# Lab8 : FE and DID

## *Introduction to Econometrics,Spring 2023*

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*26/05/2023*

Section 1

# FE in Stata

Subsection 1

## Panel Data

# Panel Data in Stata

- Panel Data
  - Panel data refers to data with observations on **multiple entities**, where each entity is observed at **two or more points in time**.
  - We focus on **balanced** and **micro** panel data.
  - **Balanced** panel: each unit of observation i is observed the same number of time periods, T.
  - **Micro** : large N, and small T, more similar to cross-section data.

Subsection 2

## Review the Theory

# FE in Stata

- Review the Theory
  - Fixed effects regression is a method for **controlling for omitted variables** in panel data when the omitted variables **vary across entities (states)** but do **not change over time**.
  - Specification :

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_i + u_{it} \qquad (11.1)$$

- Because $Z_i$ varies from one state to the next but is constant over time,then let $\alpha_i = \beta_0 + \beta_2 Z_i$,the Equation becomes

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it} \qquad (11.2)$$

- This is the **fixed effects regression model**, in which $\alpha_i$ are treated as *unknown intercepts* to be estimated, one for each state. The interpretation of $\alpha_i$ as a *state-specific intercept* in Equation (11.2).
- Arbitrarily omit the binary variable $D1_i$ for the first group. Accordingly, the fixed effects regression model in Equation (7.2) can be written equivalently as

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \gamma_2 D2_i + \gamma_3 D3_i + ... + \gamma_n Dn_i + u_{it} \qquad (7.3)$$

# FE in Stata

- Review the Theory
  - Estimation:

    entity-demeaned :

$$\hat{\beta}_{demean} = \frac{\sum_{i=1}^{n}\sum_{t=1}^{T}\tilde{Y}_{it}\tilde{X}_{it}}{\sum_{i=1}^{n}\sum_{t=1}^{T}\tilde{X}_{it}^2}$$

    first-difference estimator :

$$\hat{\beta}_{fd} = \frac{\sum_{i=1}^{n}\sum_{t=2}^{T}\Delta Y_{it}\Delta X_{it}}{\sum_{i=1}^{n}\sum_{t=2}^{T}\Delta X_{it}^2}$$

# FE in Stata

- Summary
  - FE 实质上就是在传统的线性回归模型中加入 N-1 个虚拟变量;
  - 使得每个截面都有自己的截距项，截距项的不同反映了个体的某些不随时间改变的特征;
  - 我们关注的是 X 的系数，而非每个截面的截距项。

Subsection 3

## Examples for FE

# FE in Stata

- Examples for FE
  - unbalance —> balance

```
. use abond.dta, clear
. xtset id year
       panel variable:  id (unbalanced)
        time variable:  year, 1976 to 1984
                delta:  1 unit
```

# FE in Stata

- Examples for FE
  - unbalance —> balance

```
. xtdes          /*unbalanced*/
      id:  1, 2, ..., 140                                 n =        140
    year:  1976, 1977, ..., 1984                         T =          9
           Delta(year) = 1 unit
           Span(year)  = 9 periods
           (id*year uniquely identifies each observation)
Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         7       7       7         7         8       9       9
     Freq.  Percent    Cum. |  Pattern
 ---------------------------+---------
       62     44.29   44.29 |  1111111..
       39     27.86   72.14 |  .1111111.
       19     13.57   85.71 |  .11111111
       14     10.00   95.71 |  111111111
        4      2.86   98.57 |  11111111.
        2      1.43  100.00 |  ..1111111
 ---------------------------+---------
      140    100.00         |  XXXXXXXXX
```

# FE in Stata

- Examples for FE
  - unbalance —> balance

```
. sum           /*many missing values*/
    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
          c1 |          0
         ind |      1,031    5.123181    2.678095         1          9
        year |      1,031    1979.651     2.21607      1976       1984
         emp |      1,031    7.891677    15.93492      .104    108.562
        wage |      1,031     23.9188    5.648418    8.0171    45.2318
-------------+---------------------------------------------------------
         cap |      1,031    2.507432    6.248712      .0119    47.1079
    indoutpt |      1,031    103.8012    9.938008       86.9    128.3653
           n |      1,031    1.056002    1.341506  -2.263364    4.687321
           w |      1,031    3.142988    .2630081   2.081577      3.8118
           k |      1,031   -.4415775    1.514132  -4.431217    3.852441
-------------+---------------------------------------------------------
          ys |      1,031    4.638015    .0939611   4.464758     4.85488
         rec |      1,031         516    297.7684          1        1031
      yearm1 |      1,031    1979.644    2.213454      1976       1984
          id |      1,031    73.20369    41.23333          1        140
         nL1 |        891    1.083518    1.338469  -2.095571    4.687321
-------------+---------------------------------------------------------
         nL2 |        751    1.107716    1.333478  -2.079442    4.687321
         wL1 |        891    3.132166    .2639638   2.081577      3.8118
         kL1 |        891   -.4131872    1.501461  -4.431217    3.852441
         kL2 |        751    -.392113    1.486371  -4.431217    3.852441
         ysL1 |        891    4.651039    .0923352   4.464758     4.85488
-------------+---------------------------------------------------------
```

# FE in Stata

- Examples for FE
  - unbalance —> balance

```
. xtbalance, rang(1978 1982) miss(_all)    /*written by arlion*/
(331 observations deleted due to out of range)
(62 observations deleted due to missing)
(238 observations deleted due to discontinues)
. xtdes
      id:  5, 6, ..., 140                                    n =         80
    year:  1978, 1979, ..., 1982                             T =          5
           Delta(year) = 1 unit
           Span(year)  = 5 periods
           (id*year uniquely identifies each observation)
Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         5       5       5         5         5       5       5
     Freq.  Percent    Cum. |  Pattern
 ---------------------------+---------
        80   100.00  100.00 |  11111
 ---------------------------+---------
        80   100.00         |  XXXXX
```

# FE in Stata

- Examples for FE
  - Data：Baum(2006)
  - 包含美国 48 个州 1982-1988 年交通死亡率相关变量:

    fatal (交通死亡率)

    beertax (啤酒税)

    spircons (酒精消费量)

    unrate (失业率)

    perinck (人均收入, 千元)

    state (州)

    year (年)

# FE in Stata

- Examples for FE
  - Pooled OLS & Pooled OLS with Time (Wrong)

```
. use traffic, clear
. est clear
. eststo : qui reg fatal beertax
(est1 stored)
. eststo : qui reg fatal beertax i.year
(est2 stored)

. esttab, star(* .1 ** .05  * .01)    ///
      nogap nonumber replace          ///
      se(%5.4f) ar2
```

# FE in Stata

- Examples for FE
  - Pooled OLS & Pooled OLS with Time (Wrong)

| | fatal | fatal |
|---|---|---|
| beertax | 0.365* | 0.366* |
| | (0.0622) | (0.0626) |
| 1982.year | | 0 |
| | | (.) |
| 1983.year | | -0.0820 |
| | | (0.1117) |
| 1984.year | | -0.0717 |
| | | (0.1117) |
| 1985.year | | -0.111 |
| | | (0.1117) |
| 1986.year | | -0.0161 |
| | | (0.1117) |
| 1987.year | | -0.0155 |
| | | (0.1117) |
| 1988.year | | -0.00103 |
| | | (0.1117) |
| _cons | 1.853* | 1.895* |
| | (0.0436) | (0.0857) |
| N | 336 | 336 |
| adj. R-sq | 0.091 | 0.079 |

Standard errors in parentheses
* p<.1, ** p<.05, * p<.01

# FE in Stata

- Examples for FE
  - Fixed effects regression

```
. xtset state year   //设定state与year为面板（个体）变量及时间变量
       panel variable:  state (strongly balanced)
        time variable:  year, 1982 to 1988
                delta:  1 unit
. xtdes
   state:  1, 4, ..., 56                                  n =         48
    year:  1982, 1983, ..., 1988                          T =          7
           Delta(year) = 1 unit
           Span(year)  = 7 periods
           (state*year uniquely identifies each observation)
Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         7       7       7         7         7       7       7
     Freq.  Percent    Cum. |  Pattern
 ---------------------------+---------
        48    100.00  100.00 |  1111111
 ---------------------------+---------
        48    100.00         |  XXXXXXX
```

# FE in Stata

- Examples for FE
  - Fixed effects regression

```
. xtsum fatal beertax spircons unrate perinck state year
```

| Variable | | Mean | Std. Dev. | Min | Max | Observations | |
|---|---|---|---|---|---|---|---|
| fatal | overall | 2.040444 | .5701938 | .82121 | 4.21784 | N = | 336 |
| | between | | .5461407 | 1.110077 | 3.653197 | n = | 48 |
| | within | | .1794253 | 1.45556 | 2.962664 | T = | 7 |
| beertax | overall | .513256 | .4778442 | .0433109 | 2.720764 | N = | 336 |
| | between | | .4789513 | .0481679 | 2.440507 | n = | 48 |
| | within | | .0552203 | .1415352 | .7935126 | T = | 7 |
| spircons | overall | 1.75369 | .6835745 | .79 | 4.9 | N = | 336 |
| | between | | .6734649 | .8614286 | 4.388572 | n = | 48 |
| | within | | .147792 | 1.255119 | 2.265119 | T = | 7 |
| unrate | overall | 7.346726 | 2.533405 | 2.4 | 18 | N = | 336 |
| | between | | 1.953377 | 4.1 | 13.2 | n = | 48 |
| | within | | 1.634257 | 4.046726 | 12.14673 | T = | 7 |
| perinck | overall | 13.88018 | 2.253046 | 9.513762 | 22.19345 | N = | 336 |
| | between | | 2.122712 | 9.95087 | 19.51582 | n = | 48 |
| | within | | .8068546 | 11.43261 | 16.55782 | T = | 7 |
| state | overall | 30.1875 | 15.30985 | 1 | 56 | N = | 336 |
| | between | | 15.44883 | 1 | 56 | n = | 48 |
| | within | | 0 | 30.1875 | 30.1875 | T = | 7 |

# FE in Stata

- Examples for FE
  - Fixed effects regression

```
. xtline fatal if year==1982
. graph export fefig1.png,width(500) replace
(file fefig1.png written in PNG format)
```

# FE in Stata

- Examples for FE
  - Fixed effects regression

```
. xtreg fatal beertax spircons unrate perinck, fe
Fixed-effects (within) regression               Number of obs      =       336
Group variable: state                           Number of groups   =        48
R-sq:                                           Obs per group:
     within  = 0.3526                                         min =         7
     between = 0.1146                                         avg =       7.0
     overall = 0.0863                                         max =         7
                                                F(4,284)           =     38.68
corr(u_i, Xb)  = -0.8804                        Prob > F           =    0.0000

------------------------------------------------------------------------------
       fatal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     beertax |  -.4840728   .1625106    -2.98   0.003    -.8039508   -.1641948
    spircons |   .8169652   .0792118    10.31   0.000     .6610484    .9728819
      unrate |  -.0290499   .0090274    -3.22   0.001    -.0468191   -.0112808
     perinck |   .1047103   .0205986     5.08   0.000      .064165    .1452555
       _cons |   -.383783   .4201781    -0.91   0.362    -1.210841    .4432754
-------------+----------------------------------------------------------------
     sigma_u |  1.1181913
     sigma_e |  .15678965
         rho |  .98071823   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(47, 284) = 59.77                     Prob > F = 0.0000
. est store FE
```

# FE in Stata

- Examples for FE
  - Fixed effects regression
  - clustered standard errors

```
. xtreg fatal beertax spircons unrate perinck, fe vce(cluster state)
Fixed-effects (within) regression               Number of obs      =       336
Group variable: state                           Number of groups   =        48
R-sq:                                           Obs per group:
     within  = 0.3526                                         min =         7
     between = 0.1146                                         avg =       7.0
     overall = 0.0863                                         max =         7
                                                F(4,47)            =     21.27
corr(u_i, Xb)  = -0.8804                        Prob > F           =    0.0000
                                    (Std. Err. adjusted for 48 clusters in state)
------------------------------------------------------------------------------
             |               Robust
       fatal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     beertax |  -.4840728   .2218754    -2.18   0.034    -.9304285    -.037717
    spircons |   .8169652   .1272627     6.42   0.000     .5609456    1.072985
      unrate |  -.0290499   .0094581    -3.07   0.004    -.0480772   -.0100227
     perinck |   .1047103   .0341455     3.07   0.004     .0360184    .1734022
       _cons |   -.383783   .7091738    -0.54   0.591    -1.810457    1.042891
-------------+----------------------------------------------------------------
     sigma_u |  1.1181913
     sigma_e |  .15678965
         rho |  .98071823   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. est store FE_cse
```

# FE in Stata

- Examples for FE
  - Fixed effects regression
  - Both Entity and Time Fixed Effects

```
. xtreg fatal beertax spircons unrate perinck i.year, fe vce(cluster state)
Fixed-effects (within) regression               Number of obs      =       336
Group variable: state                           Number of groups   =        48
R-sq:                                           Obs per group:
     within  = 0.4528                                         min =         7
     between = 0.1090                                         avg =       7.0
     overall = 0.0770                                         max =         7
                                                F(10,47)           =     14.13
corr(u_i, Xb)  = -0.8728                        Prob > F           =    0.0000
                                 (Std. Err. adjusted for 48 clusters in state)
------------------------------------------------------------------------------
             |               Robust
       fatal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     beertax |  -.4347195   .2442775    -1.78   0.082    -.9261425    .0567036
    spircons |    .805857   .1161087     6.94   0.000     .5722764    1.039438
      unrate |  -.0549084    .011763    -4.67   0.000    -.0785725   -.0312443
     perinck |   .0882636   .0322971     2.73   0.009     .0232901     .153237
             |
        year |
        1983 |  -.0533713   .0312438    -1.71   0.094    -.1162256    .0094831
        1984 |  -.1649828   .0439375    -3.75   0.000    -.2533737    -.076592
        1985 |  -.1997376   .0496167    -4.03   0.000    -.2995535   -.0999218
        1986 |  -.0508034   .0661756    -0.77   0.447    -.1839315    .0823248
        1987 |  -.1000728   .0756768    -1.32   0.192    -.2523149    .0521693
```

# FE in Stata

- Examples for FE
  - Fixed effects regression

```
. esttab FE FE_cse FE_TW, star(* .1 ** .05  * .01)        ///
>     nogap nonumber replace se(%5.4f) ar2 drop(1982.year)
```

| | fatal | fatal | fatal |
|---|---|---|---|
| beertax | -0.484* | -0.484** | -0.435* |
| | (0.1625) | (0.2219) | (0.2443) |
| spircons | 0.817* | 0.817* | 0.806* |
| | (0.0792) | (0.1273) | (0.1161) |
| unrate | -0.0290* | -0.0290* | -0.0549* |
| | (0.0090) | (0.0095) | (0.0118) |
| perinck | 0.105* | 0.105* | 0.0883* |
| | (0.0206) | (0.0341) | (0.0323) |
| 1983.year | | | -0.0534* |
| | | | (0.0312) |
| 1984.year | | | -0.165* |
| | | | (0.0439) |
| 1985.year | | | -0.200* |
| | | | (0.0496) |
| 1986.year | | | -0.0508 |
| | | | (0.0662) |
| 1987.year | | | -0.100 |
| | | | (0.0757) |
| 1988.year | | | -0.134 |
| | | | (0.0864) |
| _cons | -0.384 | -0.384 | 0.129 |
| | (0.4202) | (0.7092) | (0.6238) |
| N | 336 | 336 | 336 |
| adj. R-sq | 0.236 | 0.345 | 0.436 |

```
Standard errors in parentheses
* p<.1, ** p<.05, * p<.01
```

Section 2

# DID in Stata

Subsection 1

## Review the Theory

# DID in Stata

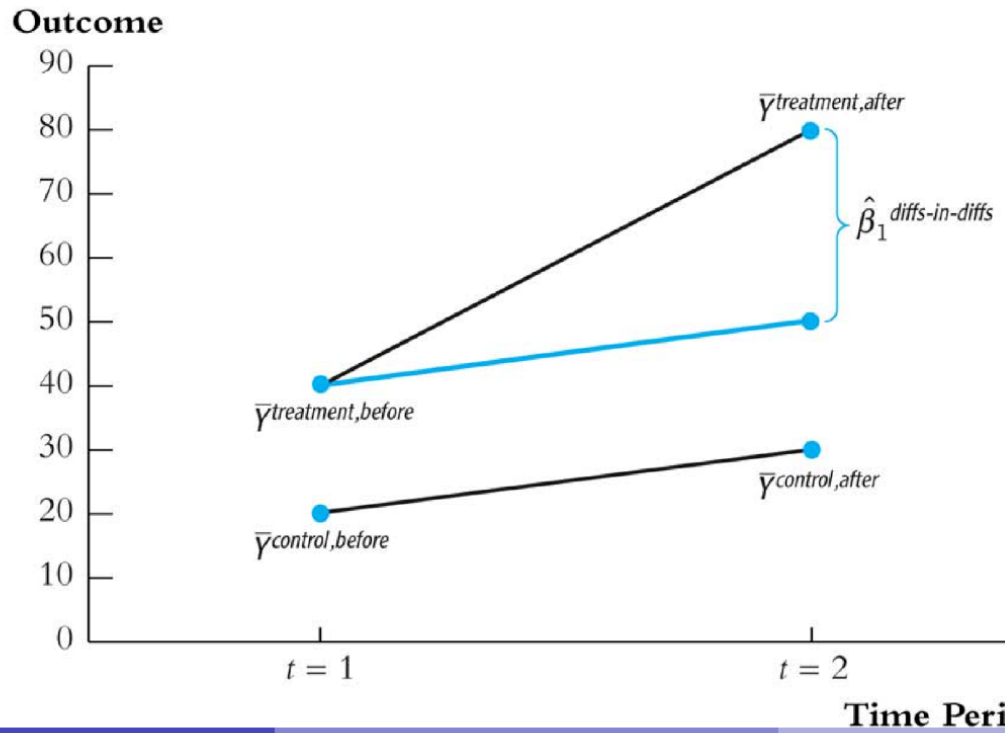
- Review the Theory



## DID estimator

- The DID estimator is

$$\hat{\beta}_{DID} = (\bar{Y}_{treat,post} - \bar{Y}_{treat,pre}) - (\bar{Y}_{control,post} - \bar{Y}_{control,pre})$$



# DID in Stata

- Review the Theory



## Regression DD - Card and Krueger

- A $2 \times 2$ matrix table

| | | treat or control | |
|---|---|---|---|
| | | NJ=0(control) | NJ=1(treat) |
| pre or post | d=0(pre) | $\alpha$ | $\alpha + \gamma$ |
| | d=1(post) | $\alpha + \lambda$ | $\alpha + \gamma + \lambda + \delta$ |

- Then DID estimator

$$\begin{aligned}\hat{\beta}_{DID} &= (\bar{Y}_{treat,post} - \bar{Y}_{treat,pre}) - \\ &\quad (\bar{Y}_{control,post} - \bar{Y}_{control,pre}) \\ &= (NJ_{post} - NJ_{pre}) - (PA_{post} - PA_{pre}) \\ &= [(\alpha + \gamma + \lambda + \delta) - (\alpha + \gamma)] - [(\alpha + \lambda) - \alpha] \\ &= \delta\end{aligned}$$

# DID in Stata

- Review the Theory
  - Specification :

$$Y_{ist} = \alpha + \beta D_{st} + \gamma Treat_s + \delta Post_t + \Gamma X'_{ist} + u_{ist}$$

    - Where $D_{st}$ means $(Treat \times Post)_{st}$
  - Using Fixed Effect Models further to transform into

$$Y_{ist} = \beta D_{st} + \alpha_s + \delta_t + \Gamma X'_{ist} + u_{ist}$$

    - $\alpha_s$ is a set of groups fixed effects, which captures $Treat_s$.
    - $\delta_t$ is a set of time fixed effects, which captures $Post_t$.

Subsection 2

## Examples for DID

# DID in Stata

- Examples for DID
  - Data :

    历史上 A、B、C、D、E、F、G 这 7 个地区非常相似

    然而 1994 年后 E、F 和 G 三个地区（treatment group）颁布了一项政策

    其余 4 个地区（control group）没有。

```
. use did, clear
```

# DID in Stata

- Examples for DID

```
. * 假设政策执行时间为1994年，设置虚拟变量
. gen time = (year>=1994) & !missing(year)

. * 假设政策执行地为大于4的地方，设置虚拟变量
. gen treated = (country>4) & !missing(country)

. * 构建DID估计量，即时间和空间的交互项
. gen did = time*treated
```

# DID in Stata

- Examples for DID

```
. * DID <方法一>
. * 显然在10%水平上，政策实施有显著的负效应
. reg y did time treated, r
Linear regression                               Number of obs     =         70
                                                F(3, 66)          =       2.17
                                                Prob > F          =     0.0998
                                                R-squared         =     0.0827
                                                Root MSE          =     3.0e+09
------------------------------------------------------------------------------
             |               Robust
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         did |  -2.52e+09   1.45e+09    -1.73   0.088    -5.42e+09    3.81e+08
        time |   2.29e+09   9.00e+08     2.54   0.013     4.92e+08    4.09e+09
     treated |   1.78e+09   1.05e+09     1.70   0.094    -3.11e+08    3.86e+09
       _cons |   3.58e+08   7.61e+08     0.47   0.640    -1.16e+09    1.88e+09
------------------------------------------------------------------------------

. * DID <方法二>
. qui reg y time##treated, r
```

# DID in Stata

- Examples for DID

```
. * DID <方法三>
. * 与前两种方法结果一样

. *ssc install diff
. diff y, t(treated) p(time)
DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS
Number of observations in the DIFF-IN-DIFF: 70
            Before          After
   Control: 16              24           40
   Treated: 12              18           30
            28              42
------------------------------------------------------------------------------
 Outcome var.    |  y        |  S. Err.  |    |t|    |  P>|t|
-----------------+-----------+-----------+-----------+-----------
Before           |
   Control       |   3.6e+08 |           |           |
   Treated       |   2.1e+09 |           |           |
   Diff (T-C)    |   1.8e+09 |   1.1e+09 |  1.58     |  0.120
After            |
   Control       |   2.6e+09 |           |           |
   Treated       |   1.9e+09 |           |           |
   Diff (T-C)    |  -7.4e+08 |   9.2e+08 |  0.81     |  0.422
                 |           |           |           |
Diff-in-Diff     |  -2.5e+09 |   1.5e+09 |  1.73     |  0.088*
------------------------------------------------------------------------------
R-square:    0.08
* Means and Standard Errors are estimated by linear regression
**Inference: *** p<0.01; ** p<0.05; * p<0.1
```

# DID in Stata

- Examples for DID
  - Test Paralled Trend

    只有当地区在政策前足够相似才能够保证 DID 提取的是政策的因果效应；

    因此，需要知道两组地区在政策前有多大差异；

    生成年份虚拟变量 × 实验组虚拟变量的交互项，捕捉两组地区在每一年份的差异；

    如果两组地区的确有 Paralled Trend，那么预期在 1994 年前的那些交互项的回归结果将不显著，而 1994 年后的将显著。

# DID in Stata

- Examples for DID
  - Test Paralled Trend

```
. *生成年份虚拟变量与实验组虚拟变量的交互项(此处选在政策前后各3年)
. gen Dyear = year-1994
. gen Before3 = (Dyear==-3 & treated==1)
. gen Before2 = (Dyear==-2 & treated==1)
. gen Before1 = (Dyear==-1 & treated==1)
. gen Current = (Dyear==0 & treated==1)
. gen After1 = (Dyear==1 & treated==1)
. gen After2 = (Dyear==2 & treated==1)
. gen After3 = (Dyear==3 & treated==1)
```

# DID in Stata

- Examples for DID
  - Test Paralled Trend

```
. * 将以上交互项作为解释变量进行回归
. * 可以看出Before3 Before2 Before1 的系数均不显著, After1的系数负向显著

. xtreg y time treated Before3 Before2 Before1 Current After1 After2 After3 i.year,
note: treated omitted because of collinearity
note: 1999.year omitted because of collinearity
Fixed-effects (within) regression               Number of obs      =        70
Group variable: country                         Number of groups   =         7
R-sq:                                           Obs per group:
     within  = 0.3885                                         min =        10
     between = 0.0116                                         avg =      10.0
     overall = 0.3040                                         max =        10
                                                F(16,47)           =      1.87
corr(u_i, Xb)  = -0.0654                        Prob > F           =    0.0497

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        time |   1.62e+09   1.40e+09     1.16   0.250    -1.18e+09    4.43e+09
     treated |          0  (omitted)
     Before3 |   5.26e+08   2.30e+09     0.23   0.820    -4.10e+09    5.16e+09
     Before2 |   1.94e+09   2.30e+09     0.84   0.404    -2.69e+09    6.57e+09
     Before1 |  -4.53e+08   2.30e+09    -0.20   0.845    -5.08e+09    4.18e+09
     Current |  -8.06e+08   2.30e+09    -0.35   0.728    -5.44e+09    3.82e+09
      After1 |  -7.15e+09   2.30e+09    -3.10   0.003    -1.18e+10   -2.52e+09
      After2 |  -9.04e+08   2.30e+09    -0.39   0.696    -5.54e+09    3.73e+09
      After3 |   3.21e+08   2.30e+09     0.14   0.890    -4.31e+09    4.95e+09
```

# DID in Stata

- Examples for DID
  - Test Paralled Trend
  - -coefplot-图示

```
. * keep() : 保留关键变量
. * vertical : 转置
. * recast(connect) : 系数连线，观察动态效果:
. * yline(0) : 增加直线y=0

. coefplot reg, keep(Before3 Before2 Before1 Current After1 After2 After3)   ///
      vertical recast(connect) scheme(s1mono) msymbol(circle_hollow)          ///
      yline(0, lwidth(vthin) lpattern(dash) lcolor(teal))                     ///
      xline(4, lwidth(vthin) lpattern(dash) lcolor(teal))                     ///
      ciopts(lpattern(dash) recast(rcap) msize(medium))

. graph export did.png,width(500) replace
(note: file did.png not found)
(file did.png written in PNG format)
```

# DID in Stata

- Examples for DID
  - Test Paralled Trend
  - -*coefplot*-图示

    发现系数在政策前在 0 附近波动，而政策后一年系数显著为负，但很快又回到 0 附近；说明 treatment group 和 control group 可以进行比较，而政策效果可能出现在颁布后一年，随后又很快消失。