Introduction to Macro and Loop in Stata

SOC 561

Programming for the Social Sciences

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Overview

- Macros (local and global macros)
- Loops (foreach and forvalues)
- Tempvar
- Tempfile

Macro: What is it and what does it do?

- Macros are abbreviations for a string of characters or a number (Long 2009:83). They also represent expressions, so as to make programming efficient.

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Local and Global Macro

- **Local macros** are ephemeral macros. When you work with do-file editor, local macros are valid only in a single execution of commands in do-files or ado-files. Yet, when you work interactively, they persist until you delete them or the session is ended.
- **Global macros** are persisting macros. Once defined whether in do-file editor or in interactive command window, they persist until you delete them or the session is ended.

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Local and Global Macro

- In general, using local macros are recommended. This is because when you work with many do-files or ado-files at the same time, global macros can cause conflicts across do-files or ado-files, which is error-prone.

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Syntax of Macro Assignment

`local` macroname “string”
`local` macroname = expression
`global` macroname “string”
`global` macroname = expression

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Using Macros

back quote

single quote

local : `macroname'

global: $macroname

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Example

It works without quotation marks

```
. local y "female age income"

. display "`y'"
female age income
```

Assignment

Usage

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Example

```
. global xyz "female age income"

. display "$xyz"
female age income
```

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Example

```
. local y2 = 345+123

. display `y2'
468
```

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Example

```
. sysuse nlsw88, clear
(NLSW, 1988 extract)

. local myvars "age race married grade south smsa"

. summarize `myvars'
```

Variable	Obs	Mean	Std. Dev.	Min	Max
age	2,246	39.15316	3.060002	34	46
race	2,246	1.282725	.4754413	1	3
married	2,246	.6420303	.4795099	0	1
grade	2,244	13.09893	2.521246	0	18
south	2,246	.4194123	.4935728	0	1
smsa	2,246	.7039181	.4566292	0	1

This way, you can truncate a long list of variable, which helps you debug.

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Example

```
. local model_1   "age race"

. local model_2   "married grade"

. regress wage `model_1'
```

Source	SS	df	MS
Model	611.586289	2	305.793145
Residual	73756.3811	2,243	32.8829162
Total	74367.9674	2,245	33.1260434

Number of obs	2,246
F(2, 2243)	9.30
Prob > F	0.0001
R-squared	0.0082
Adj R-squared	0.0073
Root MSE	5.7344

wage	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
age	-.0771988	.0396188	-1.95	0.051	-.1548921	.0004945
race	-1.008454	.2549917	-3.95	0.000	-1.508498	-.5084093
_cons	12.08309	1.608499	7.51	0.000	8.928792	15.2374

You can group different variables to different macros, which can reduce mistakes.

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Example

```
. regress wage `model_1' `model_2'
```

Source	SS	df	MS		
Model	8251.11998	4	2062.78	Number of obs	= 2,244
Residual	66103.2105	2,239	29.523542	F(4, 2239)	= 69.87
				Prob > F	= 0.0000
				R-squared	= 0.1110
				Adj R-squared	= 0.1094
Total	74354.3305	2,243	33.1495009	Root MSE	= 5.4336

wage	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
age	-.0551124	.037593	-1.47	0.143	-.1288331	.0186084
race	-.6067613	.2487806	-2.44	0.015	-1.094626	-.1188966
married	-.6599472	.2439325	-2.71	0.007	-1.138305	-.1815896
grade	.7269462	.045974	15.81	0.000	.6367901	.8171023
_cons	1.606477	1.701157	0.94	0.345	-1.729533	4.942488

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Example

- Macros can be used when you want to specify long options as well (Long 2009:88-89).
- e.g.) local opt_tab “cell miss nolabel chi2”

  tabulate south smsa, `opt_tab’

  local opt_linF “lpattern(solid) lwidth(medthick) lcolor(black) msymbol(i)”

  graph twoway (connected wage hours, `opt_linF’)

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Loop: What is it and what does it do?

- Loops refer to commands which execute a group of commands multiple times (Long 2009:92). Think about the situation where you should replace some values of 1,000 variables the same way. You can do it manually, but it takes a lot of time and it is error-prone. Also, it can be the case that you need to do it again for some reasons, like false calculation or different theoretical consideration. Loops are useful in situations above.

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Loop: What is it and what does it do?

- Loops are useful in following tasks (Long 2009:95-96):
- Listing variable and value labels
- Creating interaction variables
- Fitting models with alternative measures of education
- Recoding multiple variables the same way
- Creating a macro that holds accumulated information
- Retrieving information returned by Stata

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foreach and forvalues

- Foreach is a more general loop. String, numeric, and variables are allowed as list, and lists do not have to have a pattern.
- Forvalues is a more specific loop. Only numeric is allowed as lists, and lists should have a clear pattern.

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Syntax of `foreach` (in) command

```
foreach macroname in list {
    commands referring to `macroname'
}
```

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Syntax of `foreach` (of) command

```
foreach macroname of list-type {
    commands referring to `macroname'
}
```

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Syntax of `foreach` (of) command

List-types are

- Local
- Global
- Varlist: you should list variables
- Newlist: you should list the name of new variables
- Numlist: you should list numbers

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Syntax of `forvalues` command

```
forvalues macroname = range {
    commands referring to `macroname'
}
```

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Syntax of `forvalues` command

Range can have three forms (Long 2009:95):

- #1(#d)#2: from #1 to #2 in steps of #d
  e.g.) 1(2)10 -> 1, 3, 5, 7, 9
- #1/#2: fron #1 to #2 in steps of 1
  e.g.) 1/10 -> 1, 2, 3, 4, …, 10
- #1 #t to #2: from #1 to #2 in steps of (#t-#1)
  e.g.) 1 3 to 10 -> 1, 3, 5, 7, 9

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Levelsof command

- Levelsof command identify all values in a variable and put those values in a macro (http://www.ssc.wisc.edu/sscc/pubs/stata_prog1.htm).
- Syntax: levelsof variable, local (macro)
- It is useful when the variable of interest has many values, like hundreds or thousands values.

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Example

```
. sysuse nlsw88, clear
(NLSW, 1988 extract)

. tab1 race

-> tabulation of race

      race |      Freq.     Percent        Cum.
-----------+-----------------------------------
     white |      1,637       72.89       72.89
     black |        583       25.96       98.84
     other |         26        1.16      100.00
-----------+-----------------------------------
     Total |      2,246      100.00
```

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Example

```
. * foreach (in) example
. foreach i in 1 2 3 {
  2.         summarize wage if race==`i'
  3. }
```

Macroname. It can be anything. You assign it.

list

command

macroname

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Example

```
. * foreach (in) example
. foreach i in 1 2 3 {
  2.         summarize wage if race==`i'
  3. }
```

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	1,637	8.082999	5.955069	1.004952	40.19808

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	583	6.844558	5.076187	1.151368	40.74659

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	26	8.550781	5.20943	1.80602	25.80515

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Example

```
. * levelsof example
. levelsof race, local(races)
1 2 3

. foreach i in `races' {
  2.         summarize wage if race==`i'
  3. }
```

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	1,637	8.082999	5.955069	1.004952	40.19808

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	583	6.844558	5.076187	1.151368	40.74659

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	26	8.550781	5.20943	1.80602	25.80515

Alternatively, we can use levelsof command to specify values in race variable

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Example

```
. * foreach (in) example 2
. foreach i in south smsa union {
  2.         tabulate `i', missing
  3. }
```

lives in south	Freq.	Percent	Cum.
0	1,304	58.06	58.06
1	942	41.94	100.00
Total	2,246	100.00	

lives in SMSA	Freq.	Percent	Cum.
nonSMSA	665	29.61	29.61
SMSA	1,581	70.39	100.00
Total	2,246	100.00	

union worker	Freq.	Percent	Cum.
nonunion	1,417	63.09	63.09
union	461	20.53	83.62
.	368	16.38	100.00
Total	2,246	100.00	

List can contain variables, string, and numeric.

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Example

```
. * foreach (in) example - trace
. foreach i in south smsa union {
  2.         summarize `i'
  3. }
- foreach i in south smsa union {
- summarize `i'
= summarize south

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       south |      2,246    .4194123    .4935728          0          1
- }
- summarize `i'
= summarize smsa

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        smsa |      2,246    .7039181    .4566292          0          1
- }
- summarize `i'
= summarize union

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       union |      1,878    .2454739    .4304825          0          1
- }
```

Loops execute commands from the top to the bottom, and execute them again from the beginning.

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Example

```
. * foreach (of) example
. foreach i of numlist 1 2 3 {
  2.         summarize wage if race==`i'
  3. }

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        wage |      1,637    8.082999    5.955069    1.004952   40.19808

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        wage |        583    6.844558    5.076187    1.151368   40.74659

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        wage |         26    8.550781     5.20943     1.80602   25.80515
```

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Example

```
. * forvalues example
. forvalues i = 1(1)3 {
  2.         summarize wage if race==`i'
  3. }
```

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	1,637	8.082999	5.955069	1.004952	40.19808

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	583	6.844558	5.076187	1.151368	40.74659

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	26	8.550781	5.20943	1.80602	25.80515

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Example

```
. * loop exampled 1
. * listing variable and value labels
. foreach i in married south smsa {
  2.          local varlabel : variable label `i'
  3.          display "`i'" _col(12) "`varlabel'"
  4. }
married     married
south       lives in south
smsa        lives in SMSA
```

This way, you can check as many variables' name and label as what you want at once.

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Example

```
. * loop exampled 2
. * creating interaction variables
. foreach i in married south smsa {
  2.         generate               gradX`i'=collgrad*`i'
  3.         label variable  gradX`i' "collgrad*`i'"
  4. }

. summarize gradXmarried gradXsouth gradXsmsa

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
gradXmarried |      2,246    .1531612     .360223          0          1
  gradXsouth |      2,246    .0970614    .2961073          0          1
   gradXsmsa |      2,246    .1856634    .3889214          0          1
```

You can quickly make variables with a loop.

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Example

```
.
. * loop exampled 3
. * fitting different models at once
. foreach i in 1 2 3 {
  2.         regress wage grade if race==`i'
  3. }
```

Results are omitted. A researcher can see difference effects of grade on wage by race quickly. For example, if you want to see different effects of a certain variable on the dependent variable in 100 countries, loops would be helpful.

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Example

```
. * loop exampled 4
. * recoding multiple variables the same way
. generate meanwage=.
(2,246 missing values generated)

. forvalues k=34(1)46 {
  2.         summarize wage if age==`k'
  3.         replace meanwage=r(mean) if age==`k'
  4. }
```

See the next slide for the explanation

```
. tabulate meanwage, missing

   meanwage |      Freq.     Percent        Cum.
------------+-----------------------------------
   6.815027 |         53        2.36        2.36
   7.169666 |        163        7.26        9.62
   7.306658 |         78        3.47       13.09
   7.333253 |        160        7.12       20.21
   7.522215 |        222        9.88       30.10
   7.675594 |        165        7.35       37.44
   7.680887 |        208        9.26       46.71
   7.884183 |        225       10.02       56.72
   7.990341 |        234       10.42       67.14
   8.048292 |        260       11.58       78.72
   8.115071 |        219        9.75       88.47
   8.136585 |        257       11.44       99.91
   16.45329 |          2        0.09      100.00
------------+-----------------------------------
      Total |      2,246      100.00
```

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Example

- This command tries to get mean wages by respondents' age and assign the derived value to each respondent.
- Alternatively, we can consider the following command:

  generate meanwage=.

  summarize wage if age==34

  replace meanwage=r(mean) if age==34

  (same commands for all age values from 35 to 46)
- Forvalues loop is more efficient than the commands above.

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Example

```
. * counters in loops
. local counter = 0

. foreach i in married south smsa {
  2.          local counter = `counter'+1
  3.          local varlabel : variable label `i'
  4.          display "`counter'. `i'" _col(12) "`varlabel'"
  5. }
1. married married
2. south   lives in south
3. smsa    lives in SMSA
```

If you want to assign numbers to each result, using counters would be helpful.

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Example

```
. * using loops to save results to a matrix
. * make 3x2 matrix called 'res', having missing values
. matrix res = J(3, 2, .)

. * assign column and row names
. * 1st column = coefficient of grade
. * 2nd column = standard error of grade
. matrix colnames res = coeff se

. matrix rownames res = white black other
```

Loops allow a researcher to save results for future analysis. Suppose we want to see different effect of grade on wage by race. First, I make a matrix as above in which results will be saved.

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Example

```
. local irow = 0

. foreach i in 1 2 3 {
  2.          local ++irow
  3.          quietly regress wage grade if race==`i'
  4.          matrix res[`irow',1] = _b[grade]
  5.          matrix res[`irow',2] = _se[grade]
  6. }

. matrix list res

res[3,2]
              coeff          se
white     .68035405   .05892988
black     .83147089    .0716403
other     .76242972   .21754353
```

Same with local irow = `irow' + 1

In this way, we can make a graph of coefficients standard errors or further analysis.

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Tempvar: What is it and what does it do?

- Tempvar creates a temporary variable which is valid only in a single execution of commands in do-files or ado-files.
- Alternatively, we can make variables and then erase them manually. Yet, using tempvar is more efficient.
- Syntax step1: tempvar var1 (declaring variable name)
- Step2: commands referring to `var1'

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Example

```
. tempvar myvar // declare a temporary variable name.

. egen `myvar' = mean(wage)

. generate wageR = wage/`myvar'
```

Execution ends here.

```
. summarize wageR `myvar'

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       wageR |      2,246           1    .7410275   .1293882   5.246151
```

'myvar' has been deleted automatically.

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Tempfile: What is it and what does it do?

- Tempfile creates a temporary dataset which is valid only in a single execution of commands in do-files or ado-files.
- Alternatively, we can save a dataset and use it, and erase it. Compared to this, tempfile is more efficient.
- Or, one can consider preserve/restore commands, but preserve command stores only one dataset.
- Syntax step1: tempfile data1 (declaring data name)
- Step2: commands referring to `data1'

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Example

```
. sysuse nlsw88, clear
(NLSW, 1988 extract)

. foreach i in married south smsa {
  2.         generate               gradX`i'=collgrad*`i'
  3.         label variable  gradX`i' "collgrad*`i'"
  4. }

. summarize gradXmarried gradXsouth gradXsmsa

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
gradXmarried |      2,246    .1531612     .360223          0          1
  gradXsouth |      2,246    .0970614    .2961073          0          1
   gradXsmsa |      2,246    .1856634    .3889214          0          1
```

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Example

```
. tempfile mydata // declare a temporary file name.

. save `mydata'
file C:\Users\HYUNGJUN\AppData\Local\Temp\ST_01000001.tmp saved

. clear

. use `mydata'
(NLSW, 1988 extract)

. describe gradXmarried gradXsouth gradXsmsa

              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------
gradXmarried    float   %9.0g                 collgrad*married
gradXsouth      float   %9.0g                 collgrad*south
gradXsmsa       float   %9.0g                 collgrad*smsa
```

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Sources

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- Questions and Comments to

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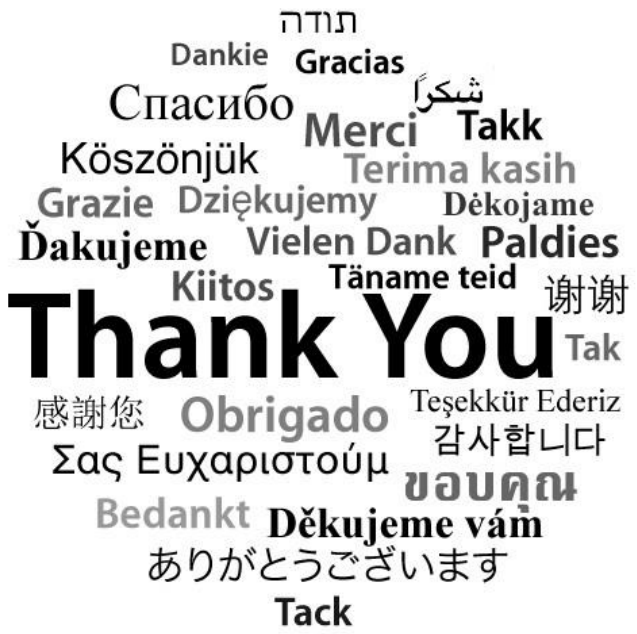
תודה
Dankie
Gracias
Спасибо
شكراً
Merci
Takk
Köszönjük
Terima kasih
Grazie
Dziękujemy
Dėkojame
Ďakujeme
Vielen Dank
Paldies
Kiitos
Täname teid
谢谢
Thank You
Tak
感謝您
Obrigado
Teşekkür Ederiz
감사합니다
Σας Ευχαριστούμε
ขอบคุณ
Bedankt
Děkujeme vám
ありがとうございます
Tack