LECTURE / DISCUSSION

Introduction to Estimation Package

Estimation Package

Software: SST

To estimate a logit model:

1. Enter the editor.

2. Create or modify an SST command file that will estimate your logit model.

3. Save the command file and exit the editor.

4. Enter SST.

5. Run the SST command file.

6. Exit SST.

7. Print the SST output file.

Note: Computer workshop material on the following pages uses the convention that anything appearing in a typewriter font represents exactly what you will see on your computer monitor or printout. SST commands appear in the normal font used throughout this notebook, and are lower case. Optional arguments (that is, what the user can change) appear in italics.

Input Data File for Computer Workshops

Heating System Choice

5 alternatives:
1. Gas central
2. Gas room
3. Electric central
4. Electric room
5. Heat pump

Number of observations: 900 single-family homes. All homes were recently constructed and have central air conditioning.

Variables:

idcase	identifies observation
depvar	identifies chosen alternative
ic1	installation cost for a gas central system
ic2	installation cost for a gas room system
ic3	installation cost for an electric central system
ic4	installation cost for an electric room system
ic5	installation cost for a heat pump system
oc1	annual operating cost for a gas central system
oc2	annual operating cost for a gas room system
oc3	annual operating cost for an electric central system
oc4	annual operating cost for an electric room system
oc5	annual operating cost for a heat pump system
income	income of household
agehed	age of household head
rooms	number of rooms in home
ncostl	identifies whether home is in north coastal region
scostl	identifies whether home is in south coastal region
mountn	identifies whether home is in mountain region
valley	identifies whether home is in valley region

smpl.out **1**

```
SST Spool File:  smpl.out


print var[idcase depvar ic1 ic2 ic3 ic4 ic5 \
oc1 oc2 oc3 oc4 oc5 income agehed rooms ncostl \
scostl mountn valley] \
if[idcase < 6]
```

Obsno	idcase	depvar	ic1
1:	1.00000	1.00000	8.66003e+002
2:	2.00000	1.00000	7.27931e+002
3:	3.00000	1.00000	5.99478e+002
4:	4.00000	4.00000	8.35172e+002
5:	5.00000	4.00000	7.55585e+002

Obsno	ic2	ic3	ic4
1:	9.62644e+002	8.59901e+002	9.95763e+002
2:	7.58885e+002	7.96823e+002	8.94691e+002
3:	7.83053e+002	7.19859e+002	9.00111e+002
4:	7.93061e+002	7.61249e+002	8.31035e+002
5:	8.46291e+002	8.58860e+002	9.85636e+002

Obsno	ic5	oc1	oc2
1:	1.13552e+003	1.99688e+002	1.51722e+002
2:	9.68898e+002	1.68657e+002	1.68656e+002
3:	1.04829e+003	1.65580e+002	1.37796e+002
4:	1.04873e+003	1.80881e+002	1.47136e+002
5:	8.83051e+002	1.74909e+002	1.38903e+002

Obsno	oc3	oc4	oc5
1:	5.53344e+002	5.05601e+002	2.37877e+002
2:	5.20242e+002	4.86488e+002	1.99189e+002
3:	4.39056e+002	4.04736e+002	1.71475e+002
4:	4.83000e+002	4.25225e+002	2.22955e+002
5:	4.04412e+002	3.89517e+002	1.78486e+002

Obsno	income	agehed	rooms
1:	7.00000e+004	25.00000	6.00000
2:	5.00000e+004	60.00000	5.00000
3:	4.00000e+004	65.00000	2.00000
4:	2.00000e+004	50.00000	4.00000
5:	2.00000e+004	25.00000	6.00000

Obsno	ncostl	scostl	mountn
1:	1.00000	0.00000	0.00000
2:	0.00000	1.00000	0.00000
3:	1.00000	0.00000	0.00000
4:	0.00000	1.00000	0.00000
5:	0.00000	0.00000	0.00000

Obsno	valley
1:	0.00000
2:	0.00000
3:	0.00000
4:	0.00000
5:	1.00000

```
spool off
```

Means of Input Variables

ic1	ic2	ic3	ic4	ic5
777	922	825	984	1046

oc1	oc2	oc3	oc4	oc5
172	154	477	430	219

income	46,411
agehed	43
rooms	4.42
ncostl	.289
scostl	.401
mountn	.197
valley	.113

depvar: proportion choosing alternative

1	.637
2	.143
3	.071
4	.093
5	.056

Steps to Estimate a Model

1. Login. You will get a window with the Unix prompt: % .

2. Enter the file manager. You will get a window showing your directories and files. Open the **mon** directory.

3. Bring the file **sample.cmd** into the editor. You will get a window showing the file. The file looks like this:

```
clear

load file[data1.sav]

spool file[sample.out]

set pb1 = ic1/oc1
set pb2 = ic2/oc2
set pb3 = ic3/oc3
set pb4 = ic4/oc4
set pb5 = ic5/oc5

mnl dep[depvar] \
      ivalt[ic: ic1 ic2 ic3 ic4 ic5 \
              pb: pb1 pb2 pb3 pb4 pb5 ] \
      prob[p2 p3 p4 p5]

set p1=1-p2-p3-p4-p5
      cova var[p1 p2 p3 p4 p5]

spool off
```

   This program will estimate a model with two explanatory variables: installation cost and payback (where payback is equal to installation cost divided by operating cost).

4. Edit the file as needed to run the model you want, then save the edited file as **sample1.cmd, sample2.cmd**,....

5. Move to the window with the Unix prompt: %. Change to the **mon** directory by giving the command:

   % **cd mon**

   and a carriage return.

6. Start SST. Do this by typing **sst** after the Unix shell prompt (a short text string ending with a %):

   emily6.qca93aj% **sst**

   SST will respond with a prompt that looks like: >

7. In SST, execute the SST command file you created by typing

   > **run sample1.cmd**

   (or whatever name you gave to your SST command file).

8. As the window display scrolls upward it stops as the screen fills up. You can move to the next screenful by pressing the space bar at the **--more--** prompt. After looking at the output on the screen, exit SST by typing

   > **q**

   You will then be returned to the Unix prompt: %.

9. Print the SST output file (if you want) by typing

   % **qlpr sample1.out**

   (or whatever name you gave your output file.)

Editor Commands

The next few pages describe how to use the mouse in connection with the Open Windows File Manager Tool and Edit Tool to assist you in editing the **sample.cmd** file.

The mouse has three buttons. The leftmost button is the SELECT button. When you use the mouse to point to a menu selection or an icon, clicking this button will select (that is, will execute) the appropriate action required. The middle button is seldom used for editing; you can ignore it. The rightmost button is the MENU button; clicking this button in a blank area of the screen will bring up the main workspace menu. If the mouse is pointing to the upper frame of a window, clicking the MENU button will bring up the window menu.

A window is ‘‘active” only when the pointer (a black arrow) is placed anywhere on it. The cursor of an active window is solid black (usually either a triangle or a rectangle). The cursor of an inactive window is either gray or shows an outline only. The pointer may change depending on where you move the mouse; for this course, you want the pointer to be the black arrow before you execute any of the instructions that follow.

An icon (a small picture on the screen, usually found around the workspace edges) is a window that has been closed. When you close a window, it is rendered inactive for the moment and tucked away. By putting the pointer on the icon and clicking with the SELECT button, you can open up the window and make it active.

You can move icons and open windows anywhere on the screen using the drag-and-drop method. Simply place the pointer on any portion of the window or icon, and hold down the SELECT button while you move the mouse. When you release the SELECT button, the window will remain in its new location.

How to Use the File Manager and Text Editor Tools to Edit ‘‘sample.cmd’’

Find the file you want to edit:

Move the pointer (black arrow) to the File Manager Tool icon. The icon looks like the front of a file drawer with **qca...** written underneath.

☞ Click MENU (rightmost) button on the mouse.

Point to OPEN on the menu.

☞ Click SELECT (leftmost) button on the mouse.

Optional tip: You can also place the pointer on the icon and click the SELECT button on the mouse twice (quickly).

The window with the Unix prompt: % will remain open in the workspace, and the File Manager window may overlap or obscure it entirely. This is fine.

Now we have to change to the appropriate directory and the Monday computer workshop, and load the correct command file for editing.

From the File Manager window, choose the directory icon for the directory labeled **tue.**

☞ Click the SELECT button **twice** on the mouse.

From the directory screen that appears, choose the file icon for the file labeled **sample.cmd.**

☞ Click the SELECT button **twice** on the mouse.

Edit the file:

A new window will emerge with the **sample.cmd** file displayed and ready for editing. You are now working in the Text Editor Tool window. The Text Editor window may overlap or obscure the File Manager window. This is also fine. To edit the file:

Move the cursor to the place where edits are required. You can use the four cursor movement arrows on the keyboard to move the cursor (which looks like a small black triangle). You can also use the pointer and click the SELECT button on the mouse to position the cursor. Remember that regardless of how you move the cursor, the pointer should always be somewhere in the Text Editor window.

Add characters by typing at the keyboard. The typed characters appear to the left of the cursor. In other words, keyboard entries are **inserted** into the file to the left of the cursor position.

Delete characters by pressing the DELETE key. Deletions are made to the left of the cursor. That is, the DELETE key first backspaces then erases one character at a time for as long as you depress the key.

When the file has been edited to your liking, move the pointer to the FILE option at the top of the Text Editor window.

☞ Click the MENU button on the mouse.

From a the small pop-up menu that appears, point to either SAVE CURRENT FILE or STORE AS NEW FILE.

☞ Click the SELECT button the mouse.

Note that SAVE CURRENT FILE saves the edited file under the original name of the file (**sample.cmd**). Choosing STORE AS NEW FILE allows you to save the editedfile under a new name. If you choose this option, a new pop-up screen will appear, and you will type in the new file name and a carriage return.

Run SST and keep editing your file until you are successful:

After saving your edited file, you want to move back to the original window (where you were after you first logged in), which has the Unix prompt: %. You will run SST in this window rather than under the File Manager Tool or Text Editor Tool. The simplest way to do this is to place the pointer anywhere on the gray frame of the window that you want to move to the foreground, and click the SELECT button on the mouse. To bring the editing window to the foreground again, place the pointer anywhere on the gray frame of its window and click the SELECT button on the mouse.

An alternate method is to place the pointer on the topmost frame of the Text Editor window (it should be in the foreground), click on the MENU button, point to the selection BACK and click on BACK with the SELECT button. This should move the Text Editor window into the background, and the window that was in the background (should be the File Manage window) will now be in the foreground.

Optional tip: Note that you can, if you wish, display both windows (Unix prompt and editor) side-by-side, so that you can just move the pointer between them without toggling windows from background to foreground. Place the pointer on the upper frame of the first window, click and hold down the SELECT button on the mouse, and move the mouse to the left so that the window is now placed on the left side of the workspace, and release the button. Do the same for the second window, only this time move the mouse right, so the second window is now located on the right side of the workspace.

If they overlap, you can resize the windows to obtain a good fit. Move the pointer to one of the corners of the windows, and watch the pointer change from an arrow to a bull's eye. Holding down the SELECT button on the mouse, move the mouse around and watch how the window's outline changes. When the outline is about right, release the button and the window adjusts to the new size.

You will run SST in one window and correct your command file in another. The process will be repeated until your SST job is successful.

Quit the Text Editor Tool:

When all your editing is finished and you have run your SST job successfully, you want to quit the Text Editor Tool window and then close the File Manager Tool and tuck it away. To quit the Text Editor window, move the pointer to the top frame of the Text Editor Tool window.

☞ Click the MENU button on the mouse.

Then point to QUIT on the small pop-up menu that appears.

☞ Click the SELECT button on the mouse.

QUIT eliminates the Text Editor Tool window entirely from the workspace.

Close the File Manager Tool:

After you have quit or closed the Text Editor Tool, you want to close (***not*** quit) the File Manager Tool. Move the pointer to the top frame of the File Manager window.

☞ Click the MENU button on the mouse.

Point to CLOSE on the pop-up menu.

☞ Click the SELECT button on the mouse.

You will see the File Manager Tool close to an icon that looks like the drawer of a file case. Note that QUIT would eliminate the File Manager Tool in this session, and you would have to launch another File Manager Tool if you wanted to edit your command file and try another SST job. Closing a window to an icon is more convenient and efficient.

How to Logout:

To logout of the workshop session, move the pointer to a blank (non-window) area of the workspace. Click the MENU button on the mouse, point to EXIT, and click on EXIT with the SELECT button. The pop-up menu that appears will ask for confirmation of the EXIT command by offering you an EXIT or CANCEL choice. Move the pointer to the EXIT option and click on the SELECT button. This officially logs you out of the Open Windows environment and ends your current session.

SST Commands

One command per "line" of input.

Note: put \ to denote continuation of a command on the next line (if your command is too long to fit on one line).

help	On-line help files.
clear	Clears variables from workspace.
spool file[*fn.out*]	Saves output in file **fn.out.**
spool off	Output is saved for procedures from "spool file" to "spool off."
list	Lists all variables.
set vr = expression	Creates a new variable, vr, using the expression.
cova var[*vr1 vr2* ...]	Prints mean, variance, etc. of variables listed in brackets.
mnl dep[*dv*] ivalt[*ivs*] coef[*bb*] prob[*p2 p3* ...] censor[*v1 v2 v3 v4 v5*]	Estimates a logit model with "dv" as dependent variable and "ivs" as explanatory variables. Estimated coefficients are saved in vector "bb." Estimated probabilities for all alternatives except the first are saved in "p2," "p3," etc.
reg dep[*dv*] ind[*ivs*]	Estimates regression with "dv" as dependent variable and "ivs" as explanatory variables.

Expressions in SST's **set** Command

Algebraic operations:	+	add
	-	subtract
	*	multiply
	/	divide
	^	exponentiate
	exp( )	exponential function
	log( )	natural log
	sqrt( )	square root
	cumnorm( )	cumulative normal
	invnorm( )	inverse cumulative normal
	phi( )	normal density
Logical operators:	<	less than
	<=	less than or equal to
	==	equals
	>=	greater than or equal to
	>	greater than
	!=	not equal to
	&	logical *and*
	|	logical *or*

Example: **set a = (depvar <= 2) + 2*(depvar > 2)**

The **a** takes the value of 1 for homes with gas heating and 2 for homes with electric heat.

SST's **if** Subop

Can be used with any command.

command if[*expression***]**

Command is performed only if expression is true.

Examples:

cova var[*income*] if[*ncostl == 1***]**

calculates statistics on income of household in north coastal region.

set b = 0
set b = 1; if[*income > 40000***]**

creates a variable **b** which identifies households with incomes over $40,000.

WORKSHOP

Run Models of Appliance Choice

Run models with the following explanatory variables. You can copy **sample.cmd** or write your own SST command file.

Model 1: Installation cost only.
Model 2: Installation and operating cost.

Does the addition of operating cost improve the model? What indicators do you use?

The life cycle cost of a system is the sum of its installation cost and the present value of the stream of future operating costs:

$$LF = IC + \sum_{t=1}^{L} \frac{OC}{(1 + r)^t}$$

where r is the discount rate and L is the life of the system. For large L, this expression becomes:

$$LF = IC + \left(\frac{1}{r} \right) OC$$

What discount rate is implied by your estimate of model 2? Is it reasonable?

Model 3:

Suppose you know the discount rate is .12, such that

$$LF = IC + \left(\frac{OC}{.12} \right)$$

Run a model that incorporates this known discount rate. That is, calculate life cycle cost for each alternative, and run a model with this explanatory variable only.

Does this model seem better or worse than model 2?

DISCUSSION OF WORKSHOP RESULTS

Output for Model 2 is shown on the following two pages.

```
SST Spool File:  sample.out
Tue Jun 20 09:04:56 1995


set pb1 = ic1/oc1
set pb2 = ic2/oc2
set pb3 = ic3/oc3
set pb4 = ic4/oc4
set pb5 = ic5/oc5

mnl dep[depvar] \
        ivalt[ic: ic1 ic2 ic3 ic4 ic5 \
              oc: oc1 oc2 oc3 oc4 oc5 ] \
        prob[p2 p3 p4 p5]


********** MULTINOMIAL LOGIT **********
Dependent variable: depvar

Value        Label        Count        Percent
    1                       573          63.67
    2                       129          14.33
    3                        64           7.11
    4                        84           9.33
    5                        50           5.56

ITERATION  1:   OLD LLF =      -1.44849e+003     STEP =            1.13775
                NEW LLF =      -1.09535e+003     GRAD*DIREC =      6.80959e+002

ITERATION  2:   OLD LLF =      -1.09535e+003     STEP =            0.98967
                NEW LLF =      -1.09524e+003     GRAD*DIREC =      0.21332

At convergence grad * dir =       4.33812e-007


Independent        Estimated             Standard               t-
 Variable         Coefficient             Error               Statistic

       ic          -6.23181e-003          3.52771e-004        -17.66529
       oc          -4.57988e-003          3.22157e-004        -14.21629

auxiliary statistics              at convergence      initial
log likelihood                      -1095.2          -1448.5
number of observations                  900
percent correctly predicted           59.111


set p1=1-p2-p3-p4-p5
cova var[p1 p2 p3 p4 p5]

Variable:       p1

Mean                     0.51695      Standard deviation      0.11991
Minimum                  0.21415      Skewness               -2.55809e-002
Maximum                  0.88844      Kurtosis                2.46927
Valid observations        900
```

```
Variable:       p2

Mean                    0.24031       Standard deviation      9.63399e-002
Minimum                 3.92557e-002  Skewness                0.54242
Maximum                 0.59265       Kurtosis                2.86138
Valid observations       900

Variable:       p3

Mean                    0.10414       Standard deviation      5.18498e-002
Minimum                 2.08648e-002  Skewness                1.16819
Maximum                 0.38053       Kurtosis                4.94327
Valid observations       900

Variable:       p4

Mean                    5.14172e-002  Standard deviation      3.42658e-002
Minimum                 4.56894e-003  Skewness                1.88094
Maximum                 0.27703       Kurtosis                8.14993
Valid observations       900

Variable:       p5

Mean                    8.71902e-002  Standard deviation      5.01102e-002
Minimum                 1.49600e-002  Skewness                1.96991
Maximum                 0.53065       Kurtosis               11.64511
Valid observations       900


spool off
```