Introduction to STATA
ECONOMICS 30331

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Fall 2008

This handout provides a very brief introduction to STATA, a convenient and versatile econometrics package. In a few short years, STATA has become one of the leading programs used by researchers in applied micro economics. STATA was written by economists so it is more intuitive for researchers in our field. It is fast and relatively easy to use. STATA's speed advantage comes from the fact that all data is loaded into RAM. Subsequently, the amount of high memory restricts the size of the problem. Given the size of the data sets we will use in class and the available memory on typical machines, this will not prove to be a constraint.

All the STATA data files, sample programs, this handout, etc., will be available for download from the course web page, http://www.nd.edu/~wevans1/econ30331.htm. In the lower right hand side of the page is a link to "STATA programs and data files".

This outline demonstrates those STATA procedures necessary for the course. However, this handout only scratches the surface of STATA's capabilities. The text is written so that you should be able to follow along on a computer with STATA and gradually build up to the point where you can generate simple statistics. My suggestion is that you print out this tutorial, find a computer with STATA, enter the program, then follow along with the tutorial.

Some places on the web where you can learn more about STATA include

- STATA faq's http://www.stata.com/support/faqs/
- Resources for learning STATA
- The STATA listserv http://www.stata.com/statalist/
- UCLA's resources for learning STATA http://www.ats.ucla.edu/stat/stata/

STATA Availability

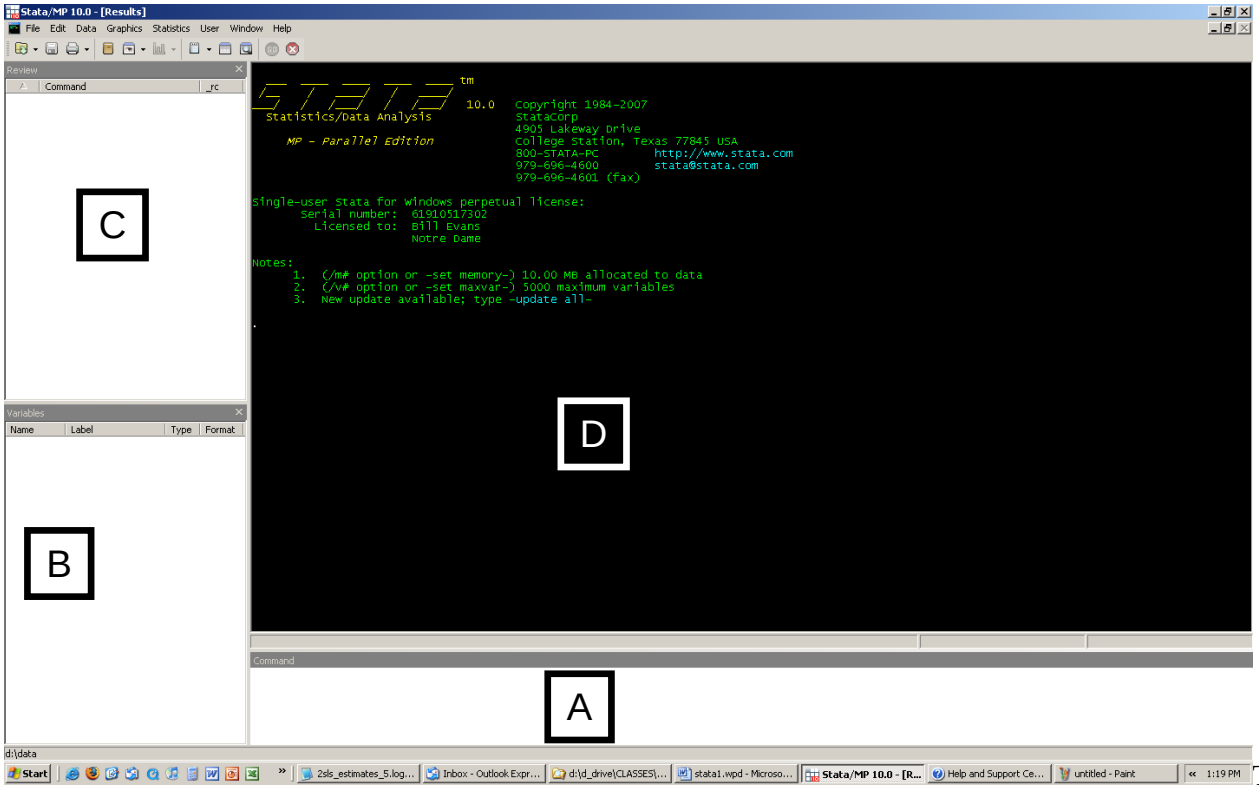
STATA is available in all clusters and classrooms on campus. If you want your own copy of STATA, a one-year site license for STATA 10/IC can be purchased through the STATA Grad Purchase plan. The web site is http://www.stata.com/order/new/edu/gradplans/gp-campus.html and the cost is $95. This is not required for class but if you want to use STATA on your own laptop/desktop, this is the only available avenue.

Once you are into STATA

When you first enter STATA, the screen will look like Figure 1 below. You will notice that there are four boxes on the screen.

- Area A is called the command line. This is where you will type executable statements.
- Area B is the variable list. Once you load a data set into STATA, all the variables available to you will be listed in the box.
- Area C is the review box and it will contain a history of all the commands executed during this STATA session.
- Area D is where any results will be reported.

Figure 1



The command line is the active area of the screen where you will be typing all your commands. The contents of the other boxes will be determined by what you type here. Once in STATA, the cursor should be blinking in the command line indicating to you that the program is waiting to accept input. Commands are executed by hitting return after you have typed the command.

Throughout this tutorial, anything written in `COURIER FONT` is a command that should be executed through the command line.

There are two ways to produce statistics in STATA. First, you can write executable statements, line by line from the command line, and execute the codes. Alternatively, you can write an entire program that contains a group of executable statements, then submit the program from the command line. In the text below, we will indicate the 'line-by-line' interactive approach but in Appendix 1, I provide a STATA program, cps87.do, that generates all the results in this tutorial. At the end of the handout, I also outline how to execute the batch program. The results from this single program are reported in Appendix 2. Please refer to these results when you want to see the output from any particular line-by-line statement in the tutorial below.

From the command line, you can ask for help at any point. Suppose you wanted some information about how to describe the contents of data sets. From the command line, you would type

```
help describe
```

then hit return. A pop-up box appears that outlines the syntax for the 'describe' command. Notice also that the command you executed is now in the Review box C. If at any time you want to re-use a command that has already been executed, using the mouse, click once on the command and the text appears in the command line.

The Basics of STATA

In any software package, in order to generate statistical results, you must do three things:

1. Read in raw data from another format and store in a form usable to the statistical package
2. Manipulate the data (delete observations, create new variables) as needed
3. Generate the statistics

As you will quickly learn, the bulk of your time will be spent on tasks 1 and 2. Generating results in most software packages is trivial; getting the data in a form that is usable is what takes time. Over the next few sections, I will illustrate some ways that STATA handles each of the tasks above.

STATA assumes that all external files and stored on the default subdirectory (folder). What that default directory is depends on how your particular machine is set up. What I recommend is that you construct a subdirectory for your STATA work and once in STATA, change the default folder. So for example, suppose that you have constructed a folder d:\bill\econ30331 for your STATA work. From the command line, you would type

```
cd d:\bill\econ30331
```

and hit return. Now STATA will look in this folder for all data sets and write all results to this folder as well.

When you are working interactively, you may want to save a 'log' of your activity – a list of all the commands and results from your current STATA session that are posted in the results section (area D in Figure 1). You can construct a log by typing the following command.

```
log using stata_log_1.log,replace
```

and hitting return. The log will be written to the file 'stata_log_1.log' and the replace option tells the program to overwrite an existing file with that name. At the end of your session, you will type

```
log close
```

and hit return to close the log file. Please note that STATA commands, data set names, and variable names are *case sensitive*.

Opening a STATA data file

A data set contains a collection of variables that describe different units. Think of the data set as a matrix having columns and rows. The rows are separate observations (people, companies, cities, time periods) while each column is a different variable that describes a specific characteristic of the observations in the sample. What all statistical software packages are designed to manipulate are the columns in the matrix or the different variables. So you may want to know average earnings across the respondents in your sample or what fraction of people voted in the last election or the correlation between income and years of education for people.

For many projects, you will have access to a STATA data file that is already in STATA format and ready for use by

the program. STATA data files always have a .dta extension and loading them into STATA is straightforward. Before we demonstrate this, a quick word about memory. STATA is a very fast program because it requires that all data be read into RAM. Therefore, the constraint on the program is usually the available RAM. The program will not let you load the data set if there is not enough RAM. How much RAM is allocated to STATA at the start is a function of the machine you are using. However, you can allocate more RAM to STATA at anytime during your STATA session. For most of the class projects, 2 meg of RAM should be sufficient so before you get started, set the RAM by typing from the command line

```
set memory 2m
```

and hit return. If the class projects need more RAM, I will let you know.

On the class we page is a STATA data set cps87.dta. Please download that into the folder you are using for this class. Suppose the data set has been downloaded and the folder is named c:\bill\econ30331. To load the data into STATA, simply type

```
use cps87
```

and hit return. The variables data is now available for use in STATA. One the data set is in memory, you can construct new variables, delete particular observations, and generate statistics. After you have constructed new variables, you can save the revised data set by saving the data under a new name

```
save cps87_update
```

or you can save the new data set under the old name by typing

```
save cps87, replace
```

If you no longer need the data set, you can clear it out of memory by typing

```
clear
```

and hit return. Before going on in this tutorial, please clear this data out of memory.

Reading raw data into STATA

For most empirical projects, you will receive data in some format like ASCII, and you must read the data into a STATA data file. This can be accomplished through a variety of different steps and what I illustrate below is but one way to take data from a spreadsheet like EXCEL and transport the data into a STATA data set.

Pictured below in Figure 2 are the first 32 lines from the EXCEL data set cps87.xls. This data set is available for download from the class web page. Please download the file to the folder you are using for this class.

The data file is a matrix with 7 columns and 19,906 rows. Each row represents data for another observation (person) and each column is a new variable. The data is taken from the 1987 Current Population Survey and this data file consists of males, aged 21-64 who worked full time (>30 hours per week) at the time of the survey. The variables in order are: age, race, years_educ, union_status, smsa_size, region, and weekly_earn, and detailed descriptions of the variables are provided in Table 1 below. Looking at the variable definitions in Table 1, the first observation is from a 55 year old white man with 12 years of education, in a union, from one of the largest 19 standard metropolitan

statistical areas in the northeast and making $750 per week.

EXCEL stores data differently than STATA so we must transform the EXCEL file into something usable for STATA. This is done by saving the data into format called “comma delimited” data, or CSV format. In CSV format, each row is stored on a different line and variables are separated by commas.

When in EXCEL, from the toolbar along the top, choose File, then Save As, and in the “Save as Type” section in the “Save As” box, choose “CSV (Comma delimited))(*.csv)”. This will construct a data set named “cps87.csv”. If you open the data set into a program editor you will see data as it appears in Figure 3. Notice that the first row contains variable names while the other rows contain the data. All rows are on different lines and all variables are separated by commas. Make sure the cps87.csv file has been added to the default folder you are using for this class.

STATA is all set up to read a data set in this format into a STATA data file. From the command line, if you type

```
insheet using cps87.csv, comma
```

then hit return, the data will be loaded up into STATA. This command tells STATA to read in the file cps87.csv and all the variables are separated by commas.

You will notice in the results box that 7 variables and 19,906 observations were loaded up into STATA. You will notice in the variables box that 7 variables are listed.

It is good programming practice to LABEL your variables which are short descriptions of the variables that are helpful for later use. To provide a label for the variable age, you would type

```
label var age “age in years”
```

then hit return. Sample labels for the other 6 variables are listed below. You may want to type these now or at some other time.

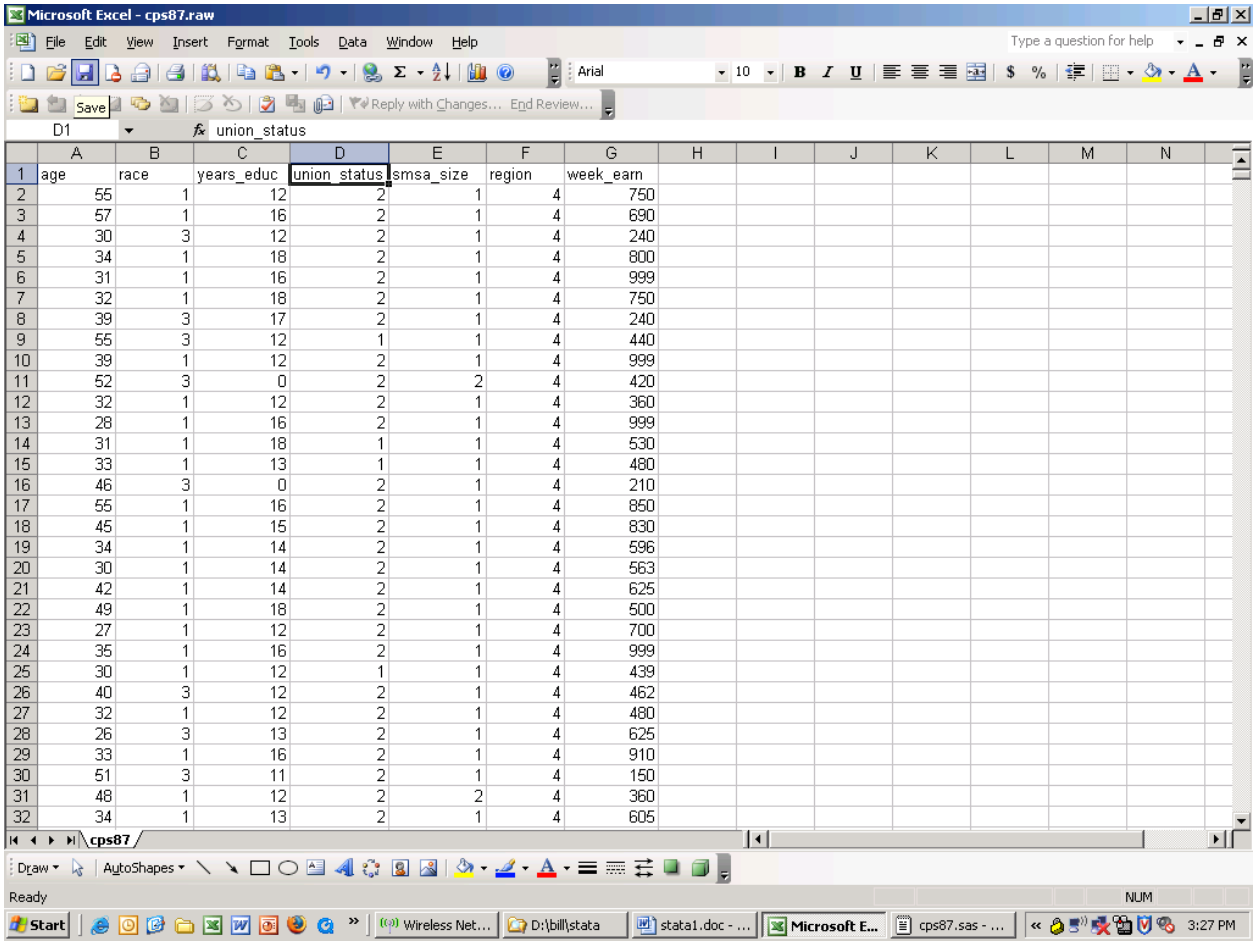
```
label var race “=1 if white non-Hisp, =2 if black non-Hisp, =3 if Hispanic”
label var years_educ “years of competed education”
label var union_status “=1 if in union, =2 otherwise”
label var smsa_size “=1 if largest 19 smsa, =2 if other smsa, =3 not in smsa”
label var region “=1 if northeast, =2 if midwest, =3 if south, =4 if west”
label var weekly_earn “usual weekly earnings, up to $999”
```

At any time, you can get a list of all of the variables in your data set by typing

```
describe
```

and hit return. A description of the data set so far is printed in block A of results in Appendix 2.

Figure 2
Contents of cps87.xls



	A	B	C	D	E	F	G
1	age	race	years_educ	union_status	smsa_size	region	week_earn
2	55	1	12	2	1	4	750
3	57	1	16	2	1	4	690
4	30	3	12	2	1	4	240
5	34	1	18	2	1	4	800
6	31	1	16	2	1	4	999
7	32	1	18	2	1	4	750
8	39	3	17	2	1	4	240
9	55	3	12	1	1	4	440
10	39	1	12	2	1	4	999
11	52	3	0	2	2	4	420
12	32	1	12	2	1	4	360
13	28	1	16	2	1	4	999
14	31	1	18	1	1	4	530
15	33	1	13	1	1	4	480
16	46	3	0	2	1	4	210
17	55	1	16	2	1	4	850
18	45	1	15	2	1	4	830
19	34	1	14	2	1	4	596
20	30	1	14	2	1	4	563
21	42	1	14	2	1	4	625
22	49	1	18	2	1	4	500
23	27	1	12	2	1	4	700
24	35	1	16	2	1	4	999
25	30	1	12	1	1	4	439
26	40	3	12	2	1	4	462
27	32	1	12	2	1	4	480
28	26	3	13	2	1	4	625
29	33	1	16	2	1	4	910
30	51	3	11	2	1	4	150
31	48	1	12	2	2	4	360
32	34	1	13	2	1	4	605

Table 1: Detailed Variable Definitions for cps87.xls

Variable	Definition
AGE	Age in years
RACE	=1 if white, non-Hispanic, =2 if black, non-Hispanic, =3 if Hispanic
EDUC	Years of completed education, maximum is 18.
UNIONM	=1 if a union member, =2 otherwise
SMSA	=1 if live in one of 19 largest Standard metropolitan Statistical Areas (SMSA), =2 if live in other SMSA, =3 if live in non-SMSA
REGION	=1 if live in Northeast, =2 if live in Midwest, =3 if live in South, =4 if live in West
EARNWKE	Usual weekly earnings, nominal 1987 dollars, maximum is $999

Figure 3
Contents of cps87.csv

```
age,race,years_educ,union_status,smsa_size,region,week_earn
55,1,12,2,1,4,750
57,1,16,2,1,4,690
30,3,12,2,1,4,240
34,1,18,2,1,4,800
31,1,16,2,1,4,999
32,1,18,2,1,4,750
39,3,17,2,1,4,240
55,3,12,1,1,4,440
39,1,12,2,1,4,999
52,3,0,2,2,4,420
32,1,12,2,1,4,360
28,1,16,2,1,4,999
31,1,18,1,1,4,530
33,1,13,1,1,4,480
46,3,0,2,1,4,210
55,1,16,2,1,4,850
45,1,15,2,1,4,830
34,1,14,2,1,4,596
30,1,14,2,1,4,563
42,1,14,2,1,4,625
49,1,18,2,1,4,500
27,1,12,2,1,4,700
35,1,16,2,1,4,999
30,1,12,1,1,4,439
40,3,12,2,1,4,462
```

Generating new variables in STATA

Additional variables can easily be created with the "gen" command. The syntax for "gen" is

```
gen new variable name=mathematic expression
```

The new variable is the name of the newly created variable and it must follow STATA naming conventions. The basic rules for variable names are:

- STATA is case-sensitive.
- Names can contain no more than 32 characters.
- They can contain letters, numbers, or underscores (_).
- Spaces or other special characters (like &,*,%, etc.) are not allowed.
- The first character must be a letter or underscore, not a number.

Below are six examples of the gen statement that construct new variables from the data set we just loaded into memory.

```
gen age2=age*age
gen ln_weekly_earn=ln(weekly_earn)
gen union=union_status==1
```

```
gen nonwhite=((race==2)|(race==3));
gen big_northeast_city=((region==1)&(smsa==1));
```

The first two lines use standard mathematical operators to construct new variables. Here, we construct age squared (forget for now why we are interested in this variable) and the natural log of usual weekly earnings. We usually analyze ln(earnings) rather than earnings because the latter is a 'skewed' variable while the former is normally distributed.

One of the most common variables in applied work is a "dummy variable" that equals 1 or 0, separating people into two groups (male or female, black or white, etc). These variables are easy to construct with the use of "logical operators." Logical operators are of the form gen y=(logical statement) that construct a new variable Y that equals 1 when the logical statement is true and zero otherwise.

The last three variables listed above demonstrate how to use logical operators. The variable *union* constructs a variable that equals 1 for union members and zero otherwise. Notice that two equal signs must be used when exact equality is indicated in a logical statement. Combinations of logical statements can be used to construct dummy variables. The vertical line "|" represents "or" and the "&" sign represent "and." The variable *nonwhite* equals 1 if races equals 1 OR 2, and *big_ne* equals 1 if a respondent comes from a big SMSA from the Northeast census region.

After the variables are constructed, I add a set of variable LABELs. The syntax for labels is illustrated in the next six lines.

```
label var age2 "age squared"
label var ln_weekly_earn "ln usual earnings per week"
label var union "1=in union, 0 otherwise"
label var nonwhite "1=nonwhite, 0=white"
label var big_ne "1= live in big smsa from northeast,
0=otherwsie"
```

Getting descriptive statistics

Once you have the correct collection of variables in your STATA data file, you may want to construct some simple descriptive statistics. Summary statistics (mean, min, max and standard deviation) are produced with the "sum" command. So the command

```
sum
```

gets descriptive statistics for all variables. If you only want information for a subset of variables, like age and education, then add the variables after the sum command

```
sum age years_educ
```

and hit return.

If you want more detailed information on a particular variable (quantiles, medians, skewness, kurtosis, etc.), use the "sum" command, list the variables, and ask for detailed calculations.

```
sum weekly_earn age, detail
```

generates detailed statistics for only two variables. Results from these three exercises are reported in blocks B, C and D respectively in Appendix 2. In Block B, note that the average age is 37.97 years and 23% of workers are in unions. In Box D, note that median weekly earnings are $449 dollars but average earnings are higher at $488.26.

Summary statistics for subsamples of the population are easily calculated as well. For example, suppose one wanted to look at average weekly earnings across different racial and ethnic groups. First, you would sort the data by race

```
sort race
```

then ask to have the means calculated for the racial subgroups

```
by race:  sum weekly_earn
```

The *by variable:* option must be ended with a colon (:) and the data must be sorted in order for this option to work. The *by* option can be used with virtually all of STATA's commands. Results from this exercise are reported in Box E of Appendix 2. Note that average earnings for whites, black and Hispanics are $506, $383, and $369.

Suppose instead that one needed sample means for those with at least a high school education. In this case, the "if' statement can be used as an option and he sample restricted to those people where the if statement is correct. So for example

```
sum weekly_earn if years_educ>=12
```

will only generate sample means for those people with 12 or more years of education. The observations with years_educ<12 have not been deleted from the sample, but rather, they were simply not used in the previous command. These results are in Box F in Appendix 2 and note that average earnings increase to $509.62 when lower educated workers are excluded.

You can obtain complete distributions for discrete variables by using the TABULATE command. For example if you want to know the fraction of people by racial/ethnic group, you would type

```
tabulate race
```

and hit return. These results are reported in block G in Appendix 2 and 85.9 percent of the sample is white, non-Hispanic, 8.25 are Black, non-Hispanic while 5.83% are Hispanic.

You can construct two-way contingency tables by listing the two variables in the TABULATE command. For example, in the line

```
tabulate region smsa, row column
```

and hit return. STATA will count the number of observations for all 12 unique groups of region and SMSA. The row and column options to the command tell STATA to produce row and column totals. The results from this exercise are reported in Block H of Appendix 2. Notice in this case that 2906 observations have region=1 (northeast) and smsa=1 (one of the 19 largest smsa) while 1133 observations have region=4 (west) and smsa=3 (non-SMSA).

Testing whether means in two subsamples are the same

The simplest statistical test than can be performed is to examine whether the means from two different groups are the same. In this case, we will examine weekly earnings for union and non-unions workers. The difference in means across samples is tested with a t-test and the syntax is

```
ttest weekly_earn, by(union)
```

The results from this exercise are reported in section I of the results. In this case, notice that the mean earnings among unions workers is $515.28 while the mean earnings for non-union workers is $480.15 and therefore the difference across the two groups (non-union minus union) is -$35.13. The t-statistic on this difference is -27.35. The 95% critical value of a t-test with 19,904 degrees of freedom is 1.96 so we can easily reject the null hypothesis that the means across the two subsamples are the same, which is indicated by the low p-value on the t-test.

Running a simple OLS regression

The most-often estimated model in labor economics is the human capital earnings function. Log weekly wages has been shown to be roughly linear in education and quadratic in age. In the next few lines, we run a simple OLS regression. Basic regressions are generated by the *reg* command and the syntax is simple where the first variable after *reg* is the dependent variable and all other variables are independent variables. In this example, there are five covariates: *age, age2, years_educ, union and non-white.* STATA automatically adds a constant to every model unless otherwise specified. The regression statement in the sample program is as follows.

```
reg ln_weekly_earn age age2 years_educ nonwhite union
```

The results from this example are reported in Block J of Appendix 2. We will not interpret these results at this time.

In many empirical models, observations can be grouped into discrete categories. Sometimes, the number of categories is small (e.g., race and sex) Sometimes the categories are numerous (states and countries). In a sample with people from 50 states, to add state dummy variables requires the construction of 49 variables. STATA has an automated procedure that will construct the discrete variables and add them to a model. Before the REG command is invoked, the XI option signals to STATA that the variables defined by i.name.

Clearing and closing

Once you are done with your interactive STATA session, you can close the log file by typing

```
log close
```

and hitting return. Also, in order to exit, you must clear the data out of memory which can be done by typing

```
clear
```

You can clear the data out of memory at this point.

Running *.do programs

The text above describes an interactive STATA session where lines of code are typed in the command line and submitted one at a time. An interactive session is excellent way to learn STATA: you see the errors right away and you adjust as you go along.

However, as you get more proficient in your programming, you will turn want to write STATA programs and submit them as a 'batch' job. STATA programs can be written in any ASCII editor such as Wordpad or Notepad and the files must have a .do extension.

All of the lines of code discussed above have been collected in a STATA .do program called cps87.do and a copy of this program is contained in Appendix 1 below. The program is also available for download from the class web page. Please download this file to the default folder you are using for this class.

STATA reads each line of this program as a separate executable statement. Note that between the executable statements there are lines that begin with *'s. These stars indicate that the line is a comment and is not an executable command. It is good programming practice to include comments in your programs. This helps you when you go back to a program after a long delay and detailed comments helps anyone else who reads your program understand what you are up to.

A few lines into the program you will notice the line

```
set more off
```

When you execute a program, STATA will fill up one screen's worth of text, then wait for the operator to hit return in order to proceed. The command above turns this feature off.

If you have a copy of the comma-delimited data set cps87.csv and a copy of the STATA program cps87.do on your default folder, you can execute the STATA batch program by typing the following

```
do cps87
```

and hit return. The command *do* will look for the cps87.do file and execute the commands line by line. The results from this program should be identical to that in Appendix 2.

Handling errors

If your program has errors, enter any ASCII editor, call up the program, then edit and save the program. You will need to close any open log from the command line by typing 'log close' and 'clear' any active variables in memory. You are then ready to re-run your program.

If you hit the "page up" key, you will notice that previously-entered commands appear in the command line. This is a quick way of recalling lines of code.

Exiting STATA

To exit STATA, please do to the command line, type CLEAR and hit return which clears all variables from memory, then type EXIT and hit return.

Appendix A
cps87.do

```
* set the memory to 2 meg
set memory 2m

* set it such that the computer does not
* need the operator to hit the return key
* to continue
set more off

* write results to a log file

log using cps87.log,replace

* read in raw data from comma delimited data
insheet using cps87.csv, comma

* label the variables
label var age "age in years"
label var race "=1 if white non-Hisp, =2 if black non-Hisp, =3 if Hispanic"
label var years_educ "years of competed education"
label var union_status "=1 if in union, =2 otherwise"
label var smsa_size "=1 if largest 19 smsa, =2 if other smsa, =3 not in smsa"
label var region "=1 if northeast, =2 if midwest, =3 if south, =4 if west"
label var weekly_earn "usual weekly earnings, up to $999"* describe what is in the
data set
describe


* generate new variables
* lines 1-2 illustrate basic math functoins
* line 3 line illustrates a logical operator
* line 4 illustrate the OR statement
* line 5 illustrates the AND statement

gen age2=age*age
gen ln_weekly_earn=ln(weekly_earn)
gen union=union_status==1
gen nonwhite=((race==2)|(race==3))
gen big_ne=((region==1)&(smsa==1))
```

```
label var age2 "age squared"
label var ln_weekly_earn "log earnings per week"
label var union "1=in union, 0 otherwise"
label var nonwhite "1=nonwhite, 0=white"
label var big_ne "1= live in big smsa from northeast, 0=otherwsie"

* get descriptive statistics for all variables
sum

* get statistics for only a subset of variables
sum age years_educ

* get detailed descriptics for a subset of variables
sum weekly_earn age, detail

* to get means across different subgroups in the
* sample, first sort the data, then generate
* summary statistics by subgroup

sort race
by race: sum weekly_earn

* get weekly earnings for only those with a
* high school education
sum weekly_earn if years_educ>=12

* get frequencies of discrete variables
tabulate race

* get two-way table of frequencies
tabulate region smsa, row column

* test whether means are the same across two subsamples
ttest weekly_earn, by(union)

*run simple regression
reg ln_weekly_earn age age2 years_educ nonwhite union

* run regression adding smsa, region and race fixed-effects
xi: reg ln_weekly_earn age age2 years_educ union i.race i.region i.smsa

* close log file
log close
* see ya
```

Appendix B: Results

cps87.log

```
-------------------------------------------------------------------------------
      log:  d:\bill\stata\cps87.log
  log type:  text
 opened on:  12 Aug 2008, 12:22:05

.
. * read in raw data from comma delimited data
. insheet using cps87.csv, comma
(7 vars, 19906 obs)

.
. * label the variables
. label var age "age in years"

. label var race "=1 if white non-Hisp, =2 if black non-Hisp, =3 if Hispanic"

. label var years_educ "years of competed education"

. label var union_status "=1 if in union, =2 otherwise"

. label var smsa_size "=1 if largest 19 smsa, =2 if other smsa, =3 not in smsa"

. label var region "=1 if northeast, =2 if midwest, =3 if south, =4 if west"

. label var weekly_earn "usual weekly earnings, up to $999"

. * describe what is in the data set
. describe

Contains data
  obs:        19,906
 vars:             7
 size:       318,496 (88.6% of memory free)
```

Box A

```
-------------------------------------------------------------------------------
              storage  display     value
variable name   type   format      label      variable label
-------------------------------------------------------------------------------
age             byte   %8.0g                  age in years
race            byte   %8.0g                  =1 if white non-Hisp, =2 if
                                                black non-Hisp, =3 if Hispanic
years_educ      byte   %8.0g                  years of competed education
union_status    byte   %8.0g                  =1 if in union, =2 otherwise
smsa_size       byte   %8.0g                  =1 if largest 19 smsa, =2 if
                                                other smsa, =3 not in smsa
region          byte   %8.0g                  =1 if northeast, =2 if midwest,
                                                =3 if south, =4 if west
weekly_earn     int    %8.0g                  usual weekly earnings, up to
                                                $999
-------------------------------------------------------------------------------
Sorted by:
     Note:  dataset has changed since last saved

.
.
. * generate new variables
. * lines 1-2 illustrate basic math functoins
. * line 3 line illustrates a logical operator
. * line 4 illustrate the OR statement
```

```
. * line 5 illustrates the AND statement
.
. gen age2=age*age

. gen ln_weekly_earn=ln(weekly_earn)

. gen union=union_status==1

. gen nonwhite=((race==2)|(race==3))

. gen big_ne=((region==1)&(smsa==1))

.
. label var age2 "age squared"

. label var ln_weekly_earn "log earnings per week"

. label var union "1=in union, 0 otherwise"

. label var nonwhite "1=nonwhite, 0=white"

. label var big_ne "1= live in big smsa from northeast, 0=otherwsie"

.
```

Box B

```
. * get descriptive statistics for all variables
. sum

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
         age |     19906    37.96619    11.15348         21         64
        race |     19906    1.199136     .525493          1          3
  years_educ |     19906    13.16126    2.795234          0         18
union_status |     19906    1.769065    .4214418          1          2
   smsa_size |     19906    1.908369    .7955814          1          3
-------------+--------------------------------------------------------
      region |     19906    2.462373    1.079514          1          4
 weekly_earn |     19906     488.264    236.4713         60        999
        age2 |     19906    1565.826    912.4383        441       4096
ln_weekly_~n |     19906    6.067307     .513047   4.094345   6.906755
       union |     19906    .2309354    .4214418          0          1
-------------+--------------------------------------------------------
    nonwhite |     19906    .1408118    .3478361          0          1
      big_ne |     19906    .1409625    .3479916          0          1
```

Box C

```
. * get statistics for only a subset of variables
. sum age years_educ

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
         age |     19906    37.96619    11.15348         21         64
  years_educ |     19906    13.16126    2.795234          0         18
```

Box D

```
. * get detailed descriptics for a subset of variables
. sum weekly_earn age, detail

              usual weekly earnings, up to $999
-------------------------------------------------------------
      Percentiles      Smallest
```

```
 1%          128             60
 5%          178             60
10%          210             60       Obs                19906
25%          300             63       Sum of Wgt.        19906

50%          449                      Mean            488.264
                        Largest       Std. Dev.       236.4713
75%          615            999
90%          865            999       Variance         55918.7
95%          999            999       Skewness         .668646
99%          999            999       Kurtosis        2.632356

                        age in years
-------------------------------------------------------------
      Percentiles      Smallest
 1%           21             21
 5%           23             21
10%           24             21       Obs                19906
25%           29             21       Sum of Wgt.        19906

50%           36                      Mean            37.96619
                        Largest       Std. Dev.       11.15348
75%           46             64
90%           55             64       Variance        124.4001
95%           59             64       Skewness        .4571929
99%           63             64       Kurtosis        2.224794
```

Box E

```
. * to get means across different subgroups in the
. * sample, first sort the data, then generate
. * summary statistics by subgroup
.
. sort race

. by race: sum weekly_earn

-------------------------------------------------------------------------------
-> race = 1

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
 weekly_earn |     17103    506.4874    237.2567         60        999

-------------------------------------------------------------------------------
-> race = 2

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
 weekly_earn |      1642     383.095    196.2224         90        999

-------------------------------------------------------------------------------
-> race = 3

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
 weekly_earn |      1161    368.5512    200.6758         66        999
```

Box F

```
. * get weekly earnings for only those with a
```

```
. * high school education
. sum weekly_earn if years_educ>=12

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
 weekly_earn |     17129    509.6206    238.1675         60        999
```

.

Box G

```
. * get frequencies of discrete variables
. tabulate race

=1 if white |
  non-Hisp, |
=2 if black |
  non-Hisp, |
      =3 if |
   Hispanic |      Freq.     Percent        Cum.
------------+-----------------------------------
          1 |     17,103       85.92       85.92
          2 |      1,642        8.25       94.17
          3 |      1,161        5.83      100.00
------------+-----------------------------------
      Total |     19,906      100.00
```

.

Box H

```
. * get two-way table of frequencies
. tabulate region smsa, row column

+--------------------+
| Key                |
|--------------------|
|     frequency      |
|  row percentage    |
| column percentage  |
+--------------------+

     =1 if |
northeast, |
     =2 if |
  midwest, |
     =3 if |   =1 if largest 19 smsa, =2 if
 south, =4 |    other smsa, =3 not in smsa
   if west |         1          2          3 |     Total
-----------+---------------------------------+----------
         1 |     2,806      1,349        842 |     4,997
           |     56.15      27.00      16.85 |    100.00
           |     38.46      18.89      15.39 |     25.10
-----------+---------------------------------+----------
         2 |     1,501      1,742      1,592 |     4,835
           |     31.04      36.03      32.93 |    100.00
           |     20.58      24.40      29.10 |     24.29
-----------+---------------------------------+----------
         3 |     1,501      2,542      1,904 |     5,947
           |     25.24      42.74      32.02 |    100.00
           |     20.58      35.60      34.80 |     29.88
-----------+---------------------------------+----------
         4 |     1,487      1,507      1,133 |     4,127
           |     36.03      36.52      27.45 |    100.00
           |     20.38      21.11      20.71 |     20.73
-----------+---------------------------------+----------
```

```
     Total |     7,295      7,140      5,471 |    19,906
           |     36.65      35.87      27.48 |    100.00
           |    100.00     100.00     100.00 |    100.00
```

.

Box I

```
. * test whether means are the same across two subsamples
. ttest weekly_earn, by(union)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |   15309    480.1503    2.017734    249.6532    476.1953    484.1053
       1 |    4597    515.2845    2.705061    183.4063    509.9813    520.5878
---------+--------------------------------------------------------------------
combined |   19906     488.264    1.676048    236.4713    484.9788    491.5492
---------+--------------------------------------------------------------------
    diff |           -35.13423    3.969334               -42.91446     -27.354
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -8.8514
Ho: diff = 0                                     degrees of freedom =    19904

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

.

Box J

```
. *run simple regression
. reg ln_weekly_earn age age2 years_educ nonwhite union

      Source |       SS       df       MS              Number of obs =   19906
-------------+------------------------------           F(  5, 19900) = 1775.70
       Model |  1616.39963     5  323.279927            Prob > F      =  0.0000
    Residual |  3622.93905 19900  .182057239            R-squared     =  0.3085
-------------+------------------------------           Adj R-squared =  0.3083
       Total |  5239.33869 19905  .263217216            Root MSE      =  .42668

------------------------------------------------------------------------------
ln_weekly_~n |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0679808   .0020033    33.93   0.000     .0640542    .0719075
        age2 |  -.0006778   .0000245   -27.69   0.000    -.0007258   -.0006299
  years_educ |    .069219   .0011256    61.50   0.000     .0670127    .0714252
    nonwhite |  -.1716133   .0089118   -19.26   0.000    -.1890812   -.1541453
       union |   .1301547   .0072923    17.85   0.000     .1158612    .1444481
       _cons |   3.630805   .0394126    92.12   0.000     3.553553    3.708057
------------------------------------------------------------------------------
```

.

Box K

```
. * run regression adding smsa, region and race fixed-effects
. xi: reg ln_weekly_earn age age2 years_educ union i.race i.region i.smsa
i.race            _Irace_1-3          (naturally coded; _Irace_1 omitted)
i.region          _Iregion_1-4        (naturally coded; _Iregion_1 omitted)
i.smsa_size       _Ismsa_size_1-3     (naturally coded; _Ismsa_size_1 omitted)

      Source |       SS       df       MS              Number of obs =   19906
-------------+------------------------------           F( 11, 19894) =  920.86
       Model |  1767.66908    11  160.697189            Prob > F      =  0.0000
    Residual |  3471.66961 19894  .174508375            R-squared     =  0.3374
```

```
-------------+------------------------------           Adj R-squared =  0.3370
       Total |  5239.33869 19905  .263217216           Root MSE      =  .41774

------------------------------------------------------------------------------
ln_weekly_~n |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |    .070194   .0019645    35.73   0.000     .0663435    .0740446
        age2 |  -.0007052    .000024   -29.37   0.000    -.0007522   -.0006581
  years_educ |   .0643064   .0011285    56.98   0.000     .0620944    .0665184
       union |   .1131485    .007257    15.59   0.000     .0989241    .1273729
    _Irace_2 |  -.2329794   .0110958   -21.00   0.000     -.254728   -.2112308
    _Irace_3 |  -.1795253   .0134073   -13.39   0.000    -.2058047   -.1532458
  _Iregion_2 |  -.0088962   .0085926    -1.04   0.301    -.0257383     .007946
  _Iregion_3 |  -.0281747    .008443    -3.34   0.001    -.0447238   -.0116257
  _Iregion_4 |   .0318053   .0089802     3.54   0.000     .0142034    .0494071
_Ismsa_siz~2 |  -.1225607   .0072078   -17.00   0.000    -.1366886   -.1084328
_Ismsa_siz~3 |  -.2054124   .0078651   -26.12   0.000    -.2208287   -.1899961
       _cons |    3.76812   .0391241    96.31   0.000     3.691434    3.844807
------------------------------------------------------------------------------
```

```
.
. * close log file
. log close
      log:  d:\bill\stata\cps87.log
  log type:  text
 closed on:  12 Aug 2008, 12:22:06
-------------------------------------------------------------------------------
```