0.0663100 1.1116745   
##   
## Coefficients:  
## Estimate Std. Error t-value Pr(>|t|)   
## lprbarr -0.195152 0.036704 -5.3169 1.562e-07 \*\*\*  
## lprbconv -0.111339 0.021730 -5.1238 4.210e-07 \*\*\*  
## lprbpris -0.097665 0.038424 -2.5418 0.011315 \*   
## lavgsen -0.023962 0.031460 -0.7617 0.446594   
## lwmfg -0.576232 0.132950 -4.3342 1.753e-05 \*\*\*  
## ldensity 0.769416 0.337740 2.2781 0.023118 \*   
## lpctymle 1.246045 0.434638 2.8669 0.004312 \*\*   
## d82 0.025280 0.027297 0.9261 0.354811   
## d83 0.021608 0.035170 0.6144 0.539217   
## d84 0.012070 0.042636 0.2831 0.777209   
## d85 0.058874 0.052797 1.1151 0.265310   
## d86 0.158618 0.065225 2.4319 0.015353 \*   
## d87 0.278223 0.077213 3.6033 0.000344 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Total Sum of Squares: 17.991  
## Residual Sum of Squares: 14.383  
## R-Squared: 0.20051  
## Adj. R-Squared: 0.045771  
## F-statistic: 10.167 on 13 and 527 DF, p-value: < 2.22e-16

lm4b<-plm(lcrmrte~lprbarr+lprbconv+lprbpris+lavgsen+lwmfg+ldensity+lpctymle,data=crime\_df,model='within')  
summary(lm4b)

## Oneway (individual) effect Within Model  
##   
## Call:  
## plm(formula = lcrmrte ~ lprbarr + lprbconv + lprbpris + lavgsen +   
## lwmfg + ldensity + lpctymle, data = crime\_df, model = "within")  
##   
## Balanced Panel: n = 90, T = 7, N = 630  
##   
## Residuals:  
## Min. 1st Qu. Median 3rd Qu. Max.   
## -9.8696e-01 -7.6027e-02 -6.3602e-05 7.6603e-02 1.0762e+00   
##   
## Coefficients:  
## Estimate Std. Error t-value Pr(>|t|)   
## lprbarr -0.225501 0.037567 -6.0026 3.593e-09 \*\*\*  
## lprbconv -0.133819 0.022093 -6.0571 2.620e-09 \*\*\*  
## lprbpris -0.134857 0.039311 -3.4305 0.0006492 \*\*\*  
## lavgsen 0.021567 0.030766 0.7010 0.4836138   
## lwmfg -0.341942 0.101497 -3.3690 0.0008090 \*\*\*  
## ldensity 0.985805 0.333826 2.9531 0.0032853 \*\*   
## lpctymle -0.045674 0.306372 -0.1491 0.8815476   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Total Sum of Squares: 17.991  
## Residual Sum of Squares: 15.877  
## R-Squared: 0.11752  
## Adj. R-Squared: -0.041429  
## F-statistic: 10.1397 on 7 and 533 DF, p-value: 6.1148e-12

pFtest(lm4a,lm4b)

##   
## F test for individual effects  
##   
## data: lcrmrte ~ lprbarr + lprbconv + lprbpris + lavgsen + lwmfg + ldensity + ...  
## F = 9.1178, df1 = 6, df2 = 527, p-value = 1.665e-09  
## alternative hypothesis: significant effects