# Introduction to Stata

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- Have you heard about Stata?

## What is Stata?

- Statistical software
- Has a user interface *and* code
- Most statistical methods are implemented
- It's licensed software, so it's not free

## Why Stata?

- User interface: means users do not need to know how to write code
- It is great for mixed models, survey data analysis, etc
- Can be used for reproducible work via *do* files
- Researchers can contribute their modules: there's even a Stata journal

## Main components

- Data browser
  - View your data
  - *Can* edit but not recommended
- Help files: very detailed and interconnected
- Can import data from many file types
- Intuitive menu
- Console: shows the latest code
- Log: shows the latest results
- *do* file editor: make your work reproducible

Are you ready to start using Stata?

First, type the following command (or copy paste it)

```
sysuse autos
```

What do you get?

```
sysuse autos
```

```
. sysuse autos
file "autos.dta" not found
r(601);

end of do-file
r(601);
```

So, what went wrong?

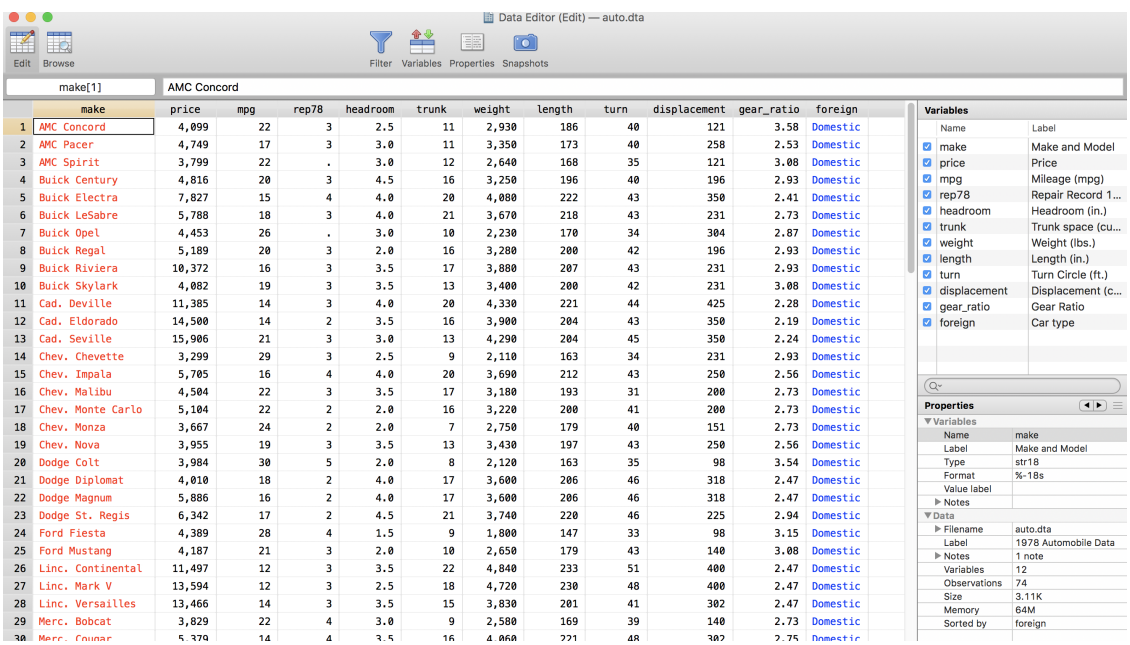
Lets see if the error message gives us a hint as to what could have gone wrong.

```
The filename you specified cannot be found.  Perhaps you
mistyped the name, or it may be on another CDor directory.
```

Ohh, it could be that we incorrectly typed the name! Try this next:

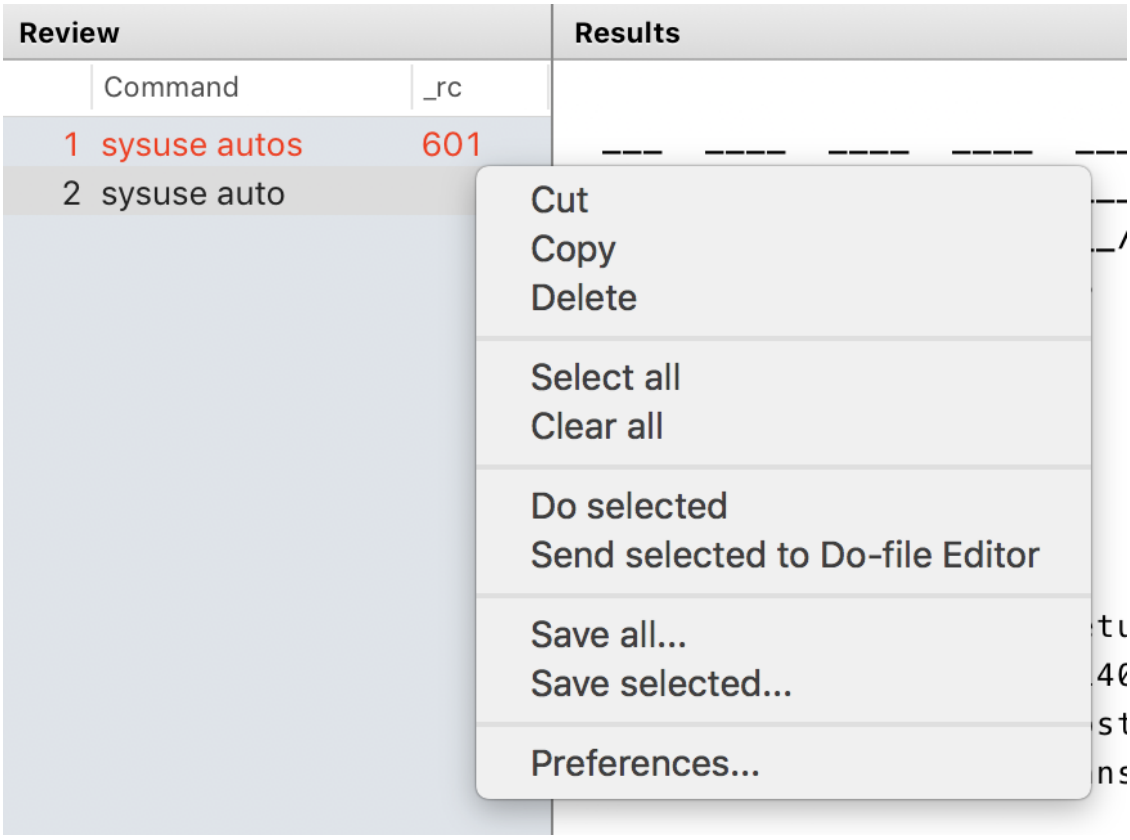
```
sysuse auto
```

## Now lets explore the data




| | make | price | mpg | rep78 | headroom | trunk | weight | length | turn | displacement | gear_ratio | foreign |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AMC Concord | 4,099 | 22 | 3 | 2.5 | 11 | 2,930 | 186 | 40 | 121 | 3.58 | Domestic |
| 2 | AMC Pacer | 4,749 | 17 | 3 | 3.0 | 11 | 3,350 | 173 | 40 | 258 | 2.53 | Domestic |
| 3 | AMC Spirit | 3,799 | 22 | . | 3.0 | 12 | 2,640 | 168 | 35 | 121 | 3.08 | Domestic |
| 4 | Buick Century | 4,816 | 20 | 3 | 4.5 | 16 | 3,250 | 196 | 40 | 196 | 2.93 | Domestic |
| 5 | Buick Electra | 7,827 | 15 | 4 | 4.0 | 20 | 4,080 | 222 | 43 | 350 | 2.41 | Domestic |
| 6 | Buick LeSabre | 5,788 | 18 | 3 | 4.0 | 21 | 3,670 | 218 | 43 | 231 | 2.73 | Domestic |
| 7 | Buick Opel | 4,453 | 26 | . | 3.0 | 10 | 2,230 | 170 | 34 | 304 | 2.87 | Domestic |
| 8 | Buick Regal | 5,189 | 20 | 3 | 2.0 | 16 | 3,280 | 200 | 42 | 196 | 2.93 | Domestic |
| 9 | Buick Riviera | 10,372 | 16 | 3 | 3.5 | 17 | 3,880 | 207 | 43 | 231 | 2.93 | Domestic |
| 10 | Buick Skylark | 4,082 | 19 | 3 | 3.5 | 13 | 3,400 | 200 | 42 | 231 | 3.08 | Domestic |
| 11 | Cad. Deville | 11,385 | 14 | 3 | 4.0 | 20 | 4,330 | 221 | 44 | 425 | 2.28 | Domestic |
| 12 | Cad. Eldorado | 14,500 | 14 | 2 | 3.5 | 16 | 3,900 | 204 | 43 | 350 | 2.19 | Domestic |
| 13 | Cad. Seville | 15,906 | 21 | 3 | 3.0 | 13 | 4,290 | 204 | 45 | 350 | 2.24 | Domestic |
| 14 | Chev. Chevette | 3,299 | 29 | 3 | 2.5 | 9 | 2,110 | 163 | 34 | 231 | 2.93 | Domestic |
| 15 | Chev. Impala | 5,705 | 16 | 4 | 4.0 | 20 | 3,690 | 212 | 43 | 250 | 2.56 | Domestic |
| 16 | Chev. Malibu | 4,504 | 22 | 3 | 3.5 | 17 | 3,180 | 193 | 31 | 200 | 2.73 | Domestic |
| 17 | Chev. Monte Carlo | 5,104 | 22 | 2 | 2.0 | 16 | 3,220 | 200 | 41 | 200 | 2.73 | Domestic |
| 18 | Chev. Monza | 3,667 | 24 | 2 | 2.0 | 7 | 2,750 | 179 | 40 | 151 | 2.73 | Domestic |
| 19 | Chev. Nova | 3,955 | 19 | 3 | 3.5 | 13 | 3,430 | 197 | 43 | 250 | 2.56 | Domestic |
| 20 | Dodge Colt | 3,984 | 30 | 5 | 2.0 | 8 | 2,120 | 163 | 35 | 98 | 3.54 | Domestic |
| 21 | Dodge Diplomat | 4,010 | 18 | 2 | 4.0 | 17 | 3,600 | 206 | 46 | 318 | 2.47 | Domestic |
| 22 | Dodge Magnum | 5,886 | 16 | 2 | 4.0 | 17 | 3,600 | 206 | 46 | 318 | 2.47 | Domestic |
| 23 | Dodge St. Regis | 6,342 | 17 | 2 | 4.5 | 21 | 3,740 | 220 | 46 | 225 | 2.94 | Domestic |
| 24 | Ford Fiesta | 4,389 | 28 | 4 | 1.5 | 9 | 1,800 | 147 | 33 | 98 | 3.15 | Domestic |
| 25 | Ford Mustang | 4,187 | 21 | 3 | 2.0 | 10 | 2,650 | 179 | 43 | 140 | 3.08 | Domestic |
| 26 | Linc. Continental | 11,497 | 12 | 3 | 3.5 | 22 | 4,840 | 233 | 51 | 400 | 2.47 | Domestic |
| 27 | Linc. Mark V | 13,594 | 12 | 3 | 2.5 | 18 | 4,720 | 230 | 48 | 400 | 2.47 | Domestic |
| 28 | Linc. Versailles | 13,466 | 14 | 3 | 3.5 | 15 | 3,830 | 201 | 41 | 302 | 2.47 | Domestic |
| 29 | Merc. Bobcat | 3,829 | 22 | 4 | 3.0 | 9 | 2,580 | 169 | 39 | 140 | 2.73 | Domestic |
| 30 | Merc. Cougar | 5,379 | 14 | 4 | 3.5 | 16 | 4,060 | 221 | 48 | 302 | 2.75 | Domestic |

## Command review




## Basic syntax

What do you want to do?

- Described by an action
- Think of it as a **verb**
- For example, load a data set included in Stata with `sysuse`

What are you going to use for that action?

- That's the actual data that you will use
- Think of it as the **subject**
- For example, the `auto` data set

## Keep track of your work

- Do you remember all the options in a user interface you used 6 months ago?
- It's important to keep track of your work!
- Useful when learning so you can revisit what you did: see what worked, what didn't
- Two main options in Stata: log files and do files

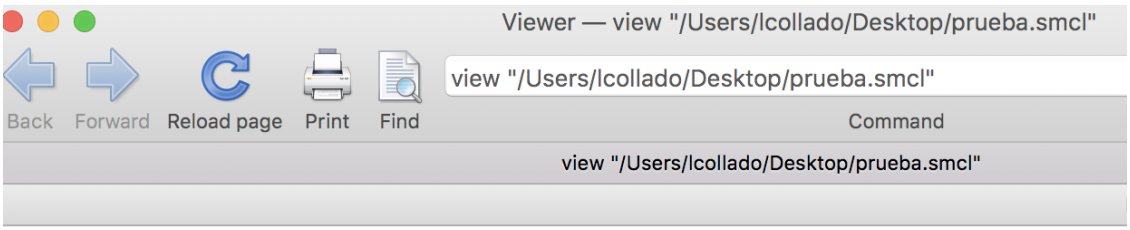
## Log files

These files keep track of everything:

- The commands you used
- The commands that specify what you did with the user interface
- The output you generated: tables, results
- They do not save images

Start a log for our session

## Example log file

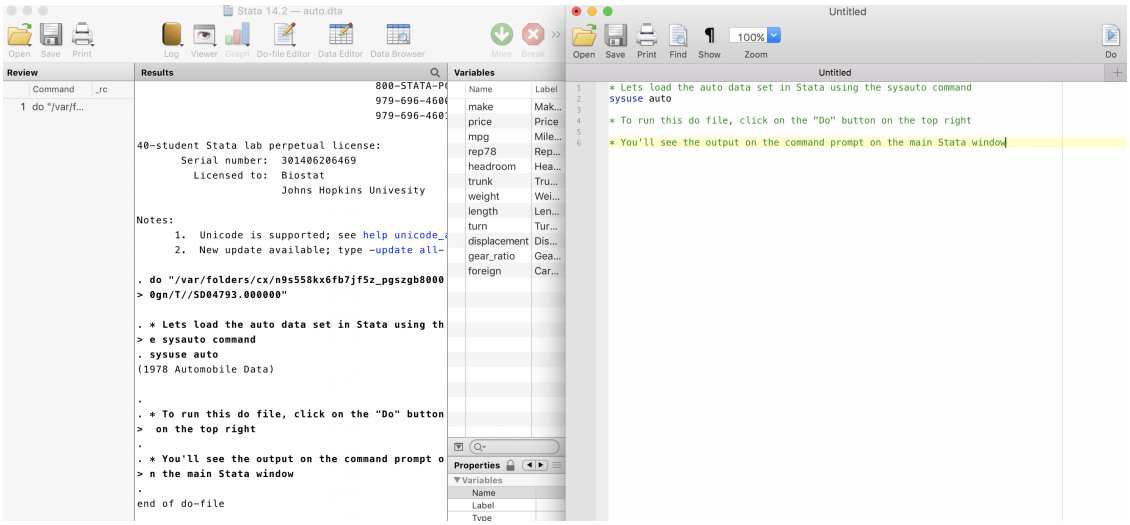



```
      name:  <unnamed>
       log:  /Users/lcollado/Desktop/prueba.smcl
  log type:  smcl
 opened on:  23 Dec 2016, 17:39:21

. tab foreign

   Car type |      Freq.     Percent        Cum.
------------+-----------------------------------
   Domestic |         52       70.27       70.27
    Foreign |         22       29.73      100.00
------------+-----------------------------------
      Total |         74      100.00

. graph bar foreign

. exit
```

## Do files

- These files contain commands only
- They are an executive summary of what you did
- Great for analyses you want to share
- You can include comments describing the logic of what you are doing
- You can *execute* them to run commands
- Cleaner than *log* files.
- Open the do file and paste the command to load the `auto` data set.

## Example do file




## Exercise

Use the Afghanistan data from the Worldbank and make a plot of the agricultural land (in squared kilometers). Start by loading the data!

## No cheating!!!

Don't look at the next slides! Try first!

## What variable is it?

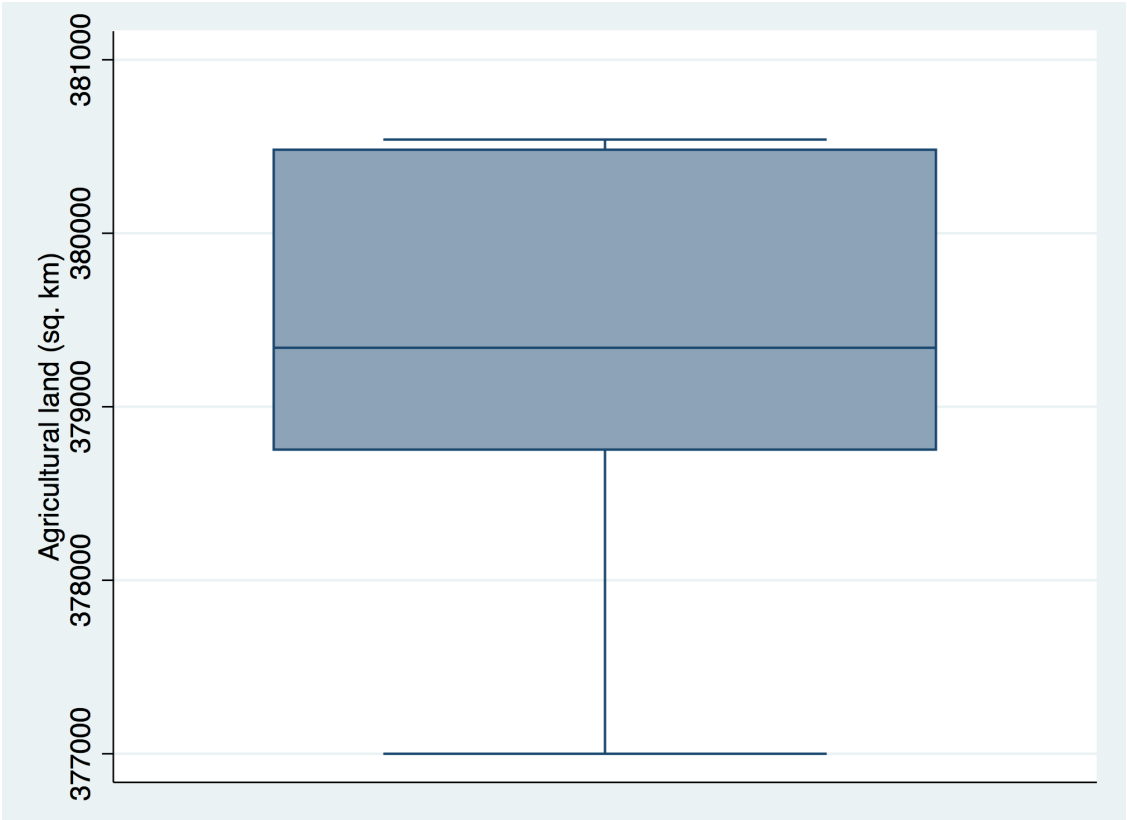
**Variables**

| Name | Label |
|---|---|
| AGAGRTRACNO | Agricultural machinery, tractors |
| AGLNDAGRIK2 | Agricultural land (sq. km) |
| AGLNDAGRIZS | Agricultural land (% of land area) |
| AGLNDIRIGAGZS | Agricultural irrigated land (% of total agricultural land) |
| AGLNDTRACZS | Agricultural machinery, tractors per 100 sq. km of arable land |
| ENATMMETHAGKTCE | Agricultural methane emissions (thousand metric tons of CO2 equivalent) |
| ENATMMETHAGZS | Agricultural methane emissions (% of total) |
| ENATMNOXEAGKTCE | Agricultural nitrous oxide emissions (thousand metric tons of CO2 equivalent) |
| ENATMNOXEAGZS | Agricultural nitrous oxide emissions (% of total) |
| SLEMPINSVFEZS | Share of women in wage employment in the nonagricultural sector (% of total nona |
| SLISVIFRMFEZS | Informal employment, female (% of total non-agricultural employment) |
| SLISVIFRMMAZS | Informal employment, male (% of total non-agricultural employment) |
| SLISVIFRMZS | Informal employment (% of total non-agricultural employment) |
| TMVALAGRIZSUN | Agricultural raw materials imports (% of merchandise imports) |
| TXVALAGRIZSUN | Agricultural raw materials exports (% of merchandise exports) |

agricultural

It's AGLNDAGRIK2

```
use afg_worldbank_2016.dta, clear
graph box AGLNDAGRIK2
```




Looks pretty easy, right? Just 2 lines of code.

A1 | Data Source

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Data Source | World Development Indicators | | | | | | | |
| 2 | Last Updated Date | 12/16/16 | | | | | | | |
| 3 | | | | | | | | | |
| 4 | Country Name | Country Code | Indicator Name | Indicator Code | 1960 | 1961 | 1962 | 1963 | 1964 |
| 5 | Afghanistan | AFG | Mobile account, income, richest 60% (% ages 15+) [w2] | WP15163_4.9 | | | | | |
| 6 | Afghanistan | AFG | Mobile account, income, poorest 40% (% ages 15+) [w2] | WP15163_4.8 | | | | | |
| 7 | Afghanistan | AFG | Mobile account, female (% age 15+) [w2] | WP15163_4.3 | | | | | |
| 8 | Afghanistan | AFG | Mobile account, male (% age 15+) [w2] | WP15163_4.2 | | | | | |
| 9 | Afghanistan | AFG | Mobile account (% age 15+) [w2] | WP15163_4.1 | | | | | |
| 10 | Afghanistan | AFG | Account at a financial institution, income, richest 60% (% ages 15+) | WP_time_01.9 | | | | | |
| 11 | Afghanistan | AFG | Account at a financial institution, income, poorest 40% (% ages 15+ | WP_time_01.8 | | | | | |
| 12 | Afghanistan | AFG | Account at a financial institution, female (% age 15+) [ts] | WP_time_01.3 | | | | | |
| 13 | Afghanistan | AFG | Account at a financial institution, male (% age 15+) [ts] | WP_time_01.2 | | | | | |
| 14 | Afghanistan | AFG | Account at a financial institution (% age 15+) [ts] | WP_time_01.1 | | | | | |
| 15 | Afghanistan | AFG | Presence of peace keepers (number of troops, police, and military c | VC.PKP.TOTL.UN | | | | | |
| 16 | Afghanistan | AFG | Intentional homicides (per 100,000 people) | VC.IHR.PSRC.P5 | | | | | |
| 17 | Afghanistan | AFG | Internally displaced persons (number, low estimate) | VC.IDP.TOTL.LE | | | | | |
| 18 | Afghanistan | AFG | Internally displaced persons (number, high estimate) | VC.IDP.TOTL.HE | | | | | |
| 19 | Afghanistan | AFG | Battle-related deaths (number of people) | VC.BTL.DETH | | | | | |
| 20 | Afghanistan | AFG | Travel services (% of commercial service exports) | TX.VAL.TRVL.ZS.WT | | | | | |
| 21 | Afghanistan | AFG | Transport services (% of commercial service exports) | TX.VAL.TRAN.ZS.WT | | | | | |
| 22 | Afghanistan | AFG | High-technology exports (% of manufactured exports) | TX.VAL.TECH.MF.ZS | | | | | |
| 23 | Afghanistan | AFG | High-technology exports (current US$) | TX.VAL.TECH.CD | | | | | |
| 24 | Afghanistan | AFG | Commercial service exports (current US$) | TX.VAL.SERV.CD.WT | | | | | |
| 25 | Afghanistan | AFG | Computer, communications and other services (% of commercial se | TX.VAL.OTHR.ZS.WT | | | | | |
| 26 | Afghanistan | AFG | Export value index (2000 = 100) | TX.VAL.MRCH.XD.WD | | | | | |
| 27 | Afghanistan | AFG | Merchandise exports to low- and middle-income economies within | TX.VAL.MRCH.WR.ZS | 23.24649299 | 12.35955056 | 13.58234295 | 18.54493581 | 25.43103448 |
| 28 | Afghanistan | AFG | Merchandise exports by the reporting economy (current US$) | TX.VAL.MRCH.WL.CD | 49900000 | 53400000 | 58900000 | 70100000 | 69600000 |
| 29 | Afghanistan | AFG | Merchandise exports by the reporting economy, residual (% of tota | TX.VAL.MRCH.RS.ZS | 30.26052104 | 42.13483146 | 51.10356537 | 46.07703281 | 44.25287356 |
| 30 | Afghanistan | AFG | Merchandise exports to low- and middle-income economies in Sub- | TX.VAL.MRCH.R6.ZS | | | | | |

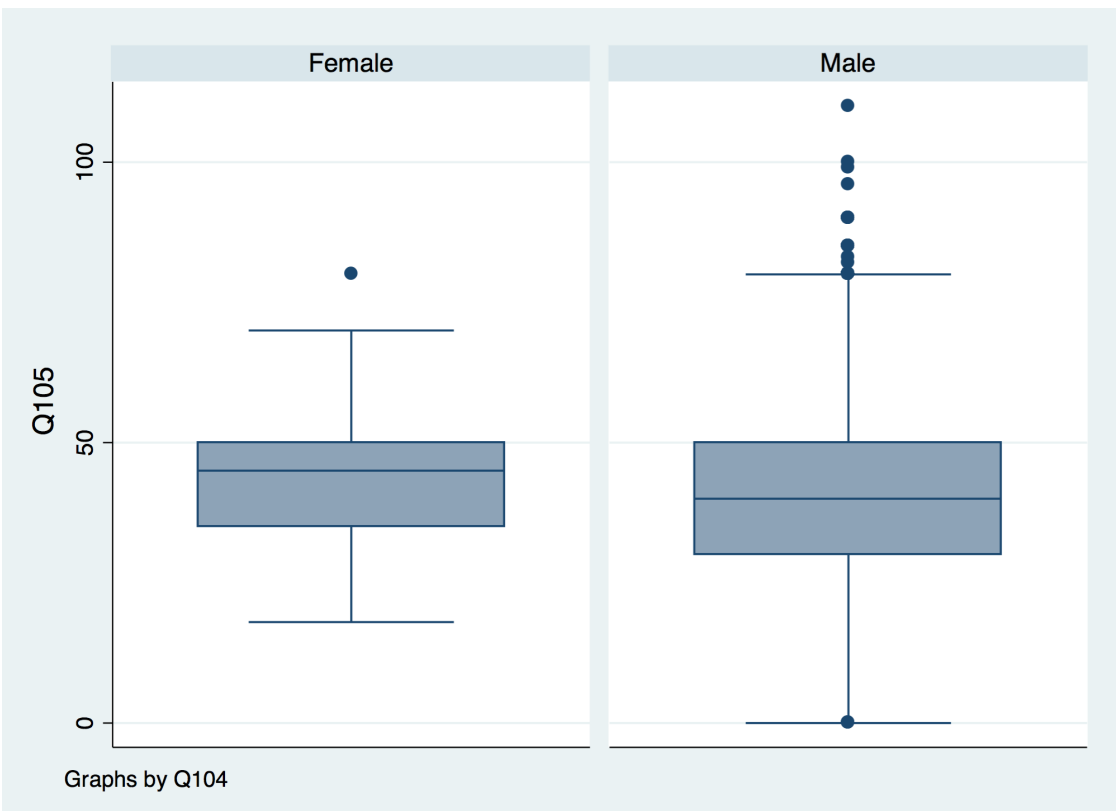
The original data was a bit more messy! Transforming it to something we can use is called *data cleaning* or *data tidying*.

## Stata syntax: options

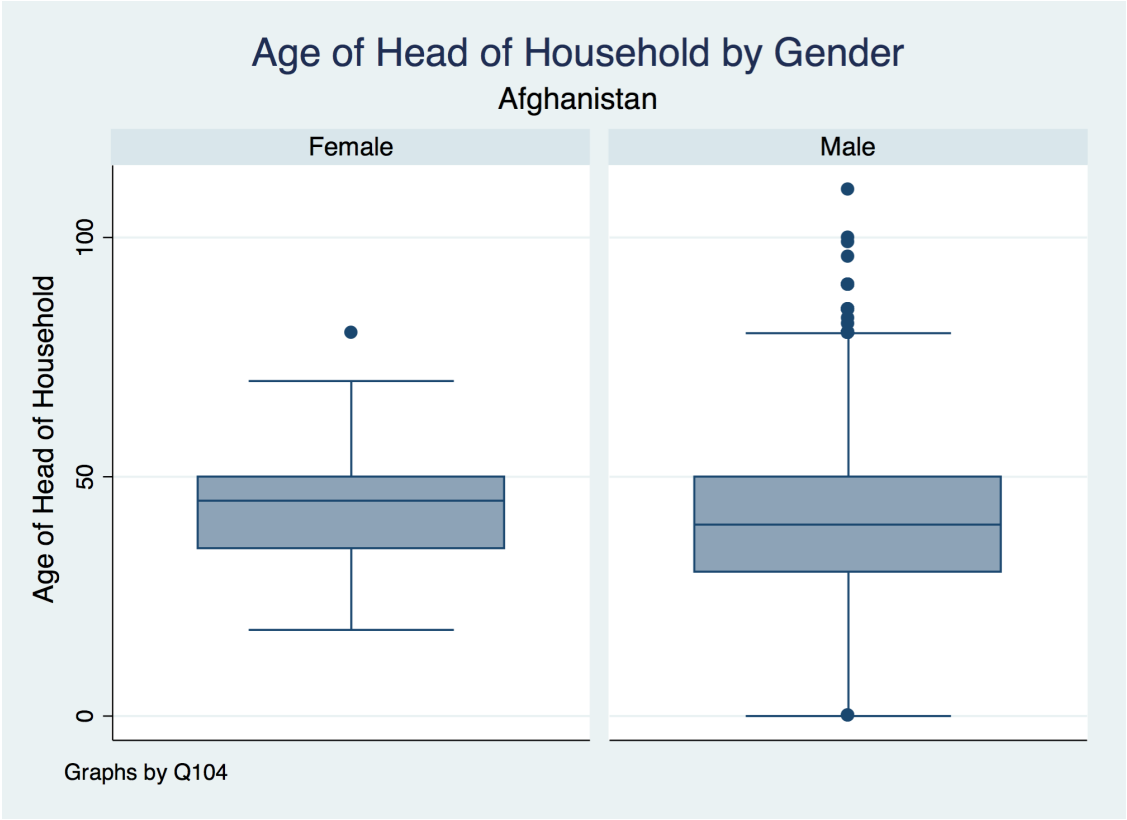
- Many Stata commands have options that give us more fine tuned control over what we want to do
- You can find them also via the user interface: many are checkboxes
- Think of options as **adjectives**
- Examples: title of a graph, which data to use, colors
- They normally come after a comma
- You can find the options in the Stata help

## Options example

```
use "HH Listing.dta"
graph box q105 if q103 == 1, by(q104)
```




```
graph box q105 if q103 == 1,ytitle(Age of Head of Household)/*
    */ by(, title(Age of Head of Household by Gender) /*
    */ subtitle(Afghanistan)) by(q104)
```



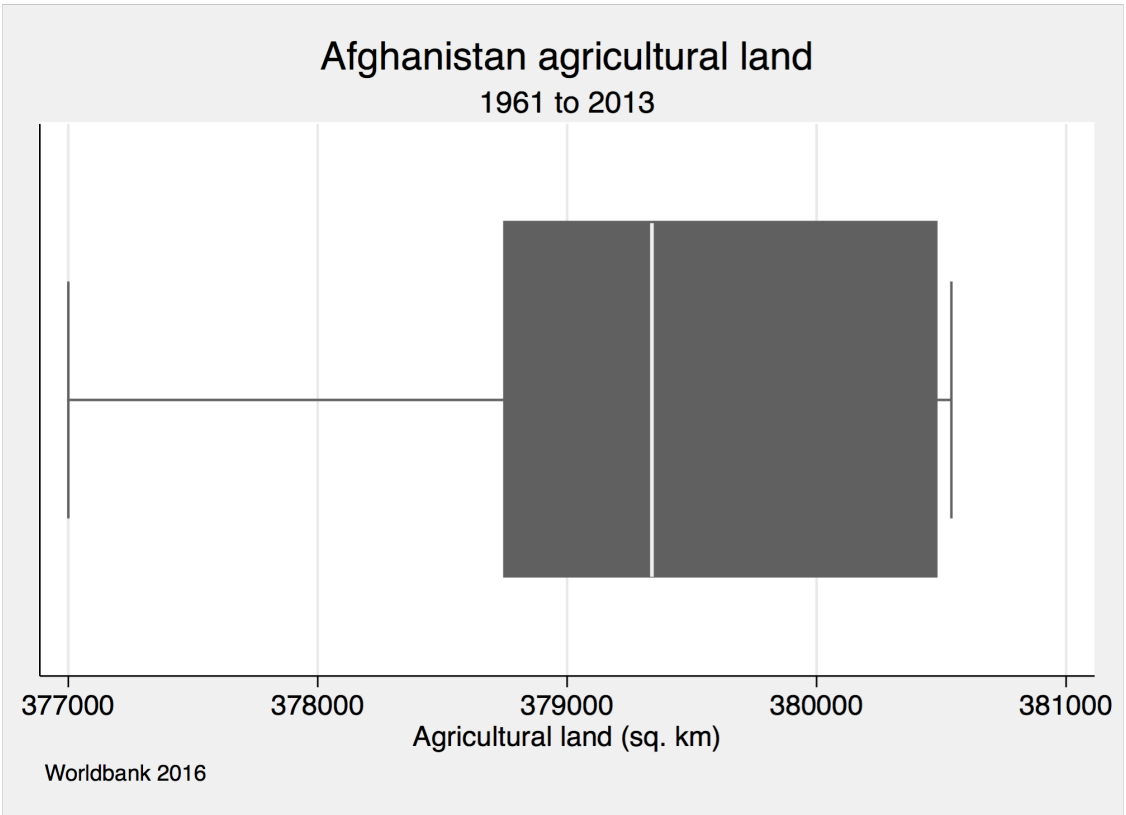

## Stata help

- It comes in two shapes: help pages for commands and PDF documents
- Help pages are more direct
- Sometimes it's easier to scroll down to the examples section
- The help pages are interconnected, so use the hyperlinks
- Check out the help page for graph box: `help graph box`

## Exercise continued

Improve the plot you made earlier as if you were to show the distribution of the agricultural land of Afghanistan in the media (news) or a journal.

```
graph hbox AGLNDAGRIK2, title(Afghanistan agricultural land) /*
    */ subtitle(1961 to 2013) note(Worldbank 2016) scheme(sj)
```




### See all the entries for a variable: list

```
list AGLNDAGRIK2
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. list AGLNDAGRIK2

     +----------+
     | AGLNDA~2 |
     |----------|
  1. |        . |
  2. |   377000 |
  3. |   377600 |
  4. |   378100 |
  5. |   378730 |
     |----------|
  6. |   378750 |
  7. |   379130 |
  8. |   379790 |
  9. |   379800 |
 10. |   379960 |
     |----------|
 11. |   380060 |
```

```
12. |   380360 |
13. |   380460 |
14. |   380480 |
15. |   380480 |
    |----------|
16. |   380480 |
17. |   380480 |
18. |   380500 |
19. |   380500 |
20. |   380490 |
    |----------|
21. |   380490 |
22. |   380530 |
23. |   380540 |
24. |   380540 |
25. |   380540 |
    |----------|
26. |   380540 |
27. |   380540 |
28. |   380450 |
29. |   380400 |
30. |   380400 |
    |----------|
31. |   380400 |
32. |   380300 |
33. |   380300 |
34. |   379340 |
35. |   378130 |
    |----------|
36. |   377530 |
37. |   377520 |
38. |   377900 |
39. |   378670 |
40. |   377530 |
    |----------|
41. |   377530 |
42. |   377530 |
43. |   377530 |
44. |   379100 |
45. |   379110 |
    |----------|
46. |   379100 |
47. |   379100 |
48. |   379100 |
49. |   379100 |
50. |   379100 |
    |----------|
51. |   379100 |
52. |   379100 |
53. |   379100 |
54. |   379100 |
55. |        . |
    |----------|
56. |        . |
```

```
 57. |        . |
     +----------+
```

## codebook: main information

```
codebook AGLNDAGRIK2
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. codebook AGLNDAGRIK2

---------------------------------------------------------------------------------------------------------
AGLNDAGRIK2                                                                                Agricultural
---------------------------------------------------------------------------------------------------------

                  type:  numeric (double)

                 range:  [377000,380540]              units:  10
         unique values:  28                       missing .:  4/57

                  mean:    379405
             std. dev:   1110.28

           percentiles:        10%       25%       50%       75%       90%
                             377530    378750    379340    380480    380530
```

## summarize: univariate statistical summary

```
summarize AGLNDAGRIK2
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. summarize AGLNDAGRIK2

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
 AGLNDAGRIK2 |         53    379404.5    1110.278     377000     380540
```

```
summarize AGLNDAGRIK2, detail
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )
```

```
. summarize AGLNDAGRIK2, detail

                 Agricultural land (sq. km)
-------------------------------------------------------------
      Percentiles      Smallest
 1%       377000         377000
 5%       377530         377520
10%       377530         377530       Obs                  53
25%       378750         377530       Sum of Wgt.          53

50%       379340                      Mean           379404.5
                        Largest       Std. Dev.      1110.278
75%       380480         380540
90%       380530         380540       Variance        1232718
95%       380540         380540       Skewness      -.5865218
99%       380540         380540       Kurtosis       2.045356
```

## describe: similar to codebook

```
describe AGLNDAGRIK2
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. describe AGLNDAGRIK2

              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------------------------------
AGLNDAGRIK2     double  %9.0g                 Agricultural land (sq. km)
```

## tabulate: make a table

```
tabulate AGLNDAGRIK2
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. tabulate AGLNDAGRIK2

Agricultura |
l land (sq. |
        km) |      Freq.     Percent        Cum.
------------+-----------------------------------
     377000 |          1        1.89        1.89
     377520 |          1        1.89        3.77
     377530 |          5        9.43       13.21
     377600 |          1        1.89       15.09
     377900 |          1        1.89       16.98
```

```
     378100 |          1        1.89       18.87
     378130 |          1        1.89       20.75
     378670 |          1        1.89       22.64
     378730 |          1        1.89       24.53
     378750 |          1        1.89       26.42
     379100 |         10       18.87       45.28
     379110 |          1        1.89       47.17
     379130 |          1        1.89       49.06
     379340 |          1        1.89       50.94
     379790 |          1        1.89       52.83
     379800 |          1        1.89       54.72
     379960 |          1        1.89       56.60
     380060 |          1        1.89       58.49
     380300 |          2        3.77       62.26
     380360 |          1        1.89       64.15
     380400 |          3        5.66       69.81
     380450 |          1        1.89       71.70
     380460 |          1        1.89       73.58
     380480 |          4        7.55       81.13
     380490 |          2        3.77       84.91
     380500 |          2        3.77       88.68
     380530 |          1        1.89       90.57
     380540 |          5        9.43      100.00
------------+-----------------------------------
      Total |         53      100.00
```

## tabulate: include missing observations

```
tabulate AGLNDAGRIK2, missing
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. tabulate AGLNDAGRIK2, missing

Agricultura |
l land (sq. |
        km) |      Freq.     Percent        Cum.
------------+-----------------------------------
     377000 |          1        1.75        1.75
     377520 |          1        1.75        3.51
     377530 |          5        8.77       12.28
     377600 |          1        1.75       14.04
     377900 |          1        1.75       15.79
     378100 |          1        1.75       17.54
     378130 |          1        1.75       19.30
     378670 |          1        1.75       21.05
     378730 |          1        1.75       22.81
     378750 |          1        1.75       24.56
     379100 |         10       17.54       42.11
     379110 |          1        1.75       43.86
     379130 |          1        1.75       45.61
```

```
     379340 |          1        1.75       47.37
     379790 |          1        1.75       49.12
     379800 |          1        1.75       50.88
     379960 |          1        1.75       52.63
     380060 |          1        1.75       54.39
     380300 |          2        3.51       57.89
     380360 |          1        1.75       59.65
     380400 |          3        5.26       64.91
     380450 |          1        1.75       66.67
     380460 |          1        1.75       68.42
     380480 |          4        7.02       75.44
     380490 |          2        3.51       78.95
     380500 |          2        3.51       82.46
     380530 |          1        1.75       84.21
     380540 |          5        8.77       92.98
          . |          4        7.02      100.00
------------+-----------------------------------
      Total |         57      100.00
```

### count number of observations

```
count if AGLNDAGRIK2 == .
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. count if AGLNDAGRIK2 == .
  4
```

### generate: create a new variable

```
generate agrilog = log10(AGLNDAGRIK2)
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. generate agrilog = log10(AGLNDAGRIK2)
(4 missing values generated)

. summarize agrilog

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
     agrilog |         53    5.579101     .001272   5.576341     5.5804
```

### drop: delete variables

```
drop agrilog
```

```
. use afg_worldbank_2016.dta, clear
(Written by R.              )

. generate agrilog = log10(AGLNDAGRIK2)
(4 missing values generated)

. drop agrilog
```

You can use `keep` if the list of variables you want to retain is shorter than the list of variables you want to delete.

## *Tougher* exercise

Calculate a t-test for a difference in means for the agricultural land between the even and the odd years.

Tip: remember that in math the modulus 2 is 0 for even values and 1 for odd values.

```
. use afg_worldbank_2016.dta
(Written by R.              )

. generate modulus = mod(Year, 2)

. label define moduluslabel 0 "Even" 1 "Odd"

. label values modulus moduluslabel

. ttest AGLNDAGRIK2, by(modulus)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
    Even |      26    379436.2    214.8517    1095.533    378993.7    379878.6
     Odd |      27    379374.1    220.2221    1144.308    378921.4    379826.7
---------+--------------------------------------------------------------------
combined |      53    379404.5    152.5084    1110.278    379098.5    379710.6
---------+--------------------------------------------------------------------
    diff |            62.07977    307.9249               -556.1052    680.2647
------------------------------------------------------------------------------
    diff = mean(Even) - mean(Odd)                                 t =   0.2016
Ho: diff = 0                                     degrees of freedom =       51

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.5795         Pr(|T| > |t|) = 0.8410          Pr(T > t) = 0.4205
```

## Some *common* complicated tasks

- Reshaping data sets: wide to long and viceversa
- Merging data sets: Stata ultimately wants you to get all the data you need in a single table
- Looping over a list to do a task
- Working with strings
- Working with dates: there are many different ways to specify time

## Finding help

- Try using the user interface then check the code that results from your choices
- Use the `help` command or search the help (top right)
- Google: lots of goodies in older mailing list posts
- Check the UCLA Stata website

## More information

- The *Statistics with Stata* by Lawrence Hamilton you already have!
- A quick rundown of the main commands in Stata by the UNC Caroline Population Center
- A recording of an introduction to Stata by Dr Marie Diener-West
- SPSS to Stata table
- UCLA Stata Starter Kit