
SAS code for panel data analysis
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Code to sort along the states then years if the data are not already arranged.

```
proc sort data=crop_int;  
by State Year;  
run;
```

Code to print overall mean, standard deviation, maximum and minimum.

```
proc means data= crop_int;  
var CI    GIA  FR   FL   PD;  
run;
```

Code to print mean, standard deviation, maximum and minimum observation for each state for between group.

```
proc means data= crop_int;  
class state;  
var CI    GIA  FR   FL   PD;  
run;
```

Code to print mean, standard deviation, maximum and minimum observation for each state for within group.

```
proc means data= crop_int;  
class year;  
var CI    GIA  FR   FL   PD;  
run;
```

Code to estimate overall, between and within variation of the panel data.

```
proc anova data=crop_int;  
class state;  
model CI= state;  
run;  
quit;
```

Code to generate variance influence factor and Durbin-Watson statistic.

```
PROC REG DATA= crop_int;  
MODEL CI  = GIA      FR   FL   PD/VIF dw ;  
RUN;
```

Code for estimation of all the panel models used in the thesis.

```
proc panel data=crop_int outest=estimates;  
id state year;
```

```

POOLED:    model CI    = GIA      FRFL      PD/pooled;
FIX2:      model CI    = GIA      FR FL      PD/FIXTWO;
FIX1:      model CI    = GIA      FR FL      PD/FIXONE;
FIX1T:     model CI    = GIA      FR FL      PD/FIXONETIME;
FD:        model CI_FD    = GIA_FD FR_FD FL_FD
PD_FD/pooled;
ran2FB:    model CI    = GIA      FR FL      PD/rantwo
vcomp=fb BP2;
ran2WK:    model CI    = GIA      FR FL      PD/rantwo
vcomp=wk BP2;
ran2WH:    model CI    = GIA      FR FL      PD/rantwo
vcomp=wh BP2;
ran2NL:    model CI    = GIA      FR FL      PD/rantwo
vcomp=nl BP2;
ran1FB:    model CI    = GIA      FR FL      PD/ranone
vcomp=fb BP;
ran1WK:    model CI    = GIA      FR FL      PD/ranone
vcomp=wk BP;
ran1WH:    model CI    = GIA      FR FL      PD/ranone
vcomp=wh BP;
ran1NL:    model CI    = GIA      FR FL      PD/ranone
vcomp=nl BP;
Parks:     model CI    = GIA      FR FL      PD/ parks;
Dasilva:   model CI    = GIA      FR FL      PD/ dasilva
m=1;
BETWEEN:   model CI    = GIA      FR FL      PD/btwng;
BETWEEN:   model CI    = GIA      FR FL      PD/btwnt;
run;

```

Code for dynamic panel models:

Code to produce a version of the data that contains first-order lags of CI.

```

proc panel data=crop_int;
id state year;
clag CI(1) / out=crop_int_lag;
run;
data crop_int_lag;
set crop_int_lag;
label CI_1 = 'Lagged Cropping intensity';
run;

```

Code for dynamic panel models

```

proc panel data=crop_int outest=estimates;
id state year;
POOLED:    model CI    = CI_1 GIA      FRFL      PD/pooled;
FIX2:      model CI    = CI_1 GIA      FR FL      PD/FIXTWO;

```

```

FIX1:      model CI  = CI_1 GIA      FR FL
           PD/FIXONE;
FIX1T:     model CI  = CI_1 GIA      FR FL
           PD/FIXONETIME;
FD:        model CI_FD      = CI_1 GIA_FD FR_FD FL_FD
PD_FD/pooled;
ran2FB:     model CI  = CI_1 GIA      FR FL      PD/rantwo
vcomp=fb BP2;
ran2WK:     model CI  = CI_1 GIA      FR FL      PD/rantwo
vcomp=wk BP2;
ran2WH:     model CI  = CI_1 GIA      FR FL      PD/rantwo
vcomp=wh BP2;
ran2NL:     model CI  = CI_1 GIA      FR FL      PD/rantwo
vcomp=nl BP2;
ran1FB:     model CI  = CI_1 GIA      FR FL      PD/ranone
vcomp=fb BP;
ran1WK:     model CI  = CI_1 GIA      FR FL      PD/ranone
vcomp=wk BP;
ran1WH:     model CI  = CI_1 GIA      FR FL      PD/ranone
vcomp=wh BP;
ran1NL:     model CI  = CI_1 GIA      FR FL      PD/ranone
vcomp=nl BP;
Parks:      model CI  = CI_1 GIA      FR FL      PD/
parks;
Dasilva:    model CI  = CI_1 GIA      FR FL      PD/
dasilva m=1;
BETWEEN:    model CI  = CI_1 GIA      FR FL
           PD/btwng;
BETWEEN:    model CI  = CI_1 GIA      FR FL
           PD/btwnt;
run;

```

Code to print actual versus predicted values

```

PROC SGPLOT DATA=rrt;
SERIES Y=_ACTUAL_ X=Obs;
SERIES Y=PREDICTED X=Obs;
RUN;

```